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# CONTENTS OF VOLUME VI

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Publication Date</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An Annotated List of the Butterflies of San Diego County, California.</td>
<td>William S. Wright</td>
<td>February 28, 1930</td>
<td>1-40</td>
</tr>
<tr>
<td>3. New and Renamed Subspecies of Crotalus confluentus Say, with Remarks on Related Species.</td>
<td>Laurence M. Klauber</td>
<td>February 28, 1930</td>
<td>95-144</td>
</tr>
<tr>
<td>4. Upper Eocene Orbitoid Foraminifera from the Western Santa Ynez Range, California, and their Stratigraphic Significance.</td>
<td>W. P. Woodring</td>
<td>July 12, 1930</td>
<td>145-170</td>
</tr>
<tr>
<td>5. A New Race of Gilded Flicker from Sonora.</td>
<td>A. J. van Rossem</td>
<td>July 12, 1930</td>
<td>171-172</td>
</tr>
<tr>
<td>7. Notes on some Species of Epitonium, Subgenus Nitidiscala, from the West Coast of North America.</td>
<td>A. M. Strong</td>
<td>August 30, 1930</td>
<td>183-196</td>
</tr>
<tr>
<td>8. Two New Subspecies of Birds from Sonora.</td>
<td>A. J. van Rossem</td>
<td>August 30, 1930</td>
<td>197-198</td>
</tr>
<tr>
<td>9. The Races of Auriparus flaviceps (Sundevall).</td>
<td>A. J. van Rossem</td>
<td>August 30, 1930</td>
<td>199-202</td>
</tr>
<tr>
<td>10. Comment on the Marsh Sparrows of Southern and Lower California, with the Description of a New Race.</td>
<td>Laurence M. Huey</td>
<td>August 30, 1930</td>
<td>203-206</td>
</tr>
<tr>
<td>11. New Sonora Races of Toxostoma and Pheugopedius.</td>
<td>A. J. van Rossem</td>
<td>September 30, 1930</td>
<td>207-208</td>
</tr>
<tr>
<td>13. A New Verdin from Central Lower California, Mexico.</td>
<td>Laurence M. Huey</td>
<td>September 30, 1930</td>
<td>211-212</td>
</tr>
</tbody>
</table>

15. A New Least Bittern from Sonora. By A. J. van Rossem. Published November 28, 1930. 227-228

16. A New Race of Bell Sparrow from Lower California, Mexico. By Laurence M. Huey. Published December 24, 1930. 229-230

17. Two New Pocket Mice of the spinatus Group and one of the longimembris Group. By Laurence M. Huey. Published December 24, 1930. 231-234

18. A New Clapper Rail from Sonora. By Donald R. Dickey. Published December 24, 1930. 235-236


21. A Molluscan Species New to the Recent West Coast Fauna. By Don L. Frizzell. Published April 30, 1931. 319-324 Plate 22.

22. Descriptions of New Birds from the Mountains of Southern Nevada. By A. J. van Rossem. Published June 5, 1931. 325-332

23. Notes on the Worm Snakes of the Southwest, with Descriptions of Two New Subspecies. By Laurence M. Klauber. Published July 8, 1931. 333-352

24. Crotalus tigris and Crotalus enyo, Two Little Known Rattlesnakes of the Southwest. By Laurence M. Klauber. Published July 8, 1931. 353-370 Plate 23.

25. Age of the Orbitoid-bearing Eocene Limestone and Turritella variata Zone of the Western Santa Ynez Range, California. By W. P. Woodring. Published August 31, 1931. 371-388

26. A New Subspecies of Peromyscus from the Gulf Coast of Lower California, Mexico. By Laurence M. Huey. Published August 31, 1931. 389-390
AN ANNOTATED LIST OF THE BUTTERFLIES
OF
SAN DIEGO COUNTY, CALIFORNIA

BY

William S. Wright
Curator of Insects, San Diego Society of Natural History

SAN DIEGO, CALIFORNIA
Printed for the Society
February 28, 1930
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AN ANNOTATED LIST OF THE BUTTERFLIES
OF
SAN DIEGO COUNTY, CALIFORNIA

BY
WILLIAM S. WRIGHT
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SAN DIEGO, CALIFORNIA
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AN ANNOTATED LIST OF THE BUTTERFLIES OF SAN DIEGO COUNTY, CALIFORNIA

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INTRODUCTION

To produce a complete list of all insects that occur in any large circumscribed area is practically an impossibility. Even an accurate record of all the butterflies to be found in so extensive and varied a territory as San Diego County entails a vast amount of field work at every season of the year, supplemented by ample technical facilities and knowledge. The writer therefore makes no claim of infallibility for the present paper, and presents it merely as the sum of his accumulated data and experience at the present time. The future will doubtless bring about changes and additions, especially when more intensive collecting is done in the eastern and northern parts of the County.

In 1908 the writer published a list\(^1\) containing eighty species and forms. Since that time further collections have been made covering more territory within the County, records have been checked and rumors followed with great care in an effort to render the list as nearly complete as possible. The present list contains the names of 148 species, races, forms and aberrations, several of which have been described since the last list was given to the press, and one of which—Kelsey's Blue—is here given first publication. Most of the butterflies named are represented in the collections of the San Diego Society of Natural History; the others may be found in the collections of local entomologists. Accurate checking has thus been possible.

This paper has been in preparation for the last three years, and the author wishes to express his gratitude to the several people who have helped. Among those to whom especial acknowledgment is due is Dr. John Adams Comstock of Los Angeles, whose excellent new book on the butterflies of California\(^2\) has been the source not only


\(^2\) COMSTOCK, JOHN ADAMS. Butterflies of California. Los Angeles, California, 1927.
of the English names used, but also of certain statements relative to
habits and distribution. The sequence and nomenclature of Dr. Com-
stock's book have been adopted for the present paper instead of those
of Drs. Barnes' and Benjamin's "List," in order to aid amateur collec-
tors who may wish to use this as a check list for local material in
combination with "Butterflies of California." To J. D. Gunder of Pas-
da the author is also indebted for material assistance in securing
specimens and data regarding a number of species and forms here given.

Dr. Comstock was kind enough to read the manuscript of this list
and the writer's thanks are hereby tendered him for his kindly and valu-
able criticism. The writer also desires to express his appreciation of the
assistance of George H. Field of San Diego, his companion and co-
worker in the field. Mr. Field's knowledge of San Diego County and his
ability as a collector have been of great value as well as a source of
inspiration. Others, whose names occur in the text, have aided in no
small way by giving information about species and locations that were
unknown to the writer.

It will be noted that no reference is made to the "life zones" of any
of the butterflies in the list, as is so often done in the consideration of
plants, birds and mammals. As yet no serious attempt has been made to
zone San Diego County entomologically. This is a work that would
require a vast amount of research and its completion may not be expected
for many years to come.

Barnes, W. M. and Benjamin, F. H. List of the Diurnal Lepidoptera of Boreal America
North of Mexico: Bulletin Southern California Academy of Sciences, Vol XXV,
Part 1, January, 1926.
BUTTERFLIES OF SAN DIEGO COUNTY, CALIFORNIA

SUPERFAMILY PAPILIONOIDEA

Family PAPILIONIDAE

1. Papilio zelicaon Lucas (7)

ANISE SWALLOWTAIL

This is the commonest Swallowtail throughout San Diego County. The larvae are abundant on anise weed and are easily bred, as they will feed on leaves of parsley or carrots if anise is not handy. This insect has been observed feeding on citrus fruit leaves, hence it may be of economic importance.

2. Papilio indra pergamus Henry Edwards (8a)

EDWARDS' SWALLOWTAIL

Pergamus is said to be confined to the mountains of southern California. In San Diego County it flies from April to July. Though not at all common it may sometimes be found at high elevations in fairly good numbers, usually in company with other Swallowtails. Examples have been taken in Pine Valley at about 4000 feet elevation, on San Miguel Mountain, on the Laguna Mountains and at Kentwood-in-the-Pines, near Julian.

3. Papilio rutulus Lucas (15)

WESTERN TIGER SWALLOWTAIL

Rutulus occurs abundantly throughout the County, as it does throughout the entire western states region. Its lazy flight makes it rather easy of capture and it is present at all seasons and at all elevations. The larvae feed on willow and alder.

4. Papilio multicaudata Kirby (16)

DAUNUS SWALLOWTAIL

George H. Field, a veteran collector, reports having observed an example of this species in flight in the vicinity of Lake Hodges. The

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fact that there are three tails on the secondaries made identification easy. May to August is the season of flight.

5. **Papilio eurymedon** Lucas (17)  
**Pale Swallowtail**

From early spring to late September *eurymedon* may be found in some part of this County. Usually it maintains a residence in the upland meadows and about the tops of high hills or mountains, but occasionally descends to the low lands near sea level. The larvae feed on California coffee berry (*Rhamnus californica*).

Family **PIERIDAE**

6. **Pieris beckerii** (Edwards) (32)  
**Becker’s White**

Examples of *beckerii* are rare in this County, but the species has been taken in the semi-desert area on the eastern edge of the County. The similarity in maculation between this species and *protodice* makes positive identification rather difficult for any but experienced collectors. The larval food plant is usually some member of the mustard family.

7. **Pieris sisymbrii** (Boisduval) (33)  
**California White**

*Sisymbrii* has been rarely taken in the Laguna Mountains and at Jacumba. Captures are usually made in the late spring or early summer months. The larvae feed on members of the mustard family.

8. **Pieris protodice** (Boisduval and Leconte) (35)  
**Common White**

With the possible exception of *P. rapae*, *P. protodice* is the most common White in the entire United States. It is found in abundance everywhere in this County from sea level to mountain top, and occurs during every month from February to November. Persons unfamiliar with the species may be pardoned for calling it *P. beckerii*, which it resembles rather closely. However, the clouding on the underside of the secondaries will serve as a means of distinguishing it. As in the case of its allied species, the larval food plant belongs to the mustard family (*Cruciferae*).

**Vernal White**

This is simply the early spring form of *protodice*. It is lighter in color above, smaller in size and usually more distinctly veined below on the secondaries. Rather common in the canyons about the City of San Diego.

10. *Pieris rapae* (Linnaeus) (38)

**Cabbage Butterfly**

There is probably no more wide spread insect pest in America than this butterfly. The larval food is preferably members of the cabbage family of plants and the annual loss to truck gardeners caused by this insect amounts to many millions of dollars. It also feeds on nasturtium and mustard plants. In this County there has been a marked increase in its occurrence during the last twenty years and it bids fair to become a rather serious pest locally. *Rapae* is of European origin, having become established in the Province of Quebec, Canada, about seventy-five years ago, whence it has spread throughout the length and breadth of North America.

The name *rapae*, according to Dr. J. A. Comstock, is applicable only to the lightly marked spring brood, while the later members of the species are designated under the next name.

11. *Pieris rapae yreka* (Reakirt) (38 gen. aest.)

**Yreka Cabbage Butterfly**

This form of *rapae* is abundant in midsummer and autumn anywhere in the County.

12. *Nathalis iole* Boisduval (39)

**Dwarf Yellow**

Although this species has been reported as a “foot-hill and lowland species,” in San Diego County it is more plentiful at higher elevations. The insect is rather rare near the coast. In the month of June, 1926, I was able to secure a large series without any trouble in the Laguna Mountains at an elevation of 6000 feet. The larval food plant in California is the downy bur marigold (*Bidens pilosa*).

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5 Comstock, J. A., op. cit., p. 36.
13. *Anthocharis lanceolata australis* (Grinnell) (43a)

**Grinnell’s Marble**

A comparatively rare form and this record—Jacumba, San Diego County, California—extends its range far outside the previously known range. Formerly reported only from the southern Sierras.

14. *Anthocharis cethura* Felder and Felder (45)

**Felder’s Orange-tip**

This form has been rare in San Diego County for a number of years, but some fifteen years ago its occurrence was rather common during early spring in the region near the coast. Dr. Comstock records it as a desert or semi-desert form, hence one should look for it on the eastern edge of the County. February to April is the best time.

15. *Anthocharis cethura deserti* W. G. Wright (45b)

**Desert Orange-tip**

A single specimen of this rare form was taken several years ago by George H. Field on Point Loma. It may turn up at almost any time along the eastern or desert edge of the County.

16. *Anthocharis sara* Boisduval (47)

**Sara Orange-tip**

In this County *sara* is found only near the coast and is considered a rare catch. The only records I have are from near Pacific Beach.

17. *Anthocharis sara stella* Edwards (47c)

**Stellar Orange-tip**

The same comment applies to this form as to the preceding. It is a dimorphic female about the same size as *sara*, but having a yellow suffusion above that varies somewhat in intensity. My specimens were captured near the coast in spring.

18. *Anthocharis sara reakirtii* Edwards (47 gen. vern.)

**Reakirt’s Orange-tip**

This is one of the earliest of our common butterflies and, in its season, very abundant in canyons about the City and in the foothills
back from the coast. April and May are the best months in which to hunt for it.

19. Anthocharis sara reakirtii ab. wrighti J. A. Comstock (Not listed)\(^6\)

**Wright’s Aberrant Orange-tip**

Only one example of this beautiful butterfly has ever been recorded. The type is in the collection of the San Diego Society of Natural History.

20. Catopsilia eubule sennae (Linnaeus) (48)

**Senna Sulphur**

Although this form of the Cloudless Sulphur is supposed to be found only in the low altitudes near the coast, it is of record in my collection from Cuyapipe Canyon, Laguna Mountains, elevation about 5000 ft. This capture was made in June, 1926.

21. Catopsilia eubule sennae form pallida (Cockerell) (48 form)

**Pallid Sulphur**

This form is an albinic female and is rather rare. The yellow tends to become white and, in extreme cases, disappears entirely. Several examples have been taken in San Diego County.

22. Zerene eurydice (Boisduval) (56)

**California Dog-face**

A rare insect in the immediate vicinity of San Diego, but is occasionally found in Mission Valley, where its larval food plant, false indigo (Amorpha californica), grows. At El Monte, and in well watered canyons in the mountains, it flies in abundance during April and May. A second brood makes its appearance in July, and it may be taken occasionally as late as November.

23. Zerene eurydice bernardino (Edwards) (56a)

**Margined Dog-face**

In this form the secondaries of the male bear a black margin of

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greater or less extent. The females are the same as in the preceding species. Both forms are found in the same association here, and a long series will show intergrades from one extreme to the other.

24. Zerene eurydice amorphae (Henry Edwards)  
(56 gen. aest.) 

**Clouded Dog-face**

A rare female form with markings that suggest the female of the Southern Dog-face. The amount of dark varies greatly in different individuals. I have one example taken in Mission Valley several years ago.

25. Zerene caesonia (Stoll)  
(57) 

**Southern Dog-face**

Only one specimen of this species is known by the writer to have been taken within the County. This was captured near Mountain Springs in July, 1906.

26. Eurymus eurytheme (Boisduval)  
(61) 

**Boisduval's Sulphur**

Scarcely a month in the year goes by but that some form of *eurytheme* may be found. Those occurring in early spring are said to be typical. They are usually smaller than the later forms and have but little of the characteristic orange suffusion on the disk of the primaries. Because of the larval habit of attacking alfalfa, it has been called the Alfalfa Butterfly in some sections of the country.

27. Eurymus eurytheme ab. alba (Strecker)  
(61 ab.) 

**Boisduval's Pale Sulphur**

This white female form occurs constantly with all the forms of *eurytheme*. White takes the place of the yellow ground color, but in all other respects it is like the typical species.

28. Eurymus eurytheme amphidusa (Boisduval)  
(61 form) 

**Flavid Sulphur**

*Amphidusa* is the summer form of *eurytheme* and is much more abundant than typical *eurytheme*. The larvae attack alfalfa and clovers
to such a degree that, as one writer suggests, "each of these yellow beauties represents just so much butter that has taken wing from the profits of the farmer."

29. **Eurymus harfordii** (Henry Edwards) (64)

**Harford's Sulphur**

*Harfordii* is often found associated with *eurytheme* in the foothills and mountain regions. It is rarely taken at coast elevations. The clear yellow of the wings and entire lack of orange suffusion, together with the contrasty black borders, serve admirably to separate the species from other Sulphurs of this locality.

30. **Eurema mexicana** (Boisduval) (75)

**Mexican Yellow**

Only a few captures of this species have been recorded for San Diego County. It is, however, fairly common on the desertward slopes of the mountains.

31. **Eurema nicippe** (Cramer) (77)

**Nicippe Yellow**

Wherever cassia grows, Nicippe Yellow is of more or less common occurrence. Very abundant in Balboa Park during late August and early September.

**Family DANAIĐAE**

32. **Danaus menippe** (Hubner) (85)

**Monarch**

The Monarch is probably the best known butterfly in the United States and is common throughout the County from early spring to late fall. Wherever milkweed grows, there the Monarch may be found. It has been known to indulge in the habit of assembling in great numbers in the fall in this region on several occasions. In 1923 a great migratory swarm settled on the eucalyptus trees in Mission Valley not far from Old Town and was visited by numbers of people. About the same time another flight settled in a row of eucalyptus and cypress trees near Camp Hearn at Imperial Beach. Similar flights have been reported from Carlsbad and Del Mar. This is an interesting phenomenon and
well worth observation and study. The species is better known under its former names of *Anosia plexippus* or *Danaus archippus*.

33. **Danaus menippe ab. fumosus** (Hulst) (85 ab.)

**Smoky Monarch**

This is simply an aberration of the Monarch and is rather rare. I have one or two specimens taken in this County. In *fumosus* the rich red-brown of typical Monarch is replaced by smoky gray-brown, and in my examples the yellow or buff spots at the apex of the primaries have a tendency to become white.

34. **Danaus berenice strigosa** (Bates) (86a)

**Striated Queen**

Although *strigosa* is reported as rare in California, it is quite common in this County. The food plant is milkweed and its occurrence at various times from early spring to late autumn would indicate a number of broods. When flowers are most bountiful in the canyons, *strigosa* is fairly common and later it frequents gardens. Lantana, when in bloom, is very attractive to both the Monarch and the Queen.

**Family SATYRIDAE**

35. **Coenonympha californica** Westwood & Hewitson (102)

**California Ringlet**

Grassy hills and sunny slopes are the favorite trysting places for hundreds of these delicate little Ringlets. A habit of flying low and darkening of colors beneath serve to prevent it from becoming conspicuous at any time. The collector may find it as early as February, and, in favored localities, as late as September. It is most abundant in April and May. I have never collected *californica* anywhere but in the area between the coast and the foothills.

36. **Coenonympha californica galactinus** (Boisduval) (102 form)

**Boisduval's Ringlet**

This form is characterized by the “creamy-yellow on the superior surface of the wings and brownish-yellow shadings on under side.”
number of eye-spots on the secondaries varies greatly and an occasional specimen will be found with the apical eye on the primaries twinned. Not at all common and never early. Associated with typical *california* in late summer.

37. **Cercyonis silvestris** (Edwards) (116)  
**Sylvan Satyr**

During July and August this is a rather common butterfly on brushy hillsides in foothills and mountains of this County. It has been taken in some numbers in canyons just east of the City of San Diego. The insect is rather difficult to capture because of its habit of flying close to the ground in brushy places. It is an interesting capture at any time and well worth the effort necessary, even when attended by torn nets and scratched hands.

**Family NYMPHALIDAE**  
Subfamily *HELICONIINAE*

38. **Dione vanillae** (Linnaeus) (148)  
**Gulf Fritillary**

Everyone who raises the passion vine is well acquainted with this silver-spangled beauty. It is very common about San Diego City from early spring to late summer, pursuing its devastating way with unerring certainty, and to the sorrow of the gardener. The caterpillars are voracious eaters and in a short time will practically defoliate the plant attacked; and when the natural food gives out they have been known to turn cannibal and eat each other. This is especially true of specimens confined for purposes of study.

**Subfamily NYMPHALINAE**

39. **Euptoieta claudia** (Cramer) (149)  
**Variegated Fritillary**

There seems to be no good reason why this Fritillary should not be common here, but so far as I know, only one example has ever been taken in this County. It was brought to me alive by a school boy who found it freshly emerged in his garden. The larva is said to feed on garden pansies.
40. *Argynnis semiramis* (Edwards) (175c)

**Semiramis' Fritillary**

From the middle of June to the middle of July this is the most common Fritillary in the mountain regions. It is very easy to capture, being slow of flight and fond of the low growing composite flowers that bloom in such profusion at that time.

41. *Argynnis callippe* (Boisduval) (176)

**Callippe Fritillary**

In late May, during favorable years, *callippe* may be found in wide canyons with grassy slopes near the coast. In the mountains it is associated sparingly with *semiramis* in June and very likely well into July. The food plant is violet and wherever *callippe* is found the dried-up leaves of the violet nestle close to the ground. The eggs are deposited near, with the knowledge that the young caterpillars will find the luscious fresh leaves in the spring. In June, 1926, the writer took *callippe* on the very top of Laguna Mountains and again (in 1927) Fred Thorn took it at the same place. These facts would seem to contradict the statements of Dr. Comstock in his "Butterflies of California," where he says that this is a butterfly of the lowlands and foothills.

42. *Euphydryas chalcedona* (Doubleday & Hewitson) (204)

**Chalcedon Checker-spot**

This beautiful Checker-spot flies during May and June. Occasional examples are found near the coast, but it is quite common among the foothills and mountains. A great many variations are to be found, many of which have been given names. Any large collection is very likely to contain examples of one or more aberrations or forms.

43. *Euphydryas chalcedona quino* (Behr) (209)

**Behr's Checker-spot**

The genus *Euphydryas* is a rather difficult one to work with and the species *chalcedona* is one of its most plastic members. The name *quino* was applied first to specimens found in this general region. In 1906 the type was lost and since then there has been much searching and a great deal of discussion relative to the status of *quino*. We have been following the nomenclature of Barnes' and Benjamin's "List" and have
regarded *quino* as abundant in this County. Recently J. D. Gunder has made a study of the genus and his active collecting has finally located the race under discussion on the edge of the desert in this County and northward as far as Palm Springs. Specimens have been taken at Jacumba and at La Puerta, the former by Mr. Gunder and at the latter place by George H. Field. Dr. J. A. Comstock tells me he has taken it in canyons leading into Borego Valley in this and Riverside Counties. Early spring, about March, is the proper time to look for them.

44. *Euphydryas editha* (Boisduval) (212)

**Editha Checker-spot**

The late Dr. Rivers and Dr. Henry Skinner both identified San Diego examples of this species as *editha*. About twenty years ago, Fordyce Grinnell redescribed *quino* (Behr’s type having been lost) from specimens taken in San Diego, since which time the species has stood under that name. It is a very early flier—in some seasons as early as February, and frequents grassy slopes and hill tops near the ocean, where it is very abundant and easy to capture. The collection of the San Diego Society of Natural History contains a number of examples taken in September, which would indicate the possibility of two broods yearly.

45. *Euphydryas editha fieldi* Gunder (Not listed)

**Field’s Aberrant Checker-spot**

This is a transition form of which, so far as known, only one specimen, the type, has ever been taken. The capture was made by George H. Field in San Diego during the month of April.

46. *Euphydryas editha wrighti* Gunder (Not listed)

**Southern Checker-spot**

The type locality of this Checker-spot is in the southeastern part of San Diego City where it was collected by George H. Field in considerable numbers. It is considered by Mr. Gunder a perfectly good race of

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8 **GRINNELL, FORDYCE, Jr.,** Canadian Entomologist, Vol. XXXIX, p. 380, November, 1907.

edilha, differentiated from the typical species by certain color differences and the uniformly smaller size. The race is not easily recognized and a person will be obliged to make close comparisons with specimens taken in other localities to be sure. Mr. Gunder is of the opinion that this locality is the extreme northern edge of its range and that more collecting, in locations farther south, will show smaller examples and more evident color variations.

47. *Melitaea gabbii* (Behr) (225)

**Gabbb's Checker-spot**

During March, April and May *gabbii* may be found in every canyon from ocean to mountain. It is usually very abundant and easy to capture.


**Chara Checker-spot**

Reported by Dr. Comstock from the Borego Valley region. The home of this little gem is the desert region of southern and southeastern California. It occurs in two broods, the first in March and April, the second in October. "Only in rare seasons of unusual rainfall is it to be found in any numbers."\(^{10}\)

49. *Melitaea leanira wrightii* (Edwards) (237)

**Wright's Checker-spot**

This race is rather rare in San Diego County, although every season yields a small series to some fortunate collector. Examples have been taken at Torrey Pines, along the hills bordering Mission Valley, in the Laguna Mountains and at many other places; but it is never found in large numbers.

50. *Phyciodes phaon* (Edwards) (249)

**Phaon Crescent**

We follow Dr. J. A. Comstock in using the name *phaon*, and would also here correct his slip in reference to publications.\(^{11}\) The

\(^{10}\) *Comstock, J. A., op. cit., p. 112.*

\(^{11}\) *Comstock, J. A., op. cit., p. 116.*
species was published as *tharos* and *marcia* by W. G. Wright (not W. S. Wright) in his “Butterflies of the West Coast.” Phaon has made its appearance in San Diego County only within the last few years. It may be taken almost anywhere in the County from sea level to mountain top. Midsummer is the time of its flight.

51. *Phyciodes mylitta* (Edwards) (258)

**Mylitta Crescent**

The only record I have for *mylitta* in this County is a small series taken at Bailey’s, Palomar Mountain, July 17, 1927. It was quite common there in a small meadow, and industrious collecting would probably have resulted in a much larger series. The individuals are slightly smaller than northern and eastern specimens.

52. *Chlosyne lacinia crocale* (Edwards) (265c)

**Crocale Patch**

Not common in this region, but has been recorded from La Puerta and Vallecitos, in the Colorado desert, as of July occurrence.

53. *Chlosyne californica* (W. G. Wright) (266)

**California Patch**

March and April, September and October are the months when this beauty may be looked for. According to Dr. J. A. Comstock the species is a rarity and very local in its distribution. The San Diego Society of Natural History has a record for July at Mountain Springs and others are known from The Narrows, an opening into the desert near La Puerta.

54. *Polygonia satyrus* (Edwards) (274)

**Satyr**

The Satyr occurs rather sparingly in willow thickets near the coast and in shady places near running water in the mountains. Midsummer hikers may run across one almost any time.

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55. *Polygonia satyrus marsyas* (Edwards) (274a)
   
   **Marsyas Angle-wing**
   
   This form is often found in the same locality as the preceding species, of which some of our leading lepidopterists believe it to be simply a seasonal variety. Breeding has been suggested as a means of definitely fixing its status.

56. *Polygonia zephyrus* (Edwards) (277)
   
   **Zephyr**
   
   A record for this species occurs in the collection of George H. Field, giving Descanso as the locality and July 1st as the date of capture.

57. *Aglais californica* (Boisduval) (283)
   
   **California Tortoise-shell**
   
   The California Tortoise-shell is one of the earliest fliers in the mountain regions. My own records are from the vicinity of Henshaw Dam, in March. It is said that in favorable localities the larvae sometimes are so numerous as completely to defoliate the food plant—*Ceanothus*. When this occurs the adults are likely to swarm and obey an instinct to migrate, usually in a northerly direction. A flight of this kind is recorded from the Lake Tahoe region that continued for three days and consisted of many thousands of individuals.

58. *Aglais antiopa* (Linnaeus) (285)
   
   **Mourning Cloak**
   
   A very common butterfly in all parts of the Temperate Zone. It flies nearly all the year round in San Diego, breeds on willow and other related plants and is very easy to rear. Two forms are illustrated by Dr. Comstock which are likely to be found here. One is described as having an extraordinarily wide border, the other as having no blue spots in the border.

59. *Vanessa atalanta* (Linnaeus) (286)
   
   **Alderman**
   
   This butterfly is better known as the Red Admiral, but the true Admiral butterflies belong to another genus, so Dr. Comstock has chosen
to label it the Alderman, a name applied in England, probably referring to the colorful costumes worn by the old-time Aldermen of London. In this County it may be found from tide-water to mountain top although not very common. The food plant is commonly nettles, but the larvae will feed on hop and other allied plants.

60. Vanessa virginiensis (Drury) (287)

Virginia Lady

This is a widely distributed member of the Painted Lady group. Holland calls it Hunter’s Painted Lady and lists it as V. huntera. About San Diego the larvae feed on “everlasting” (Gnaphalium), and the adults like to fly about barren hill tops where they have a habit of choosing a bare spot which they guard, giving chase to everything that approaches. Midsummer is the best time to look for them.

61. Vanessa cardui (Linnaeus) (288)

Painted Lady

It is said that cardui is the most universally distributed butterfly in the world. Wherever thistles grow it may be found in some one or more of its numerous forms or races. While thistle seems to be the favorite larval food, many other plants are eaten with relish. There are seasons also when this butterfly appears in great swarms or flights, sometimes called “migratory flights.” Two such flights have been observed in San Diego recently. During the spring of 1924 great numbers were observed coming from the southwest and flying in a general northerly direction. In 1925 the flight was repeated, but this time in greater numbers. It is not known what causes these flights, where the insects come from or where they go.

62. Vanessa carye (Hubner) (289)

West Coast Lady

While cardui is practically universal in its occurrence, carye is confined to the west coast of the Americas from Vancouver to Patagonia. It is of much the same appearance as cardui, except that it is smaller and the apex of the fore wings is straight, not rounded. The larval food plant is usually some form of mallow (Malva).
63. Vanessa carye ab. letcheri (Grinnell) (289 ab.)

Letcher's Butterfly

Of the several aberrations of carye this seems to be the most common. It is likely to be found at any time and in any place where the typical insect is found. My own experience seems to point to late summer as the best season and lantana and the white marguerite daisy as the plants most likely to be frequented by them.

64. Junonia coena Hubner (290)

Buckeye

Dr. Comstock, in "Butterflies of California," tells us that "The Buckeye is one of the most strikingly marked butterflies of North America, on account of the eye-spots." At any rate, once seen, the impression left is a lasting one. The beautiful rich brown of the background, the large "eyes" and the pugnacious habit of the butterfly command instant attention. In this County it may be taken at all elevations from sea level to mountain top (6500 ft.) and from early spring to late summer.

65. Basilarchia loruquini (Boisduval) (310)

Lorquin's Admiral

While loruquini is most often found along river bottoms and about moist areas, it is frequently found in the dry canyons adjacent to such locations, if willow grows there. Individuals often select a bright, sunny, open spot, bordered by willows, which they seem to guard, and will dart viciously at any insect, bird or even human that dares to enter the area.

66. Heterochroa bredowii californica Butler (313a)

California Sister

The California Sister has been known in southern California as the Oaktree Butterfly, having been given this name rather locally because of its habit of frequenting the live oaks and because the larvae feed thereon. It is a beautiful insect, rarely found in company with others of its kind, and too often entirely out of reach of the collector's net. However, during early forenoon or late afternoon, individuals descend to damp ground for a sip of water, when the careful collector may be rewarded with little effort.
Family RIODINIDAE

67. Apodemia mormo (Felder and Felder) (324)
   Mormon Metal-mark

   The home of this butterfly is said to be the "desert regions to the
   south and east of Los Angeles County, on the Mojave Plateau, in the
   Owen's Valley and the Mono Basin."13 We have to record it from
   La Puerta, San Diego County, on the eastern edge of the County, in
   semi-desert area.

68. Apodemia mormo virgulti (Behr) (324a)
   Behr's Metal-mark

   Virgulti is a very interesting butterfly, common from sea level to
   mountain top in San Diego County. It might well be called the Darting
   Shadow, as its habit of flight during the heat of the day makes it look
   like a shadow and it is almost as elusive.

69. Apodemia palmerii marginalis (Skinner) (325 form)
   Margined Metal-mark

   We are told that marginalis is limited to Imperial Valley and
   contiguous desert areas. We record it from La Puerta Valley on the
   eastern edge of San Diego County in abundance during July.

70. Calephelis nemesis (Edwards) (334)
   Dusky Metal-mark

   We refer to Dr. Comstock as authority for the occurrence of
   nemesis only in desert or semi-desert regions. It occurs in abundance at
   San Diego along the San Diego River and in all canyons leading to it
   near the coast. The larval food plant is said to be Bebbia juncea.

71. Calephelis nemesis australis (Edwards) (334)
   Southern Metal-mark

   The habitat of this race is given as the same region as the typical
   species. We record it from La Puerta on the western edge of the
   Colorado desert, where it occurs commonly in July.

Family *LYCAENIDAE*
Subfamily *THECLINAE*

72. **Habrodais grunus** (Boisduval) (338)

   **Boisduval’s Hair-streak**

   A rather somber-colored butterfly frequenting oak bushes in the live oak district. At times there are veritable swarms of them. The writer has seen them at Cuyamaca Lake in immense numbers, fluttering about the low live oak bushes.

73. **Atlides halesus** (Cramer) (339)

   **Great Purple Hair-streak**

   We have records of this beauty from the vicinity of Jacumba and in the Laguna Mountains. It is said to be more plentiful on the edge of the desert about water-holes. At best it is never abundant in this locality.

74. **Strymon columella** (Fabricius) (350)

   **Columella Hair-streak**

   Only a few examples of this modest little Hair-streak have ever been taken here. It is considered a rare catch.

75. **Strymon leda** (Edwards) (354)

   **Leda Hair-streak**

   The writer has taken this beauty in the summer and in the fall. A fine series from the Laguna Mountains taken in August and at least one specimen in the City of San Diego (Mahogany Canyon) in October. It is never abundant.

76. **Strymon leda ines** (Edwards) (354a)

   **Ines Hair-streak**

   Our records for *ines* in this County are confined to the vicinity of Jacumba in July, 1906. A small series was taken at that time and place about the cat’s claw trees (*Acacia greggii*).

77. **Strymon melinus** Hubner (357)

   **Common Hair-streak**

   Everywhere a common insect. We have examples taken at all elevations within the County and at all seasons.
78. *Strymon californica* (Edwards) (365)

**California Hair-streak**

A very common butterfly in the foothills and mountains from June to August. We have found it most common about the flowers of milkweed. It is easily taken and easily recognized.

79. *Strymon sylvinus* (Boisduval) (367)

**Sylvan Hair-streak**

The Sylvan Hair-streak will be found most commonly in association with willows along watercourses or in adjacent canyons. It is often called *dryope* when compared with illustrations in "Butterflies of the West Coast," but it has been observed that *dryope* occurs only in central and northern California.  

80. *Strymon auretorum spadix* (Henry Edwards) (373a)

**Nut-brown Hair-streak**

A large series of this interesting and comparatively rare species fell to my net at Cuyamaca Lake some years ago. It is said to be found only on rare occasions and at widely separated places. June and July may produce them for the conscientious collector.

81. *Strymon adenostomatis* (Henry Edwards) (374)

**Gray Hair-streak**

This might well be called the Chaparral Hair-streak, since its principal place of abode is the so-called Elfin Forest. Very common everywhere in San Diego County.

82. *Strymon saepium chlorophora* Watson & W. P. Comstock (375 form)

**Purplish-brown Hair-streak**

This species is found in association with the previous species and is very common throughout our district from tide-water to mountain top during June and July. Almost any patch of dodder, if in bloom, will yield them in abundance.

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83. **Mitoura spinetorum cuyamaca** W. S. Wright (377)

**Cuyamaca Hair-streak**

While Barnes and Benjamin have reduced this form to synonymy we are still of the opinion that it is a good race, since it is the only race taken in this region. Typical *spinetorum* has never been recorded from this County. Rather abundant in its season on Laguna Mountains, and has been taken at Julian and Cuyamaca Lake.

84. **Mitoura nelsoni** (Boisduval) (379)

**Nelson’s Hair-streak**

Three specimens from Cuyapipe Canyon, Laguna Mountains, and a small series from Palomar, all taken in June, seem to be this species. I have seen no others from this locality, but there seems to be no reason why the species, or a form of it, should not be found here.

85. **Mitoura nelsoni** ab. exoleta (Henry Edwards) (379ab.)

A small series answering to the description of aberration *exoleta*, a variety in which the whole lower surface of the wings is immaculate and of a “dull chestnut brown” color, has been taken on Palomar Mountain.

86. **Mitoura loki** (Skinner) (383)

**Skinner’s Hair-streak**

*Loki* is probably closely allied to *M. siva* or is a form of that species. It occurs only in the juniper belt from Jacumba, the type locality, northward. Not very plentiful in this County. The type was taken in July, but the season probably begins about the middle of June.

87. **Incisalia iroides** (Boisduval) (385)

**Western Elfin**

This is one of the earliest butterflies in San Diego County. I have taken them near the coast as early as February. They are usually fairly abundant in the mountains in June.

88. **Incisalia eryphon** (Boisduval) (392)

**Western Banded Elfin**

It has never been my privilege to take a specimen of this species.
but my friend, George H. Field, tells me it has been taken on the Laguna Mountains in recent years. As the larval food-plant is believed to be pine, and there is a decided pine belt on these and other mountains in the County, it should be taken here.

89. Callophrys dumetorum (Boisduval) (394)

Bramble Hair-streak

On hillsides and low elevations dumetorum makes its appearance rather early—March and April. Its rather slow habit of flying makes it easy of capture. It has been taken abundantly on the slopes toward the sea on Point Loma and on the hill tops farther east, at least to Flynn Springs.

90. Callophrys dumetorum perplexa Barnes & Benjamin (394a)

Perplexing Hair-streak

This is a race of the preceding species and is found to be quite common about the City. It will be known by the entire absence of white spots on the under side of the wings or by simply a suggestion of the spots on the secondaries.

Subfamily CHRYSOPHANINAE

91. Tharsalea virginiensis (Edwards) (403)

Nevada Copper

Specimens in the collection of the San Diego Society of Natural History taken near Jacumba, San Diego County, and a series in the collection of George H. Field, taken at Warner’s Hot Springs, are undoubtedly virginiensis. This note will extend the range of this species as the latest published records state that it occurs from “northeastern California to Colorado.” The larval food plant is known to be wild currant and gooseberry both of which are common in this County.

92. Tharsalea hermes (Edwards) (404)

Hermes Copper

In late May, all of June and early July, the canyons leading into

Mission Valley near San Diego are inhabited by a number of very interesting species, among them *hermes*. Its beautiful combination of brown and yellow makes it a veritable fairy and gives untold joy to the collector fortunate enough to get one. Its trysting places are being rapidly taken over by realtors and the species may soon become extinct, unless colonies yet undiscovered are located in other regions. I am told that Chris. Henne, of Los Angeles County, captured specimens in the vicinity of Ensenada, Mexico, which seems to indicate that we are on the northern extremity of its range.

93. **Heodes gorgon** (Boisduval)  (405)

**Gorgon Copper**

While *gorgon* is reputed to be of State-wide distribution and has been taken in this County, it is apparently quite rare here. Some years ago it was known to be established in the Morena Dam region, but not in anything like large numbers. It was taken then in association with the next species.

94. **Heodes xanthoides** (Boisduval)  (407)

**Great Copper**

Very common throughout the foothills and mountain districts. Every meadow will produce them in considerable numbers.

95. **Heodes helloides** (Boisduval)  (412)

**Purplish Copper**

Almost any moist meadow land from sea coast to mountain top has a colony of *helloides*. It is easily captured and may usually be taken in large numbers.

Subfamily *LYCAENINAE*

96. **Leptotes marina** (Reakirt)  (421)

**Marine Blue**

A very dainty little creature, rather difficult to capture because of its swift, darting flight. It is partial to the bloom of alfalfa and the common deerweed (*Lotus scoparius*) and is to be found everywhere within our region.
97. Brephidium exilis (Boisduval) (422)

Pigmy Blue

This is said to be the smallest American butterfly. It may be
found throughout the County wherever the so-called Australian salt
grass (*Atriplex semi-baccata*) is to be found. Very abundant along the
bay shores and on hillsides and mesas throughout the City and County.

98. Brephidium exilis ab. coolidgei Gunder (422 ab.)

Coolidge’s Aberrant Blue

A single specimen of *exilis* is in the collection of the San Diego
Society of Natural History, in which the characteristic marks of the
typical species are absent in large measure. Above, the specimen has the
same appearance as *B. exilis*, but beneath, practically all the marks are
either absent altogether or greatly accented.

On the primaries beneath, the terminal line of white spots is much
more conspicuous than in the type. The rest of the wing is the same as
that of the typical species in general color, but the white cross lines and
strigations are entirely absent. On the underside of the secondaries the
marginal row of black spots is reduced from six in number to four and
the white band in which they are situated is much wider and more
brilliant. The three black dots near the base of the wing are trans-
formed into three black dashes, broad and conspicuous, lying parallel
with the veins, no other marks appearing. J. D. Gunder has called this
form aberration *coolidgei*.

99. Hemiargus gyas (Edwards) (426)

Edwards’ Blue

During June, 1926, the writer took large numbers of this Blue
in the meadows about Laguna Lake, Laguna Mountains. It was the
most plentiful species present at the time. The species occurs everywhere
in the County.

100. Hemiargus isola (Reakirt) (428)

Reakirt’s Blue

George H. Field reports this species as occurring in Jacumba in
July.

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101. *Everes amyntula* (Boisduval) (430)
*Western Tailed Blue*

This is the only Blue in this region that sports a tail on the secondaries. Wherever the so-called loco weed (*Astragalus leucopsis*) is found, there *amyntula* plays in its season.

102. *Plebejus melissa* (Edwards) (432)
*Orange-margined Blue*

In the female of this species both wings are margined with a line of orange-colored lunules joined to form a continuous band. This band is also present as a line of spots on the underside of the wings in both sexes. It is very common in low places where vetch grows; also sweet clover is very attractive to it. In 1902 a colony was discovered in an area now covered by the waters of Morena Reservoir, in which the individuals were so numerous that in the cool of evening they hung on the grass like azure pendants.

103. *Plebejus saepiolus* (Boisduval) (435)
*Greenish Blue*

*Saepiolus* occurs on Palomar Mountain at Bailey’s and, in its season, could probably be taken in some numbers. The species has many variants. The specimens under consideration may prove to be form *hilda*.

104. *Plebejus saepiolus rufescens* (Boisduval) (435 form)
*Rufescent Blue*

This is a dark female form of *saepiolus* and is rare. Only one specimen of record has ever been taken in this County, on Palomar Mountain several years ago. However, it is likely to occur at any time wherever *saepiolus* is found.

105. *Plebejus saepiolus hilda* (Grinnell) (435b)
*Hilda Blue*

A relatively rare race found only in the southern part of California at high elevations. Palomar Mountain produced the specimens in the collection of the San Diego Society of Natural History and they were taken at Bailey’s in July.
106. **Plebejus icarioides** ab. **daedalus** (Behr) (438 ab.)  
**Daedalus Blue**  
A comparatively rare form of the typical species. The writer has taken it at Dulzura. It is very likely that it may occur through the higher elevations in this County.

107. **Plebejus icarioides evius** (Boisduval) (438b)  
**Evius Blue**  
Frequently found in the mountains in considerable numbers. Very plentiful on the Lagunas during June, 1926, where it was found frequently on the blooms of the lupine.

108. **Plebejus pheres** (Boisduval) (440)  
**Pheres Blue**  
Examples are in the collection of George H. Field bearing *pheres* label that were taken on Cuyamaca Mountain in the vicinity of Cuyamaca Lake.

109. **Plebejus acmon** (Westwood & Hewitson) (442)  
**Acmon Blue**  
One of the earliest and latest of our Blues. Abundant everywhere. Has many varieties due to elevation, flora and climate.

110. **Plebejus acmon cottlei** (Grinnell) (442a)  
**Cottle's Blue**  
This is a spring form of *acmon* in which the orange band on the secondaries is somewhat wider than in typical *acmon* and the blue of the upperside is richer in tint. The ground color beneath is a darker grey than in typical *acmon*. A series from near Henshaw Dam taken in early spring is thus designated.

111. **Plebejus acmon** ab. **kelseyi** W.S. Wright new aberration  
**Kelsey's Blue**  
The description of aberrations we believe is not to be encouraged to any great extent, but when a form appears that seemingly has no explainable reason for being, one feels fairly safe in adding a new name. Such is the case here.
The specimen under consideration was taken along with a large series of perfectly normal examples. It has an expanse of only 16.5 mm. In color above, it is a normal male with only a trace of the orange red color on the secondaries (probably due to the remarkably small size) and with the black spots much reduced. Beneath, all wings are light gray and immaculate but for a normal row of black dots near the margin, a discal, elongated transverse dash and the apical dot on primaries twinned. The row of dots on the secondaries is normal, with supplementary minute dots in the space between veins 4 and 5 and at the apex. The most prominent feature of this form is the immaculism of the underside of the wings. The form approaches labecula Watson and W. P. Comstock, an aberration of cottlei.

I have given it the name of kelseyi as a courtesy to my friend, Prof. F. W. Kelsey, who has presented me with many interesting specimens in all orders.

112. **Plebejus monticola** (Clemence) (444)

**Clemence’s Blue**

Dr. J. A. Comstock makes this species a form of acmon, but I am holding to the classification of Barnes and Benjamin. It is fairly common in the higher elevations throughout the County, characterized by large size and lustrous quality of the blue. An interesting capture at any time.

113. **Philotes battoides bernardino** Barnes & McDunnough (448b)

**San Bernardino Blue**

*Bernardino* is very common throughout the County during June and July. It is fond of the flowers of the wild buckwheat (*Eriogonum*). There seem to be several local varieties, some of which may deserve names when further collections bring enough specimens together to render close study possible.

114. **Philotes sonorensis** (Felder and Felder) (454)

**Sonora Blue**

Not a common insect in this County although, when located, a colony may consist of many hundreds of individuals. Point Loma, in the vicinity of the Bennington Monument, supports a colony, and other
smaller ones are to be found at La Jolla and near Encanto. It is an exquisite little insect and may be considered a prize well worth a long, hard trip.

115. Phaedrotes piasus (Boisduval) (455)
   **Arrow-head Blue**

   “Butterflies of the West Coast” figures this species as *sagittigera* and it doubtless rests in many collections under this name. The only records for this County are from a point about three miles west of Henshaw Dam, in the San Luis Rey River Valley, where it was found feeding on a species of lupine.

116. Glaucopsyche lygdamus australis Grinnell (456e)
   **Southern Blue**

   This beautiful insect may usually be found in March in the canyons near San Diego. The males are deep blue above, the females more or less dark brown on the outer third of the wings. Beneath they are gray, with a series of small black spots encircled with white. It is also common among the foothills in early spring.

   **SUPERFAMILY HESPERIOIDEA**
   **Family HESPERIIDAE**
   **Subfamily URBANINAE**

117. Polygonus lividus arizonensis (Skinner) (464a)
   **Skinner’s Arizona Skipper**

   John C. Fortiner has three specimens of this interesting species taken several years ago on lantana bushes in Balboa Park, San Diego. We have never seen it in this County, but there is no reason why it should not occur in abundance.

118. Epargyreus tityrus (Fabricius) (467)
   **Silver-spotted Skipper**

   Rather rare in this County but has been taken in the City and at Henshaw Dam. It is a rapid flier and difficult to capture.
119. **Goniurus proteus** (Linnaeus) (469)

**LONG-TAILED SKIPPER**

*Proteus* makes its appearance in the City periodically. It is common about gardens when it is to be found. Never abundant. The larvae feed on beans, hence it may be of economic importance.

120. **Thorybes mexicana** (Herrick-Schaeffer) (488)

**MEXICAN DUSKY-WING**

A fairly good series of this Skipper was taken on Laguna Mountains during June, 1926. It is probably found also in other places of similar elevation.

121. **Urbanus ruralis** (Boisduval) (498)

**TWO-BANDED SKIPPER**

One specimen taken on Palomar Mountain in July seems to represent this species. It is, however, somewhat lighter in color than more northerly captures.

122. **Urbanus tessellata occidentalis** (Skinner) (503a)

**WESTERN CHECKERED SKIPPER**

A very common Skipper occurring throughout the County from tide-water to mountain top at all times of the year except during the winter months.

123. **Urbanus ericetorum** (Boisduval) (505)

**LARGE WHITE SKIPPER**

While the collector naturally looks for this active fellow only in the higher altitudes of the County, it is not uncommon at sea level. There has been a considerable colony in Mahogany Canyon on the eastern edge of the City for a number of years.

124. **Antigonus pulverulenta** (R. Felder) (509)

**POWDERED SKIPPER**

Frank Stephens has taken examples of this species at La Puerta on the western edge of the desert in March. Not common at any point where known.
125. **Pholisora libya** (Scudder) (512)  
**Mojave Sooty-wing**

It is not uncommon to take *libya* during March on the edge of the desert. La Puerta is a good place to look for it.

126. **Pholisora catullus** (Fabricius) (513)  
**Sooty-wing**

A few specimens were taken at the west entrance to San Felipe Rancho in the early spring of 1926. This is a very widely distributed species, occurring in practically all temperate regions of North America.

127. **Erynnis lacustra** (W. G. Wright) (526)  
**Wright’s Dusky-wing**

John C. Fortiner tells me he has taken *lacustra* in some numbers on the Laguna Mountains at an elevation of approximately 6000 ft. Dr. J. A. Comstock states in “Butterflies of California” that it is recorded from widely separated areas of high altitudes in the south; so it should occur here.

128. **Erynnis persius afranius** (Lintner) (528a)  
**Afranius Dusky-wing**

Very abundant in the higher altitudes about damp locations. Occurs sparingly in the vicinity of San Diego, principally in Mission Valley.

129. **Erynnis juvenalis** (Fabricius) (531)  
**Juvenal’s Dusky-wing**

Dr. Comstock states, in “Butterflies of California,” that there is some doubt as to the occurrence of *juvenalis* in California, but the writer has taken it (identified by the late Dr. Henry Skinner) in almost every association in San Diego County.

130. **Erynnis propertius** (Scudder & Burgess) (532)  
**Propertius Dusky-wing**

The Dusky-wings are very difficult to separate, so that microscopic anatomical diagnosis is almost necessary for correct determination. A
long series of the previous species is sure to show some individuals that answer to the description of the present one, so it is included here. George H. Field has it from Volcan Mountain taken in July and identified by the late Dr. Henry Skinner.

131. Erynnis tristis (Boisduval) (538)
Mournful Dusky-wing

We have made no microscopic anatomical studies among the Skippers, hence no positive identifications are given. San Diego County is included in the general region inhabited by tristis, and we have examples that answer in a superficial way, at least, to this species, so it is here included.

132. Erynnis funeralis (Scudder & Burgess) (539)
Funereal Dusky-wing

The species of Dusky-wing having a white fringe on the secondaries that is taken in San Diego and immediate vicinity is undoubtedly funeralis. It is fairly abundant from early spring to late summer.

Subfamily HESPERIINAE

133. Copaeodes aurantiaca (Hewitson) (552)
Hewitson’s Skipper

It is said that this species frequents the desert areas, but it may be found almost anywhere in the County. Specimens have been taken at tide-water and also at an elevation of 6000 ft. It is not common anywhere.

134. Pseudocopaeodes eunus (Edwards) (554)
Eunus Skipper

A colony of this species exists at Jacumba and may be taken there during July and August. Specimens in our collection were collected by J. D. Gunder on a species of aster growing in a meadow close to the international boundary. The writer took a single specimen in the same locality the year following Mr. Gunder’s captures. Probably a very rare species in this County.
135. Hesperia columbia (Scudder) (565)

Columbia Skipper

George H. Field obtained examples of this species from San Miguel Mountain, April 15, 1914. The collection was made near Cockatoo Grove.

136. Hesperia juba (Scudder) (569)

Juba Skipper

This species, together with other near relatives, is a puzzle to the amateur and likely to give a lot of trouble. Examples in the collection of George H. Field have been given this name by experts, so we include it in our list. It is a common resident of the higher altitudes in July.

137. Hesperia viridis (Edwards) (571)

Green Skipper

This is in the same class with the preceding species and may give some difficulty in identification. However, it is common in the Laguna Mountains and should be found at all similar elevations throughout the County.

138. Hylephila phylaeus (Drury) (582)

Fiery Skipper

In San Diego this is the most abundant of all the Skippers. Every grass patch teems with them during the summer.

139. Ochlodes sylvanoides (Boisduval) (583)

Woodland Skipper

We have a very good series taken on the Laguna Mountains during June, 1926, and there is no doubt that it occurs on the mountains and higher hills to the north as well. A single specimen was captured in Balboa Park in 1928.

140. Ochlodes nemorum (Boisduval) (584)

Forest Skipper

Nemorum occurs in the same association as the preceding species and has been taken in the City of San Diego.
141. *Polites sabuleti* (Boisduval) (596)

**San Diego Skipper**

A very common Skipper on lawns throughout the City and in grassy spots in canyons leading into Mission Valley. It probably occurs in favorable localities in the back country.

142. *Polites sabuleti comstocki* Gunder (596b)

**Desert San Diego Skipper**

To quote from “Butterflies of California” by Dr. John Adams Comstock: This is “a desert race of *sabuleti*. In this form the spots and light yellow streaks on the underside of the secondaries are so faint as to give the appearance of a clear yellow surface.” Mr. Gunder tells me that he has taken it at Jacumba in this County.

143. *Atalopedes campestris* (Boisduval) (599)

**Field Skipper**

The males of this species are distinguished by the presence of a large oval black gland on the disk of the primaries. Common about low, swampy places in the mountains.

144. *Atrytone vestris* (Boisduval) (605)

**Dun Skipper**

A specimen of this species rests in George H. Field's collection, having been captured at the “head of Potrero grade,” near Potrero.

145. *Lerodea eufala* (Edwards) (650)

**Eufala Skipper**

This species has been recorded from San Diego County at the foot of Cottonwood grade. More plentiful along the edge of the desert.

146. *Prenes errans* (Skinner) (658)

**Wandering Skipper**

A very common Skipper along the water-front from San Diego to San Onofre in July and August.

**Family MEGATHYMIDAE**

147. *Megathymus yuccae navajo* Skinner (660b)

**Navajo Skipper**

A race of *M. yuccae* has been taken sparingly in Mahogany Can-
yon on the eastern edge of the City and it may occur in other parts of the County, since its food plant—one of the yuccas—is abundant throughout this region. We believe this to be the race navajo.

148. **Megathymus stephensi** Skinner (669)

**Stephens’ Skipper**

A rare butterfly in collections, but rather abundant in its habitat near La Puerta on the edge of the desert. It is on the wing from July to October and is very difficult to capture because of its rapid, darting flight.

**SPECIES AND FORMS OF POSSIBLE OCCURRENCE**

**BUT NOT YET OF RECORD**

**Pieris rapae novangliae** (Scudder) (38ab.)

**Tinted Cabbage White**

While this form has never been recorded from California it may appear at any time in our higher altitudes. Specimens that approach it in depth of the yellow tinting on the upper surface have been taken in this County.

**Euchloe creusa lotta** Beutenmuller (40c)

**Southern Marble**

This form has been reported from the Coachella Valley and it would seem that it might occur in similar habitat in the northeastern part of this County.

**Cercyonis silvestris paulus** (Edwards) (116a)

**Little Satyr**

The dominant *Cercyonis* in this region is *silvestris*, but through errors in identification years ago, it has been rather widely distributed as *paulus*, which is only a race of *silvestris* and is said not to occur here. Specimens approaching this race may be taken in this County.

**Euptoieta hegesia** (Cramer) (150)

**Mexican Fritillary**

This is a Mexican species and has never been taken in California. However, our proximity to the border makes for many possibilities, so that collectors should be on the lookout for it.
Euphydryas chalcedona (Doubleday & Hewitson) (204)

- ab. fusimacula (Barnes)
- ab. suprafusa J. A. Comstock
- ab. fusisecunda J. A. Comstock
- ab. mariana (Barnes)
- ab. supranigrella J. A. Comstock
- ab. hemimelanica J. A. Comstock
- ab. omniluteofuscus Gunder
- ab. hemiluteofuscus Gunder

All of the above named aberrations of the Chalcedon Checker-spot have been given appropriate English names by Dr. J. A. Comstock in his recent book. No localities are given for their occurrence but, since the typical species is common in this County and since its habitat here is subject to temperature and altitudinal changes that are likely to produce such varied forms in a species so plastic as chalcedona, we may expect to find one or more of these aberrations here at any time.

Euphydryas quino augusta (Edwards) (209)

**AUGUSTA CHECKER-Spot**

For many years the *editha* of this County was known and distributed as *augusta*, but recent publications have restricted the latter to the San Bernardino region. However, we have a feeling that close collecting in the higher altitudes bordering the desert may reveal a colony of this comparatively rare form.

Melitaea gabbii (Behr) (225)

- ab. newcombi (J. A. Comstock)
- ab. gunderi (J. A. Comstock)
- ab. pasadenae (Gunder)

None of these aberrations have so far been taken in this County, but there is reason to believe that one or more of them may turn up at any time, since *gabbii* is one of the most abundant Checker-spots found here.

Melitaea leanira wrightii (Edwards) (237)

- ab. cerrita (W. G. Wright)
- ab. carolynae (Gunder)

These two aberrations of Wright's Checker-spot may occur at any time, so collectors should be on the lookout for them.
Phyciodes campestris (Behr) (253)

Field Crescent

According to Dr. J. A. Comstock this species occurs in all parts of the State, hence it should occur here. Collectors are asked to keep a sharp lookout for examples in moist mountain meadows.

Chlosyne lacinia (Geyer) (265)

Bordered Patch

Dr. Comstock tells us that this species does not occur in typical form north of the Mexican line. The specimens that are occasionally taken in Imperial Valley and adjacent desert areas are probably C. l. adjutrix Scudder. Crocale has been taken at La Puerta and since the species is a very plastic one, lacinia itself might occur on the eastern edge of the County. The following color forms are also likely to occur—rufescens (Edwards) and nigrescens (Cockerell).

Chlosyne californica ab. chinoi Gunder (266 ab.)

Chino Patch

This form was collected at Palm Springs not very far north of San Diego County and might also occur in this County, since similar conditions prevail in the northeast corner.

Libythea bachmanii Kirtland (323)

Snout Butterfly

Not yet recorded from this County, but has been taken in Imperial County and may be discovered in the Laguna Mountain district.

Apodemia mormo (Felder and Felder) (324)

Mormon Metal-mark

At least one good race of this species has been recorded in this County—virgulti (Behr)—and there are two more that may turn up at any time, namely: mejicanus (Behr), near the Mexican border, and deserti Barnes & McDunnough in the desert areas on the eastern edge of the County.

Strymon saepium (Boisduval) (375)

Hedge-row Hair-streak

At least two good forms of this species have been recorded.17

Chlorophora Watson & W. P. Comstock is known to occur here and, while there are no definite records of the typical species in this region, there seems to be no good reason why it should not be found. The form fulvescens (Henry Edwards) may also occur here. The points of difference are well shown on Plate 49 of Comstock's "Butterflies of California."

Mitoura siva juniperaria J. A. Comstock (380a)  
**Juniper Hair-streak**

Specimens approaching this race have been taken in the juniper belt and there seem to be possibilities worth investigation along the eastern edge of the County.

Tharsalea arota (Boisduval) (402)  
**Arota Copper**

*Arota* is found in practically all parts of the State and should be found here. If it is, it may prove to be the race *T. nubila* J. A. Comstock, which is described as the southern form of *Arota*.

Heodes xanthoides luctuosa (Watson & W. P. Comstock) (407 form)  
**Mourning-garbed Copper**

While this race was named from specimens collected in the central part of the State—Tehachapi Pass—it may also occur in the higher altitudes of San Diego County.

Philotes sonorensis ab. sonoralba Watson & W. P. Comstock (454ab.)  

Philotes sonorensis comstocki Gunder (454 form)  
Both these insects are likely to occur here. The variations from typical *sonorensis* are well shown in figures on Plate 56, "Butterflies of California," Comstock.

Poanes melane (Edwards) (617)  
**Umber Skipper**

Further collecting in the wooded areas of the County may produce this species. It is known to be common in parts of southern California.
<table>
<thead>
<tr>
<th>Volume</th>
<th>Date</th>
<th>Pages</th>
<th>Price</th>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>I, No. 1</td>
<td>1905</td>
<td>1-25</td>
<td>$0.50</td>
<td>Life Areas of California</td>
<td>by Frank Stephens</td>
</tr>
<tr>
<td>I, No. 2</td>
<td>1907</td>
<td>25-83</td>
<td>Not available</td>
<td>Mollusks and Brachiopods Collected in San Diego, Calif.</td>
<td>by A. W. Vogdes</td>
</tr>
<tr>
<td>I, No. 3</td>
<td>1911</td>
<td>83-113</td>
<td>$0.50</td>
<td>The Genus Haliotis</td>
<td>by Henry Hemphill</td>
</tr>
<tr>
<td>II, No. 1</td>
<td>Nov., 1914</td>
<td>1-60</td>
<td>$0.60</td>
<td>A Preliminary List of the Hemiptera of San Diego County, California</td>
<td>by E. P. Van Duzee</td>
</tr>
<tr>
<td>II, No. 2</td>
<td>1916</td>
<td>61-76</td>
<td>$0.25</td>
<td>The Variation Exhibited by Ancistrodon halys (Pallas), A Pit-Viper Inhabiting the Far East</td>
<td>by Joseph C. Thompson</td>
</tr>
<tr>
<td>II, No. 3</td>
<td>1916</td>
<td>77-102</td>
<td>$0.25</td>
<td>Annotated List of the Birds of San Diego County, California</td>
<td>by Frank Stephens</td>
</tr>
<tr>
<td>III, No. 1</td>
<td>July 20, 1917</td>
<td>1-142</td>
<td>$1.40</td>
<td>Palaeozoic Crustacea—The publications and notes on the genera and species during the past twenty years, 1895-1917</td>
<td>by Anthony Wayne Vogdes</td>
</tr>
<tr>
<td>III, No. 2</td>
<td>Feb. 15, 1919</td>
<td>1-40</td>
<td>$0.40</td>
<td>An Annotated List of the Birds of San Diego County, California</td>
<td>by Frank Stephens</td>
</tr>
<tr>
<td>III, No. 3</td>
<td>April 20, 1921</td>
<td>41-56</td>
<td>$0.25</td>
<td>An Annotated List of the Mammals of San Diego County, California</td>
<td>by Frank Stephens</td>
</tr>
<tr>
<td>III, No. 4</td>
<td>April 20, 1921</td>
<td>57-69</td>
<td>$0.25</td>
<td>An Annotated List of the Amphibians and Reptiles of San Diego County, California</td>
<td>by Frank Stephens</td>
</tr>
<tr>
<td>IV, No. 1</td>
<td>1924</td>
<td>1-158, plates 1, 2</td>
<td>$1.60</td>
<td>Palaeozoic Crustacea. Part I—Bibliography of Palaeozoic Crustacea, Part II—List of the Genera and Subgenera of the Trilobita, Part III—Historical Summary of the Ordovician Genus Cybele Loven</td>
<td>by Anthony Wayne Vogdes</td>
</tr>
<tr>
<td>V, No. 1</td>
<td>February 20, 1927</td>
<td>1-10, plate 1</td>
<td>$0.25</td>
<td>A Discussion of the Zonal Status of the Sierra San Pedro Martir, Lower California, Mexico, with Descriptions of a New Kangaroo Rat and a New Woodpecker from that Region</td>
<td>by Laurence M. Huey</td>
</tr>
<tr>
<td>V, No. 2</td>
<td>July 14, 1927</td>
<td>11-40, plates 2, 3</td>
<td>$0.35</td>
<td>Birds Recorded in Spring at San Felipe, Northeastern Lower California, Mexico, with the Description of a New Woodpecker from that Locality</td>
<td>by Laurence M. Huey</td>
</tr>
<tr>
<td>V, No. 3</td>
<td>March 15, 1927</td>
<td>41-44</td>
<td>$0.15</td>
<td>Two New Geometridae from San Diego County, California</td>
<td>by William S. Wright</td>
</tr>
</tbody>
</table>
Foraminifera from the Eocene near San Diego, California. 
........................................................................................................................................by Joseph A. Cushman and Marcus A. Hanna

A New Kangaroo Rat and a New Brush Rabbit from Lower California, Mexico. 
........................................................................................................................................by Laurence M. Huey

Late Tertiary and Quaternary Elphidiums of the West Coast of North America. 
........................................................................................................................................by Joseph A. Cushman and U. S. Grant, IV.

A New Louisiana Heron and a New Round-tailed Ground Squirrel from Lower California, Mexico. 
........................................................................................................................................by Laurence M. Huey

A New Silky Pocket Mouse and a New Pocket Gopher from Lower California, Mexico. 
........................................................................................................................................by Laurence M. Huey

West Coast Species of Hinnites. 
........................................................................................................................................by Hoyt Rodney Gale

Notes on the Vaqueros and Temblor Formations of the California Miocene with Descriptions of New Species. 
........................................................................................................................................by Lionel William Wiedey

The Trimorphodon (Lyre Snake) of California, with Notes on the Species of the Adjacent Areas. 
........................................................................................................................................by Laurence M. Klauber

A New Echinoid from the California Eocene. 
........................................................................................................................................by Hubert G. Schenck

A New Fox from the Cape Region of Lower California, Mexico. 
........................................................................................................................................by Laurence M. Huey

Discocyclina in California. 
........................................................................................................................................by Hubert G. Schenck

A New Pocket Gopher and a New Antelope Ground Squirrel from Lower California, Mexico. 
........................................................................................................................................by Laurence M. Huey

Notes on the Marine Pleistocene Deposits of San Diego County, California. 
........................................................................................................................................by Frank Stephens

A New Miocene Echinoid from California. 
........................................................................................................................................by Hubert Lyman Clark

Loliolopsis Chiroctes, a New Genus and Species of Squid from the Gulf of California. 
........................................................................................................................................by S. Stillman Berry

A New Pacific Race of Gull-Billed Tern. 
........................................................................................................................................by Griffing Bancroft

Fossil Diatoms Dredged from Bering Sea. 
........................................................................................................................................by G. Dallas Hanna

An Annotated List of the Butterflies of San Diego County, California. 
........................................................................................................................................by William S. Wright

Tertiary Foraminifera From Humboldt County, California. A Preliminary Survey of the Fauna. 
........................................................................................................................................by Joseph A. Cushman and Roscoe E. and Katherine C. Stewart

New and Renamed Subspecies of Crotalus Confluens Say, With Remarks on Related Species. 
........................................................................................................................................by Laurence M. Klauber
TRANSACTIONS

OF THE

SAN DIEGO SOCIETY OF NATURAL HISTORY

Volume VI, No. 2, pp. 41-94, plates 1-8, chart

TERTIARY FORAMINIFERA FROM HUMBOLDT COUNTY, CALIFORNIA
A Preliminary Survey of the Fauna

BY
JOSEPH A. CUSHMAN
Cushman Laboratory for Foraminiferal Research
AND
ROSCOE E. & KATHERINE C. STEWART
Ventura, California

SAN DIEGO, CALIFORNIA
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CLINTON G. ABBOTT, Editor
TERTIARY FORAMINIFERA FROM HUMBOLDT COUNTY, CALIFORNIA
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INTRODUCTION

The material for this paper represents only a small part of a large collection made by the junior authors during a six months period spent in Humboldt County during 1927 in the interests of the Chanslor-Canfield Midway Oil Company. The paper itself is a preliminary survey of the fauna from 48 scattered localities preparatory to a much more detailed and inclusive study of Humboldt County Tertiary Foraminifera which we now have in preparation.

The recorded Tertiary of Humboldt County is represented by scattered patches which lie in troughs formed by folding and faulting in beds whose age is generally considered to be not younger than Cretaceous.

The largest of these patches covers an area of some 350 square miles in the vicinity of the lower courses of the Eel and Van Duzen rivers, and extends northward from the north flank of Bear River Ridge to the northern arm of Humboldt Bay. Structurally it is a broad syncline whose axis passes approximately through the mouth of Eel River and the town of Fortuna, with perhaps some faulting and folding to the north in the vicinity of Salmon Creek, Elk River and Freshwater Creek, and to the east in the vicinity of T. 1 N., R. 2 E. Lawson applied the name "Wildcat Series" to the beds in this area due to their typical development in the Wildcat country between Ferndale and Bear River Ridge.

The remaining Tertiary patches consist of small outliers in the vicinities of Bear River, Davis Creek, Domingos Creek, McNutt Gulch, Mattole River, Redwood Creek and Briceland, South Fork of Eel River near Garberville, Hoagland Creek south of Bridgeville, Mad River,

Jacoby Creek, Big Lagoon, Prairie Creek and Gold Bluff, and at a few other places.

The samples used here were taken from the large Tertiary area first described and from the vicinities of Bear River, Domingos Creek and Redwood Creek. Quite a number of species were found in this material in addition to those which we have recorded, but they are represented by either too few or too poor specimens for satisfactory determination, or else belong to groups in which determination will have to be preceded by much more work with type material.

In order to avoid the cumbersomeness of having the names of triple authors attached to specific names, the authorship of the species named in this paper is divided as follows: *Nodosaria paretixis* Cushman & K. C. Stewart, *Bulimina subcalva* Cushman & K. C. Stewart, *Bulimina subacuminata* Cushman & R. E. Stewart, *Globorotalia crassula* Cushman & R. E. Stewart.

In the species distribution chart, inserted at page 79, the following abbreviations are used as indicated: VR—very rare, R—rare, C—common, A—abundant, VA—very abundant, Plio.—Pliocene, Mio.—Miocene. In the case of stations 34 and 35, the Pliocene age indicated by the foraminifera is questioned pending further field examination, due to the fact that these two stations appear to be stratigraphically lower than stations 36, 37, 38, 39 and 40 in the synclinal trough which marks the vicinity of the mouth of Bear River. The foraminifera suggest a fault between these two stations and the five to the south whose ages are clearly Miocene, but no such fault was noted at the time the samples were taken, although dips ranging from $60^\circ$ to $78^\circ$ were noted in Tertiary beds in the vicinity of these two stations while those measured to the south were much less. The fauna from station 48 is considered too small to justify an age determination.

The following two lists give the species which in our material are restricted to the Pliocene and Miocene respectively. In the Pliocene list those species which occur in the material from stations 34 and 35 but not in that from the five Miocene stations (36 to 40) are preceded by interrogation points pending the determination of the age status of these two stations.

Species which, in the material examined for this paper, are confined to the Pliocene:

*Cyclammina cancellata* H. B. Brady
*Textularia cf. abbreviata* d'Orbigny
Textularia flintii Cushman
Verneuilina scabra (Williamson)
Gaudryina triangularis Cushman
Clavulina communis d'Orbigny
C. communis d'Orbigny, var. pallida Cushman
Quinqueloculina akneriana d'Orbigny
Sigmoilina celata (Costa)
Robulus nikobarenis (Schwager)
Planularia sp. (Pl. 2, fig. 6)
Dentalina insecta (Schwager)
D. sp. (Pl. 2, figs. 11 & 12)
Nodosaria brevicula Schwager
N. deceptria Schwager
N. insecta Schwager
N. parexilis Cushman & K. C. Stewart
N. sp. (Pl. 3, fig. 2)
N. sp. (Pl. 3, fig. 3)
N. tosta Schwager
Glandulina laevigata d'Orbigny
Frondicularia foliacea Schwager
Lagenaria acuticosta Reuss
L. foveolata Reuss
L. hexagona (Williamson)
L. hexagona (Williamson), var. scalariformis Williamson
L. substriata Williamson
L. sulcata (Walker & Jacob)
L. williamsoni (Alcock)
Polymorphina charlottensis Cushman
Nonion umbilicatula (Montagu)
Nonionella miocenica Cushman
Elphidium hannai Cushman & Grant
E. hughesi Cushman & Grant
E. oregonense Cushman & Grant
Plectofrondicularia californica Cushman & R. E. Stewart
(?) Nodogenerina lepidula (Schwager)
Buliminella elegantissima (d'Orbigny)
Bulimina inflata Seguenza
B. pagoda Cushman
B. rostrata H. B. Brady (?)
(?) B. subacuminata Cushman & R. E. Stewart
B. subcalva Cushman & K. C. Stewart
Bolivina subadvena Cushman
B. subadvena Cushman, var. spissa Cushman
Uvigerina peregrina Cushman
U. peregrina Cushman, var. bradyana Cushman
U. proboscidea Schwager
U. senticosa Cushman

Angulogerina carinata Cushman
A. hughesi (Galloway & Wissler)

Ellipsolagena apiculata (Reuss)

Valvulineria araucana (d'Orbigny)
Gyroidina soldanii d'Orbigny
Eponides ornata (d'Orbigny)
E. peruviana (d'Orbigny)
E. tenera (H. B. Brady)

Cassidulina californica Cushman & Hughes
C. corbyi Cushman & Hughes

Ehrenbergina compressa Cushman
Pullenia bulloides (d'Orbigny)
Sphaeroidina bulloides d'Orbigny
Globigerina inflata d'Orbigny
G. conglomerata Schwager

Orbulina universa d'Orbigny, var.
Globorotalia crassula Cushman & R. E. Stewart

Planulina ornata (d'Orbigny)
Cibicides cicatricosa (Schwager)

Species which, in the material examined for this paper, are confined to the Miocene:

Robulus americanus Cushman, var. spinosus Cushman
Nodosaria koina Schwager
Nonion incisa (Cushman)
Plectofrondicularia miocenica Cushman
Bulimina pseudotorta Cushman
Bolivina advena Cushman
B. imbricata Cushman
Uvigerinella californica Cushman, var. ornata Cushman
Siphogenerina branneri (Bagg)
S. hughesi Cushman
Pulvinulinella subperuviana Cushman

The maps generally available for geological work in Humboldt County are not as good as might be desired, but several furnished by Mr. Frank E. Herrick of Eureka from his personal files give parts of the country in excellent detail, and the Tactical Maps and Progressive Military Maps of the Corps of Engineers, U. S. Army, and Belcher's
Pocket Map of Humboldt County, California, Belcher Abstract and Title Company, Eureka, California, proved exceedingly helpful.

A partial list of published literature bearing upon the Humboldt County Tertiary follows:


Hoots, H. W., Oil Possibilities and Survey of Oil and Gas Exploration in S. W. Humboldt County, Calif., The Oil Age, vol. XXV, no. 3, Mar. 1928.

ACKNOWLEDGMENTS

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county and interested in its development, also gave valuable assistance in connection with the field work.

The careful work of Miss Margaret S. Moore in making drawings from selected specimens of most of the species, as well as that of Mr. R. P. Osborn of Redondo Beach, California, in numbering and lettering the plates and species distribution chart, is greatly appreciated.

**SAMPLED LOCALITIES**

Townships and Ranges refer to Humboldt Base and Meridian.

Sta. 1 Charley Hill Gulch (Branch of Ryan's Slough). Center of W. \( \frac{1}{2} \) sec. 5, T. 4 N., R. 1 E.

Sta. 2 Freshwater Creek 50 yds. below mouth of Cloney Gulch, sec. 3, T. 4 N., R. 1 E.

Sta. 3 Freshwater Creek just below mouth of Cloney Gulch, NW. \( \frac{1}{4} \) SE. \( \frac{1}{4} \) sec. 3, T. 4 N., R. 1 E.

Sta. 4 Freshwater Creek at swimming pool between mouths of Graham and Cloney gulches, sec. 3, T. 4 N., R. 1 E.

Sta. 5 Freshwater Creek 75 yds. upstream from mouth of Graham Gulch, SE. \( \frac{1}{4} \) sec. 3, T. 4 N., R. 1 E.

Sta. 6 Elk River, NW. \( \frac{1}{4} \) sec. 26, T. 4 N., R. 1 W.

Sta. 7 Diggings for spring near house above North Fork of Elk River about 30 yds. W. of center of sec. 30, T. 4 N., R. 1 E.

Sta. 8 North Fork of Elk River, NW. corner, NE. \( \frac{1}{4} \) sec. 32, T. 4 N., R. 1 E.

Sta. 9 South Fork of Elk River, 200 yds. downstream from Falk railroad bridge, sec. 36, T. 4 N., R. 1 W.

Sta. 10 South Fork of Elk River, 150 yds. downstream from Falk railroad bridge, sec. 36, T. 4 N., R. 1 W.

Sta. 11 South Fork of Elk River, west side of Falk mill pond, SE. \( \frac{1}{4} \) sec. 36, T. 4 N., R. 1 W.

Sta. 12 Little South Fork of Elk River, SW. \( \frac{1}{4} \) sec. 5, T. 3 N., R. 1 E.

Sta. 13 Below lighthouse at west end of Table Bluff, elev. 40', sec. 27, T. 4 N., R. 2 W.

Sta. 14 Salmon Creek near west line of NW. \( \frac{1}{4} \) sec. 10, T. 3 N., R. 1 W.

Sta. 15 Salmon Creek near center of sec. 10, T. 3 N., R. 1 W.

Sta. 16 Salmon Creek near center of NW. \( \frac{1}{4} \) sec. 14, T. 3 N., R. 1 W.

Sta. 17 Salmon Creek, SE. \( \frac{1}{4} \) SW. \( \frac{1}{4} \) sec. 13, T. 3 N., R. 1 W.

Sta. 18 Salmon Creek, SE. \( \frac{1}{4} \) SW. \( \frac{1}{4} \) sec. 13, T. 3 N., R. 1 W., about 100 yds. downstream from Sta. 17.

Sta. 19 Salmon Creek, center of sec. 13, T. 3 N., R. 1 W.
Sta. 20 Strong's Creek, about 100 yds. below fork at west side of sec. 31, T. 3 N., R. 1 E.
Sta. 21 Strong's Creek, SE. ¼ sec. 31, T. 3 N., R. 1 E.
Sta. 22 Strong's Creek, SE. ¼ sec. 31, T. 3 N., R. 1 E., 50 yds. upstream from Sta. 21.
Sta. 23 Cliffs along coast, NE. ¼ sec. 26, T. 2 N., R. 1 W.
Sta. 24 Price Creek at intersection with east line of sec. 28, T. 2 N., R. 1 W.
Sta. 25 Scotia Bluffs railroad cut above Eel River at about N. line of SE. ¼ sec. 5, T. 1 N., R. 1 E.
Sta. 26 Scotia Bluffs railroad cut about 10 ft. stratigraphically below Sta. 25.
Sta. 27 Scotia Bluffs railroad cut 120 yds. southward from Sta. 25.
Sta. 28 Scotia Bluffs railroad cut 160 yds. southward from Sta. 25.
Sta. 29 Scotia Bluffs railroad cut 200 yds. southward from Sta. 25.
Sta. 30 Scotia Bluffs railroad cut 400 yds. southward from Sta. 25.
Sta. 31 Scotia Bluffs railroad cut 425 yds. southward from Sta. 25.
Sta. 32 Van Duzen River, sec. 9, T. 1 N., R. 2 E.
Sta. 33 Van Duzen River, SW. side of Carlotta-Bridgeville highway at NW. end of bridge, north line of sec. 16, T. 1 N., R. 2 E.
Sta. 34 Small stream in sec. 11, T. 1 N., R. 3 W., 60 yds. upstream from mouth.
Sta. 35 Small stream in sec. 11, T. 1 N., R. 3 W., 100 yds. upstream from mouth.
Sta. 36 Cliffs along coast, NW. ¼ sec. 22, T. 1 N., R. 3 W.
Sta. 37 Bear River near center sec. 14, T. 1 N., R. 3 W.
Sta. 38 Bear River 10 yds. downstream from Sta. 37.
Sta. 39 Bear River near center of N. line of NW. ¼ sec. 19, T. 1 N., R. 2 W.
Sta. 40 Bear River, near center of S. line of sec. 18, T. 1 N., R. 2 W.
Sta. 41 Bear River, NW. ¼ sec. 20, T. 1 N., R. 2 W.
Sta. 42 Bear River, NE. ¼ sec. 20; T. 1 N., R. 2 W.
Sta. 43 Near mouth of South Fork of Bear River at the crossing of the road up Bear River.
Sta. 44 South Fork of Bear River, 200 yds. upstream from crossing of road up Bear River. Near line between sections 21 & 22, T. 1 N., R. 2 W.
Sta. 45 Domingos Creek, 250 yds. upstream from highway, sec. 24, T. 1 S., R. 3 W.
Sta. 46 Domingos Creek, 460 yds. upstream from highway, sec. 24, T. 1 S., R. 3 W.
Sta. 47 Domingos Creek, 475 yds. upstream from highway, sec. 24, T. 1 S., R. 3 W.
Sta. 48 Redwood Creek, near old tanbark extractor ½ mile downstream from Briceland, sec. 18, T. 4 S., R. 3 E.
LIST OF SPECIES

Family LITUOLIDAE

Subfamily Lituolinae

Genus CYCLAMMINA H. B. Brady, 1876

Cyclammina cancellata H. B. Brady

“Nautiloid Lituola” W. B. Carpenter, The Microscope, ed. 5, 1875, p. 536, figs. 274a-c.


There are a few large specimens that are similar in general characters to those already recorded from the West Coast of America in the last reference given above. The specimens are mostly white in color, and over 3 mm. in length. Some of them show evidences of crushing and distortion.

Family TEXTULARIIDAE

Subfamily Textulariinae

Genus TEXTULARIA Defrance, 1824

Textularia cf. abbreviata d’Orbigny

Plate 1, figure 3

Test short and broad, compressed; periphery acute, broadening rapidly from the pointed initial end giving a broadly triangular form in front view; chambers few, not inflated; sutures distinct, only slightly depressed; wall coarsely arenaceous but smoothly finished, apertural end flattened or even slightly concave; aperture, a narrow slit at the inner margin of the chamber.

This form has already been recorded from the West Coast of America (Cushman, Bull. Scripps Inst. Oceanography, Tech. Ser., vol. 1, 1927, p. 136). The same form is figured here. It is very close to d’Orbigny’s species.

Textularia flintii Cushman

Plate 1, figures 1 a, b

Textularia flintii Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 21, figs. 36 a, b (in text).


Test triangular in front view, irregularly rhombic in end view, rapidly increasing in size from the early portion, rather thick, but somewhat compressed laterally; chambers numerous, low and broad, inflated; sutures distinct, fairly deep; wall very finely arenaceous but smooth and shining; aperture, an elongate slit slightly above the base of the inner margin of the chamber.

This is rare in the Humboldt County material, but is identical with this species as found in other parts of the Pacific.

Family VERNEUILINIDAE

Genus VERNEUILINA d’Orbigny, 1840

Verneuilina scabra (Williamson)

Plate 1, figure 4

Bulimina scabra Williamson, Rec. Foram. Great Britain, 1858, p. 65, pl. 5, figs. 136, 137 (B. arenacea on explanation of plate).


Specimens very similar to those from the West Coast of America and recorded in the last reference above occur in the Humboldt County collections.

Genus GAUDRYINA d’Orbigny, 1839

Gaudryina triangularis Cushman

Plate 1, figure 2


Test slightly longer than broad, for the most part triangular, the angles subacute, early chambers triserially arranged, later ones biserial, few; wall coarsely arenaceous, smoothly finished; aperture, a narrow slit at the inner margin of the last-formed chamber.

The Humboldt County specimens are identical with those from off the West Coast of America.

Genus CLAVULINA d’Orbigny, 1826

Clavulina communis d’Orbigny

Plate 1, figures 5, 6


This widely distributed species occurs in typical form in the collection, identical with Recent specimens from the American West Coast.

**Clavulina communis** d'Orbigny, var. pallida Cushman

Plate 1, figures 7, 8


Test differing from the type in the more slender form and the characters of the wall which is of fine material, chalky white in color, the sutures throughout distinct and depressed.

Specimens belonging to this variety, described from Recent collections off the Western Coast of America, occur in the Humboldt County material.

**Family MILIOLIDAE**

**Genus QUINQUELOCULINA** d'Orbigny, 1826

**Quinqueloculina akneriana** d'Orbigny

Plate 2, figures 1, 2


This species described by d'Orbigny from the Vienna Basin, is very close to *Quinqueloculina seminulum* (Linné), but is somewhat shorter and more rounded.

**Genus SIGMOILINA** Schlumberger, 1887

**Sigmoidina celata** (Costa)

Plate 2, figure 3


This species is close to and perhaps identical with *S. schlumbergeri* Silvestri, but a study of the types is necessary to make clear the actual
relations of the two. The surface is finely arenaceous but the main under wall of the test calcareous and imperforate.

**Family LAGENIDAE**

**Genus** **ROBULUS** Montfort, 1808

**Robulus nikobarensis** (Schwager)

Plate 2, figures 5, 7

*Cristellaria nikobarensis* Schwager, *Novara-Exped.*, Geol. Theil., pt. 2, 1866, p. 243, pl. 6, fig. 87.

*Cristellaria polita* Schwager (not Reuss), *op. cit.*, p. 242, pl. 6, fig. 86.

*Robulus cushioni* Galloway and Wissler, *Journ. Pal.*, vol. 1, 1927, p. 51, pl. 8, fig. 11.

This is evidently a very variable species as are most of the species of this genus. As shown in the figures given here, the keel in this species is very variable, sometimes present especially in the earlier stages and in others missing. The microspheric form has more chambers in the coil and grows to a larger size as shown. The sutures may become limbate or even raised. In some specimens there is a tendency to a slight uncoiling. The species is very different from *Lenticulina rotulata* Lamarck. The specimens described as *Robulus cushioni* are identical with the Kar Nicobar ones.

**Robulus americanus** (Cushman), var. *spinosus* Cushman

Plate 8, figure 2


Test closely coiled, slightly keeled with slight spines on the periphery, composed of but six or seven chambers in the last-formed coil; sutures slightly raised and ending in a raised umbonal area, surface otherwise smooth; aperture radiate without a definite projection, the ventral slit enlarged.

**Genus** **PLANULARIA** Defrance, 1824

**Planularia** sp.?

Plate 2, figure 6

There is a single incomplete specimen here figured which is evidently a *Planularia*, but cannot be named until more specimens are available.
Genus **DENTALINA** d'Orbigny, 1826

*Dentalina insolita* (Schwager)

Plate 2, figure 10


Test elongate, tapering, slightly arcuate; chambers numerous, inflated, each much broader than long; sutures distinct, depressed; wall smooth; apertural end with a short neck.

Schwager described this species from the Pliocene of Kar Nicobar, and it is still living off shore in the Philippine region. The specimens from Humboldt County are very typical.

**Dentalina insecta** (Schwager)

Plate 2, figures 8, 9


Test elongate, straight or more usually slightly curved; chambers numerous, inflated; sutures depressed; wall smooth, proloculum with a long spinous projection placed asymmetrically; apertural end with a slight neck.

Schwager's types were from the Pliocene of Kar Nicobar. Karrer records it from the Late Tertiary of Luzon in the Philippines, Schubert from the Late Tertiary of the Bismarck Archipelago and vicinity, and Koch from the Late Tertiary of Kabu, Java. The senior author has found it to be still living in the Philippine region.

**Dentalina** sp.?

Plate 2, figures 11, 12

There are a few broken specimens of a peculiar spinose species figured here which do not give the full characters.

Genus **NODOSARIA** Lamarck, 1812

*Nodosaria deceptoria* Schwager (?)

Plate 2, figure 4

This costate species was described from the Pliocene of Kar Nicobar and recorded by Karrer from the Late Tertiary of the Philippines. The incomplete specimen figured is close to this species if not identical with it.

**Nodosaria brevicula** Schwager (?)

Plate 2, figure 16


The specimen figured does not have as large a megalospheric proloculum as does the specimen figured by Schwager, but resembles it in other characters.

**Nodosaria tosta** Schwager

Plate 3, figure 1


There are but a few incomplete specimens of this species but they seem identical with Schwager’s species from the Pliocene of Kar Nicobar. The few thin plate-like costae are usually somewhat twisted as in the type figures.

Liebus’s specimen is from the Tertiary of upper Bavaria. Koch records it from the Late Tertiary of Kabu, Java.

**Nodosaria parexilis** Cushman and K. C. Stewart, new name

Plate 2, figures 13-15

*Nodosaria exilis* Schwager (not Neugeboren), *Novara-Exped.*, Geol. Theil., pt. 2, 1866, p. 223, pl. 5, fig. 52.

There are specimens like that figured, composed of several chambers, increasing gradually in diameter and length as added, with the sutures distinct and slightly depressed, the wall entirely smooth and the initial end without a spine, which are very close to the species figured by Schwager from Kar Nicobar. It is not the same as Neugeboren’s species.

Holotype (Cushman Coll. No. 12451) from Bear River, NE ¼ sec. 20, T. 1 N., R. 2 W., Humboldt County, California.

**Nodosaria koina** Schwager

Plate 8, figure 1

Test slender, slightly curved, very gently tapering, initial end rounded; chambers numerous, ten or more, inflated, gradually increasing in size as added; sutures distinct, but only slightly depressed; wall smooth, matte; aperture radiate, nearly central.

This species was originally described from the Pliocene of Kar Nicobar, and has since been recorded from the Miocene of California.

**Nodosaria** sp.?

Plate 3, figure 2

The incomplete or abnormal specimen here figured may be worthy of record for future workers.

**Nodosaria** sp.?

Plate 3, figure 3

This specimen, probably a young stage, is figured for record only.

**Genus** **Glandulina** d’Orbigny, 1826

**Glandulina laevigata** d’Orbigny

Plate 3, figure 4


This common species is well represented in the collection. The species shows the usual differences in the megalospheric and microspheric forms, the latter being more or less pointed at the base and usually with a distinct spine while the former is much broader, with fewer chambers and may lack the spine. The numerous records for **G. laevigata** and **N. rotundata** should be examined with the possibility of many of them being the two forms of one species.

**Genus** **Frondicularia** Defrance, 1824

**Frondicularia foliacea** Schwager

Plate 3, figure 6

**Frondicularia foliacea** Schwager, Novara-Exped., Geol. Theil., pt. 2, 1866, p. 236, pl. 6, fig. 76.—Karrer, in von Drasche, Frag. Geol. Insel Luzon,

Test longer than broad, very much compressed, periphery subacute; chambers comparatively few, distinct, elongate; sutures distinct, slightly depressed, only slightly curved; wall thin, finely perforate, matte; megalospheric proloculum thicker than the remainder of the test.

Schwager described this species from the Pliocene of Kar Nicobar, and it is also known from the Late Tertiary of Luzon and from the Miocene of California.

**Frondicularia advena** Cushman

Plate 3, figure 5


No complete specimen was found, but the fragment figured probably represents this species.

Genus **LAGENA** Walker and Jacob, 1798

**Lagena substriata** Williamson

Plate 3, figure 9


The figured specimen agrees fairly well with this species which is widely distributed.

**Lagena acuticosta** Reuss

Plate 3, figure 10


The specimen figured may be referred to this widely distributed species.

**Lagena hexagona** (Williamson)

Plate 3, figure 7


The specimen figured represents a very finely reticulate, nearly
globular form much finer in its hexagonal areas than are most specimens assigned to this species.

**Lagena hexagona** (Williamson), var. **scalariformis** Williamson  
Plate 3, figure 8

**Entosolenia squamosa** (Montagu), var. **scalariformis** Williamson, Rec. Foram.  
Great Britain, 1858, p. 13, pl. 1, fig. 30.

**Lagena scalariformis** (Williamson), Reuss, Sitz. Akad. Wiss. Wien, vol. 46,  

**Lagena hexagona** (Williamson), var. **scalariformis** (Williamson), Cushman,  
Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 17, pl. 6, fig. 4; Bull. Scripps  

Test subglobular, surface ornamentation of a generally reticulate pattern but the areas in vertical series, the sides of the reticulations thickened, forming costae, the top and bottom borders less conspicuous.

**Lagena foveolata** Reuss  
Plate 3, figure 11

p. 332, pl. 5, fig. 65.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913,  
p. 17, pl. 7, fig. 3.

This species is characterized by the pyriform shape, the greatest width near the base and the surface ornamented by longitudinal costae with very slightly raised costae between.

**Lagena sulcata** (Walker and Jacob)  
Plate 3, figure 12

“**Serpula (Lagena) striata sulcata rotundata**” Walker and Boys, Test. Min.,  
1784, p. 2, pl. 1, fig. 6.

**Serpula (Lagena) sulcata** Walker and Jacob, Adams’ Essays, Kaumacher’s ed.,  
1798, p. 634, pl. 14, fig. 5.

**Lagena sulcata** (Walker and Jacob), Parker and Jones, Philos. Trans., vol. 155,  
1865, p. 351.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 57,  
pl. 11, fig. 1; Bull. Scripps Inst. Oceanography, Tech. Ser., vol. 1, 1927,  
p. 145.

Test typically subglobose, slightly longer than broad; wall with numerous longitudinal costae, 14-18 in number; neck elongate, often with spiral costae.

This species is widely distributed and has been recorded from the West Coast of America in Recent dredgings.
Lagena williamsoni (Alcock)
Plate 8, figure 5


Test subglobular to pyriform, broadest toward the base, apertural end tapering to a short, slender neck; wall ornamented with a few high, plate-like costae, occasionally twisted, coalescing at the upper end and forming a collar made up of a reticulate network below the neck.

This species occurs in the Pliocene of southern California, and is living off the western coast of America as well as in the Atlantic.

Family POLYMORPHINIDAE
Genus POLYMORPHINA d'Orbigny, 1826

*Polymorphina charlottensis* Cushman
Plate 4, figure 6

*Polymorphina charlottensis* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, 1925, p. 41, pl. 6, fig. 9; Special Publ. No. 1, Cushman Lab. Foram. Res., 1928, pl. 26, fig. 9.—Cushman and Ozawa, Jap. Journ. Geol. & Geogr., vol. 6, 1929, p. 72, pl. 13, fig. 8; pl. 15, figs. 11, 12; pl. 16, fig. 1.

*Polymorphina compressa* Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 89, pl. 40, fig. 3.

*Polymorphina complanata* Bagg (not d'Orbigny), Bull. 513, U. S. Geol. Survey, 1912, p. 69, pl. 20, figs. 13, 14.

*Polymorphina biserialis* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 53, pl. 9, fig. 4.

*Polymorphina elongata* Galloway and Wissler, *op. cit.*, vol. 1, 1927, p. 54, pl. 9, fig. 7.

Test elongate, more or less compressed, tapering slightly from the broadly rounded initial end, edges more or less angular; chambers compressed, not much elongated, arranged at first in a clockwise, sigmoid series in the microspheric form, but in an almost alternating biserial series in the megalospheric form, each succeeding chamber removed much farther from the base; sutures not depressed, generally limbate and distinct; wall smooth, translucent; aperture radiate.

This species is known from the Pliocene of western America and Japan, and is living off the coasts of the northern Pacific.
Family NONIONIDAE
Genus NONION Montfort, 1808

Nonion costifera (Cushman)
Plate 3, figures 13 a, b


Test longer than broad, periphery acute, almost keeled, composed of numerous chambers, as many as 20 in the last-formed coil, slightly umbilicate; sutures distinct, limbate, slightly raised above the general surface, increasing in thickness and height toward the umbilicus, forming an acute angle with the periphery; in apertural view heart-shaped or broadly triangular, flattened or slightly concave, the aperture a very small semi-circular opening at the base of the apertural face between it and the preceding coil.

This species was described from the Miocene of California. It occurs also in the Pliocene but the sutures tend to become somewhat less raised.

Nonion umbilicatula (Montagu)
Plate 3, figures 14 a, b

Nautilus umbilicatulus Montagu, Test. Brit., 1803, p. 191; Suppl., p. 78, pl. 18, fig. 1.


Specimens very similar to those already figured from dredgings off the West Coast of America occur in the Humboldt County material. The umbilicus is deep, the sutures flush and limbate, wall coarsely perforate and the aperture from one umbilical area to the other.

Nonion incisa (Cushman)


Test longer than broad, periphery acute, composed of numerous chambers, about fifteen in the last-formed coil, slightly umbilicate; sutures distinct, deeply incised, curved, forming an acute angle with the periphery; wall smooth; in apertural view the apertural face broad, slightly convex, the aperture an elongate, narrow, arched opening at the base of the apertural face between it and the preceding coil.
This species was described from the Miocene of San Luis Obispo County, California.

Genus **NONIONELLA** Cushman, 1926

**Nonionella miocenica** Cushman

Plate 8, figures 6 a-c


Test subtrochoid, small, periphery broadly rounded, seven to ten chambers in the last-formed coil, distinct, dorsal side not completely involute, the sutures obliquely curved, the last chambers with the umbilical end forming a distinct rounded lobe; wall smooth; aperture low, elongate.

This species described from the Miocene of California also persists in the present ocean off the Pacific coast of America. It has fewer chambers than the more southern *Nonionella auris* (d’Orbigny).

Genus **ELPHIDIUM** Montfort, 1808

**Elphidium hughesi** Cushman and Grant

Plate 3, figure 15


Test rather small, periphery broadly rounded throughout, increasingly so in the last chambers, the diameter about 2½ times the thickness; umbilical region slightly depressed, typically with a series of irregular flattened areas formed by the cut-off ends of the pointed inner ends of the chambers with depressions between; chambers as many as fourteen in the last-formed coil, usually less than twelve, the last few inflated and the periphery lobulated, earlier ones not inflated and the periphery entire; sutures very distinct, the later ones strongly depressed, slightly curving toward the periphery, retral processes few and short; wall fairly thick, very finely perforate; aperture a series of small rounded openings at the base of the apertural face, none in the face itself. Diameter, 0.60-0.70 mm.; thickness, 0.25-0.30 mm.

Specimens identical with those of the Pliocene of more southern localities in California have occurred in the collection from Humboldt County.
Elphidium hannai Cushman and Grant
Plate 3, figures 16, 17


Test of medium size, the diameter about twice the thickness, periphery rounded but not broad, umbilical region flattened or very slightly concave, rarely slightly convex; chambers distinct, about fifteen in the last-formed coil, not inflated; sutures very distinct, limbate, flush with the surface, with a line of very fine pores, sometimes irregularly doubled, continuing to the very center of the umbilical region, the sutures appearing as darker curved lines on the lighter mass of the thick but very finely perforate wall; aperture consisting of a series of very fine pores along the base of the apertural face and numerous others scattered irregularly all over the outer wall making up the apertural face. Diameter 1 mm.; thickness 0.50 mm.

This species known from Recent dredgings and from the Pliocene of California occurs in the Humboldt County collections. The form is similar to the Pliocene ones already described in the above reference.

Elphidium oregonense Cushman and Grant
Plate 4, figures 1, 2

Elphidium oregonense Cushman and Grant, Trans. San Diego Soc. Nat. Hist., vol. 5, 1927, p. 79, pl. 8, fig. 3.

Test comparatively large, complanate, compressed, periphery rounded, umbilical region strongly umbonate with a rounded boss of clear shell material with several large pores; chambers numerous, 20 or more in the adult, slightly inflated; sutures curved, depressed except toward the periphery where they are indistinct, pores numerous, rounded, except toward the periphery where they become elongate; wall thick; aperture consisting of a low broad opening at the base of the apertural face with circular pores on the middle portion of the lower half of the flattened wall of the apertural face. Length up to 1.8 mm.; breadth 0.60 mm.

The types of this fine large species are from the Pleistocene of Oregon. It is of much interest to find very large typical specimens in the Humboldt County collections.
Family Heterohelicidae

Genus Plectofrondicularia Liebus, 1903

Plectofrondicularia californica Cushman and R. E. Stewart

Plate 4, figures 3, 4


Test somewhat compressed, very elongate, narrow, usually bilaterally symmetrical, occasionally asymmetrical due to a slight curvature of the early portion, the broad faces concave, sides diverging uniformly from the initial end which is rounded, more in the megalospheric and less in the microspheric form, the greatest breadth of the test being made by the last-formed chamber, the peripheral portion with 3 sharp plate-like carinae, one in the middle line, the other two lateral; chambers numerous, early ones biserial, later ones uniserial, low, 2 to 3 times as wide as high, increasing very slightly in relative height toward the apertural end; sutures slightly limbate, later ones very slightly depressed; wall smooth, with a short central costa on the earlier portion.

This species which we have previously described from the Pliocene of Southern California has appeared in the collection from Humboldt County represented by some very excellent specimens.

Plectofrondicularia miocenica Cushman

Plate 4, figure 9


Test elongate, narrow, gradually tapering, very much compressed, periphery acute, keeled; chambers numerous, distinct, elongate, early ones biserial, alternating; sutures distinct, slightly depressed, curved; wall very thin except in the earlier chambers which are thickened, ornamented by a few longitudinal costae, strongest over the proloculum thence gradually spreading and decreasing in size.

This species seems to be much more rare than the preceding. It was originally described from the Miocene of San Luis Obispo County, California.

Genus Nodogenerina Cushman, 1927

Nodogenerina lepidula (Schwager)

Plate 4, figure 5

Nodosaria lepidula Schwager, Novara-Exped., Geol. Theil., pt. 2, 1866, p. 210, pl. 5, figs. 27, 28.—Karrer, in von Drasche, Frag. Geol. Insel Luzon,
This species seems to be common in the Late Tertiary of the Pacific area and living in the Pacific in the Philippine region and elsewhere. The test is slender, axis straight, chambers increasing rather uniformly in size, somewhat pyriform in shape with a series of short costae or blunt spines about the widest portion, apertural end with a definite neck often with a slight flange, the aperture itself circular without teeth or radiating portions.

**Family BULIMINIDAE**

**Genus BULIMINELLA Cushman, 1911**

*Buliminella elegantissima* (d’Orbigny)

*Plate 4, figures 7 a, b*


This species described by d’Orbigny from the West Coast of South America is abundant in parts of the Pacific, and occurs in the Humboldt County material in typical form.

**Buliminella subfusiformis Cushman**

*Plate 4, figures 8 a, b*


Test spiral, much elongate, subcylindrical, early portion tapering, sides for most of the test nearly parallel, periphery lobulate; chambers numerous, inflated, distinct, 3 or 4 making up a coil; sutures distinct, depressed; wall smooth, very finely punctate; aperture narrow, elongate.

This occurs in the Humboldt County material in typical form rather than the recent var. *tenuata*. The types are from the Miocene of San Luis Obispo, California.

**Genus BULIMINA d’Orbigny, 1826**

*Bulimina inflata* Seguenza

*Plate 4, figure 10*

Typical specimens occur in the Humboldt County collection as in the Pliocene of Southern California and in recent dredgings off the coast.

**Bulimina subcalva** Cushman and K. C. Stewart, new species

Plate 4, figures 11 a, b

Test slightly longer than broad, rapidly tapering from the acute initial end to the greatest width near the apertural end, generally triserial; chambers numerous, inflated; sutures distinct, depressed; wall in the earlier chambers ornamented by distinct and rather plate-like costae, later chambers roughly granular or smooth, initial end of the test often with a distinct spine especially in the microspheric form; aperture elongate, oval, rather large for the genus. Length 0.50 mm.; breadth 0.35 mm.

Holotype (Cushman Coll. No. 12454) from Scotia Bluffs, about 160 yds. southward from north line of SE 1/4 sec. 5, T. 1 N., R. 1 E., Humboldt County, California. Paratypes—Stewart Coll. No. 503; San Diego Society of Natural History Coll. No. 8.

With its very tapering form and plate-like costae of the earlier chambers this species differs from any of the other semi-nude forms of the genus.

**Bulimina rostrata** H. B. Brady (?)  

Plate 5, figure 1

These specimens represented by that figured have a few longitudinal costae continuous from the early portion to the last-formed chambers, but the sutures visible. In typical *B. rostrata* the longitudinal costae are even more strongly developed and the sutures usually obscured.

**Bulimina subacuminata** Cushman & R. E. Stewart, new species

Plate 5, figures 2, 3 a, b

Test longer than broad, tapering rapidly from the acute and spinose initial end to the greatest width made by the last whorl of chambers, triserial; chambers distinct and depressed; wall distinctly perforate, ornamented by high, thin plates, longitudinally placed and in general in definite longitudinal series from one chamber to another, the lower end of each costa often slightly produced into a definite angle; aperture elongate, ovate. Length 0.50 mm.; breadth 0.28 mm.
Holotype (Cushman Coll. No. 12456) from Bear River, NE ¼ sec. 20, T. 1 N., R. 2 W., Humboldt County, California. Paratypes—Stewart Coll. No. 504; San Diego Society of Natural History Coll. No. 9.

This species may be closely related to *B. subcalva* as the ornamentation of the very earliest chamber of *B. subcalva* is similar, and the general shape of the two species is much alike.

**Bulimina pagoda** Cushman

Plate 5, figures 6 a-c


Test tapering, broadest near the apertural end, pointed at the initial end; chambers distinct, deeply cut under at the base; periphery of the chamber with a series of large stout spines projecting outward and curving downward, several on each chamber; wall thin and translucent, otherwise smooth.

Specimens evidently belonging to this species occur in the Humboldt County material. The spines are not always so greatly developed as in the Recent specimens but they have the characteristic form and arrangement. The species occurs off the Western coast of America.

**Bulimina pseudotorta** Cushman


Test tapering, greatest breadth near the apertural end, outline slightly lobulate, initial end narrow, rounded, rapidly increasing in diameter to just below the broadly rounded or even truncate apertural end; chambers few, inflated; sutures distinct, very slightly depressed; wall thin, very finely perforate, smooth, matte; aperture either elongate or almost cruciform.

This species was described from the Miocene of San Luis Obispo County, California.

**Genus GLOBOBULIMINA** Cushman, 1927

**Globobulimina pacifica** Cushman

Plate 5, figure 4

Test subglobular in the adult, usually widest toward the initial end, the last three chambers making up the exterior by enclosing the preceding ones; sutures distinct, slightly depressed; wall very thin, finely perforate, smooth; aperture loop-shaped with a slight border, a broad apertural tooth or plate and an internal spiral tube.

This species is a common one in the Late Tertiary of California as well as in a living state off the coast.

Genus **BOLIVINA** d’Orbigny, 1839

**Bolivina subadvena** Cushman

*Plate 5, figure 5*


This is a variable species. The specimen here figured has the chambers smoother than in the usual Miocene specimens.

**Bolivina subadvena** Cushman, var. *spissa* Cushman

*Plate 5, figure 7*


*Bolivina spissa* Cushman, Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 72, pl. 11, figs. 14-16.

This variety is also variable in its characters, on the one side tending to the roughness and thick walled character of the typical form, and on the other approaching *B. argentea* Cushman. These specimens from Humboldt County tend toward the latter species strongly. It is often abundant in dredgings off the West coast of America.

**Bolivina advena** Cushman


Test of early portion compressed, later portion thickened; early chambers low, close-set, later ones higher; sutures of early portion slightly limbate, in later portion very narrow, somewhat depressed, periphery of early portion acute, later rounded; wall smooth but distinctly perforate.

This species is common in some parts of the Monterey Miocene of California.
Bolivina advena Cushman, var. striatella Cushman


Variety differing from the typical in the longer, more tapering form, the initial end subacute, about nine chambers making up the last half of the test; sutures somewhat distinct, very slightly depressed; wall finely perforate, surface of the early portion ornamented with very fine, numerous, longitudinal costae, the later portion smooth.

This variety is also known from the Miocene of California.

**Bolivina imbricata** Cushman

Plate 8, figure 3


Test much compressed, of medium size for the genus, periphery acute, keeled throughout; chambers numerous, distinct, eight chambers making up the last half of the test; sutures distinctly limbate, much curved, deeply depressed in the later portion so that the chambers appear imbricate; wall thin, finely perforate, surface with a few longitudinal costae near the base and a central ridge.

This species is common in some parts of the Miocene, Monterey, of California.

Genus **UVIGERINELLA** Cushman, 1926

**Uvigerinella californica** Cushman, var. *ornata* Cushman

Plate 5, figure 8


This form described from the Miocene of San Luis Obispo County, California seems to occur in the Humboldt County collection. The neck is very short and sunken with the aperture compressed and angled toward the inner border of the chamber. The surface is very finely costate.

Genus **UVIGERINA** d’Orbigny, 1826

**Uvigerina senticosa** Cushman

Plate 5, figure 9


Test fusiform, slender, broadest toward the apertural end, initial
end rounded; chambers numerous, inflated; sutures distinct and depressed; wall in the early portion roughened with bristly points, very fine and numerous, not as conspicuous in later chambers except in the sutural regions; apertural end with a short cylindrical neck and slightly flaring lip.

This species which is common off the Pacific coast of America is also found in the Pleistocene and Pliocene of California.

**Uvigerina proboscidea** Schwager

Plate 5, figure 10


This is a shorter broader species than the preceding, and the surface while roughened is not truly spinose. The originals are from the Pliocene of Kar Nicobar and it is also recorded from the later Tertiary of the Philippines as well as recorded as Recent from the North Pacific.

**Uvigerina peregrina** Cushman

Plate 5, figure 11


This species occurs living off the Pacific coast of America and also in the Pleistocene and Pliocene of California.

**Uvigerina peregrina** Cushman, var. *bradyana* Cushman

Plate 5, figure 12


This variety differing from the typical form in the more elongate, slender less coarsely punctate test and fewer and lower costae occurs in considerable numbers in the Humboldt County collections. It is very variable and some of the specimens become nearly smooth especially in the later chambers. Another variant shows the costae broken up into smaller elongate ridges.
Genus **SIPHOGENERINA** Schlumberger, 1883

*Siphogenerina branneri* (Bagg)

Plate 5, figure 15

*Siphogenerina branneri* (Bagg), Cushman, Proc. U. S. Nat. Mus., vol. 67, art. 25, 1926, p. 7, pl. 1, figs. 7-9; pl. 4, fig. 7.  
*Sagrina californiensis* Bagg, Bull. 268, U. S. Geol. Surv., 1905, p. 41, pl. 7, fig. 5.  
*Sagrina elongata* Bagg, *op. cit.*, p. 41, pl. 7, fig. 6.

Test subcylindrical, the microspheric form tapering, the megalo-spheric fusiform; chambers numerous, inflated, sutures distinct, slightly depressed; surface ornamentation consisting of numerous distinct, slightly raised, longitudinal costae, the chamber at the sutures continued backward along these costae giving a scolloped edge to the suture; aperture with a short, cylindrical neck and narrow phialine lip.

These specimens from Humboldt County seem to be identical with Bagg’s species from the Monterey shale farther South.

**Siphogenerina hughesi** Cushman

Plate 5, figure 13


Test elongate, fairly thick, two or three times as long as broad, circular in transverse section; chambers short and broad, the early chambers irregularly spiral, later ones uniserial; sutures distinct and depressed; wall thick, the exterior smooth throughout; aperture terminal, rounded, with a short neck and slight lip.

The figured specimen from Humboldt County seems to be entirely identical with this species described from the Miocene Monterey shale of San Luis Obispo County, California.

Genus **ANGULOGERINA** Cushman, 1927

**Angulogerina hughesi** (Galloway and Wissler)

Plate 5, figure 16

*Uvigerina hughesi* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 76, pl. 12, fig. 5.

This species described from the Pleistocene beds of Lomita Quarry occurs in typical form in the Humboldt County collection. The early
chambers have traces of costae and are somewhat rounded, the later ones becoming angular and assuming the generic characters.

**Angulogerina carinata** Cushman

Plate 5, figure 14

*Angulogerina carinata* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 159, pl. 4, fig. 3.

The angled and carinate chambers, more slender and elongate than the preceding, will identify this species which has a wide range on the Pacific coast from Juan Fernandez on the South to the West coast of the United States.

**Family ELLIPSOIDINIDAE**

Genus *ELLIPSOLAGENA* A. Silvestri, 1923

*Ellipsolagena apiculata* (Reuss)

Plate 5, figures 17, 18

*Oolina apiculata* Reuss, in Haidinger’s Nat. Abhandl., vol. 4, abth. 1, 1851, p. 22, pl. 1, fig. 1.


The specimens from Humboldt County, one of which is here figured, seem to belong to this species. They have an apical spine, are slightly compressed, and have the aperture of this genus.

**Family ROTALIIDAE**

Genus *VALVULINERIA* Cushman, 1926

*Valvulineria araucana* (d’Orbigny)

Plate 6, figures 4a-c


D’Orbigny originally described this species from the coast of Chile. It is known from other localities off the Western coast of North America, and occurs in the Pliocene of Southern California as well as in Humboldt County.
Genus **GYROIDINA** d’Orbigny, 1826

**Gyroidina soldanii** d’Orbigny

*Plate 6, figures 1 a-c*

*Rotalia (Gyroidina) soldanii* d’Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 278;
Modeles No. 36.


This is a widely distributed species and one which keeps close to its typical form. It occurs commonly off the Western coast of America and in the Pliocene. It is probable that *Rotalia nitidula* Schwager from the Pliocene of Kar Nicobar is a synonym of this species.

Genus **EPONIDES** Montfort, 1808

**Eponides ornata** (d’Orbigny)

*Plate 6, figures 2 a-c*


Test trochoid, strongly biconvex, periphery rounded; chambers very distinct, about seven in the last-formed whorl; sutures very distinct, on the dorsal side strongly limbate but slightly if at all raised, the surface between smooth and rather coarsely and distinctly perforate, on the ventral side gently curved, slightly depressed, less distinctly limbate; aperture ventral, elongate.

This species described by d’Orbigny in his South American monograph is evidently present in the Humboldt County collections.

**Eponides tenera** (H. B. Brady)

*Plate 6, figures 3 a-c*


**Eponides tenera** (H. B. Brady), Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 163, pl. 5, figs. 6, 7.

Test trochoid, biconvex; periphery acute, slightly lobulated; the earlier portion with the spire convex, the last-formed coil in the adult flattened and broader, with five to seven chambers, sutures very distinct, straight and radial, only slightly depressed; wall smooth and polished; aperture narrow, between the periphery and center of the ventral side.

This is a species particularly of the Eastern portion of the Pacific recorded from many stations from California Southward. It is a characteristic species of the California Pliocene.
Eponides peruviana (d’Orbigny)

Plate 8, figures 7 a-c


Test trochoid, nearly equally biconvex, periphery carinate, generally circular in outline; chambers numerous, distinct, about eight in the last-formed whorl, on the dorsal side forming an even surface, ventrally inflated, giving a very distinct appearance to the test; sutures distinct on the dorsal side, curved, flush with the surface, slightly limbate, on the ventral side radial, depressed; wall smooth or slightly roughened below, very finely perforate; aperture ventral, at the base of the chamber between the periphery and the umbilicus.

This species is abundant on the West coast of South America as part of a fauna which is very closely allied with that of the Pliocene of California. This is the first record as a fossil.

**Family CASSIDULINIDAE**

Genus **PULVINULINELLA** Cushman, 1926

**Pulvinulinella pacifica** Cushman

Plate 6, figures 5 a-c


Test trochoid, plano-convex, dorsal side flattened, ventral side strongly convex; periphery acute or slightly keeled, often lobulated; chambers distinct, not inflated, seven in the last-formed coil; sutures obliquely curved on the dorsal side, only slightly curved on the ventral, slightly limbate, not raised or depressed; wall finely perforate, shining; aperture elongate, narrow, nearly parallel to the periphery, ventral.

This is a very common species in the dredgings from the Western coast of America. In the Pliocene of California it is also a characteristic species.

**Pulvinulinella subperuviana** Cushman


Test small, rotaliform, biconvex, umbonate, periphery subacute; chambers numerous, 10 or 11 in the last-formed coil; sutures on the
dorsal side strongly oblique, on the ventral side nearly straight, radial, distinct but only slightly depressed; last-formed coil thin and compressed forming a fringe about the more umbonate center; wall smooth; aperture a narrow slit on the ventral side of the last-formed chamber just below and parallel with the periphery, with a tooth-like projection from the edge.

This species is fairly common in some parts of the Miocene, Monterey, of California.

Genus **CASSIDULINA** d'Orbigny, 1826

**Cassibulina pulchella** d'Orbigny

Plate 6, figures 6 a, b


Test compressed, nearly circular in side view; periphery somewhat angled with the angles of the chamber slightly projecting; chambers distinct, six or seven pairs in the last-formed coil; sutures distinct, depressed, not limbate; wall smooth; aperture elongate, nearly parallel to the axis of coiling, with a slight tooth.

This species described by d'Orbigny from off the West coast of South America has also been recorded from further North along the Eastern coast of the Pacific, and occurs in the Pliocene of California.

**Cassidulina limbata** Cushman and Hughes

Plate 6, figures 7 a, b

*Cassidulina laevigata* Bagg (not d'Orbigny), Bull. 513, U. S. Geol. Surv., 1912, p. 43.


Test nearly circular in side view, the last-formed chamber slightly projecting; periphery slightly lobulate, carinate; chambers very distinct, six pairs in the last-formed coil, the central portion of each chamber narrowest; sutures very distinct, broadly limbate, central portion with a distinct umbo of clear shell material; aperture narrow, elongate, parallel to the axis of coiling, with a slight tooth.
This is a very abundant species in the Pliocene and less so in the Pleistocene of California. It occurs also in dredgings from off the West coast of America.

**Cassidulina californica** Cushman and Hughes

Plate 6, figures 8 a, b


Test broadly oval in side view, nearly circular except for the last-formed chamber which slightly projects, periphery very slightly if at all lobulate, in apertural view with the sides parallel and the ends broadly rounded, the sides even tending to become slightly concave in the middle; chambers alternating, five pairs making up the last-formed coil, distinct; sutures very distinct, very slightly limbate but not raised, flush with the surface; wall smooth, matte; aperture in the general axis of the test at one side with a projection plate-like tooth, partially filling the actual opening.

This is a very abundant species in some parts of the Pliocene of California.

**Cassidulina corbyi** Cushman and Hughes

Plate 8, figure 4

*Cassidulina corbyi* Cushman and Hughes, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 1, 1925, p. 14, pl. 2, figs. 3 a, b.—Cushman, op. cit., vol. 1, pt. 3, 1925, p. 55, pl. 9, figs. 9, 10; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 166, pl. 6, fig. 3.

Test oval, about one and a half times as long as broad, the periphery strongly serrate, central portion slightly umbilicate, periphery acute, six or seven pairs of chambers in the last-formed coil; chambers angled at the periphery; sutures fairly straight, slightly depressed, not limbate; wall smooth; aperture elongate, in the axis of coiling, narrow.

This species is known from the Pliocene of southern California, and as a living species in the Pacific off Panama.

**Genus EHRENBERGINA** Reuss, 1850

**Ehrenbergina compressa** Cushman

Plate 6, figure 9


Test compressed, composed of few chambers, about four pairs
making up the uncoiled portion, distinct, only slightly inflated; periphery of each ending in a blunt angle, at the median line not raised and unornamented; wall smooth; aperture very elongate. Length, 0.50 mm.

This much compressed species occurs in typical form in the Humboldt County collection. The other records for it are from Recent dredgings off the Western coast of America.

Genus **PULLENIA** Parker and Jones, 1862

*Pullenia bulloides* (d'Orbigny)

Plate 7, figures 3 a, b, 5


There are some rather large specimens of this species in the Humboldt County collections.

Genus **SPHAEROIDINA** d'Orbigny, 1826

*Sphaeroidina bulloides* d'Orbigny

Plate 7, figures 2 a, b


There are but a few specimens of this widely distributed species.

**Family GLOBIGERINIDAE**

Genus **GLOBIGERINA** d'Orbigny, 1826

*Globigerina inflata* d'Orbigny


Specimens of this genus are surprisingly rare in the collection.

*Globigerina conglomerata* Schwager

9, 1929, p. 12, pl. 5, figs. 6 a-c.—Cushman and Kellett, op. cit., Art. 25, 1929, p. 14.


Globigerina dubia H. B. Brady, op. cit., pl. 79, figs. 17 a-c (not Egger).

Test subglobose, in the early stages consisting of but four chambers in each whorl, closely grouped, in later stages with five or six chambers in the whorl, the last whorl usually below the level of the preceding ones and with a distinct umbilicus; aperture small, with a distinct lip.

This is a common species in the Pacific, and is widely distributed in the Pliocene of the Pacific region. It was described originally from the Pliocene of Kar Nicobar in the Indian Ocean, and is the most common species of the genus in the eastern Pacific at the present time.

Genus **ORBULINA** d'Orbigny, 1839

Orbulina universa d'Orbigny, var.

Plate 7, figure 4

There are specimens which evidently belong to this species but which have thick walls and a papillate surface. It may be noted in this connection that Schubert records a form from the Late Tertiary of the Bismark Archipelago as var. aculeata A. Silvestri. None of our specimens were truly spinose, but may have been somewhat eroded.

**Family GLOBOROTALIIDAE**

Genus **GLOBOROTALIA** Cushman, 1927

Globorotalia crassula Cushman and R. E. Stewart, new name

Plate 7, figures 1 a-c


This is not the same as the Upper Cretaceous species of d'Orbigny. There are usually about four chambers in the last-formed coil. The ventral side is coarsely papillate, especially about the aperture which is narrow and elongate, between the periphery and umbilicus.

It is a common species in the Pacific as well as in the Pliocene of some parts of California.

Holotype—Cushman Coll.
Family ANOMALINIDAE

Genus PLANULINA d'Orbigny, 1826

Planulina ornata (d'Orbigny)

Plate 7, figures 6a, b


Test in the young, trochoid, biconvex, in the later stages with the chambers widely spreading and evolute; chambers very distinct, elongate, curved; periphery subacute, with a thickened keel; sutures distinct, limbate, raised in the earlier portion and confluent with the peripheral carina, in the last few chambers depressed; surface beautifully ornamented with coarse perforations, their borders raised forming a reticulation, this ornamentation covering all the surface except the smooth raised sutures; aperture peripheral in the adult and extending onto the dorsal side, with a flat lip.

This species described by d'Orbigny from the coast of Chile and recorded from many stations Northward to the Western coast of the United States is a common species in the Pliocene of California.

Genus CIBICIDES Montfort, 1808

Cibicides cicatricosa (Schwager)

Plate 7, figures 7a-c


Test plano-convex, dorsal side flattened or slightly concave, ventrally convex, periphery rounded; chambers nine to eleven in the last-formed coil, inflated, distinct; sutures distinct, depressed, on the dorsal side slightly curved, the earlier ones limbate and forming with the spiral suture a raised ornamentation, on the ventral side nearly radial and depressed; wall very coarsely perforate; the umbilical area on the ventral side granulose; aperture narrow, extending to the dorsal side, with a slight lip especially over the dorsal portion.

This species was described by Schwager from the Pliocene of Kar Nicobar. The specimen figured here from Humboldt County shows the same general characters as Schwager’s figures.
<table>
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<th>SPECIES DISTRIBUTION CHART</th>
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| STATION NUMBERS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| GEOLOGICAL AGE   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| SPECIES          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
PLATE 1

Figures in parentheses immediately following names of authors of species indicate stations from which the figured specimens were taken.

Figs. 1 a, b. *Textularia flintii* Cushman. (Sta. 12). X 85. a, front view; b, apertural view.

Fig. 2. *Gaudryina triangularis* Cushman. (Sta. 32). X 50. Side view.

Fig. 3. *Textularia cf. abbreviata* d'Orbigny. (Sta. 42). X 50.

Fig. 4. *Verneuilina scabra* (Williamson). (Sta. 28). X 40.

Figs. 5, 6. *Clavulina communis* d'Orbigny. (Sta. 47). X 50.

Figs. 7, 8. *Clavulina communis* d'Orbigny, var. *pallida* Cushman. (Sta. 47). X 50.
PLATE 2

Figs. 1, 2. *Quinqueloculina akneriana* d'Orbigny. (Sta. 20). X 50. Opposite sides of 2 specimens.

Fig. 3. *Sigmoidina celata* (Costa). (Sta. 45). X 80.

Fig. 4. *Nodosaria deceptoria* Schwager (?). (Sta. 42). X 50.


Fig. 6. *Planularia sp* (?). (Sta. 36). X 40.

Figs. 8, 9. *Dentalina insecta* (Schwager). (Sta. 41). X 50.

Fig. 10. *Dentalina insolita* (Schwager). (Sta. 28). X 50.

Figs. 11, 12. *Dentalina sp* (?). (Sta. 41). X 65. Fragments.


Fig. 16. *Nodosaria brevicula* Schwager. (Sta. 23). X 50.
PLATE 3

Fig. 1. *Nodosaria tosta* Schwager. (Sta. 12). X 65.

Fig. 2. *Nodosaria sp* (?). (Sta. 42). X 65.

Fig. 3. *Nodosaria sp* (?). (Sta. 41). X 65.

Fig. 4. *Glandulina laevigata* d’Orbigny. (Sta. 28). X 50.

Fig. 5. *Frondicularia advena* Cushman. (Sta. 28). X 65.

Fig. 6. *Frondicularia foliacea* Schwager. (Sta. 28). X 65.

Fig. 7. *Lagena hexagona* (Williamson). (Sta. 41). X 75.

Fig. 8. *Lagena hexagona* (Williamson), var. *scalariformis* Williamson. (Sta. 3). X 75.

Fig. 9. *Lagena substriata* Williamson. (Sta. 6). X 75.

Fig. 10. *Lagena acuticosta* Reuss. (Sta. 6). X 75.

Fig. 11. *Lagena foveolata* Reuss. (Sta. 41). X 75.

Fig. 12. *Lagena sulcata* (Walker & Jacob). (Sta. 42). X 75.

Figs. 13 a,b. *Nonion costifera* (Cushman). (Sta. 36). X 65. *a*, side view; *b*, peripheral view.

Figs. 14 a,b. *Nonion umbilicatula* (Montagu). (Sta. 7). X 75. *a*, side view; *b*, peripheral view.

Fig. 15. *Elphidiuni hughesi* Cushman & Grant. (Sta. 44). X 40.

Figs. 16, 17. *Elphidiuni hannai* Cushman & Grant. (Sta. 13). X 40.
PLATE 4.

Figs. 1, 2. *Elphidium oregonense* Cushman & Grant. (Sta. 13). X 40.


Fig. 5. *Nodogenerina lepidula* (Schwager). (Sta. 12). X 65.

Fig. 6. *Polymorphina charlottensis* Cushman (?). (Sta. 32). X 40.

Figs. 7 a, b. *Buliminella elegantissima* (d’Orbigny). (Sta. 13). X 80. a, b, opposite sides.

Figs. 8 a, b. *Buliminella subfusiformis* Cushman. (Sta. 36). X 50. a, b, opposite sides.

Fig. 9. *Pletofrondicularia miocenica* Cushman. (Sta. 39). X 80.

Fig. 10. *Bulimina inflata* Seguenza. (Sta. 45). X 50.

Figs. 11 a, b. *Bulimina subcalva* Cushman & K. C. Stewart, n. sp. (Sta. 28). X 65.
PLATE 5

Fig. 1. *Bulimina rostrata* H. B. Brady (?). (Sta. 45). X 65.

Figs. 2, 3a, b. *Bulimina subacuminata* Cushman & R. E. Stewart, n. sp. (Sta. 42). X 65.

Fig. 4. *Globobulimina pacifica* Cushman. (Sta. 15). X 75.

Fig. 5. *Bolivina subadvena* Cushman. (Sta. 45). X 50.

Figs. 6a-c. *Bulimina pagoda* Cushman. (Sta. 1). X 75. a, c, side views of 2 different specimens; b, apertural view.

Fig. 7. *Bolivina subadvena* Cushman, var. *spissa* Cushman. (Sta. 12). X 65.

Fig. 8. *Uvigerinella californica* Cushman, var. *ornata* Cushman. (Sta. 38). X 65.

Fig. 9. *Uvigerina senticosa* Cushman. (Sta. 23). X 65.

Fig. 10. *Uvigerina proboscidea* Schwager. (Sta. 45). X 65.

Fig. 11. *Uvigerina peregrina* Cushman. (Sta. 35). X 65.

Fig. 12. *Uvigerina peregrina* Cushman, var. *bradyana* Cushman. (Sta. 3). X 65.

Fig. 13. *Siphogenerina hughesi* Cushman. (Sta. 36). X 50.

Fig. 14. *Angulogerina carinata* Cushman. (Sta. 12). X 80.

Fig. 15. *Siphogenerina branneri* (Bagg). (Sta. 36). X 50.

Fig. 16. *Angulogerina hughesi* (Galloway & Wissler). (Sta. 3). X 80.

PLATE 6

Figs. 1 a-c. *Gyroidina soldanii* d'Orbigny. (Sta. 45). X 65. a, dorsal view; b, ventral view; c, apertural view.

Figs. 2 a-c. *Eponides ornata* (d'Orbigny). (Sta. 1). X 65. a, dorsal view; b, ventral view; c, apertural view.

Figs. 3 a-c. *Eponides tenera* (H. B. Brady). (Sta. 23). X 65. a, dorsal view; b, ventral view; c, apertural view.

Figs. 4 a-c. *Valvulineria araucana* (d'Orbigny). (Sta. 45). X 50. a, dorsal view; b, ventral view; c, apertural view.

Figs. 5 a-c. *Pulvinulinella pacifica* Cushman. (Sta. 24). X 65. a, dorsal view; b, ventral view; c, apertural view.

Figs. 6 a, b. *Cassidulina pulchella* d'Orbigny. (Sta. 1). X 65. a, side view; b, apertural view.

Figs. 7 a, b. *Cassidulina limbata* Cushman & Hughes. (Sta. 1). X 65. a, side view; b, apertural view.

Figs. 8 a, b. *Cassidulina californica* Cushman & Hughes. (Sta. 23). X 40. a, side view; b, apertural view.

Fig. 9. *Ebrenbergina compressa* Cushman. (Sta. 23). X 65.
PLATE 7

Figs. 1 a-c. Globorotalia crassula Cushman & R. E. Stewart, new name. (Sta. 7). X 75. a, dorsal view; b, ventral view; c, apertural view.

Figs. 2 a, b. Sphaeroidina bulloides d'Orbigny. (Sta. 12). X 75. a, ventral view; b, dorsal view.

Figs. 3 a, b, 5. Pullenia bulloides (d'Orbigny). (Fig. 3, Sta. 45; Fig. 5, Sta. 7). X 65. a, apertural view; b, side view.

Fig. 4. Orbulina universa d'Orbigny, var. (Sta. 47). X 40.

Figs. 6 a, b. Planulina ornata (d'Orbigny). (Sta. 23). X 65. a, b, opposite sides.

Figs. 7 a-c. Cibicides cicatricosa (Schwager). (Sta. 12). X 65. a, dorsal view; b, ventral view; c, apertural view.
PLATE 8

Fig. 1. *Nodosaria koina* Schwager. (Sta. 38). X 120.

Fig. 2. *Robulus americanus* (Cushman), var. *spinosus* (Cushman). (Sta. 36). X 70.

Fig. 3. *Bolivina imbricata* Cushman. (Sta. 36). X 120.

Fig. 4. *Cassidulina corbyi* Cushman and Hughes. (Sta. 1). X 70.

Fig. 5. *Lagena williamsoni* (Alcock). (Sta. 15). X 120.

Figs. 6 a-c. *Nonionella miocenica* Cushman. (Sta. 12). X 120. a, dorsal view; b, ventral view; c, peripheral view.

Figs. 7 a-c. *Eponides peruviana* (d'Orbigny). (Sta. 13). X 70. a, dorsal view; b, ventral view; c, peripheral view.
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BY

LAURENCE M. KLAUBER
Curator of Reptiles and Amphibians, San Diego Society of Natural History

SAN DIEGO, CALIFORNIA
Printed for the Society
February 28, 1930
San Diego Society of Natural History

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INTRODUCTION

Somewhat over two years ago I became interested in the form of rattlesnake described by Kennicott in 1861 as Caudisona scutulata, or, according to modern terminology, Crotalus scutulatus. It has appeared to me from experience with a considerable series of live specimens that the present customary classification of this form as a phase of Crotalus atrox or, less often, as C. oreganus or C. confluentus is inaccurate. With the results of this investigation I hope to deal in a subsequent report; I would say at this time that I have reached the conclusion that C. scutulatus is a valid species which, although more closely related to the confluentus than the atrox group, apparently intergrades with neither. Some of the evidence upon which this conclusion is based is cited in the final discussion in this paper, since the relationships of various closely related species cannot be outlined without defining scutulatus.

Of course in the use of the term C. scutulatus I am not referring at random to any rattlesnake with paired scutes between the supralabials, but rather to the snake that Kennicott described, which has other characteristics as definitely distinguishing it from its nearest relatives as this character from which it derives its name. My conclusions are based on scale counts of 157 specimens of C. scutulatus, of which 88 are recent acquisitions in my own collection. In addition I have seen not less than 100 other specimens alive. Availability of new and adequate material (at least from some areas) rather than a new angle of approach has, I think, permitted a definite determination on this scutulatus problem, which because it has heretofore involved the confusion of specimens of a single species with two other valid species (atrox and confluentus) has led to perplexity in all of these.

In the course of this investigation as to the status of scutulatus it was necessary to examine a considerable series of the various species and subspecies of the atrox and confluentus groups. Each new accession of material has led to new problems and new lines of investigation in an
ever-widening geographical range. Altogether, scale counts and comparative measurements were made on well over a thousand specimens of rattlesnakes from most of the western states and northern Mexico, and in the course of these excursions I chanced upon two apparently unnamed subspecies of *C. confluentus* and two, which, while well known, require new names. It is with these subspecies that the present paper deals.

**THE RATTLENAKE OF THE GREAT BASIN**

The Great Basin rattlesnake has long been recognized as a subspecies of *Crotalus confluentus* (or *Crotalus oreganus*) yet even today it has not a valid name. The following comments on the designations here-tofore proposed will clarify the situation.

Neither the name *C. oreganus*, Holbrook, 1840, nor *C. lucifer*, Baird and Girard, 1852, is applicable to this form, since both refer to the snake of the Pacific coast rather than the plateau region. Through the courtesy of Dr. Witmer Stone of the Academy of Natural Sciences of Philadelphia, I have lately seen a photograph of Holbrook’s type specimen, thus corroborating the description and Holbrook’s figure. It is evidently of the coast form. Also there is reason to believe that this specimen was collected between Walla Walla, Washington, and the Pacific Ocean; and since the coast form occurs at least as far east as Walla Walla (*vide* USNM 10914), we may conclude that *Crotalus confluentus oreganus* is the proper designation of this subspecies,¹ and that this name is not applicable to the Great Basin rattler. Similarly it is known that *C. lucifer* refers to the coast form, both by reason of the route of the collecting party (The Wilkes’ Exploring Expedition) and the description, although the type locality is indefinite, being “Oregon and California,” and both subspecies inhabit these states.

The next name possibly applicable is *Crotalus lecontei* Hallowell, 1852. Cope in some of his later papers referred to the Great Basin rattler as *Crotalus confluentus lecontei*, stating: “This form is the *C. confluentus* of the Great Basin.”² But more recently Stejneger has

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¹ I am indebted to Dr. T. S. Palmer, Senior Biologist, U. S. Bureau of Biological Survey, for reference to “A Journey to the Columbia River, and a Visit to the Sandwich Islands, Chili, etc.” by J. K. Townshend, 1840. This described the expedition to which Nuttall was attached when the type specimen was collected. The type locality is given as “the Banks of the Oregon or Columbia River.” The Townshend-Nuttall party struck the Columbia at the junction with the Walla Walla River.

shown\(^3\) that this name is invalid, the type locality being beyond the range of the present subspecies.

Van Denburgh states:\(^4\) "The snakes of Utah, Nevada and eastern California may perhaps deserve similar treatment (i.e., be regarded as a subspecies) since their color pattern is usually different from that of typical C. oreganus." But he does not suggest a new name.

Do Amaral\(^5\) most recently has renamed this subspecies Crotalus confluentus kellyi, but this name, I regret to state, is likewise invalid, since the subspecies under consideration is confused with the troublesome C. scutulatus and both the type and paratype of kellyi belong to the latter species. These two specimens are Nos. 194 and 195 in my own collection; they are from Needles, California, beyond the range of the Great Basin rattler. It is with regret that I find the name kellyi inapplicable to this subspecies, since Dr. Howard A. Kelly, for whom it was named, was largely instrumental in causing me to become interested in herpetological literature and I am indebted to him for many favors.

The Great Basin rattler differs consistently from scutulatus in characteristics of form, color, markings and scutellation. Of these I will at this time point out two of the most definite, as indicated by the specimens at hand:\(^6\)

A. SCALES BETWEEN NASALS IN CONTACT WITH ROSTRAL (INTERNASALS)

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<td>6</td>
<td>38</td>
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B. MINIMUM SCALE ROWS BETWEEN SUPR AOcularS

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<td>140</td>
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This, in spite of some overlapping, seems to me quite significant in a genus such as Crotalus, in which there is much variation of scutellation

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\(^6\) In this and the following tables the numbers in the body of the tables indicate the number of specimens falling into each classification. Occasionally there are two counts per specimen. The variation in totals between tables is often due to the illegibility of certain characters in some specimens.

\(^7\) May be due to abrasion and regrowth in captivity.
within a species owing to the tendency of almost any scale occasionally to be split or fused with a neighbor. If we deduce from the above tables that *scutulatus* should have two internasals and the Great Basin form three or more; and again that *scutulatus* should have two scale rows between supraoculars, while the other form should have three or more, then not a single specimen out of some 317 of both forms falls into the other's territory in both characteristics. One Great Basin rattler (LMK 2280 from Zion Park, Utah) has two internasals and three scale rows between supraoculars. The other six having three scale rows have three or more internasals. And there are other characteristics in which the two forms differ quite as definitely, as for instance in the width of the postocular light stripe, the presence of a supraocular light cross mark, etc.

So far as is now known, 150 miles of mountain and desert separate the ranges of these two forms at their nearest points. Even were they conspecific, intergradation could only be through a third subspecies.

This rattlesnake of the intermountain states, having no valid name, I therefore re-describe as

**Crotalus confluentus lutosus**, subsp. nov.

**Great Basin Rattlesnake**


*Diagnosis.*—A subspecies of *Crotalus confluentus* differing from the typical form in the width of the postocular light line, which is two or three scales wide in *lutosus* and one wide in *confluentus.* Likewise, *lutosus* has a higher average number of scale rows between supraoculars and a greater irregularity in blotch borders than has *confluentus.* *Lutosus* is usually drab or buff in coloration; *confluentus* is gray, green, olive, brown or red-brown.

From *oreganus, lutosus* differs primarily in color, the former being black, dark gray or dark brown; also in the character of the body blotches, which in *lutosus* tend toward narrow (measured longitudinally) hexagons well separated, while in *oreganus* the blotches are diamonds, circles, rectangles or hexagons proportionately wider along the body and with less relative separation. Since these two subspecies intergrade, differences of coloration and markings are

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8 Clayey. Referring to the coloration.

9 In the interest of brevity, I have used the term *confluentus* when the subspecies *Crotalus confluentus confluentus* is meant and *C. confluentus* to indicate the species.
more pronounced between representatives distant from the area of intergradation.

From *Crotalus scutulatus*, *lutosus* differs in having ordinarily three or more internasals, instead of two as in the former; in having a higher number of scale rows between supraoculares; in greater width of the postocular light line, which is rarely more than one scale wide in *scutulatus*; in color, which in *scutulatus* is yellow-green, green, olive or brown; and in the light supraocular cross bar, which, when at all discernible in *scutulatus*, is an amorphous light area, while in *lutosus* it is always present and is emphasized by contrasting, even margins.

**Description of Type.**—Young adult male. Length 832 to rattles, tail 60, ratio 0.072. Length of head 35.5, times contained in body length 23.4. Width of head 28. Width across supraoculares 16.2, distance between supraoculares 7.0, ratio 2.3. The head is subtriangular, depressed, and except for the supraoculares, covered with small scales. Scale rows 27-25-21,11 keeled, except the last two rows on each side. Ventralis 183, anal entire, caudals 26, supraoculares 15-15,12 infralabials 16-17. Rostral higher than wide. Four scales in contact with rostral between prenasals, total in contact 8, including both prenasals. Prenasals in contact with first supralabial. Scales on top of head along canthus rostralis 3-3, the posterior larger. Scales on head anterior to supraoculares about 30. Minimum scale rows between supraoculares 6. No supraocular sutures. Nasals 2-2; loreals 2-2, the upper small. Postnasal not in contact with upper preocular. Preoculars 2-2, post- and suboculars 5-6. Preoculars undivided vertically. Scale rows between labials and orbit 3+4, 3+3. First infralabials in contact on median line. Genials in a single pair with relatively obtuse terminal angles. Infrafalabials in contact with genials 3-3.

Across the supraoculares there is a light band about 1 mm. wide, evenly margined with a darker, contrasting color. A preocular light stripe about two scales wide has its upper edge carried from the lower edge of the eye to the last supralabial. There is a postocular light line two to three scales wide, which occupies rows 4 and 5 above the supralabials at the commissure. The top of the head back of the supraoculares is irregularly blotched with brown on a drab ground color.

The dorsal body pattern consists of a series (42) of roughly margined subhexagonal blotches degenerating into rings posteriorly. The blotches are brown (darker on their interior borders) on a drab background. At midbody the blotches are 2 1/2 to 3 scales wide (along the body) by about 10 scale rows across. The interspaces approximately equal the blotches in width. On the sides a secondary series of smaller blotches of double frequency is faintly in evidence. Toward the tail, half of these merge into the main rings.

Using Ridgway's Color Standards (1912) the ground color averages "Light Drab," the blotches "Olive Brown" to "Natal Brown."

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10 These measurements were made before the specimen had been placed in alcohol to harden. All measurements in millimeters.

11 One head length behind head, at midbody and at vent.

12 Right side given first.
The ventrals are "Baryta Yellow" mottled with gray which increases caudad. The head is lighter below, although the infralabials and genials are punctated with gray.

The tail rings number eight and are approximately equal in width to the interspaces. The last two are black and have less definite outlines. The ground color of the tail is similar to that of the body, except that it is dark at the terminus.

There are seven rattles, the string tapering from the base, thus indicating probable continued body growth. The base is black. The button is missing and would probably complete the string.

Range.—This subspecies ranges over much of the plateau region from the Rockies to the Sierras, including Utah west of the 111th Meridian, northern and central Nevada, northern California east of the Sierras, southeastern Oregon and southern Idaho. Whether specimens from northeastern Oregon and central Idaho should be referred to this subspecies, as is sometimes stated, I do not know, as I have not seen sufficient material from this area to judge. Specimens from the eastern border of Washington are of the coast form, oregonus.

A few localities near the borders of the verified territory, which will serve roughly to define it, are given hereunder. From all of these localities, specimens have been examined.

**Utah**

- Cache County
  - Wellsville Canyon
  - Wasatch Mountains
- Salt Lake County
  - Fort Douglas
- Wasatch County
  - Wasatch Mountains
- Utah County
  - Provo
- Sanpete County
  - Maple Canyon
- Garfield County
  - Border of Bryce Canyon National Park, near Tropic
- Washington County
  - Bellevue
  - St. George
  - Zion National Park
  - Springdale

**Nevada**

- White Pine County
  - Snake Valley
  - 5 1/2 mi. S.E. of Osceola
- Nye County
  - Peavine Creek, Toyabe Range
- Mineral County
  - Endowment Mine, Excelsior Mountains (intergrade)

**California**

- Mono County
  - Lundy
  - Williams Buttes
- El Dorado County
  - South of Lake Tahoe
California (Continued)

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Oregon

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Idaho

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Within the territory thus outlined, no other rattlesnake is now known to occur except *Crotalus cerastes* in southwestern Utah and southern Nevada. But intergradation of *lutosus* with other *confluentus* subspecies probably occurs along much of the boundary; also, there may be, and probably are, some areas in which the present subspecies and others occupy the same territory without intergradation.

The maximum altitude of which I have a record is 8000 ft. (Wasatch Mountains, Cache County, Utah).

**General Description and Remarks.**—The following data on this subspecies are summarized from scale counts and measurements of 190 specimens.

Size, large. Scale rows at midbody usually 25 (82 percent.), occasionally 23 (4 percent.) or 27 (9 percent.), rarely 24, 26, 28 or 29 (less than one percent. of each). Scales keeled except the first, or first and second rows, on the sides. Ventralis: males, max. 194, min. 171, av. 180 (115 specimens); females, max. 194, min. 171, av. 184 (71 specimens); both sexes, average 181 (187 specimens). Anal entire. Caudals: males 18 to 29, average 23.7 (108 specimens); females 13 to 25, average 19.3 (70 specimens). The extremes above given are seldom attained, most of the males being from 21 to 26, while the females usually range from 17 to 21. The caudals are generally entire, but a few at either end of the series or in the middle may be divided. Supralabials usually 15 (41 percent.) or 16 (36 percent.), occasionally 14 (11 percent.) or 17 (9 percent.), rarely 13, 18 or 19 (less than 2 percent. of each). Infralabials usually 15 (30 percent.), 16 (38 percent.)
or 17 (22 percent.), occasionally 14 (4 percent.) or 18 (4 percent.), rarely 13 or 19 (less than one percent. of each).

The rostral is usually higher than wide. It is generally, but not invariably, in contact with the prenasals, a negative example being Univ. Mich. 59716. While the prenasal is normally in contact with the first supralabial, such contact is not infrequently prevented by the extension to the rostral of the small scales anterior to the pit. The internasals (scales in contact with the rostral between nasals, regardless of size or relative position) are usually 3 or 4, rarely 2, 5 or 6. The canthals vary from 2 to 5. The scales on the top of the head before the supraoculars are rarely less than 20 and average about 30. The minimum scale rows between supraoculars vary from 3 to 10, averaging 6.

Supraocular sutures or indentations occur in a number of specimens (26 out of 134, or 19 percent.) The tendency to division of the supraoculars is more common in the western than the eastern specimens, thus showing a definite trend toward the subspecies next described; however, even on the western border the positive specimens are not in the majority. In character the sutures vary from single pits to circular swirls or complete transverse divisions. The pits and swirls are usually close to the outer edge on each side, corresponding to the location of the raised process in cerastes. The nasals are 2-2. About half the specimens have two loreals, the rest one; the upper is always the smaller when present. The upper preocular is usually not in contact with the postnasal. In only one specimen is the upper preocular divided vertically in the manner so often observed in mitchelli; however, the upper corner at the eye is not infrequently split off, thus constituting a third small preocular. The scale rows from labials to orbit vary from 2 to 4. I have no record of a specimen with completely divided first infralabials. Usually 3 or 4 infralabials are in contact with the genials; rarely 2 or 5.

The average ratio of the body to the head length in 95 adults (over 500 mm. in length) is 22.9, max. 26.3, min. 19.4. The ratio of the length of tail to total length exclusive of rattles varies from about .060 to .083 in the males (average .070) and .045 to .065 in the females (average .053).

13 In utilizing head sizes for comparative purposes a moderate series must be available as some deviations, owing to drying out and other difficulties in preservation or capture, are to be expected. Where live specimens are available they should be measured immediately after killing, while still limp. Juveniles must be neglected or treated graphically, as the head size is comparatively larger in the young.
The ratio of width across the supraoculars to the space between averages 2.5 (range 2.1 to 2.9).\textsuperscript{14}

The largest specimen examined measured 1075 mm. (44 in.). There is every reason to believe that a length of not less than 1230 mm. (4 ft.) is reached. The smallest specimen noted was 270 mm. in length.

The most conspicuous mark on the head is a light bar across the supraoculars which is always present even in adults; in this respect it differs from \textit{oreganus} which usually loses this mark with age. This supraocular dash is bordered by dark lines, thus giving it a clear edge (a difference from the \textit{atrox} group and \textit{scutulatus}). The edges of the dash may be parallel or inwardly divergent (the latter form predominates in \textit{confluentus}).

Behind the supraoculars there is an area of the ground color darkened by blotches or spots of irregular position and outline. Anterior to the neck there is usually a pair of blotches constituting an introduction to the dorsal series.

On the sides of the head are the pre- and postocular light stripes so characteristic of the rattlers. These are separated by a dark stripe about three scales wide arising at the eye and passing backward and downward, the lower edge being above the angle of the mouth. The anterior light stripe, about two scales wide, arises at the upper preocular and usually includes the last supralabial. There is often a characteristic dark spot on the labials splitting this light line at about the ninth and tenth supralabials. The posterior light stripe, 2 to 4 scales wide, arises at the upper posterior corner of the eye and passes backward to the neck, always above the supralabials. Its interior edge is often ill defined.

Below, the head is usually immaculate, except that the mental and infralabials are dark.

The ground color of the body is drab, or buff. On this there is a dorsal row of irregular brown blotches usually subhexagonal in shape. These blotches vary in number from 35 to 49 (average of 156 specimens, 40.9). The blotches are ordinarily greater in dimension across the body than longitudinally (about 10 scales to 3). Usually the interval between blotches at midbody is approximately equal to their width, but it may be less, thus approaching \textit{oreganus}.

The blotches are generally dark brown, at least at the edges; however, in some large adults they are much faded. Rarely the blotches are

\textsuperscript{14} 34 random specimens of \textit{scutulatus} have an average of 3.3 (range 2.6 to 4.0).
of solid color, but generally the borders are darker; sometimes the border only is conspicuously different from the ground color. The blotch edges are irregular or serrated, but not closely following scale lines (i.e., with unicolored scales) as in *scutulatus* and *molossus*. The blotches are not bordered with a row of scales lighter than the ground color as in *oreganus* and *scutulatus*, nor by a narrow bright line as in *confluentus*. On the sides there is a secondary set of blotches faintly in evidence and often of double frequency. Toward the tail the dorsal and side series join to form rings which, however, do not cross the ventrals.

The tail has the same ground color as the body (differing from the *atrox* group and *scutulatus*). It is crossed by rings approximately equal to the interspaces and showing the following variation in number: males 5 to 8, average of 95 specimens 7.2; females 5 to 7, average of 58 specimens 5.8. The last two or three rings are usually dark brown or black, are narrow and often less evenly defined than the others, a characteristic of *confluentus*.

Below, the color is cream or straw suffused with gray. The dark areas are more evident on the edges of the ventrals and posteriorly. The underside of the tail is usually mottled with black. The base of the rattles is black.

The young of this subspecies differ less in color and markings from *oreganus* and *confluentus* than the adults.

As seems to be generally the case with rattlers, the males of this subspecies in collections exceed the females in the ratio of about 60 to 40.

**THE TIGER RATTLE SNAKE AND ITS AFFINITIES**

When, in 1893, the Death Valley Expedition collection was worked up there seem to have been available in the National Museum only three specimens of *Crotalus tigris*, the co-types USNM 471 and 472 from Sierra Verde and USNM 5271 from Fort Buchanan, Arizona. The former were already over forty years old and in rather poor condition. The latter was a peculiar specimen, a faded skin of doubtful classification.\(^{15}\) It was natural, therefore, when the Expedition brought in fourteen fine specimens from California and Nevada that certain differences of marking and form, evident in a larger series, between the northern and southern specimens should have gone unnoted. Since that time the California-Nevada specimens available have been increased by the Heller (Field Museum) collection and a number in the Museum of

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\(^{15}\) I would classify it as *C. c. confluentus*. 
Vertebrate Zoology of the University of California. But few additions have come in from Arizona, so that the California-Nevada material has quite overshadowed that from Arizona until quite recently.

Camp in 191616 remarked concerning three rattlers taken at Horn Mine, southeastern San Bernardino County, California: “In scutellation and coloration these examples show departure from some of the typical characteristics of mitchellii and seem to approach to a certain extent those of tigris.” He was speaking primarily of the separation by small scales of the rostral and prenasal, which separation had long been considered the test for mitchellii.

Do Amaral,17 in his study of tigris and mitchellii in 1929, determined that intergradation was indicated not only in this essential characteristic but in color as well. He therefore concluded that mitchellii is a subspecies of tigris, and referred to it as Crotalus tigris mitchellii.

From time to time in the course of extracting venom from San Diego County specimens of mitchellii I have noted individuals having a prenasal partly or wholly in contact with the rostral on one or both sides. A study was therefore begun on the relationship of this form with tigris and, from a consideration of material which has only recently become available, it was determined:

First: That the California-Nevada form of tigris not only intergrades with mitchellii as previously determined by do Amaral, but likewise intergrades with lutosus in west central Nevada; and,

Second: That the Arizona form of tigris seems to be quite distinct from the California-Nevada race.

Intergradation of the Arizona, or true tigris, with mitchellii is not evident from any available material, as is the case with the California-Nevada form. Thus the Arizona species remains Crotalus tigris, while the California-Nevada form becomes a subspecies of C. confluentus as does mitchellii as well.

The first conclusion particularly was a surprise to me, for an acquaintance with mitchellii and oreganus as they are found in their coincident ranges in San Diego County, California, would never have caused me to suspect so close a relationship.18

16 Univ. of Calif. Pubs. in Zool., Vol. 12, No. 17, p. 533.
17 Bull. Antivenin Inst. of Am., Vol. II, No. 4, p. 82.
18 Stejneger anticipated this relationship when he studied the Death Valley series. “A study of the present series convinces me that the nearest affinity of the ‘tiger rattler’ is with the true Crotalus confluentus of the plains in spite of the rather striking and in many respects peculiar aspect of the former.” N. A. Fauna, No. 7, p. 215.
In this investigation, through the kindly help of several institutions and some purchased material, I have been able to assemble 30 preserved specimens of the form hitherto considered *tigris* from California-Nevada and 12 of the true *tigris* from Arizona. I have had for comparative purposes, 52 specimens of *mitchellii*. I have seen alive several additional *tigris* from each area and about 150 specimens of *mitchellii*.

Since the California-Nevada form hitherto considered *tigris* differs both from *Crotalus confluentus lutosus*, with which it intergrades to the north, and *Crotalus confluentus mitchellii* (as the latter must now be known) to the south, it requires a new name for which I suggest

**Crotalus confluentus stephensi**,19 subsp. nov.

**Panamint Rattlesnake**

Plate 10, fig. 2.

*Type.*—No. 6699 in the collection of the Museum of Vertebrate Zoology of the University of California. Collected two miles west of Jackass Springs, Panamint Mts., altitude 6200 ft., Inyo County, California, by Dr. Joseph Grinnell, October 8, 1917.

*Diagnosis.*—A subspecies of *Crotalus confluentus* differing from the other subspecies except *mitchellii* in markings and coloration; in lower average internasals and scale rows; in having a rostral usually wider than high; also in high proportion of indented or sutured supraoculars. From *mitchellii* it differs in having the rostral generally in contact with the prenasal. From *C. tigris* it differs in greater number of ventrals, supra- and infralabials; in markings and color; in sutured supraoculars and in larger proportionate head size.

*Description of Type.*—Young adult male. Length 591 to rattles, tail length 48, ratio .081. Length of head 26, times contained in body length 22.8. Width of head 20. Width across supraoculars 12.0, distance between supraoculars 4.4, ratio 2.7. The head is subtriangular, moderately depressed and, except for the supraoculars, covered with small scales. These are irregular and unkeeled except posteriorly.

The scale rows are 25-25-19, keeled except the first row. Ventrals 177, anal entire, caudals 25, supralabials 15-15, infralabials 14-15. Rostral wider than high. Two scales in contact with the rostral between prenasals; total in contact 7 including both prenasals. Prenasals in contact with first supralabials (right almost separated). Scales on top of head along canthus rostralis 4-4, the posterior larger. Scales on head anterior to supraoculars 25. Minimum scale rows between supraoculars 5. Supraoculars sutured at outer edges and of rough texture. Nasals 2-2, loreals 2-3. Postnasal not in contact with upper

19 Named in honor of my good friend Frank Stephens, Curator Emeritus of The San Diego Society of Natural History and a member of the Death Valley Expedition which first collected this form nearly forty years ago.
preocular. Preocullars 2-2, post- and subocu- lars 5-5. Partial split in right upper preocul ar. Scale rows between labials and orbit 2+3+4, 2+3+4. First infralabials in contact on median line; three infralabials in contact with the genials on either side. Genials in a single pair, short and with relatively obtuse terminal angles.

Above, the head is light brown mottled with darker. A supraocular cross mark is faintly in evidence on one side. Side stripes on the head are obsolete. Below the color is straw, the mental and infralabials suffused with gray.

The dorsal body pattern consists of a series of thirty-five roughly margined subhexagonal brown blotches on a drab background, tending to grayish on the sides. Punctations are in evidence in both blotches and background. The anterior and posterior bordering scales of the blotches are often tipped with black. At midbody the blotches are 2½ to 3 scales wide (along the body) by about 11 scale rows across. The interspaces are slightly narrower than the blotches. A secondary series on the sides is quite in evidence and is of double frequency. Beginning at about blotch 17 the dorsal and half the side marks are confluent, from which point the blotches degenerate into rings. The ventrals are mottled with patches of gray dots.

The tail rings number 6, of which the terminal 2 are black, the last being wider. The interspaces are narrower than the rings. Below, the tail is mottled, the last ring only being complete on the underside.

There are 5 rattles in the string, tapering from the base, thus indicating future growth. The base is black. Probably only the button is missing.

Range.—This subspecies ranges from northwestern Esmeralda County, Nevada, and Round Valley, Mono County, California, southeasterly to Clark County, Nevada, and northern San Bernardino County, California. In southern Mineral County, Nevada, there is intergradation with lutosus. From near Mono Lake, California, two specimens that I have seen were pure lutosus. In Inyo County, California, stephensi occurs in the Inyo, Coso, Panamint, Argus, Black, Slate, Grapevine and Funeral Ranges. West of Owens Valley it ascends the east slope of the Sierras at least to an altitude of 6500 ft. (Independence Creek). Here intergradation with oreganus is possible although not indicated by present specimens. The southerly limit is difficult of definition because of the gradual intergradation with mitchelli. I have referred to stephensi specimens as far south as Randsburg and Cave Springs, San Bernardino County, while those to the south from Barstow, Turtle Mountains and near Needles, California, because of size and coloration, have been considered mitchelli, in spite of occasional incomplete rostral separation. In Nevada the eastern limit is imperfectly known. One specimen is available from Nye County near the state line, and three from the vicinity of Las Vegas, Clark County, which show mitchelli tendencies in markings and color.

General Description and Remarks.—The following is a summary of scale counts and measurements of 30 specimens.

Size medium. Scale rows at midbody 23 or 25, average 23.6. Scales are keeled, except occasionally the first or first and second rows.
Ventrels, males 166 to 181, average 174; females 173 to 182, average 178. Anal entire. Caudals, males 23 to 27, average 25; females 17 to 22, average 19. Supralabials usually 13, 14 or 15, rarely 12 or 16, average 14.3. Infrafalabials usually 14 to 16, rarely 17 or 18, average 15.3.

The rostral is wider than high (rarely equal) and is at least partly in contact with the prenasals. The prenasals are generally in contact with the first supralabial. There are two internasals, except in one instance in which there are four, owing to the beginning of the separation typical of *mitchelli*. The canthals vary from 2 to 5, being generally 3 or 4. Scales on top of the head anterior to the supraoculars are rarely less than 20 and average 24. (The corresponding figure for *tigris* is 16). The minimum scale rows between supraoculars are usually 5 or 6, occasionally 3, 4 or 8.

Supralocular sutures or indentations are evident in 29 cases out of 30.\(^{20}\) They usually take the form of lines or circular swirls at the outer edges. The supralocuarians are roughened even where they are unbroken. Occasionally the outer edge is rough, as if bits had fallen away at the sutures. The nasals are 2-2; the loreals 1 or 2, rarely 3. The upper preocular may be entire or split either vertically or at angle. The minimum scale rows from labials to orbit are 2 or 3. The first infralabials are undivided; three are usually in contact with the genials on each side.

In color this subspecies is highly variable, as if the several desert mountain ranges had produced different races. The ground color may be straw, tan, yellow-brown, buff, gray or blue-gray. The dorsal blotches are usually subhexagonal, but may approach diamonds, squares or rectangles. They vary from gray to buff, brown or red-brown and may or may not be sharply contrasting with the ground color. The edges are seldom even or clearly defined. Posteriorly the blotches deteriorate into rings. In number the blotches vary from 30 to 43, average 37. Punctations resembling those of *mitchelli* are often in evidence. Below, the color is yellow or straw mottled with gray. Specimens from the southeastern section of the range are lighter, with less pronounced blotches and are usually punctated in the *mitchelli* manner. Many specimens have characteristic black tips on the scales bordering the blotches.\(^{21}\) The head is not brightly marked. The pre- and postocular light stripes are generally obsolete; where present the postocular stripe is

\(^{20}\) In *tigris* the count is ten negative and one doubtful out of eleven.

\(^{21}\) Occasionally seen also in *mitchelli* and *lutosus*.
2 scales wide and passes above the angle of the mouth. The supraocular cross mark is usually missing but is occasionally faintly in evidence.

The tail rings vary from 3 to 6 in the females (usually 5) and 6 to 8 in the males (usually 6 or 7). From 1 to 3 terminal rings are black. The ground color of the tail does not differ essentially from the body color. The base of the rattles is black.

The ratio of body length to head in adults varies from 20.2 to 24.0, the average being 22.2. The corresponding figures for lutosus are 19.4 to 26.3, average 22.9 and for tigris with its conspicuously small head 24.6 to 27.6, average 25.9. For southern California mitchellii the average is 21.9; for Arizona mitchellii 22.8.

The ratio of tail to total length except rattles is, for the males, .074 to .089, average .081, and for the females .053 to .066, average .061.

The ratio of the distance across the supraoculars to the space between varies from 2.3 to 3.3, average 2.7.

The largest specimen examined measured 840 mm., the smallest 257 mm.

A NEW SUBSPECIES FROM THE UPPER COLORADO BASIN

In the valleys of the Colorado and Green Rivers above their junction there exists a stunted, light colored form of C. confluentus differing materially from its neighbors on all sides. If any rattlesnake deserves to be called a "White" rattler it is this, although it is in reality cream colored. However, it is lighter than any mitchellii or cerastes that I have ever seen and specimens have even been considered albinos. For this subspecies I propose the name

_Crotalus confluentus decolor,_22 subsp. nov.*

**MIDGET FADED RATTLE SNAKE**

_Type._—No. 923 in the collection of the Field Museum of Natural History. Captured at Grand Junction, Mesa County, Colorado. Collected by E. S. Riggs and H. W. Menke in the summer of 1900. Paratype: No. 922 taken at the same time and place.

_Diagnosis._—A subspecies of _Crotalus confluentus_ differing from all other

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22 Faded; also degenerate.

* After the completion of this paper, but too late to permit its modification, I received A. M. Woodbury's paper entitled "A New Rattlesnake from Utah," Bulletin of the University of Utah, Vol. 20, No. 6, Dec. 1, 1929, in which _Crotalus concolor_ from King's Ranch, Garfield County, Utah, is described. That this will probably throw _Crotalus confluentus decolor_ into synonymy is evident.
subspecies in coloration and size, being the lightest as well as the smallest of the several subspecies.

Description of Type.—Adult male. Length 513 to rattles, tail length 43, ratio tail to total length .084. Length of head 23, times contained in body length 22.3. Width across supraoculars 11.6, space between 4.8, ratio 2.4. The head is subtriangular, moderately depressed and, except for the supraoculars, covered with small scales. These are practically unkeeled throughout. The canthus rostralis is sharp and the nose upturned.

The scale rows are 25-25-19, keeled except the first on each side. Ventrals 169, anal entire, caudals 25, supralabials 15-14, infralabials 16-13. The rostral is higher than wide. Three scales in contact with the rostral between prenasals; total in contact 8, including both prenasals. The prenasal is in contact with the supralabials on the left but not the right. Scales along the canthus rostralis from rostral to supraoculars 4-5, of irregular size. Scales on head anterior to supraoculars about 45. Minimum scale rows between supraoculars 5. Supraoculars striated, with two small border pits on right, one on left. Nasals 2-2, loreals 2-3. Upper preoculars, undivided, not in contact with postnasals. Preoculars 2-2, post- and suboculars 6-7. Scale rows between labials and orbit 3+3, 3+4. First infralabials undivided and in contact on median line; three infralabials in contact with genials on each side. A single pair of genials, short and with outer edges curved.

Above, the head is buff. A preocular light line is faintly in evidence and thus the supraoculars are lighter. No postocular light line is to be seen, but this may be due to the condition of the specimen. A supraocular light cross dash is faintly perceptible; it is inwardly divergent.

The body (in alcohol) is buff as to ground color. This color is due to a multiplicity of small brown dots barely visible to the naked eye. Upon this ground color is superimposed a series of 43 inconspicuous subrectangular blotches with edges faintly outlined in brown and with centers slightly darker than the ground color. These blotches have moderately even edges and in width are approximately equal to the interspaces. At midbody they measure 3 to 4 scales longitudinally by 10 scale rows across the body. A secondary series of blotches is faintly in evidence on the sides. The ventrals are immaculate and of a somewhat lighter shade than the ground color.

The tail rings number about 9, the last one only being dark. This ring is the most conspicuous mark on the body. There are 9 rattles in the string, with an indeterminate number lost. Those which remain are uniform in size, indicating that this snake has practically reached his full growth. The rattle dimensions are 7.7 mm. across by 4.2 mm. thick. The length is 18.5 mm. for 9 full exterior rings. The base of the rattles is black.

Range.—This subspecies is found in northeastern Utah, extreme western Colorado and southwestern Wyoming in the valleys of the Green and Colorado Rivers above their junction. It may also be found in the valley of the San Juan; a single specimen from that area is tentatively placed in the group although differing from the others in some particulars.
Specimens have been examined from the following localities:

Grand Junction, Mesa County, Colorado (Field Museum 923-922). Type and paratype.

Green River, Sweetwater County, Wyoming, 4 mi. north of Linwood, Utah (USNM 48680).

White River, Uintah County, Utah (Carnegie 1429).

Dragon, Uintah County, Utah (Field Museum 2791).

East of Helper, Carbon County, Utah (Univ. Mich. 62143).

Thompson, Grand County, Utah (CAS 39098, 40960).

Grand Gulch, San Juan County, Utah (tentative) (AMNH 18104).

From within the territory bounded by these localities all *Crotalus* specimens examined have consistently fallen into this classification. Little is known as to the exact limits of the territory occupied, since specimens are not available from closely contiguous points. This is not the only subspecies in Colorado west of the Rockies; I have seen specimens of typical *confluentus* from Maybell, Moffatt County, and Naturita, Montrose County, which localities are north and south of the Colorado River. The areas of intergradation remain to be determined.

**General Description and Remarks.**—The following are the results of an examination of the 9 specimens listed, of which two are, unfortunately, in poor condition.

Size, small. Scale rows at midbody 23 or 25, average 24.3. Scales are keeled except the first one or two rows on either side.


The rostral is higher than wide and is in contact with the prenasals. The prenasals may be in contact with the supralabials or separated therefrom by a row of scales. The internasals vary from 2 to 5, average 3.6. The canthals vary from 2 to 4. Scales on the top of the head anterior to the supraoculars average 33. The minimum scale rows between supraoculars vary from 4 to 7, averaging 6. Supraocular indentations are evident only in the type specimen. The nasals are 2-2; the loreals 1 to 3, more often 2. The upper preocular is occasionally split; it is not in contact with the postnasal. The scale rows from labials to orbit vary from 2 to 4. One specimen has irregularly divided first infralabials. Usually 3 infralabials are in contact with the genials on each side.

The color (in alcohol) of this subspecies is chalk white, straw or
cream. The ground color is partly derived from a thick sprinkling of dots which are sometimes quite conspicuous. The dorsal blotches are usually subrectangular in shape, with the long axis across the body. Occasionally they are elliptical or square. In one specimen (CAS 38098) they are quite obsolete and the specimen is unicolor. Usually the blotch centers are similar in color to the area outside with only the borders in evidence, but occasionally the centers are darker, although still in contrast with the dark brown of the edges. The edges are even, as in confluentus, rather than irregular, as in lutosus. The body blotches average 40. The color below is clear or faintly mottled. The tail rings average 8, the last one or two being generally black, constituting the most conspicuous item of the coloration.

On the head, supraocular cross dashes of the inwardly divergent type are usually present, thus resembling confluentus. The pre- and postocular light stripes are sometimes faintly in evidence. The posterior when apparent is 2 to 3 scales wide, thus showing affinity to lutosus. In body blotches and tail rings this subspecies seems more nearly to resemble confluentus; but the scale rows between the supraoculairs and width of the postocular light line indicate affinity to lutosus.

The ratio of body length to head averages 23.1 (range 22.3-23.7). The ratio of tail to total length averages for the males .077 and for the females .056. The ratio of the distance across the supraoculairs to the interspace is 2.5.

The largest specimen examined measures 640 mm., the smallest 451 mm., average 537 mm. That this is not a chance collection of immature specimens is clearly indicated by the character of the rattles, which are small and in most cases have reached parallelism.

This summary is based entirely on alcoholic material; I have seen none of this subspecies alive.

GRAND CANYON RATTLESNAKE

In the Grand Canyon occurs a peculiar phase of Crotalus confluentus distinguished by its vermillion or salmon coloration and an almost complete absence of markings in the adult. This may be known as

Crotalus confluentus abyssus, 23 subsp. nov.

GRAND CANYON RATTLESNAKE

Plate 11, fig. 1.

Type.—No. 2216 in collection of L.M.K. Captured alive on the Tanner

23 Having reference to habitat.
Trail 300 ft. below the south rim of the Grand Canyon, Coconino County, Arizona; altitude approximately 7000 ft. Collected Sept. 15, 1929, by E. D. McKee.

**Diagnosis.**—A large form of *Crotalus confluence* differing from all other subspecies in coloration and in virtual absence of markings in the mature adults.

**Description of Type.**—Adult male. Length 905 to rattles, tail length 62, ratio of tail to total length .069. Length of head 39, times contained in body length 23.2. Width of head 32. Width across supraoculars 19.3, distance between 7.4, ratio 2.6. Head flat-topped and depressed, suboval in outline, and, except for the supraoculars, covered with small scales. Posteriorly these are keeled.

The scale rows are 25-25-19, all except the first row on each side being keeled. The ventrals are 173, anal entire, caudals 25, supralabials 17-17, infralabials 15-15. The rostral is higher than wide. Four scales in contact with the rostral between the prenasals; total in contact 8, including both prenasals. Pre-nasal in contact with the first supralabial on each side. Scales along the canthus rostral is from rostral to supraocular 5-5, the posterior largest. Scales on head anterior to the supraoculars about 35. Minimum scale rows between supraoculars 6. Supraoculars rough with a slight fold in evidence on each. Nasals 2-2, loreals 1-1, upper preocular not in contact with postnasal, not divided vertically. Preoculars 2-2, sub- and postoculars 6-6. Scale rows between labials and orbit 3+4, 3+4. First infralabials undivided and in contact on median line; 4-3 in contact with genials. A single pair of genials, short and with outer edges curved.

The head is fawn color above. A preocular light stripe is faintly in evidence, of orange color; the postocular stripe is obsolete. Supraocular cross mark faintly in evidence, inwardly divergent.

The ground color of the body dorsally (shortly after preservation in alcohol) was “Fawn Color”24, on the sides “Onion-skin Pink”, below “Pinkish Buff” suffused with gray. In life the dorsal color was lighter and brighter, being between “Flesh-ocher” and “Salmon Color.”

When held at a proper angle with the light, a series of 42 dorsal blotches may be seen, faintly darker than the ground color—particularly the borders. These are of characteristic *confluence* subrectangular shape and measure about 9 scales across the body by $3\frac{1}{2}$ longitudinally. The interspaces are somewhat narrower. A secondary series of blotches is faintly discernible posteriorly. The tail rings number 8 of which the last two are almost black, constituting the only conspicuous marks on the body.

The rattles are an incomplete string of 12 of which at least 10 show parallel dimensions (13.3 mm. across). The base is black.

**Range.**—This form has been taken only in the Grand Canyon of the

---

24 Quotation marks refer to color designations of Ridgway, 1912.
Colorado in the vicinity of Grand Canyon P. O., Coconino County, Arizona, but on both sides of the river and at least to the rim of the Canyon.

**General Description and Remarks.**—The first specimen seen of this striking form was kindly forwarded me by Mr. Vernon Bailey. Subsequently I received three live specimens through the courtesy of Mr. E. D. McKee, Naturalist at Grand Canyon National Park and his assistant Mr. S. B. Jones. Altogether I have examined the following specimens from the immediate vicinity of the Canyon (in the Park region) covering a distance of about 40 miles along the river:

<table>
<thead>
<tr>
<th>Number</th>
<th>Locality</th>
<th>Bank</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCNP R37</td>
<td>Tonto Platform near Bright Angel Trail Alt. 4000 ft.</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>GCNP R38</td>
<td>Plateau near Navajo Point, Alt. 7000 ft.</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>GCNP R49</td>
<td>Phantom Ranch, north of Bright Angel Creek</td>
<td>S</td>
<td>SK</td>
</tr>
<tr>
<td>GCNP R50</td>
<td>Desert View Point</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>GCNP R51</td>
<td>Desert View Point</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>LMK 2093</td>
<td>Roaring Springs Power Plant</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>LMK 2215</td>
<td>Roaring Springs Power Plant</td>
<td>N</td>
<td>A</td>
</tr>
<tr>
<td>LMK 2216</td>
<td>Tanner Trail, 300 ft. below South Rim, Alt. 7000 ft. (Type)</td>
<td>S</td>
<td>A</td>
</tr>
<tr>
<td>LMK 2272</td>
<td>Grand View Trail, 2000 ft. below South Rim</td>
<td>S</td>
<td>A</td>
</tr>
<tr>
<td>USNM 32725</td>
<td>Grand Canyon</td>
<td>SK</td>
<td></td>
</tr>
<tr>
<td>USNM 59747</td>
<td>Shimuno Creek</td>
<td>N</td>
<td>SK</td>
</tr>
<tr>
<td>USNM 78477</td>
<td>Bright Angel Canyon</td>
<td>N</td>
<td>SK</td>
</tr>
<tr>
<td>USNM 78478</td>
<td>Burro Spring</td>
<td>N</td>
<td>SK</td>
</tr>
</tbody>
</table>

(Notes: A—Seen alive. P—Poor condition. SK—Skin. GCNP—Grand Canyon National Park Specimen.)

It will be observed that several of these specimens are in poor condition or are skins. Concerning these the evidence is by no means conclusive, as important characteristics cannot be safely determined from them. From an examination they seem neither to prove nor disprove the theory that this is a consistent subspecies with the confines of the Canyon. I have every reason to believe that *confluentus confluentus* as it ranges in north central Arizona comes quite up to the Canyon rim; I have seen specimens from Anita, Valle and points farther south. I am of the opinion that GCNP R38, R50 and R51 may be considered *confluentus confluentus* or intergrades. Of the balance all the adults show the pink or salmon coloration modified by the method of preservation used. Blotches are more or less in evidence depending on age.
With reference to the specimens examined alive, LMK 2272 is a juvenile of a coloration not differing essentially from either *confluentus* or *oreg anus*. LMK 2215 is a young adult with conspicuous orange brown dorsal blotches on a salmon background. LMK 2093 (not seen alive) is similar in color to the type, of large size and with blotches even less evident.

From the 10 specimens taken within the Canyon, the following general description and variations of the form may be compiled: Size large. Scale rows 25 or 27; ventrals 173 to 191 (males 173 to 185, females 183 to 191); anal entire; caudals, males 23 to 27, females 21 or 22. Supralabials usually 15 or 16, occasionally 17; infralabials 14 to 17, usually 15 or 16. First infralabials undivided (one shows a tendency toward division). Rostral higher than wide and in contact with prenasals. Internasals 3 to 6, usually 4; canthals 2 to 4. Scales on head before supralabials 24 to 35, average 30. Minimum scale rows between supralabials 5 to 8, average 6.6. Supraocul ars usually without sutures. Nasals 2-2; loreals usually 2-2, occasionally 1-1. Preocul ars 2 or 3; sub and postocul ars 5 to 8.

Posterior light stripe 2 to 3 scales wide, often obsolete. Body spots 39 to 46, average 43. Tail rings 6 to 8, the last 1 to 3 darker. The body blotches, when in evidence, have serrated edges. The supraocular light cross bars, when present, may have either parallel or inwardly divergent borders.

Thus we have here a form which is not unlike either *lutosus* or *confluentus* in the juvenile state, but which later departs from both. In general it seems more closely related to *lutosus* in character of body markings, width of postocular stripe, scales before and between suproocu lar s and in tail rings. In color it more nearly resembles *confluentus*, especially the stunted red form found in the vicinity of Winslow, Arizona. The latter, however, is a darker, richer red with typical *confluentus* markings and scutellation. This may be a case of parallel development or intergradation down the Little Colorado River.

**DIFFERENTIATION OF C. SCUTULATUS**

It appears desirable to conclude these notes with a general survey of the subspecies of *Crotalus confluentus* with particular reference to their ranges and areas of intergradation.

As I have stated, although the studies which led to the preparation of the present paper were initiated in an endeavor to understand
scutulatus, the data on the latter are as yet unassembled and may appear later. However, I cannot at this time summarize confluentus without first indicating sufficient scutulatus differences to clear it from the picture.

To return therefore to scutulatus, here was a snake, the classification of which seemed to be often based largely on geographical considerations. When from the Mojave Desert or the Antelope Valley in California it was classified as oreganus; when from central Arizona as oreganus, confluentus or atrox; and when from southern Arizona or Mexico as atrox or, rarely, as molossus. Yet when these several specimens are brought together they are obviously the same species, differing consistently in no characteristics. The only conclusion therefore is that either this species differs from those with which it has been combined or such species themselves are all identical; and the latter is certainly not the case as between atrox and the members of the confluentus group.

The differences between scutulatus and atrox or confluentus are even more evident in live specimens than preserved;²⁵ it must be admitted that in poorly preserved material, particularly if faded, there will be cases difficult of decision. But with live or well preserved material I have yet to see a border-line case. I have tried the experiment with a commercial dealer (they usually do not differentiate between atrox and scutulatus) of suggesting that he note certain differences in coloration, markings, head form, etc., and segregate his snakes accordingly. Nothing was said about head scales or such technical points. Out of about 100 live snakes only one mistake was made and this was corrected at once when I suggested that one snake in a cage of nine was still wrongly placed.

Possibly one difficulty in the segregation of scutulatus is that too much stress has been placed on the paired scutes between supraoculairs. This is not a certainty in classification, for occasionally one of these two scales will be split in scutulatus and specimens of both atrox and confluentus are sometimes met having fewer than normal scale rows at this point. Besides, it is evident that classification on a single characteristic, between forms having coincident ranges, is merely division rather than classification. But when we note as between two such species as atrox and scutulatus a considerable number of differences in which there

²⁵ "It sometimes happens that two animal forms when studied as museum specimens are so extremely similar as to be scarcely separable, or even not always separable with certainty, although in life they could not be confused." A. H. Clark, Scientific Monthly, Sept., 1929, p. 256.
may be some overlapping in one or two at a time, but in which the weight of the evidence is always definite, we may conclude that a real difference exists. And there are always characteristics not susceptible of statistical enumeration which aid in classification; as, for instance, the evident punctations in the pattern of atrox as compared with scutulatus, the sharpness of the canthus rostralis in the latter, the texture of the head scales, etc. These alone would differentiate the two species.

Some of the tabular differences follow. Only Arizona specimens will be taken, for here the species are most often confused and have similar ranges and habitats. In California, where the two species have separate ranges, it might be thought that geographical races were indicated by such differences.

A. Minimum Scale Rows Between Supraoculalrs

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrox</td>
<td>0</td>
<td>18</td>
<td>38</td>
<td>23</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>92</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

B. Postnasal-Preocular Contact
(Postnasal in contact with upper preocular; or, if not in contact, such contact prevented by an upper loreal.)

<table>
<thead>
<tr>
<th>Contact or loreal</th>
<th>No contact and no loreal</th>
<th>Indeterminate (borderline)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrox</td>
<td>170</td>
<td>1</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>8</td>
<td>172</td>
</tr>
</tbody>
</table>

(Two counts per snake)

C. Tail Rings

<table>
<thead>
<tr>
<th></th>
<th>All black</th>
<th>Part black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrox</td>
<td>87</td>
<td>0</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>13</td>
<td>83</td>
</tr>
</tbody>
</table>

D. Postocular Light Stripe

<table>
<thead>
<tr>
<th>Intersects</th>
<th>Above</th>
<th>Indeterminate (faded, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouth</td>
<td>mouth</td>
<td></td>
</tr>
<tr>
<td>Atrox</td>
<td>87</td>
<td>0</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>0</td>
<td>81</td>
</tr>
</tbody>
</table>

E. Supraocular Dash

<table>
<thead>
<tr>
<th>Present</th>
<th>Absent</th>
<th>Indeterminate (faded, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrox</td>
<td>72</td>
<td>11</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>8</td>
<td>79</td>
</tr>
</tbody>
</table>

(Differences in totals due to incomplete records made of some specimens)

This appears to be a rather definite proof of the difference between _atrox_ and _scutulatus_. Amongst all of these specimens there is only one which overlaps or is indeterminate in more than two characteristics. And these are by no means all of the characters in which these snakes differ. Even in ventral scale counts there is a considerable average separation as shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Atrox</em></td>
<td>46</td>
<td>192</td>
<td>177</td>
<td>184</td>
<td>35</td>
<td>195</td>
<td>177</td>
<td>187</td>
</tr>
<tr>
<td><em>Scutulatus</em></td>
<td>55</td>
<td>184</td>
<td>171</td>
<td>177</td>
<td>39</td>
<td>192</td>
<td>172</td>
<td>180</td>
</tr>
</tbody>
</table>

Similarly, differences may be pointed out between _scutulatus_ and Arizona _oreganus_ (cerberus?). Again the territories of these species overlap, but here the habitats are not entirely the same. In Arizona _oreganus_ is a mountain form, while _scutulatus_ is largely found on the desert. However, _scutulatus_ does ascend the mountains and has even been taken at an altitude of 6800 ft., while _oreganus_ ranges down at least to 2000 ft. So there is some overlapping (they are known to occur together in the vicinity of Prescott) yet there seems to be no intergradation. Some differences follow:

A. **Minimum Scale Rows Between Supraoculars**

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Oreganus</em></td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><em>Scutulatus</em></td>
<td>92</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

B. **Scales in Contact With Rostral Between Prenasals**

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Oreganus</em></td>
<td>0</td>
<td>3</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td><em>Scutulatus</em></td>
<td>93</td>
<td>1</td>
<td>1^{27}</td>
<td>0</td>
</tr>
</tbody>
</table>

None of these specimens overlaps in both characteristics. Another useful check is the postocular light line, which in Arizona _oreganus_ is almost invariably two scales wide while in _scutulatus_ it is one.

The overlapping of the ranges of _scutulatus_ and _confluentus confluentus_ in northern Arizona is not yet indicated except by specimens of somewhat uncertain locality. It is probable that the ranges are approximately contiguous, which would lead one naturally to expect intergradation in species having so much in common. Yet I have not thus far seen any well preserved material in which the dorsal pattern did not show the following differences: _Confluentus_, squares, rectangles,

^{27} May be due to abrasion and regrowth in captivity.
hexagons or ovals with the borders cutting scales indiscriminately; scutulatus, diamonds or hexagons with unicolor scale borders (i.e., colors following scale outlines; cf. Plate 9, fig. 1 and Plate 12, fig. 1).

The following are some statistical comparisons, using only Arizona specimens, as before:

A. **Minimum Scale Rows Between Supraoculares**

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confluentus</td>
<td>2</td>
<td>29</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>92</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

B. **Scales in Contact With Rostral Between Prenasals**

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confluentus</td>
<td>3</td>
<td>13</td>
<td>22</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>93</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

C. **Tail Rings**

**Males:**

<table>
<thead>
<tr>
<th></th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confluentus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>11</td>
<td>13</td>
<td>6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Scutulatus</td>
<td>0</td>
<td>4</td>
<td>29</td>
<td>20</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Females:**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>11</th>
<th>4</th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confluentus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Scutulatus</td>
<td>14</td>
<td>20</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Here again, while we have some overlapping (except in the tail rings), there are always sufficient cumulative differences so that there is never doubt in the case of well preserved specimens. For instance I have one confluentus (LMK 196 from Winslow, Arizona) in which the head scales show no differences from scutulatus, one of the possible reversions to type that seem occasionally to arise in Crotalus. But the pattern is clearly confluentus not only in color, form and arrangement, but the numbers of body blotches and tail rings are both higher than in any Arizona scutulatus amongst nearly 100 specimens. So there is no difficulty in classification when all differential characteristics are canvassed and the material is alive or well preserved.

I have already indicated some outstanding differences between scutulatus and lutosus.

In California, intergradation between scutulatus and oreganus might be expected in the Tehachapi Mountains northwest of Antelope Valley or the San Gabriel and San Bernardino Ranges southwest of the desert. Yet notwithstanding considerable available material no intergrades as yet have been forthcoming.
So I conclude that the specific validity of *scutulatus* is demonstrated. I do not think any form should be assumed identical with another or even conspecific without definite proof.

It may be thought that there has been inconsistency in assuming a subspecific status of *decolor* and *abyssus* while *scutulatus* is considered a full species, although actual intergrades are not more available in the former cases than the latter. But the cases differ in this: first the character differences are less in the former; and secondly the former are known from comparatively few specimens and there is an absence of material from probable areas of intergradation, while in the case of *scutulatus* such areas have been investigated and both species occur pure in overlapping territory.

It is far from my intention to suggest that this is the first paper to give adequate recognition to *scutulatus*, for such is entirely contrary to fact. While is has not usually been recognized in recent check lists and keys it has from time to time been given proper status, as for instance by Boulenger in 1896. Cope in his last work treated it as a subspecies of *adamanteus* (as *atrox* was also considered). Brown in his review considered *scutulatus* synonymous with *atrox*, but after seeing live material revised his opinion and regarded it as a valid species. Van Denburgh recognized its affinity with *oreganus* rather than *atrox* and thought it possibly a subspecies. He was unfortunately supplied with inadequate material, as there are only four specimens of *scutulatus* in the California Academy of Sciences collection out of their excellent series of over 300 rattlers. Most recently do Amaral has considered *scutulatus* a "morphological variation to be met with in such forms as *atrox, confluentus* and *horridus" thus following Stejneger.

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RANGES AND RELATIONSHIPS OF SUBSPECIES OF 

*C. CONFLUENTUS*

For a better understanding of the relationships between the several subspecies of *confluentus* and particularly such intergraditions as are now definitely known, the map shown on page 137 has been prepared. This shows the ranges of the subspecies *C. confluentus* recognized in this paper together with the outlines of the areas covered by *scutulatus*, *tigris* and *atrox* in the United States.

This map is based upon approximately 1500 specimens examined, together with a few others not seen, but concerning the identity of which there could be no question.

First of all it should be emphatically stated that the blank areas on the map do not necessarily indicate the absence of *Crotalus confluentus* in the form of one or more of its subspecies. On the contrary these white areas merely show that the particular subspecies occupying the territory is as yet undetermined. One might make quite probable predictions as to the subspecies to be found in many of these areas, but it appeared advisable to base the map upon known facts. In general it can be said that some subspecies of *Crotalus confluentus* occupies all of the territory included on this map with the possible exception of the highest mountain ranges and a few desert areas in Arizona, Nevada and the Antelope Valley of California; and even in these latter one of the desert-inhabiting forms such as *stephensi*, *lutosus* or *mitchelli* may later be found.

Stejneger's classic paper in 1895\(^{35}\) separated *confluentus* from *oreganus* (*lucifer*) as independent species and until recently this scheme has been followed in most check lists and keys. It is true that Cope in several of his papers\(^{36}\) considered these as subspecies, but his differentiation was based on such characters that the ranges were interwoven and the classification could not stand. More recently do Amaral\(^{37}\) has again joined *confluentus* and *oreganus* into a single species (*confluentus*) with the Great Basin subspecies *kellyi* occupying the territory between.

Stejneger's differentiation of *oreganus* and *confluentus* was based almost entirely on the width of the postocular light line and the position


of the ocular dark band. It might be assumed that, with differences of such small character and with snakes of such wide distribution, intergradation, if occurring at all, would take place on wide frontiers. Such has in fact been stated by do Amaral, who shows intermediate forms of confluentus and oreganus in Arizona and in Mexico south of the boundary. Between his Great Basin kellyi and confluentus, do Amaral finds intermediate material in Idaho and the vicinity of Winslow, Arizona. Between oreganus and the Great Basin form, he finds intergradation or intermediate forms in the southern San Joaquin Valley in California and in southeastern Oregon.

It is only in the latter territory that I find myself substantially in agreement with do Amaral. Taking the Great Basin form, which I have called lutosus, and oreganus together as a group the demonstrated connecting links to confluentus confluentus are far more tenuous than might at first be supposed; and while I have finally reached the conclusion that such intergradation actually does occur through abyssus across the Grand Canyon, the link is so indefinite that it is not shaded on the map. I am also of the opinion that intergradation is quite likely to occur at other points, as, for instance, in northwestern Wyoming and eastern Idaho, or along the line of the Union Pacific east of Ogden into Wyoming, but there being no available material from these areas, such linkage is not as yet demonstrated.

I would caution anyone referring to the map not to jump at conclusions with reference to the intergradation of closely allied forms having abutting frontiers. Such frontiers are often explained by topographic or ecologic conditions which cannot be shown with clearness on a map, and therefore a contour or life zone map should be used in conjunction with this range map. We may have, for instance, one species inhabiting the Lower Sonoran area of a desert, while another species ranges down from the Transition area of a mountain mass into its desert foothills. A map, except one drawn to the largest scale, would indicate that these forms have a common frontier, and one not familiar with the territory or the habits of the species in question would immediately conclude, if the forms be closely related, that they intergrade and are conspecific. Such for instance would be shown by a map of the respective ranges of atr ox and exsul in Riverside, San Diego and Imperial Counties, California, for here atr ox occupies the desert while exsul ranges down in the desert foothills almost to the bottom of the slope. Specimens have already shown that not more than sixteen miles separate
the ranges of these two forms in western Imperial County and in all probability the distance is much less. However, no intergradation has ever been indicated, and if it does occur it is not across this small gap, but is by the way of the Cape region of Lower California and the islands of the Gulf. So, in the map attached, contiguous areas, or slightly overlapping areas, are not to be assumed as indicating intergradation. It may exist but has not been proven unless such be shown by appropriate map legend.

To what extent mountains and deserts offer barriers to the different subspecies of *confluentus* remains to be determined and quite evidently differs in the different forms. The desert is a definite barrier to *oreganus* as it occurs in southern California, yet there are virtually desert areas along the west side of the San Joaquin Valley that are inhabited by a light colored phase of this subspecies. The desert is certainly no barrier to the closely related *lutosus* and of course *mitchellii* is a typically desert species, although found as high as Transition in southern California and northern Lower California. *Oreganus*, and *confluentus* as well, in the Sierras and the Rockies respectively, appear to ascend to considerable altitudes, sufficiently high, at least, to filter through the mountain passes.

I now proceed to a discussion of the ranges, as at present known, and the possible contacts of the several subspecies of *C. confluentus*.

*Confluentus*: It has been known for many years that at least one specimen of *confluentus* has been taken west of the main body of the northern Rockies, this being USNM 16791 from Lemhi, Idaho. *Oreganus*, on its side, has crossed the Cascades, and occupies eastern Washington. The mountains of northern Idaho would probably not offer an insurmountable barrier to intergradation; they can in fact be crossed without exceeding the 5000 ft. contour. We may therefore expect that intergradation will be shown in this northern region either through *lutosus* or direct from *confluentus* to *oreganus*. Further to the south, intergradation between *confluentus* and *lutosus* is possible in the vicinity of Yellowstone National Park, although specimens from the upper end of the Snake River Valley seem to be typical *lutosus* and there is a continuous mountain barrier of about 8000 ft. or more in altitude from near Livingston, Montana, to the southerly Idaho line.

I most strongly suspect intergradation between *confluentus* and *lutosus* in southwestern Wyoming, for here the Continental Divide can
be crossed over a considerable gap at 8000 ft. or slightly under, this being between the Uinta and Bear River Mountains. From this standpoint, material taken between Ogden, Utah, and Rock Springs, Wyoming, in the vicinity of Curvo, Evanston, Granger and Green River, would be of the highest interest. Such material, if intermediate, would give a definite line of intergradation from the prairie states to the coast.

With reference to intergradation between confluentus and decolor, such is rather to be assumed both from the territory and the characteristics of the subspecies, but available material permits no definite conclusion. It is known, however, from specimens previously mentioned, that rather typical confluentus occurs westward of the main barrier of the Rockies in Colorado, both at the headwaters of the Green (Yampa), and of a branch of the Colorado itself (Rio Dolores). Thus there may be another link between confluentus and oreganus through decolor and lutosus. Continuing south we find a strong intrusion of confluentus into northeastern Arizona, where it occupies the plateau area on both sides of the Little Colorado basin and probably the basin likewise. Specimens of quite typical confluentus have been taken as far westward as the Santa Fe's branch line to the Grand Canyon.

In the vicinity of Winslow and other points along the route of the Santa Fe westward as far as Winona, Arizona, there occurs a stunted form of confluentus which seems not to differ from the typical form in scutellation or markings, although it is true that there is a considerable proportion which have the postocular light stripe 1 1/2 or even 2 scales wide. That these snakes are stunted and not merely young specimens is indicated by a relatively large series all of approximately the same size, about 550 mm. long, many of which have long strings of rattles which have reached parallelism. These confluentus from the Winslow area are highly variable in color, running from tan, buff or fawn, to gray, red, red-brown and dark brown. Reddish specimens appear to predominate. The markings are quite clear in the adults and consist of even, subrectangular cross blotches, usually with outlines lighter than the ground color. This stunted form might have sufficient characteristics distinguishing it from confluentus confluentus to warrant a subspecific designation, were it not for the fact that throughout the same territory are found occasional large specimens, usually greenish or yellowish in coloration, more nearly resembling the typical form. It seems hardly possible that these can be a separate race from the stunted form. A solution of this problem must await the accession of additional material.
To the southwest will be noted an area of overlapping with Arizona oreganus, which form do Amaral has considered as intermediate between confluentus and oreganus. I have been unable to verify intergradation in this area. One specimen (CAS 35237) from Oak Creek, Coconino Co., Arizona, seems to have some of the characteristics of both forms; but it is unfortunately a juvenile and these seem always to be more alike than the adults of the respective subspecies.

This investigation has been somewhat handicapped by lack of material from Mexico; the general statement may be made that the rattlers as a group will never be fully understood until large series of all indigenous species are at hand from northern and central Mexico. A few specimens of confluentus are available from northeastern Sonora in the region below Douglas, Arizona, but aside from showing that the species occurs in Mexico nothing of interest is developed. None of the black Arizona oreganus has been had from below the line, although no doubt it occurs there.* Specimens of both atrox and scutulatus are available from scattered localities far down into Mexico. Usually they are not in a good state of preservation and although indicating some possible differences from the United States material they are not sufficient in either number or quality to warrant definite statements.

The characteristics of Arizona oreganus are discussed more fully later.

Altogether I consider intergradation between confluentus and oreganus most definitely proven through abyssus and lutosus and it is upon this link that I base the retention of the name confluentus oreganus for the coast form. However, as above stated, more direct links may be demonstrated when additional material to the north is available.

Decolor:†

The relationship of this subspecies has been discussed in the description. Intergradation with either confluentus to the east or north or lutosus to the west, or both, is entirely possible.

Abyssus:

This form, known from but a few specimens, is believed to intergrade with both lutosus and confluentus.

Lutosus:

The relationships of this form to the eastward have already been

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* See note page 131.
† See note page 111.
covered. To the west, intergradation with *oreganus* is quite definitely known in the northeastern counties of California and in south central Oregon. While a common frontier is shown south of Lassen County, California, to the vicinity of Mono Lake, I have seen no specimens from along this area and do not know whether intergradation actually occurs or whether the two forms are separated by the ridge of the Sierras.

Of the north limit of *lutosus* I know practically nothing. It may extend considerably to the north of the area shown on the map, especially into northeastern Oregon, or on the other hand *oreganus* and *confluentus* may close in and occupy this territory. It is quite certain that some member of the species is found practically throughout the area. To the south likewise little is known as to the territorial limit. *Lutosus* may extend considerably to the south of the range indicated, though probably not as far as Las Vegas, Nevada. Intergradation with *stephensi* is strongly indicated at one point, as above discussed.

*Stephensi*:

Although I show a common frontier for *stephensi* and *oreganus* in the southern Sierras, no specimens that I have seen indicate intergradation. The ranges may or may not overlap slightly if intergradation does not occur. Southward, intergradation with *mitchellii* is over a wide area and is so gradual that an arbitrary distinction between the contact forms cannot be drawn.

*Mitchellii*:

Besides the above mentioned intergradation with *stephensi*, *mitchellii* appears to be independent. It overlaps considerably the range of *oreganus* in the mountains of southern California and northern Lower California, but here the two subspecies are quite distinct, without the remotest indication of intergradation. Intergrading has not been shown with *oreganus* in west central Arizona, but I have seen a specimen of *oreganus* from the vicinity of Nelson, Arizona, that shows in its coloration, and particularly in the punctated application of color, a certain resemblance to *mitchellii*. It is likewise known that Arizona specimens of *oreganus* have occasionally complete separation between rostral and prenasal. It is probable that *mitchellii* will ultimately be shown to range over a considerably larger area of south central Arizona than here indicated, as the habitat conditions are exactly to its liking.

Overlapping of the range of *mitchellii* with *tigris* is indicated, but I have seen no signs of intergradation, notwithstanding some likeness
in markings. Tigris seems to be a mountain form and there may be racial differences in the groups occupying the several different mountain ranges which spot southern Arizona; but all of the specimens of tigris that I have seen differ from mitchellii quite evidently in the proportionate size of the head and likewise in the slenderness of the neck. In these characteristics tigris most nearly resembles enyo, although in other points they are quite distinct. Throughout the confluentus group the body form is relatively constant, as is also the proportionate head size. Only in mitchellii does the head appear to be more depressed than in the others, yet the proportionate size is not different. Taken as a whole, therefore, it would appear that body form, proportionate head size, etc., are more fundamental than scutellation, markings, and color, from which I should judge that intergradation between mitchellii and tigris in Arizona is not to be expected.

Oreganus:

The relationships between oreganus and the other recognized forms have already been pointed out. Whether oreganus, as it exists along the Pacific coast from British Columbia to the San Pedro Martir mountains in northern Lower California, is a single subspecies I do not as yet know. I have scale counts of about 300 specimens, some of which differ from others in colors and markings, but this material is inadequate to permit a definite determination. It is true that in the southern San Joaquin Valley and, in fact, in parts of the Sacramento Valley as well, there occurs a light phase of oreganus which do Amaral has considered intermediate with the Great Basin form. This valley type is produced by an extension of the light area between spots and consequent reduction in the dark blotch areas. But it does not seem to have the characteristic high number of scale rows between supraoculars nor the unusually wide postocular light stripe of the Great Basin form. It is, I think, a case of parallel development rather than relationship, for with the elimination of scutulatus from consideration it will be noted that a high mountain barrier occupied by another subspecies separates the San Joaquin Valley specimens from lutosus. However, it might be that this interior valley form is an intrusion from the Klamath area by way of the Pit and Sacramento Rivers. This matter warrants further study.

In general, the southern rattlers tend toward diamonds, while those

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38 It is true that mitchellii in the Cape region of Lower California has a proportionately smaller head. The full significance of this has not yet been determined.
from northern California, Oregon and Washington have round and more uniformly colored blotches. But this difference is not always consistent.

Southward into Lower California, *oreg anus* has been shown to range as far as San Quintin. Specimens from the San Pedro Martir mountains (Meek's *helleri*) do not seem to differ from the San Diego county specimens. Farther south there is a gap of 350 miles, part of which is desert, before the first known specimen of *enyo* is encountered. Across this area *oreg anus* does not seem to have penetrated. *Enyo* might come further north as it is a semi-desert form.

Through the kindness of Mr. C. C. Lamb of the University of California, I have lately seen 8 specimens of *enyo* alive and I have likewise seen 17 additional preserved specimens. I am convinced that this is a distinct species and not a subspecies of *confluent us* as has been suggested by some authors. It is true that the markings suggest *stephensi*, but here the likeness ends. *Enyo* is a snake of distinctive form, with a small and particularly narrow head and relatively large body with slender neck. In form it most nearly resembles *tigris*, although the head is proportionately longer, so that the ratio of head length to body length is not so striking. The *enyo* head somewhat suggests *polystictus*, although I see no other resemblance.

**Arizona Oreg anus (cerberus?):**

Last we come to the Arizona *oreg anus* (Coues' *cerberus*)\(^\text{39}\) which may be a valid subspecies. This, based on present material, seems to intergrade with no adjacent form. Its wide separation from the territory known to be occupied by the coast *oreg anus* is striking, nor are any existing bridges likely to be discovered. At one point following the San Bernardino Mountains there may be a spur in the range of *oreg anus* to the southeastward, but these mountains terminate in the Chocolates, which fade into desert country such as *oreg anus* does not inhabit. Toward the north end of its range, *cerberus* shows no indication of affinity to *lutosus*. *Cerberus* is a peculiar snake, varying in some particulars from the coast form, but with material at hand I have been at a loss to point out consistent differential characteristics. Seen alive, the differences are quite striking, for most adult specimens of *cerberus* are dorsally jet black, the interspaces between the obsolete diamonds being

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\(^{39}\) The term *cerberus* is used for convenience in differentiating from the coast form, rather than as an acknowledgment of validity.
indicated by a dorsal row of groups of bright yellow scale tips. With light at the proper angle the obsolete blotches can be faintly discerned. This snake apparently has the power to change, if not its color, at least its shade, so that under different conditions of light and temperature the dorsal blotches are more or less apparent, as are also the light inter-spaces. The same power to change has definitely been noted in cerastes and in certain mountain specimens of oreganus from southern California and possibly in mitchellii as well. The effect of this power is to render determination based largely on color rather ineffectual, particularly as specimens of the black Arizona oreganus change greatly upon preservation in alcohol. Some of the specimens which were black in life come out the same; while others, on the contrary, turn dark gray, with a series of large black-edged dark brown blotches on the back. For a time I thought these might be different races represented by the different mountain groups in Arizona, but I now believe that the variation is more one of preservation. Of the live specimens that I have seen, with the exception of two rather peculiar specimens from the northwestern end of the range, the color in life was quite consistent. This form really merits the name Black Rattlesnake, for the large mountain specimens, except for the yellow scale tips, are jet black and are also heavily mottled with black below. As is the case with other subspecies, juveniles do not differ so much from the typical form.*

Whether this is a valid subspecies or not I am not prepared to state. I have seen to date 24 preserved specimens and a somewhat smaller number alive. The effect of preservatives considerably complicates the problem. I have seen specimens from the San Bernardino Mountains in California not differing essentially from some preserved Arizona material, but I do not know how nearly alike they were in life.

Specimens of scutulatus found in the vicinity of Prescott, Arizona,
are quite as dark as southern California *oreganus*, but, as has been pointed out above, no intergradation with *cerberus* is indicated.

**SUBSPECIES WITH OVERLAPPING RANGES**

I realize that one aspect of the conclusions drawn in this paper will be the subject of serious question, viz., the fact that two subspecies of the same species are shown to occupy the same territory without intergradation. L. M. Huey advises me that he knows of no corresponding situation amongst the birds and mammals. Nevertheless, I see no reason why it would not be possible for a species to differentiate by degrees along a circuitous route, whereby the forms ultimately meeting might be so different as not to intermingle, but to remain pure; yet if all the links still exist there will be intergradation entirely through the series from the first form to the last, and thus all would be subspecies of a single species.

A similar condition to that which exists in *Crotalus confluentus* has already been noted by Van Denburgh in *Thamnophis*. *Thamnophis ordinoides elegans* intergrades with *T. o. couchii* in the Sierras in the vicinity of Yosemite Valley and Kings River. *Couchii* in turn intergrades with *T. o. hammondii*, probably in Kern County, but *hammondii* and *elegans* occupy the same territory in the San Bernardino Mountains and, as I have recently noted, in the Laguna Mountains of San Diego County, California, apparently without intergradation. As these two forms occur in the southern mountains they are entirely distinct, *elegans* having a complete vertebral stripe, while *hammondii* has none.

So, in the case of *Crotalus confluentus* we have a complete loop; *mitchellii* intergrading with *stephensi* in the northern Mohave Desert, this in turn intergrading with *lutosus* in Mineral County, Nevada, the latter intergrading with *oreganus* in northeastern California; but when *mitchellii* and *oreganus* finally come together as they do in southern California, they have differentiated to such an extent that, although the ranges overlap by many miles and the snakes are found everywhere together, there is no sign of intergradation. Only at one point is this chain even slightly weak, this being intergradation between *stephensi* and *lutosus*, which is based on relatively few specimens, and may eventually be shown to be a case of hybridization. However, against this theory may be cited the finding, in specimens of *lutosus* distant from the area of intergradation, certain *stephensi* characteristics, particularly the black scale tips and the tendency toward supraocular divisions.
to a more prominent degree than in other species or subspecies of the genus, except *mitchellii*. Probably this overlapping of conspecific forms is most likely to occur in regions, such as that west of the Rockies, relatively contorted both topographically and climatically.

**TENTATIVE KEY TO THE SUBSPECIES OF CROTALUS CONFLUENTUS**

1. Rostral normally separated from prenasal by small scales or granules ........................................................................................................................................................................... *mitchellii*
   Rostral normally in contact with prenasal ................................................................................................................................. 2

2. Internasals two; rostral usually wider than high; supraoculars rough, pitted or sutured ........................................................................................................................................................................... *stephensi*
   Internasals generally three or more; rostral usually higher than wide; supraoculars rarely pitted or divided ........................................................................................................................................................................... 3

3. Light postocular stripe one scale wide; body blotches commonly subrectangular with even edges and often with a narrow, light border ........................................................................................................................................................................... *confluentus*
   Light postocular stripe, if present, two or more scales wide; body blotches, if in evidence, commonly diamonds, subovals or, if rectangles, rough edged without light borders ........................................................................................................................................................................... 4

4. Color straw or cream; markings faintly in evidence or obsolete; adult size smaller, usually under 650 mm ................................................................................................................................. *decolor*
   Color darker, not straw or cream; adult size larger, usually over 650 mm ........................................................................................................................................................................... 5

5. Adult color vermilion or salmon; body blotches obsolete in adults ................................................................................................................................. *abyssus*
   Adult color other than vermilion or salmon; body blotches in evidence in adults or body black ........................................................................................................................................................................... 6

6. Ground color lighter, usually buff or drab; body blotches usually in width little greater than the interspaces; tail stripes more numerous; secondary series of lateral blotches little in evidence; intersupraocular scale rows more numerous ........................................................................................................................................................................... *lutosus*
Ground color darker; body blotches occupying more longitudinal space than interspaces; tail stripes less numerous; secondary series of lateral blotches plain; intersupraocular scale rows less numerous.\textit{crotalus scutulatus oreganus}

**SUMMARY OF CONCLUSIONS**

1. \textit{Crotalus scutulatus} is a valid species distinguished from both \textit{C. atrox} and \textit{C. confluentus}.

2. The group heretofore known as \textit{C. tigris} is composite. True \textit{tigris} is found only in Arizona and northern Mexico. Specimens from California and Nevada previously considered \textit{tigris} are a subspecies of \textit{C. confluentus} and form a connecting link, causing \textit{mitchellii} likewise to become a subspecies of \textit{C. confluentus}.

3. The following subspecies of \textit{C. confluentus} are recognized:
   A. \textit{Confluentus}. Prairie Rattlesnake.
   B. \textit{Decolor}. Midget Faded Rattlesnake.*
   C. \textit{Abyssus}. Grand Canyon Rattlesnake.
   D. \textit{Lutosus}. Great Basin Rattlesnake.
   E. \textit{Oreganus}. Pacific Rattlesnake.
   F. \textit{Stephensi}. Panamint Rattlesnake.
   G. \textit{Mitchellii}. Bleached Rattlesnake.

B, C, D and F are newly named in this paper.

\textit{Cerberus}. Black Rattlesnake is, for the present, not recognized as a valid subspecies.

\* See note page 111.
ACKNOWLEDGMENTS

I have previously stated that such novel conclusions as I have been able to draw in this survey are due to new and more extensive material than has heretofore been available to students. I am therefore particularly indebted to the many individuals who have so kindly aided me in securing live material from areas which would otherwise have been inaccessible. Likewise many persons and institutions have loaned me valuable preserved material without which the investigations would have been quite impossible. To all such individuals and institutions I am deeply indebted, especially the following: Dr. Leonard Stejneger and Miss Doris M. Cochran of the United States National Museum; Dr. B. W. Evermann, Mr. J. R. Slevin and Miss Susie Peers of the California Academy of Sciences; Dr. Joseph Grinnell, Dr. Jean Linsdale and Mr. C. C. Lamb of the Museum of Vertebrate Zoology, University of California; Dr. G. K. Noble of the American Museum of Natural History; Mr. K. P. Schmidt of the Field Museum of Natural History; Drs. C. D. Bunker and E. H. Taylor of the University of Kansas; Dr. A. Ruthven, Mrs. H. T. Gaige and Mr. H. K. Gloyd of the University of Michigan; Dr. A. H. Wright of Cornell University; Mr. G. S. Myers of Stanford University; Dr. Thos. Barbour and Mr. A. Loveridge of the Museum of Comparative Zoology, Harvard University; Dr. D. J. Leffingwell of the State College of Washington; Mr. Howard R. Hill of the Los Angeles Museum; Mr. E. D. McKee and Mr. S. B. Jones of Grand Canyon National Park; Dr. V. M. Tanner of Brigham Young University; Prof. A. M. Woodbury of the University of Utah; Prof. J. W. Hungate of the Washington State Normal School; Mr. M. G. Netting of the Carnegie Museum; Mr. Chas. Bogert of the Trail Finders; Dr. A. I. Ortenburger of the University of Oklahoma; Col. M. L. Grimmins, U.S.A.; Dr. A. do Amaral and Mr. R. H. Hutchison of the Antivenin Institute of America; Dr. A. L. Herrera, Dirección de Estudios Biológicos, Mexico; Dr. Junius Henderson, University of Colorado; Mr. Vernon Bailey, U. S. Biological Survey; Mr. F. O. Dolson, Southern Sierras Power Co.; Mr. B. C. Cain, Boy Scouts; Mr. A. T. Mercier, formerly San Diego and Arizona Railway; Mrs. G. O. Wiley, Minneapolis Public Library Museum; Messrs. C. B. Perkins, F. E. Walker, P. D. R. Ruthling, F. Weinberg, W. B. Cannon, P. R. Erwin, D. D. H. March, Tex Schubach, C. Searl, C. L. Evans, H. H. Hileman, L. B. Jones, Ed. Loyd, F. Van Cleveland, D. Barnard and H. H. Williamson. Last but by no means least I wish
to mention the splendid co-operation of the Atchison, Topeka and Santa Fe Railway which, through interest in the work of the Antivenin Institute and the San Diego Zoological Society, has forwarded a truly impressive collection of live rattlers. These, while primarily utilized for venom collection, have proved of great use in this study. Our thanks are due General Manager W. K. Etter; Superintendents E. E. McCarty, R. H. Tuttle, G. W. Simpson and C. G. Fluhr; Division Engineer O. R. West; Roadmasters B. F. Gauldin, R. L. Borden, E. Conway, F. H. Rahmgren, J. A. Rohrer and R. E. Patton together with their many section foremen; also Division Passenger Agent W. B. Frisbie of San Diego.

It should be understood that while this paper has been published by the San Diego Society of Natural History, Clinton G. Abbott, Director, the collections and facilities of the San Diego Zoological Society, with which I am likewise connected, have also been used, for which I am grateful to Dr. Harry Wegeforth, President, and Mrs. Belle Benchley, Executive Secretary. Photographer L. C. Kobler of the San Diego Consolidated Gas & Electric Co. is to be highly commended for his skill and patience with recalcitrant subjects.

Upon completion of this imposing list I am embarrassed by the meagre results which I have produced with such extensive assistance. My only excuse is that, to become familiar with the genus, a considerable quantity of data had to be assembled beyond the limits of the present paper, which I hope may form the basis of one or two additional reports, or, in the form of preserved material, be made available to other workers.
Known areas of intergradation

- C. scutulatus range limit
- C. atrox range limit
- C. tigris range limit

NOTE: Blank areas usually indicate lack of data as to proper subspecies rather than actual absence of the species.
PLATE 9

Fig. 1. *Crotalus confluens confluens*. Prairie Rattlesnake.

Fig. 2. *Crotalus confluens oreganus*. Pacific Rattlesnake.

(Note: All photographs are of live specimens)
PLATE 10

Fig. 1. *Crotalus confluens lutosus*. Great Basin Rattlesnake.

Fig. 2. *Crotalus confluens stephensi*. Panamint Rattlesnake.
Fig. 1. *Crotalus confluentus abyssus*. Grand Canyon Rattlesnake. LMK 2216. Adult male. Collected on Tanner Trail, 300 ft. below South Rim, Grand Canyon National Park, Coconino Co., Arizona, Sept. 15, 1929.

Fig. 2. *Crotalus confluentus oreganus* (*cerberus?*). Black Rattlesnake. LMK 2218. Adult male. Collected at Hillside, Yavapai Co., Arizona, Sept., 1929.
PLATE 12

Fig. 1. Crotalus scutulatus. Mojave Rattlesnake.

Fig. 2. Crotalus tigris. Tiger Rattlesnake.
Fig. 1

Fig. 2
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UPPER EOCENE ORBITOID FORAMINIFERA FROM THE WESTERN SANTA YNEZ RANGE, CALIFORNIA, AND THEIR STRATIGRAPHIC SIGNIFICANCE

BY

W. P. WOODRING

California Institute of Technology

SAN DIEGO, CALIFORNIA

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W. P. WOODRING
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INTRODUCTION

In December, 1929, Dr. W. S. W. Kew and Mr. H. L. Driver invited me to visit with them a locality on the west side of Canada de los Sauces, on the south slope of the western Santa Ynez Range about two miles northwest of Sudden, where they had discovered well-preserved specimens of a small Discocyclina in a soft limestone. When we visited this locality we also found almost equally well-preserved specimens of a small stellate "Discocyclina". K. E. Lohman and S. W. Lohman, of the California Institute of Technology, accompanied me on a later trip to the same locality in March, 1930, when additional material was collected and the stratigraphic interval between the limestone and the base of the Vaqueros formation was measured.

The limestone is a lens at the base of dark-colored shales and rests disconformably on massive sandstone with an irregular contact (see Pl. 13). At the base of the limestone are pebbles of black chert, presumably derived from Franciscan rocks, and of sandstone, derived from the massive sandstone and its ferruginous concretions on which the limestone rests. The maximum thickness of the lens of limestone is eight feet. The lower one-third to one-half consists of hard limestone made up principally of calcareous algae. The upper part is a soft marly foraminiferal limestone carrying great numbers of orbitoid foraminifera, and also other foraminifera, scattered pieces of calcareous algae, echinoid spines, and a few mollusks. Farther up the slope on the west side of the canyon the limestone thins out and finally near the crest of the ridge is represented only by a limy matrix full of calcareous algae filling holes bored by marine borers that riddle large cobbles and boulders of sandstone derived from the underlying bed. The limestone also lenses out in the opposite direction toward the bottom of the canyon. It reappears in the next little canyon to the west, where it is not more than five feet thick and all of it is hard and more sandy.
C. C. Church called my attention to another locality almost 10 miles southeast of Canada de los Sauces, where he had seen orbitoid-bearing limestone float along Jalama Creek. Kew, Driver, and I traced this float to the outcrop on the steep slope along the south side of Jalama Creek, where the limestone forms prominent white ledges. This limestone also is a lens lying in shales that overlie Upper Cretaceous shales and sandstones. It is very hard, so hard that no specimens can be extracted, but it is full of the same orbitoid foraminifera (see Pl. 17), and also carries other foraminifera, among which a small involute *Operculina* (or *Nummulites*) and a *Gypsina* are the most abundant.

The only locality where stellate orbitoids had been found heretofore in California lies in the San Rafael Mountains 45 miles east of the Jalama Creek locality, where Schenck recorded both a *Discocyclina* and a stellate "*Discocyclina*" from a limestone described by Nelson as the Sierra Blanca limestone. The *Discocyclina* and probably also the stellate species are the same as those found farther west.

The thin sections and photographs were prepared by K. E. Lohman, and the plates were made up and retouched by J. L. Ridgway. I am greatly indebted to Dr. E. Willard Berry, of Ohio State University, for the loan of specimens from Peru for comparison with the California material.

**DESCRIPTION OF SPECIES**

*Discocyclina* Gümbel


*Discocyclina* *psila*, new species

Plate 14, figs. 2, 4-6; Pl. 15; Pl. 17.


A small, very thin, flat or slightly warped *Discocyclina* bearing

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minute granules over the entire surface. The central part is not inflated, the surface of the test rising as a very low broad dome, the outline of which forms a smooth curve from edge to edge.

The diameter of 69 specimens, representing the most perfect tests that were freed from the matrix, ranges from 1.2 mm. to 4.7 mm., the average being 2.8 mm. Two maxima are represented in these measurements, one at 2.6 mm. and the other at 3.0 mm. It was suspected that they represented megalospheric and microspheric forms, respectively, but the specimens that were ground down were found to be megalospheric regardless of size. The average thickness of 25 specimens is 0.5 mm., the range being 0.5 to 0.7 mm. The surface is minutely granular in a diffused irregular fashion, but not papillate.

The median chambers are short rectangles. According to measurements on 7 thin sections they have a radial length of 30 µ near the center and as much as 70 µ or 80 µ toward the edge, and a width of 30 µ to 40 µ. The length is quite irregular in different annuli. Chambers in the same annulus communicate by passages at the outer edge that have a width of about 2 µ to 8 µ (see Pl. 15, fig. 4). These passages can not be seen on all sections nor on all parts of the same section. The thickness of the wall between successive annuli is 8 µ to 10 µ, whereas the wall between chambers of the same annulus has a thickness of 6 µ to 8 µ.

Near the center of the test the lateral chambers consist of 6 or 7 tiers, which are not arranged in definite vertical rows, but more or less overlap in successive tiers. According to measurements on two thin sections, the laterals have a height of only 8 µ, whereas the roof between them has a thickness of 11 µ to 19 µ. The height of the median chambers increases from 11 µ near the center to 23 µ near the edge. Minute pillars spring from the roof of the median chambers, but they fail to extend beyond the first tier of laterals.

The megalospheric nucleoconch consists of an initial spherical chamber, having a diameter in two sections of 80 µ and 95 µ, respectively, partly embraced by a larger second chamber. In the same two sections the entire nucleoconch has a diameter of 160 µ and 170 µ, respectively.

Type material.—5 cotypes (Calif. Inst. Tech. No. 1148) and 6 paratypes (Calif. Inst. Tech. Nos. 1147, 1150-1153, 1156), all figured. Paratypes (San Diego Soc. Nat. Hist. No. 332), figured; (also Nos. 336, 337). Paratypes have also been deposited at the U. S. National Museum, California Academy of Sciences, Scripps Institution of Oceanography, Stanford University, and the University of California.
Type locality.—South slope of western Santa Ynez Range, Santa Barbara County, California, west side of Canada de los Sauces 1.2 miles above coast (in center of first "O" in "Concepcion" on Guadalupe sheet), upper part of limestone reef; W. S. W. Kew, H. L. Driver, and W. P. Woodring, collectors; Calif. Inst. Tech. Loc. No. 595.

Other localities.—North slope of western Santa Ynez Range, Santa Barbara County, California, spur overlooking Jalama Creek, 0.5 mile N. 28° E. from 1402-Hill, lens of hard limestone; W. S. W. Kew, H. L. Driver, and W. P. Woodring, collectors; Calif. Inst. Tech. Loc. No. 596; sections only. South slope of San Rafael Mountains, Santa Barbara County, California, upper Mono Creek, Sierra Blanca limestone (Schenck).

This is a very small and thin species. Sections ground from specimens from the type locality that are readily extracted from the matrix agree closely with sections in the hard limestone on Jalama Creek and the section from the Sierra Blanca limestone described and figured by Schenck.

D. psila is similar to only a few of the 26 named American species of Discocyclina, most of which are far thicker and many of which have a distinct central boss. The following three species have already been recorded from California and Lower California. D. clarki Cushman, originally described from beds north of Coalinga referred by B. L. Clark to the Meganos formation and recorded by Schenck from beds bordering the Simi Valley referred to the Domengine formation by B. L. Clark, is larger and has a slightly inflated central boss and strong papillae. D. californica Schenck, a species of doubtful Tejon age from Santa Clara County, has a very thick central part and a thin peripheral flange. D. cloptoni Vaughan, a "middle or upper Eocene" species from Lower California, is fully twice as large and its megalospheric nucleoconch has two, four, six, or eight chambers. D. psila is not closely allied to any of these, but is similar to the following small very thin American species. D. perkinsi Vaughan (upper Eocene, Jamaica) is considerably larger (diameter 6.5 mm. to 7.0 mm.) and has smaller median and lateral chambers. D. citrensis Vaughan (upper Eocene, Florida) has a broad


4 Schenck, H. G., Trans. San Diego Soc. Nat. Hist., vol. 5, No. 14, pp. 224-227, pl. 27, figs. 3, 4, 6; pl. 28, figs. 2-6; pl. 29; pl. 30, figs. 2-3, text figs. 8-10, 1929.


6 Vaughan, T. W., Jour. Pal., vol. 1, No. 4, p. 285, pl. 46, figs. 4-5, 1928.

low central boss and is densely papillate. *D. salensis* (W. Berry\(^8\)) (upper Eocene, Peru) is about twice as large, and also has a broad low central boss and coarse papillae. *D. psila* is most closely allied to *D. perpusilla* Vaughan\(^9\), found in the Guayabal formation (upper middle Eocene, according to Vaughan) at several localities in the State of Vera Cruz, Mexico. Both species have many essential features in common, the most striking of which are the presence of minute pillars adjoining the equatorial chambers, but not extending between the lateral chambers, which overlap in successive tiers, and the location of passages between median chambers of the same annulus at the outer edge of the annulus. *D. perpusilla*, however, is even smaller (diameter 0.6 mm. to 2.3 mm.) and thinner. Inasmuch as it is thinner it has fewer tiers of lateral chambers. Though these differences are not very great, they seem to justify a new name in view of the difference in geographic range and the apparent difference in age. If the Guayabal formation were upper Eocene, *psila* would be regarded as a California race of *perpusilla*. It is now regarded as a later mutation.

**Actinocyclina** Gümbel


Whether *Actinocyclina* is regarded as a separate genus or as a subgenus of *Discocyclina* is a matter of preference. It has the same essential structure as *Discocyclina*, but in view of the large number of species of orbitoids characterized by rectangular median chambers and in view of the striking difference afforded by the presence or absence of stellate rays, it might as well be given generic rank. It is here used as a genus to embrace all species bearing stellate rays. *Asterocyclina* Gümbel\(^10\), characterized by a small number of rays that greatly modify the outline of the test, is regarded as a synonym of *Actinocyclina*, or as a minor subdivision. Any

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lot of stellate orbitoids generally consists mostly or wholly of broken specimens and the outline of the test can not very well be judged from such material. The rays are more durable than the thin web between them and broken specimens generally have a misleading stellate outline. At all events even if *Asterocyclina* is recognized, the large number of rays and the slight notching of the edge of the test place the following species in *Actinocyclus.*

The taxonomy and nomenclature of *Discocyclus* and its allies are considerably complicated by the recent description by W. Berry\textsuperscript{11} of a very remarkable upper Eocene species from Peru that has five-rayed median chambers and no indication of exterior rays, for which the name *Astero-discocyclus* was proposed as a subgenus of "*Orthophragmina*".

**Actinocyclus aster**, new species

Plate 14, figs. 3-6; Pl. 16; Pl. 17.

A thin *Actinocyclus* of medium size bearing a relatively broad moderately inflated central boss and 5 to 13 rays. On well-preserved specimens the rays barely modify the outline of the edge of the test, shallow notches lying in the interradial areas. The central boss and rays bear moderately small papillae, which are smaller toward the ends of the rays. The interradial areas bear very minute papillae or none at all, except near the boss, where they are of about the same size of those on boss and rays.

The diameter of 17 of the most perfect specimens ranges from 5.6 mm. to 10.2 mm., but all except two, which have diameters of 10 mm. and 10.2 mm., respectively, are badly broken around the edge. A lot of 38 broken specimens shows a thickness range of 0.7 mm. to 1.3 mm., the average being 1.0 mm. In 2 specimens of varying size the diameter of the central boss is 0.9 mm. to 1.8 mm. The average is 1.2 mm.

Twenty-three specimens that are not broken too far back to reveal the full number of rays have 5 to 13 rays, the average of which is between 8 and 9. On the only specimens that have the edge of the test almost unbroken (none is entirely perfect) the rays flatten out within about 1 mm. of the edge. The arrangement of rays is almost as variable as the number. Some specimens have relatively broad low rays that may bifurcate. Others have narrow high rays that generally are undivided. Both forms are shown on Plate 14. On most specimens all the rays spring from the central boss,

\textsuperscript{11} Berry, E. Willard, Eclogae Geol. Helvetiae, vol. 21, No. 2, pp. 405-407, pl. 33, 1923
but a few have primary rays (for example, 6 or 8) and secondary rays in some of the interspaces that fail to reach the boss.

According to a few measurements, the papillae on the central boss have a diameter of 65 ″ to 125 ″. Out on the rays the diameter decreases to 30 ″ or even less. Narrow rays may have a single row of closely spaced papillae. Horizontal sections of such specimens may show a solid ray (Pl. 16, fig. 1), which apparently is to be attributed to the deposition of calcite between the closely spaced papillae during the process of fossilization, thus forming a solid calcite structure.

The median chambers are elongate rectangles. According to random measurements or seven thin sections, they have a radial length of 50 ″ to 80 ″ and a width of 25 ″ to 40 ″. Chambers in the same annulus communicate by passages along the inner edge that have a diameter of about 2 ″ to 4 ″. The wall separating successive annuli is slightly thicker than the wall between chambers of the same annulus (8 ″ to 12 ″ as compared with 4 ″ to 6 ″). Near the plane of the median chambers the rays have a width of 30 ″ to 65 ″.

The lateral chambers are piled up in vertical columns consisting of 16 or 17 tiers near the center of the test and of 5 or 6 out near the edge. These chambers have a height of 19 ″ to 27 ″ and the roof has a thickness of 6 ″ to 8 ″. Both sets of measurements were made on three sections. The height of the median chambers increases from 23 ″ near the center to 68 ″ near the edge. As seen in vertical section the walls between them are strongly convex outward. The perforations could not be distinguished.

All specimens that were ground down show a megalospheric nucleoconch consisting of a small initial chamber partly embraced by a larger second chamber. In four specimens the initial chamber has a diameter of 80 ″ to 160 ″, and the maximum diameter of the entire nucleoconch is 175 ″ to 225 ″.


Type locality.—South slope of western Santa Ynez Range, Santa Barbara County, California, west side of Canada de los Sauces 1.2 miles above coast (in center of first “O” in “Concepcion” on Guadalupe sheet), upper part of limestone reef; W. S. W. Kew, H. L. Driver, and W. P. Woodring, collectors; Calif. Inst. Tech. Loc. No. 595.
Other localities.—North slope of western Santa Ynez Range, Santa Barbara County, California, spur overlooking Jalama Creek, 0.5 mile N 28° E. from 1402-Hill, lens of hard limestone; W. S. W. Kew, H. L. Driver, and W. P. Woodring, collectors; Calif. Inst. Tech. Loc. No. 596; sections only.

The broad-rayed and narrow-rayed forms are quite different, but in view of the intergrading and integrating characters it seems unreasonable that more than one species is represented. Both forms have the same kind of boss and papillae and, in so far as the evidence furnished by a few sections goes, the same kind of internal features, excepting the solid subsurface rays of some of the narrow-rayed specimens, which is regarded as due to changes during fossilization. Both broad rays and narrow rays are simple or bifurcate, though bifurcation is rare in narrow rays. Yet the differences separating these two forms are almost as great as those separating Actinocyclina mariannensis (Cushman) and A. americana (Cushman), which are found together in the upper Eocene Ocala limestone of Florida. A. mariannensis has a maximum recorded diameter of 18 mm. and bears 8 to 11 undivided rays, all of which generally spring from the small mammillary boss. A. americana has a maximum recorded diameter of 25 mm., but two magnificent specimens recently collected by W. P. Popenoe in the quarry of the Florida Basic Rock Co., 10 miles northwest of Marianna, Florida, and now in the collections of the California Institute of Technology, have a diameter of 35 mm. and 42.5 mm., respectively, and the edge of the test is broken on both. The rays of americana are irregularly arranged, due to the intercalation of secondary rays that fail to reach the boss. Those that spring from the boss may be undivided or may bifurcate. The total number of rays is as high as 22, but the number that spring from the boss is about the same as in mariannensis. Both forms have the same characteristic small mammillary boss and in both the papillae vary in size and prominence.

Twenty-three species and varieties of American stellate “Discocyclinas” have been named, but a number of them are synonyms. The California species needs comparison with only a few. As already indicated, it is much like A. mariannensis and A. americana aside from the great difference in the size of the test and in the relative size of the central boss. A. subtaramellei (Cushman), an upper Eocene species from Cuba, still

12 Cushman, J. A., U. S. Geol. Survey Prof. Paper 125, pp. 46-47, pl. 11, 1920. “Orthophragmin” mariannensis var. papillata, found with mariannensis s. s. and americana, is hardly worth distinguishing under a separate name.

is imperfectly known, for the material on which it was based clearly is badly broken. *A. aster* is closely allied to *A. calita* (W. Berry)\(^\text{14}\), described from beds near Calita Sal in Peru correlated with the upper Eocene Saman conglomerate. The Peruvian material also is badly broken. So far as it goes it closely resembles narrow-rayed specimens from California, but pillars and papillae are entirely absent. The surface of *A. calita* bears a reticulate network, due to the emergence of the columns of lateral chambers, which are protuberences or pits depending on the preservation.

**STRATIGRAPHIC SIGNIFICANCE**

In America *Discocyclina* is found in deposits of lower, middle, and upper Eocene age, whereas *Actinocyclina* has so far been recorded only from upper Eocene beds, though in Europe it also is found in middle Eocene deposits. In eastern United States *Actinocyclina* is recorded only from the Ocala limestone of Florida, Georgia, and Alabama. It is wide-spread in the West Indies, Central America, and northern South America. Independent evidence points to an upper Eocene age for these *Actinocyclina*-bearing beds at so many places that its presence has come to be considered sufficient evidence in itself for establishing the age. It can be claimed that the *Actinocyclina*-bearing beds of the Santa Ynez Range afford the most precise datum plane for establishing correlations between the Eocene sections of the Pacific and Gulf coasts that has so far been discovered. I know of no other genus found in both regions that has such a limited stratigraphic range. This statement is made with full realization of the ecologic requirements of *Actinocyclina*, which is found only in limestone or marl, or rarely in calcareous sandstone, and therefore tolerated only clear water. This facies control is clearly shown in Georgia, where *Actinocyclina* is found in the Ocala limestone and in the Tivola tongue of the Ocala as far north as the central part of the state, but not in the terrigenous sediments of the Barnwell formation of Jackson age, with which the Ocala limestone interfingers.\(^\text{15}\) The same relations are shown in Alabama.\(^\text{16}\) The absence of *Actinocyclina* in older Eocene deposits on the Gulf coast might be attributed to the absence in that part of the section of pure limestones like the Ocala limestone. Clear warm water is indi-

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\(^{15}\) Cooke, C. W., and Shearer, H. K., Deposits of Claiborne and Jackson age in Georgia: U. S. Geol. Survey Prof. Paper 120, pp. 41-81, 1918.

cated, however, by the Yellow Limestone of Jamaica and by the Plaisance limestone of Haiti, both of which are of middle Eocene age (about Lutetian), yet *Actinocyclina* is not found in them. The absence of any orbitoids in the Plaisance limestone probably is due to insufficient collecting, for *Discocyclina* is represented in the Yellow Limestone. The limestones and marls of the Vicksburg group of the eastern Gulf states and similar deposits of the same age in the West Indies offer a suitable facies in beds of Oligocene age, but "Lepidocyclina" is the only orbitoid found in them.

According to the preceding discussion the narrowly limited stratigraphic range of *Actinocyclina* can hardly be attributed to facies control. Therefore, it is concluded that the *Actinocyclina*-bearing beds of the Santa Ynez Range are of upper Eocene age, as Schenck suggested for the Sierra Blanca limestone, for there is no reason to believe that this genus lived earlier or later in California than elsewhere in America. Not only are the species of *Discocyclina* and *Actinocyclina* of the Santa Ynez Range similar to those in the Ocala limestone, but a large flat *Operculina*, represented by a few imperfect specimens collected at the locality on Canada de los Sauces (see Pl. 14, fig. 1), is very similar to *O. ocalana* Cushman. This species or a closely allied one also is recorded from Panama and Ecuador. So far as orbitoid and nummulitoid foraminifera are concerned the only striking difference between the California deposits and the Ocala limestone is the absence of "Lepidocyclina" in California. Though this genus has an extensive world-wide distribution in tropical and subtropical regions it has not yet been recorded on the Pacific coast of America north of Nicaragua.

If these deposits in the Santa Ynez Range are of upper Eocene age, the question arises as to what part of the Eocene section of the Pacific Coast is represented by them. Unfortunately not enough detailed mapping and precise zonal stratigraphy has been carried out in this region, at least not for publication, but the following preliminary considerations are offered.

The section on Canada de los Sauces is as follows:


18 **Cushman, J. A.**, U. S. Geol. Prof. Paper 128, p. 129, pl. 19, figs. 4-5, 1921.

Section on Canada de Los Sauces About Two Miles Northwest of Sudden

4. Vaqueros conglomerate and sandstone carrying “Pecten” magnolia and Turritella inezana. Disconformity

3. Dark-colored shale carrying at base a lens (maximum thickness 8 feet) of yellowish gray limestone, at the base of which are pebbles of chert and sandstone, and boulders of sandstone. The limestone carries calcareous algae, foraminifera, echinoid spines, and a few mollusks. A few feet of thin-bedded sandstone alternating with shale lies 78 feet above base. Uppermost beds consist of sandstone. Shale exposed only at rare intervals. (Thickness measured.)

2. Massive sandstone carrying ferruginous sandstone concretions. Nature of contact with No. 1 not known. (Thickness estimated.)

1. Dark gray shale.

The gray shale at the base of the section probably is of Upper Cretaceous age, for H. L. Driver reports that in a branch of this canyon farther up the slope of the range he collected from it a shell fragment consisting of fine fibers that suggest Inoceramus. The overlying massive sandstone apparently is of Eocene age, as it resembles massive Eocene sandstone farther east. No. 3 of the section, at the base of which the Actinocyclina-bearing limestone lies, may embrace more than one stratigraphic unit, but no evidence could be found to subdivide it on the basis of the meager exposures. The interval to the base of the Vaqueros conglomerate was measured in the next little canyon west of Canada de los Sauces, where the attitude of the beds could be more accurately determined. It is apparent that this abbreviated and condensed section does not help very much in determining the age relations of the Actinocyclina-bearing limestone. Nor do the other fossils. The only mollusks are fragments of a large oyster, apparently Ostrea tayloriana Gabb, and imperfect specimens probably representing Globularia and “Area”. The significance of the remaining fossils—calcareous algae, other foraminifera, and echinoid spines—is still unknown.

So far as now known the closest area where a considerable thickness of fossiliferous Eocene deposits crops out lies in the vicinity of Gaviota Pass. The following preliminary summary of the Eocene stratigraphy of
this region is based on the work of A. Clark and L. C. Hookway, both formerly of the California Institute of Technology, who carried on field work there during the summer of 1929. On the north slope of the range, north of Gaviota Pass, the oldest fossiliferous Eocene rocks (Loc. 403) carry a form of *Globularia hannibali* (Dickerson) like that found in Simi Valley and at other localities referred to the Domengine “horizon”. These beds are tentatively considered of Domengine age. In the next higher fossiliferous beds (Loc. 401) are found *Nerita triangulata* Gabb, a large form of “Euspirocrummium” clarki (Stewart), *Corbis*, and “Macrocallista” conradiana (Gabb)?. Though *Nerita triangulata* has been regarded as a Domengine species, these beds probably are younger than Domengine. The following fossils have been recognized in still higher beds in the same section (Loc. 389): a very large form of “Euspirocrummium” clarki (Stewart), like the one found at Tejon, *Loxotrema turritum* Gabb?, a *Turritella* intermediate between *T. uvasana* Conrad and *T. variata* Conrad (“lompocensis Arnold”), *Ficopsis hornii* Gabb, a gastropod allied to “Siphonalia” tularensis Anderson and Hanna (Pl. 11, fig. 7)\(^2\), another allied to “Siphonalia” merriami Wagner and Schilling, “Phos” blakianus Anderson and Hanna? (Pl. 8, fig. 16)\(^2\), *Strepsidura ficus* (Gabb), a form of *Venericardia hornii* Gabb, and “Macrocallista” conradiana (Gabb). This is a strange fauna combining a number of distinctive Tejon species with others that indicate a later age. The *Loxotrema*, which generally is considered a Domengine species, probably means nothing more than a brackish-water element, which is also attested to by a *Potamides*. These beds are regarded as a little younger than Tejon. They constitute a well-defined horizon that has been recognized as far west as Jalama Ranch, where they were found by J. R. Dorrance.

Lying higher in the section, but separated from the deposits just described by a fault, are beds characterized at many places by the abundance of “Crassatellites”. On Nojoqui Creek east of the highway (Loc. 380) they carry *Turritella “lompocensis Arnold”* (a synonym of *T. variata* Conrad), “Pecten” yneziana Arnold, which is almost indistinguishable from “Pecten” perrini Arnold of Vaqueros and Tremblor age, “Crassatellites” collina (Conrad), and a form of *Venericardia hornii* Gabb. This fauna is widespread in this region and has been recorded at

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\(^2\) These citations refer to illustrations in F. M. ANDERSON and G. D. HANNA, Occ. Papers Calif. Acad. Sci., No. 11, 1925.
several localities by Arnold and Anderson, who considered it of Tejon age. The abundant species vary from place to place, but it is not known whether this difference in distribution has any zonal significance. At some localities a giant "Cardium," erroneously identified as Cardium breweri Gabb by Arnold, and a large Glycymeris, listed as Glycymeris cf. reauchii Gabb var. major Stanton by Arnold, are abundant. At many other places "Crassatellites" collina is the prevailing species. At still others the only fossils are numerous specimens of Ostrea tayloriana Gabb, which was called Ostrea idriaensis Gabb by Arnold. Despite the difference in distribution of some of the species, several, particularly Turritella variata, "Pecten" yeziana, and "Crassatellites" collina, are widely distributed and show that the same series of beds is represented. These deposits are found on the south slope of the range along the highway on Gaviota Creek. Here the highest horizon that has yielded abundant fossils (Loc. 386) is characterized by the following: Turritella variata Conrad, Ficus gasteri Wagner and Schilling (Ficus mamillatus Gabb of Arnold), "Siphonalia" merriami Wagner and Schilling (probably Fusus occidentalis Gabb of Arnold, U. S. Geol. Survey Bull. 321, pl. 10, fig. 2, 1907), and Strepsidura lorenzana Wagner and Schilling. Thomas Antisell, who accompanied one of the parties of engineers sent out by the War Department in 1853 to explore routes for a transcontinental railroad, was the first one to collect from these beds and also from the Vaqueros formation of this region. He may not have been much of a geologist, but his lists bear witness to the care that he took to do what many modern geologists fail to do; that is, to collect fossils bed by bed and to keep the collections separate. Modern writers who attempt to hang the name Pachydesma ineziana Conrad on a Vaqueros Tivela are simply ignoring the record. I do not know whether the type of this species is extant, but I am willing to place enough confidence in Antisell to predict that it is an Eocene mactroid or a young "Crassatellites", even though Conrad described the hinge. If Antisell's lists had not been ignored or had been taken more


23 If these names are synonyms tayloriana has precedence. It would be very remarkable to find O. tayloriana in the Pliocene deposits of Cedros Island (see Jordan and Hertlein, Proc. Calif. Acad. Sci., 4th ser., vol. 15, No. 14, p. 428, 1926). After this was written I discovered that Hertlein had renamed the Cedros Island species O. erici (Jour. Pal. vol. 3, No. 3, p. 295, 1929).

24 Perhaps the names that Arnold used are the proper ones for these species, which have not yet been adequately studied.

seriously, the error of "painstakingly determining" that the name *Turritella variata* Conrad should be attached to a form of *Turritella inezana* might have been avoided.\(^\text{26}\)

These beds that carry *Turritella variata* have been called Oligocene,\(^\text{27}\) but they clearly are Eocene, for there is no more reason to believe that the giant Venericards survived until Oligocene time in California than to believe, as was once claimed, that ammonites became extinct at the close of Cretaceous time everywhere in the world except in California. That they are younger than the Tejon formation is beyond dispute. They, therefore, represent a group of Eocene deposits lying above the Tejon and according to available evidence are of upper Eocene age. They should have a name, but it seems inadvisable to propose a name before a great deal of detailed work has been done in this region. For the present they will be referred to as the *Turritella variata* zone. At least part of the deposits at the south end of the San Joaquin Valley described by Wagner and Schilling\(^\text{28}\) as the San Emigdio and Pleito formations fall in the *Turritella variata* zone, but more study is required to determine whether the San Lorenzo formation and the Lincoln "horizon" of Washington, with which these deposits have been correlated, also embrace beds of upper Eocene age.

The fauna of the *Turritella variata* zone is a strange one to be of Eocene age and it is not surprising that it has been called Oligocene. From what region did the strange species come that are utterly different from those of the preceding Eocene of California? They certainly did not come from the Gulf Coast, where Pacific Coast paleontologists are accustomed to look for Pacific cryptogenetic stocks, more as a matter of tradition and respect. The youngest Eocene beds there (Jackson formation) carry a fauna that is very much like that of the preceding Claiborne group, with which the Tejon fauna is traditionally compared. Apparently these stocks are indigenous to the Pacific and it is necessary to look farther afield around the borders of the Pacific. According to Olsson,\(^\text{29}\) the Saman conglomerate of Peru, which lies at the top of the Eocene, has a fauna consisting of a few persistent Eocene stocks combined with others that elsewhere

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\(^{27}\) **Clark, B. L.**, *Stratigraphy and faunal horizons of the Coast Ranges of California*, p. 18 [Berkeley, 1929]. Unfortunately this pamphlet was issued without any indication of place or date of publication.


are characteristic of Oligocene and Miocene deposits. This description fits the fauna of the *Turritella variata* zone admirably, but aside from the presence of giant Venericards in both and the remote similarity of *Turritella samanensis* Olsson to *T. variata* the described Saman mollusks are not much like those of the *variata* zone. Closer affinities involving some of the most striking species of the *variata* zone are apparent in the early Tertiary faunas of Japan. Nagao’s recent interesting account reveals the following:

**Similar Fossils from Japan and from Turritella Variata Zone of California**

<table>
<thead>
<tr>
<th>Japanese species</th>
<th>Species from Turritella variata zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turritella karatsuensis Nagao</td>
<td>Turritella variata Conrad</td>
</tr>
<tr>
<td>“Chrysodomus” asakuraensis Nagao</td>
<td>“Siphonalia” merriami Wagner and Schilling</td>
</tr>
<tr>
<td>Glycymeris cisshuensis Makiyama</td>
<td>Glycymeris sp. (Glycymeris cf. veatchii</td>
</tr>
<tr>
<td></td>
<td>Gabb var. major Stanton of Arnold)</td>
</tr>
<tr>
<td>“Pecten” ashiyaensis Nagao</td>
<td>“Pecten” yneziana Arnold</td>
</tr>
<tr>
<td>“Crassatellites” yabei Nagao</td>
<td>“Crassatellites” collina (Conrad)</td>
</tr>
<tr>
<td>“Cardium” hizenense Nagao</td>
<td>“Cardium” sp. (Cardium brewerii Gabb of Arnold)</td>
</tr>
</tbody>
</table>

The roots of several of the most characteristic California species seem to extend across the Pacific to Japan or to some still unknown region that sent migrants to both Japan and California. The Japanese species recorded above, except “Chrysodomus” asakuraensis and “Cardium” hizenense, both of which are referred to the upper Eocene, are recorded from beds that are considered of lower Oligocene age, but perhaps these age assignments have been influenced by the inclusion of far too much in the California Oligocene.

It is apparent that in the western Santa Ynez Range is a series of beds that on the basis of the fossil mollusks is of upper Eocene age and that they carry a strange Pacific fauna. They can without much hesitation be correlated with the Ashiya group of Japan. The *Actinocyclina*-bearing limestones also are upper Eocene and are to be correlated with the Saman conglomerate of Peru and with the Ocala limestone of Florida. The inference naturally follows that both sets of beds are synchronous, but however reasonable it is it still is a matter of inference, for the two sets of fossils have not yet been found together. Beds carrying the *Turritella*
variata fauna crop out within two miles (Arnold and Anderson's locality 4518 and vicinity) of the Actinocyclina locality in Canada de los Sauces and perhaps detailed work will more clearly show the stratigraphic relations. The orbitoid foraminifera and the large Operculina are migrants from the American tropics. They show in the clearest manner that during the latter part of Eocene time marine animals could freely migrate between the Caribbean Sea and the Pacific, though convincing evidence on this point was already available. Why many of the Jackson mollusks failed to migrate with the foraminifera and why the peculiar mollusks of the Turritella variata zone failed to gain a foothold in Atlantic waters are matters of speculation. At first glance it may seem strange to claim that tropical migrants lived along the California coast at the same time and in the same region with north Asiatic migrants. They represent, however, wholly different ecologic facies. The orbitoids lived only in places where virtually no terrigenous material was being deposited, whereas the mollusks of trans-Pacific affinities lived where sand and mud were accumulating.

A great deal still remains to be learned about the Eocene deposits of the Santa Ynez and San Rafael ranges. It would be interesting to know whether the Eocene beds that, according to Nelson's mapping, overlie the Sierra Blanca limestone carry any fossils. Nelson 31 also records an Eocene limestone in the western San Rafael range that carries "Orthophragmina", giant Cerithia, and echinoids of the genera Linthia and Amblypygus, the latter described by Israel'sky. 32 Beds, possibly of the same age, carrying giant Cerithia, as well as Velates, a form of Globularia hannibali (Dickerson), a Turritella allied to T. lawsoni Dickerson, Pseudomiltha, and Pholadomya, are found far to the east in the San Rafael Range near the eastern border of the Mt. Pinos quadrangle, where they were discovered by J. R. Dorrance. They fall somewhere in the middle Eocene, near the Domengine, but the fauna is unlike any other Domengine fauna. On the whole this region is the most fascinating one in California to anyone interested in Eocene stratigraphy and paleontology. The relations of the upper Eocene beds of the western Santa Ynez Range to the marine deposits into which the Sespe formation is described as grading in this region 33 also offers an interesting field for investigation.

View looking westward across Canada de los Sauces, showing the prominent upper Eocene Horoncose and overlying Massive Sandstone.

- Upper Eocene
- Lower Miocene
- Conglomerate and sandstone (Vagueros)
- Shale and thin-beded sandstone
PLATE 14

All specimens are from upper Eocene limestone on Canada de los Sauces, Santa Barbara County, California; Calif. Inst. Tech. Loc. No. 595.

Fig. 1. Operculina cf. ocalana Cushman. Exterior, × 5, Calif. Inst. Tech. No. 1149.

Fig. 2. Dioscocyclina psila, n. sp. Cotypes, × 5. The rough appearance of the surface is due to the adherence of small particles of matrix. Calif. Inst. Tech. No. 1148.

Fig. 3. Actinocyclina aster, n. sp. Holotype, a broad-rayed form, × 5. Calif. Inst. Tech. No. 1146.

Fig. 4. Actinocyclina aster n. sp., broad-rayed and narrow-rayed forms, and Discocyclina psila, n. sp., on hand specimen. Paratypes, × 1. San Diego Soc. Nat. Hist. No. 332.

Fig. 5. Actinocyclina aster n. sp., broad-rayed and narrow-rayed forms, and Discocyclina psila, n. sp., on hand specimen, × 1. Large specimen is holotype of Actinocyclina aster. Calif. Inst. Tech. No. 1146.

Fig. 6. Actinocyclina aster, n. sp., broad-rayed and narrow-rayed forms, and Discocyclina psila, n. sp., on hand specimen. Paratypes, × 1. Calif. Inst. Tech. No. 1147.
PLATE 15

All specimens are from upper Eocene limestone on Canada de los Sauces, Santa Barbara County, California; Calif. Inst. Tech. Loc. No. 595.

Fig. 1. *Discocyclina psila*, n. sp. Horizontal section showing median chambers. Paratype, $\times 20$. Calif. Inst. Tech. No. 1150.

Fig. 2. *Discocyclina psila*, n. sp. Specimen ground down to show megalospheric nucleoconch and minute pillars springing from roof of median chambers. Paratype, $\times 20$. Calif. Inst. Tech. No. 1151.

Fig. 3. *Discocyclina psila*, n. sp. Vertical section. Paratype, $\times 20$. Calif. Inst. Tech. No. 1152.

Fig. 4. *Discocyclina psila*, n. sp. Part of horizontal section showing passages between median chambers of the same annulus at outer edge of annulus. Paratype, $\times 100$. Calif. Inst. Tech. No. 1153.
PLATE 16

All specimens are from upper Eocene limestone on Canada de los Sauces, Santa Barbara County, California; Calif. Inst. Tech. Loc. No. 595.

Fig. 1. *Actinocyclina aster*, n. sp. Horizontal section showing median chambers, pillars, and solid subsurface rays, which apparently are due to deposition of calcite between closely spaced pillars. Paratype, × 20, San Diego Soc. Nat. Hist. No. 333.

Fig. 2. *Actinocyclina aster*, n. sp. Horizontal section showing median chambers and megalospheric nucleoconch. Paratype, × 20. Calif. Inst. Tech. No. 1154.


Fig. 4. *Actinocyclina aster*, n. sp. Vertical section through center of test. Paratype, × 20. Calif. Inst. Tech. No. 1155.
Both figures represent random rock sections cut from limestone on south slope of Jalama Creek, Santa Barbara County, California; Calif. Inst. Tech. Loc. No. 596.

Fig. 1. *Actinocyclina aster*, n. sp. (thick) and *Discocyclina psila*, n. sp. (thin), $\times$ 20. Calif. Inst. Tech. No. 1156.

Fig. 2. *Actinocyclina aster*, n. sp. (thick) and *Discocyclina psila*, n. sp. (thin), $\times$ 20. San Diego Soc. Nat. Hist. No. 335.

A small involute *Operculina* (or *Nummulites*) is visible in both views.
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A NEW RACE OF GILDED FLICKER FROM SONORA

BY

A. J. van Rossem

California Institute of Technology

In the course of the past two years several small collections of Sonora birds, totalling some 2500 skins, have been acquired by the Dickey collection at the California Institute of Technology. The writer is at present engaged in preparing a report on this material which contains many interesting range extensions of previously known forms. As publication of the final report will necessarily be delayed for some time due to the fact that field work is still being carried on, it has been decided to publish descriptions of the new forms as they come to light. The first of these is given below.

**Colaptes chrysoides tenebrosus** subsp. nov.

*Type.*—Male adult; no. 29,415 collection of Donald R. Dickey; Obregon, Sonora, Mexico; November 6, 1929; collected by J. T. Wright, original number 4366.

*Subspecific characters.*—In general size very similar to *Colaptes chrysoides chrysoides* (Malherbe) of southern Lower California, but tail relatively and actually longer; coloration darker than any of the previously described races; nearest in this respect to *Colaptes chrysoides brunnescens* Anthony of northern Lower California, but top of head very much less reddish and underparts more heavily washed with brownish gray. The measurements of the type which has been selected as demonstrating the
rational average in size are: wing, 146 mm.; tail, 96 mm.; exposed culmen, 35 mm.

Range.—Central and southern Sonora, south probably to northern Sinaloa. The habitat of this woodpecker is chiefly the giant cactus (Cereus) association of the Arid Tropical Zone.

Remarks.—Gilded Flickers from the range of tenebrosus are, even in relatively worn plumage, so different in color from Colaptes chrysoides mearnsi Ridgway of southeastern California and Arizona with which they have usually been included that comment other than the diagnosis given above is unnecessary. Specimens from Tecoripa and San Javier are somewhat intermediate toward mearnsi and these localities are probably not far south of the northern limit of tenebrosus in the interior.

Southern Sonora is a region the avifauna of which appears to be set off definitely from that of the northern part of the state. Not only does it mark the northern limits of several Arid Tropical Zone species, but most of the resident forms of wide ranging "plastic" species have been affected to a greater or less degree. The response in almost every instance is smaller size and darker (or more intense) coloration as compared with the northern Sonora and Arizona representatives. The two other genera of wide ranging "plastic" woodpeckers resident in this area show the same relative characters which distinguish the flickers; these are Dryobates scalaris agnus Oberholser and Centurus uropygialis sulfuriventer (Reichenbach).

Thirteen examples of the new form have been examined from the following localities, all of them in southern Sonora: Tecoripa, San Javier, Guaymas, Tesia, Obregon. Ample series of the three other races have been available for comparison and in this connection I wish to express my appreciation to Mr. Clinton G. Abbott and Mr. Laurence M. Huey for the privilege of using in the present instance the series of Colaptes chrysoides brunnescens in the Museum of Natural History at San Diego.
NEW SPECIES OF MOLLUSKS

BY

FRED BAKER & V. D. P. SPICER

San Diego Society of Natural History
COMMITTEE ON PUBLICATION

U. S. Grant, IV, Chairman

Fred Baker

Clinton G. Abbott, Editor
NEW SPECIES OF MOLLUSKS

BY

Fred Baker & V. D. P. Spicer
San Diego Society of Natural History

The following species of mollusks, all of which seem to be new, were collected by Fred Baker at the widely distributed localities noted in the descriptions.

1. Ostrea hiranoi Baker and Spicer, sp. nov.
   Plate 18, figures 1-3

   Shell cup-shaped, having an ovate basal attachment 32 mm. wide and 25 mm. long, then rising abruptly at the distal margin of the base to an altitude of 35 mm.; the inferior valve rising at a right angle to the base, convexly curved, corneous, thin and distantly, concentrically laminate, horn-colored to rosy on the holotype; superior valve slightly convex and parallel to the base over the body cavity, then sharply curved upward to correspond to the contour of the other valve; superior valve much smaller than the inferior; surface laminate, very irregular and showing a slight tendency toward radiate ribbing; color horn, faintly rayed with chestnut and white; umbones nearly obsolete; interior subcentrally brown, margined with white; ligamental attachment small, obtusely triangular; muscle scar large, not impressed.

   Altitude of inferior valve, 45.9 mm.; length, 47.8 mm.

   Holotype: with an attached paratype, No. 18,294, collection of the San Diego Society of Natural History; collected at a depth of sixty fathoms about five miles off the Bay of Obama on the northern coast of Hondo, Japan; May 11, 1914.

   All specimens were alive when taken, growing on a half grown, dead specimen of Hemifusus colosseus (Lamarck). All except the smallest show the marked tendency to curve sharply upwards nearly at a right angle from the attached portion.

   The species is named for the late M. Hirano who, when Principal of the Fisheries Products School of Obama, in 1914, honored the senior author with a day's dredging in the power launch of the School manned by a large crew of the students and professors that made possible the handling of the very large trawl used without the aid of hoisting gear.
2. *Strigatella (Atrimitra) coronadoensis* Baker and Spicer, sp. nov.

Plate 19, figure 1

Shell small, dark brown, fusiform, with four smooth, shining, cream-white nuclear whorls forming a moderately expanding, cylindrical nucleus with a blunt apex, abruptly changing to the rapidly expanding, brown postnuclear whorls; postnuclear whorls three, sculptured throughout with strong, nearly vertical, incremental lines enlarging and turning sharply to the right at their upper extremities, and with fine, equidistant, sharply incised, punctate spiral grooves, three appearing on the first whorl, four on the second, and five above the periphery and twelve on the base of the third or body whorl; sutures not impressed, margined below by a narrow line of paler brown, the base also being of a pale ashen brown changing abruptly to the dark brown of the balance of shell at the peripheral groove; whorls slightly convex, shining; aperture narrow, brown; columella with three oblique, whitish plaits; outer lip not thickened or expanded.

Altitude, 13 mm.; greatest diameter, 6.25 mm.; length of aperture, 8.25 mm.

**Holotype:** No. 18,295, collection of the San Diego Society of Natural History; dredged off the southeastern end of Los Coronados Islands, Lower California, Mexico, in 6 to 18 fathoms; August 5, 1902.

This species differs from the somewhat similar *Strigatella diegensis* Dall\(^1\) in general contour, in the persistence of the incised spiral lines over the base and in the coloring which is generally lighter, and presents a well defined pale line below the sutures and a uniform ashen-brown on the base. Besides other differences, it is distinctly smaller in all corresponding dimensions than *Strigatella catalinae* Dall\(^2\) and the spire is straight or slightly concave, while in *S. catalinae* it is convex.

3. *Turbonilla (Strioturbonilla) zamboangoensis* Baker and Spicer, sp. nov.

Plate 19, figure 2

Shell small, imperforate, regularly elongate-conic, translucent, shining, white; nuclear whorls about two, nearly vertical, smooth, shining, very slightly immersed in the succeeding turn; postnuclear whorls twelve, marked by strong, nearly vertical, slightly sinuous axial ribs terminating abruptly on the last whorl at the extension of the last sutural line, many of them being marked by a fine, incised, longitudinal line producing a doubled appearance of the ribs, about fourteen ribs appearing on each whorl; interspaces about equal in width to the axial

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ribs, marked by rather regularly spaced, minute incised spiral lines, between ten and fifteen appearing on each whorl; sutures well defined, impressed but not channeled; base well rounded, rather long, marked by strong incremental lines and by numerous, minute, wavy, incised spiral lines varying extremely in intensity; aperture regularly elongate-oval; posterior angle acute; outer and basal lips thin, showing the external sculpture within; columella concave, moderately calloused, slightly reflected at the umbilical region, showing only a trace of a fold at its insertion; parietal wall slightly calloused.

Length, 5.4 mm.; diameter, .9 mm.

**Holotype**: No. 18,296, collection of the San Diego Society of Natural History, and a single half grown paratype in the Baker collection; dredged in the Basilan Channel off the City of Zamboanga, Mindanao, Philippine Islands, in about four fathoms; February 24, 1914.

The species is certainly different from any species heretofore described from the Philippine Islands and seems to be different from any species already described.

4. **Gibbula harrisi** Baker and Spicer, sp. nov.

Plate 19, figures 3, 4

Shell small, rather thin, turbinate-conic, perforate; color pattern white, with a spiral series of ashy-brown flames just below the sutures, showing indistinctly on the first postnuclear whorl, progressively increasing and extending irregularly over the base; nuclear whorls two, very small, shining, ash-colored; postnuclear whorls four, narrowly, flatly shouldered above, very convex below, the first small but prominent from the beginning, marked by a single spiral cord with about eight shining, beadlike tubercles, this cord continuing prominently to the edge of the aperture and marking the lower edge of the shoulder; a second similar but smaller spiral cord appearing on the second whorl near the suture, with a third intercalating at the beginning of the third turn and a fourth appearing just below the suture in the third turn, marking the upper edge of the shoulder and extending to the aperture; these spiral cords crossed by very numerous, nearly equal but rather irregularly spaced, retractive, sinuous axial ribs extending more or less continuously over all the whorls and base deep into the umbilicus, rather badly defined on the upper turns, but with about fifty showing on the penultimate turn and eighty on the last; interspaces between the spiral cords and axial ribs generally squarish over the convex portion of the whorls and elongated axially on the shoulder; intersections of the ribs and cords marked by rounded, beadlike tubercles, with other finer tubercles irregularly placed on the axial ribs, in places giving the appearance of very minute spiral cords between the main cords; peripheral cord only slightly more prominent than the preceding one, scarcely carinating the periphery; base well rounded, marked by continuations of the axial ribs and by about six nearly equal and equally spaced spiral cords beaded at the intersections, the interspace between the upper and peripheral cord being
slightly broader than the succeeding ones; umbilicus broadly funnel-shaped, perspective, contained about four times in the greatest diameter of the shell, marked by at least seven spiral cords disappearing within, crossed by the axial ribs and producing the same beading as on the rest of the shell; aperture almost exactly circular, nacreous within, marked by yellowish to greenish luster; peritreme continuous, thin, without callus, showing the external sculpture within, not reflected but encroaching on the otherwise circular umbilicus on the columellar side; operculum circular, concave, corneous, thin, shining, pale brown with nine narrow whorls; nucleus central.

Altitude, 1.3 mm.; greatest diameter, 1.6 mm.; least diameter, 1.4 mm.

Holotype: No. 18,297, collection of the San Diego Society of Natural History, and about thirty paratypes in the Baker and Spicer collections; dredged in the Basilan Channel off the City of Zamboanga, Mindanao, Philippine Islands, in about four fathoms; February 24, 1914.

The species, which seems to be new, differs from all species of *Gibbula* described from the Philippine Islands and bears no marked resemblance to any known species. The color pattern suggests that of *Margarites parci-pictus* (Carpenter), from the California Coast. Although the shell is very small, the number taken, all of about the same size and apparently nearly, or quite mature, seems to warrant its characterization.

The species is named for Mr. Wray Harris, known for his extensive collections of mollusks in the Samoan Islands.

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EXPLANATION OF PLATES
PLATE 18

Fig. 1. *Hemifusus colosseus* (Lamarck), with attached *Ostrea hiranoi* Baker and Spicer, sp. nov.

Fig. 2. *Ostrea hiranoi* Baker and Spicer, sp. nov. Holotype, side view. Alt. of inferior valve, 45.9 mm.; length, 47.8 mm.

Fig. 3. Same, top view.
PLATE 19

Fig. 1. *Strigatella (Atrimitra) coronadoensis* Baker and Spicer, sp. nov. Holotype. Alt., 13 mm.

Fig. 2. *Turbonilla (Strioturbonilla) zamboangoensis* Baker and Spicer, sp. nov. Holotype. Alt., 5.4 mm.

(Subsequent to description and measurement, the apex of this specimen was accidentally broken off. The figure was made after mending.)

Fig. 3. *Gibbula harrisi* Baker and Spicer, sp. nov. Holotype, side view. Alt., 1.3 mm.

Fig. 4. Same, bottom view.
NOTES ON SOME SPECIES OF EPITONIUM, 
SUBGENUS NITIDISCALA, 
FROM THE WEST COAST OF NORTH AMERICA 

BY 
A. M. STRONG 
Los Angeles, California 

SAN DIEGO, CALIFORNIA 
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U. S. Grant, IV, Chairman

Fred Baker

Clinton G. Abbott, Editor
NOTES ON SOME SPECIES OF EPITONIUM, SUBGENUS NITIDISCALA, FROM THE WEST COAST OF NORTH AMERICA

BY
A. M. STRONG
Los Angeles, California

Dr. P. P. Carpenter, in his review of the shells from the Vancouver and California provinces, published in the Report of the British Association for the Advancement of Sciences for 1863, issued in 1864 and commonly referred to as the "Supplementary Report," listed six species under the genus name of Scalaria which are now placed in the genus Epitonium, subgenus Nitidiscala. Four of these are given as new and are the first species of the genus to be described from the provinces. The other two are referred to species previously described, respectively, from the Philippines and Panama. A considerable amount of material was available to Carpenter in this work and it is to be expected that most of the shore forms were represented, though the number of specimens of some of them was probably few. That Carpenter was somewhat uncertain in regard to his determinations in Scalaria is shown by the use of question marks and the following statement made in connection with his description of the Panama species: "The above species are published with doubt, as Scalaria are seldom seen in sufficient numbers to ascertain the limits of specific variation. Species described from one or two specimens must always be regarded as provisionally registered." Carpenter did not designate type specimens and the material on which he based his descriptions is in some cases difficult to place. Moreover, he would seem to have changed the use of names in later identifications. Other writers have followed these changes without referring to original descriptions or material, resulting in much confusion.

A few of the west coast species are now available in large numbers, making it possible to draw definite conclusions in regard to them. In these it is found that the number of varices and length and diameter for a given number of whorls are among the least variable characters. Little attention seems to have been paid to these characters. A comparison of

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Dall’s identifications and Arnold’s descriptions with Carpenter’s original descriptions shows wide differences on these points.

There is little difficulty in placing Carpenter’s *Scalaria* (? var. *indianorum*) *tincta*, which is listed\(^2\) as inhabiting Cedros Islands, Lower California (Ayres), and San Pedro (Cooper), with the comment, “The Lower California shell may prove distinct”. The species is briefly described as\(^3\) “Costae acute, not reflexed, whorls posteriorly tinged with brownish purple.” The only *Epitonium* known from the coast which could be described as posteriorly tinged with brownish purple is a small shell which is quite common along the southern California coast. They live in colonies in the sand at the base of sea anemones, to which they are attached by a mucus thread. The number of varices vary from 10 to 13, with a great deal of variation in the amount of coronation or angulation at the shoulder of the whorl. In some specimens the varices round into the suture with almost no sign of angulation, in others a varying number of the upper whorls show distinct coronation, while the varices on the later whorls are rounded. Occasional specimens are found on which the coronation is distinct on all whorls. The amount of reflection to the varices is also quite variable. The extent of the brown coloration in the suture is sometimes slight and in all cases fades out in dead shells or those which have been in a cabinet for any length of time. A typical adult shell with 3 smooth nuclear and 8 subsequent sculptured whorls measures 12 mm. in length by 5.5 mm. in diameter. Carpenter gave no measurements or detailed description for this species. A specimen, No. 19,510 in the United States National Museum, is labeled “*Scalaria indianorum* variety” and was collected by Cooper at San Pedro. It is probably one of the specimens referred to by Carpenter in his description. While this shell now shows no signs of the brown coloration, it agrees in all other ways with living shells from the same locality which show the colored band at the suture.

*Scalaria indianorum* is listed by Carpenter from Neah Bay, Washington (Swan),\(^4\) and described\(^5\) as having 8 to 15 (usually about 12) varices and 10 whorls measuring 26 mm. in length by 9 mm. in diameter. A specimen, No. 15,521 in the United States National Museum, from a

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lot labeled "Type of *S. indianorum* Cpr.," with 12 varices and 8 whorls without the lost nucleus, agrees otherwise with the description. Except for the much larger size, the description would come very close to a bleached specimen of *Epitonium tinctum* Cpr. on which the coronation and reflection to the varices is slight. It is evidently for this reason that Carpenter listed the latter as a doubtful variety. *Epitonium indianorum* Cpr. is a well recognized species which never shows any sign of the brown coloration in the suture. It is not only the largest member of the subgenus on the coast but the most northern in its distribution. Mr. George Willett, of the Los Angeles Museum, has collected the species in considerable numbers at Forrester Island, Alaska, some of the specimens with 12 whorls reaching a length of 35 mm. The unusual variation in the number of varices given in the description indicates that Carpenter may have included more than one species under the name in his determinations. The southern California record for the species is very doubtful and probably based on the consideration that *Epitonium tinctum* Cpr. can be classed as a variety.

"*Scalaria subcoronata* n.s." is listed by Carpenter from Monterey and described as a shell with but 13 varices, a little coronated in the young shell, and 10 whorls measuring 11 mm. in length by 5.5 mm. in diameter. Carpenter states in his description that the species is "State Collection No. 393a". This collection, made by Cooper for the California State Geological Survey, was later turned over to the State University, but the numbers do not seem to have been preserved. Specimens in the University of California collection marked "*Epitonium subcoronatum* Cpr., Cooper collection" are probably the ones referred to. A specimen, No. 14,830b in the United States National Museum, is from a lot labeled "Type of *E. subcoronatum* Cpr." and the lot is undoubtedly part of the original material. In both cases the specimens agree with Carpenter's description and measurements, but they are the shells which in a fresh condition show the brown coloration in the suture. *Scalaria subcoronata* Cpr. must be considered a synonym of *Epitonium tinctum* Cpr.

"*Scalaria crebricostata* n.s." was first mentioned by Carpenter as occurring at Monterey and San Pedro and later described as a shell with 10 whorls, measuring 17.5 mm. in length by 4.5 mm. in diameter,
having 15 reflexed varices, coronating against the suture. This would seem to be a much more slender shell than the others with more varices. Carpenter states in his description that the species is "State Collection No. 393". A lot in the University of California collection labeled "Epitonium crebricostatum Cpr., Cooper Collection" contains a number of specimens of Epitonium tinctum Cpr. and a single slender specimen with more numerous varices which seems to be the young of a different species. A specimen, No. 14,831 in the United States National Museum, is said to be characteristic of a lot labeled "Type of E. crebricostatum Cpr." It is much shorter and wider than the dimensions given by Carpenter and has only 12 varices. The varices are strongly reflected and coronated, with the exposed faces deeply axially striated. In size, shape, and number of varices this specimen agrees with Epitonium tinctum Cpr. and in spite of being a thicker and heavier shell may be an extreme form of that species. Unless a definite type can be fixed for Carpenter’s description, the species must be left as indeterminate.

Carpenter also listed "Scalaria ? gracilis" and "Scalaria ? Cumingii" as occurring at San Diego. 10 Dall states that Scalaria gracilis Sby. 11 "was originally described as a Philippine shell and its reference to the west coast of America is due to a misidentification." Scalaria cumingii Cpr. was described from Panama 12 as a shell with 8 or 9 varices, measuring 9 mm. in length by 3.5 mm. in diameter. No further reference to these two species from the California coast is found in the literature and it would be difficult to determine which of the California shells were referred to by Carpenter under these names.

Dr. J. G. Cooper, who collected many of the shells described and identified by Carpenter, lists 13 Scalaria hindii Cpr. as living, Bodega Bay to San Diego, and adds "Given in Catal. of 1888 as S. subcoronata which is now called a variety of the Panama shell, though specimens have not been found in Mexico." Scalaria hindii Cpr. was described from Panama 14 as a shell having 10 whorls, measuring 26 mm. in length by 10 mm.

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13 Cal. State Mining Bureau, Bulletin No. 4, 1894, p. 31.
in diameter, with 8 sharp varices. This is evidently a case where Carpenter changed identifications without a published record.

Dr. Ralph Arnold described a number of Pleistocene and Pliocene fossils from San Pedro, California, under the genus name of *Scala*. Among these the four belonging in the subgenus *Nitidiscala* are referred to Carpenter's living species on the strength of identifications made by Dr. Dall. *Scala crebricostata* Cpr. is very briefly described without measurements or figure. It is stated that the "specimens are identified as questionable by Dr. Dall." *Scala indianorum* Cpr. is described and figured as a shell with 10 whorls and 12 to 16 heavy varices, measuring 26.5 mm. in length by 9 mm. in diameter. The description agrees in every way with Carpenter's original description. *Scala hindsii* Cpr. is stated to equal *Scalaria subcoronata* Cpr. (*fide* Cooper) and is described as a shell with 8 whorls, 8 to 12 varices, sometimes reflexed and prominently coronated. The measurements are given as length 11.5 mm., diameter 5.2 mm. The description agrees with the original description of *Scalaria subcoronata* Cpr. and with those specimens of the living *Epitonium tinctum* Cpr. on which all the whorls show the coronation of the varices.

Under the name of *Scala tincta* Cpr. Arnold described and figured a shell with 9 or 10 whorls and 10 to 12 varices measuring 25 mm. in length by 10 mm. in diameter. It is stated that this shell differs from *Scala indianorum* Cpr. by having "a more delicate shell, thinner varices, which are not reflexed as a rule, thinner lip and much deeper suture." This is a larger shell and quite different from *Epitonium tinctum* Cpr. as known from the living specimens. Both the description and figure agree quite well with a shell which is frequently washed in along the sandy beaches of the California coast. A specimen of this shell, No. 56052 in the United States National Museum, bears a label showing an old identification by Dr. Dall as "*Epitonium indianorum tinctum* Cpr." The specimen comes from Monterey. This species seems to be left without a name and is described as *Epitonium (Nitidiscala) cooperi* in the present paper.

Dr. Dall in 1917 made the following statement in regard to the use

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15 The beds which Arnold assigned to the upper Pliocene are now believed to be lower Pleistocene.
17 loc. cit., p. 264, pl. 5, fig. 4.
18 loc. cit., p. 264.
19 loc. cit., p. 265, pl. 5, fig. 3.
of the name *Epitonium hindsii* Cpr. for a California shell\(^{20}\): “Carpenter described from Panama a species of *Nitidoscala* with 8 varices, under the name of *S. hindsii*. By some confusion he later transferred the name in 1865 to a well known shell from California which has 11 to 14 varices”. Dall proposed the name of *Epitonium fallaciosum* for the shell “commonly known from California as *S. hindsii* Cpr.” but gave no description, designated no type and gave no references to any published record. In a later publication,\(^{21}\) under *Nitidoscala fallaciosa* Dall, he referred to Keep, West Coast Shells (ed. 1911), p. 183, fig. 174. This is a figure of an adult specimen of *Epitonium tinctum* Cpr. A specimen, No. 46,222 in the United States National Museum, is labeled *E. “hindsii” Cpr. = fallaciosum* Dall, San Pedro, Carpenter. This is the same as the shell described by Arnold as *Scala tincta* Cpr. Specimens in the Cooper, Hemphill and other old California collections show that the name *S. hindsii* Cpr. has been applied to two distinct species of California shells. However, Cooper and Arnold are the only ones definitely to fix the names by published records. In view of these facts it is evident that the shell “commonly known from California as *S. hindsii* Cpr.” is *Epitonium tinctum* Cpr. and, in spite of the fact that Dall probably did not so intend it, *Epitonium fallaciosum* Dall must take its place with “*Epitonium subcoronatum*” (Cpr.) in the synonymy of *tinctum*.

*Epitonium (Nitidoscala) tiara* Cpr. is listed by Dall\(^{22}\) from California and he states\(^{23}\) “This species has 12 varices and ranges from Catalina to Todos Santos Bay, Lower California, according to specimens so named by Carpenter in the Stearns’ collection. It was originally described from Panama and I feel some doubt as to whether the California species is conspecific with that from Panama, but the question can only be settled by a comparison with the type in the British Museum.” The shell described by Carpenter was in the Cuming collection from Panama. It has been pointed out by Gray and others that the original type lots in this collection were in some cases replaced by better specimens, not always from the type locality, and the types so lost. In the case of the smaller shells, to which the earlier authorities paid little attention, this leads to much un-

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certainty. Carpenter's description,\(^24\) which is very brief, calls for a shell of 7 whorls measuring 7 mm. in length by 4 mm. in diameter, with the varices slightly winged below the sutures, and might easily apply to several different species equally well. In order to determine the species it would be necessary to compare a representative collection from the Panama fauna with both Carpenter's description and the specimens in the Cuming collection. Carpenter's specimens in the Stearns' collection can not be located and in view of the lack of all positive data it would seem best to cancel the name from the California lists.

In addition to the species described by Carpenter, the subgenus *Nitidiscala* contains about fifteen species which are described or recorded from California. Most of these are from deep water and are known to the California collectors by only a few specimens, if at all. A few species have been collected in considerable numbers. Among these is *Epitonium sawinae* Dall,\(^25\) described as collected off the south side of Catalina Island. *Epitonium sawinae* variety *? catalinense* Dall\(^26\) was later described from Catalina and the range of the typical form given as from Vancouver to San Diego, and possibly to the Gulf of California. Still later, Dall\(^27\) listed these two forms as distinct species and gave the range of *Epitonium sawinae* Dall as from Monterey to Catalina Island. *Epitonium catalinense* Dall is listed only from the type locality, Catalina Island, and is said to differ in the greater number of varices, 22 to 24 as against 16 to 19 in *Epitonium sawinae*, in the absence of angulation to the varices and by the presence of a minute umbilical perforation. There is also some difference in the measurements of the type specimens. An examination of a large number of specimens dredged in from 10 to 40 fms. at various points off the coast of southern California shows that these differences are not constant. The number of varices is more often over 20 than under and nearly all show at least some sign of angulation or spine on the varices at the shoulder of the whorls. *Epitonium catalinense* can hardly be considered even as a valid variety of *Epitonium sawinae*. *Epitonium catalinæ* Dall\(^28\) is an entirely different shell. Packard reports\(^29\) that *Epitonium sawinae*

was dredged in considerable numbers in from 39 to 46 fms. off the Golden Gate, San Francisco.

Another species in the subgenus which has been collected in large numbers in southern California is found living just under the surface of the mud on the tide flats of the bays. It has been identified as *Epitonium subcoronatum* Cpr. but, while it is of about the same length and has about the same number of whorls as those called for in Carpenter's description, it is a much more slender shell. The strongly reflected varices number 9 or 10 and are deeply axially striated. This seems to be the shell described as *Epitonium californicum* Dall. The type locality for the species is given as San Miguel Island and the range from there to the Gulf of California.

More complete descriptions of these five species have been prepared and figures of the specimens in the U. S. National Museum secured. In addition, good specimens from the local collections have been figured and the specimens themselves placed in the type collection of the San Diego Society of Natural History. Sufficient material to fix the geographic ranges for the various species was not available.

The writer wishes to acknowledge his indebtedness to Dr. Alexander Wetmore, of the U. S. National Museum, for photographs and the loan of specimens, to Mr. Wayne Loel for the photographs of the specimens placed in the collection of the San Diego Society of Natural History, and to Dr. U. S. Grant, IV, for assistance in the preparation of the manuscript.

**Epitonium (Nitidiscala) indianorum** (Carpenter)

Plate 20, figures 1, 2a, 2b


Shell large for the genus, white, fairly thick; apex very sharp, with the extreme tip broken in all the specimens examined; remaining whorls about 11 in the adult, well rounded and separated by a deep suture, regularly increasing in size, forming a slender, turreted spire; ornamented with 13 or 14 thin varices

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which meet and fuse in the suture and ascend the spire in a continuous line approximately parallel with the right side of the shell; on the middle and lower portion of the whorls the varices are somewhat reflected, exposing the edges of the layers of cell-structure as fine axial striations; at the shoulder of the whorls the varices become erect and are more or less expanded to form coronating points, beyond which they dip concavely into the suture; on the base the varices continue without change to the raised columellar lip with which they fuse; spiral sculpture entirely absent; aperture nearly circular; columellar lip evenly curved, slightly expanded at the junction with the basal lip and extending posteriorly to a junction with the outer lip, which is thickened by the last varix.

The specimen figured as No. 343, S.D.S.N.H., was collected by Mr. George Willett at Forrester Island, Alaska, and measures, length 35, maximum diameter 12 mm.

**Epitonium (Nitidiscala) tinctum (Carpenter)**

Plate 20, figures 3, 4, 5a, 5b


*Epitonium hindsii* Carpenter, Keep, West Coast Shells, ed. 1911, p. 183, fig. 174.


Shell small, fairly thick, with, in fresh specimens, a narrow, ill-defined, purplish or brownish band just below the sutures; nuclear whorls 3, minute, elevated, smooth, separated from the normal whorls by a slight constriction and forming a sharp point to the spire; normal whorls about 8 in the adult, well rounded and separated by a deep suture, rapidly but regularly increasing in size; ornamented with 11 or 12 sharp varices which meet and fuse in the sutures and ascend the spire in a continuous line approximately parallel with the right side of the shell; on the middle and lower portion of the whorls the varices are more or less reflected, exposing the edges of the layers of cell-structure as axial striations; in the sutures the varices become erect and at the shoulder of the whorls are frequently expanded to form coronating points; on the base the varices continue without change to the raised columellar lip with which they fuse; spiral sculpture entirely absent; aperture nearly circular; columellar lip curved, becoming thickened anteriorly, and extending posteriorly to a junction with the outer lip, which is thickened by the last varix.
The specimen figured as No. 344, S.D.S.N.H., comes from Point Vincent, near San Pedro, California, and measures, length 12, maximum diameter 5.5 mm.

The species differs from *Epitonium indianorum* (Carpenter) principally in the smaller size, more robust form, and in the presence of the color band.

**Epitonium (Nitidiscala) cooperi** Strong, new species

Plate 20, figures 6a, 6b, 7, 8a, 8b


Shell of medium size, pure white, thin; apex sharp, with the extreme tip broken in all the specimens examined; remaining whorls about 8 in the adult, almost semi-circular in outline between the very deep sutures, regularly increasing in size, forming a slender turreted spire; ornamented with 11 or 12 thin varices which touch the varix on the proceeding whorl before reaching the bottom of the suture, but which do not fuse, and ascend the spire in a continuous line approximately parallel with the right side of the shell; varices on the middle and lower portion of the whorls somewhat reflexed, exposing the edges of the layers of cell-structure as faint axial striations, becoming erect and expanded at the shoulder of the whorls where they form coronating points, beyond which they dip concavely into the sutures; on the base the varices continue without change to the raised columellar lip under which they dip; spiral sculpture entirely absent; aperture nearly circular; columellar lip raised, sharp, curved, somewhat expanded at the junction with the basal lip, extending posteriorly to a junction with the outer lip, which is thickened by the last varix.

The type, No. 345, S.D.S.N.H., comes from San Pedro, California, and measures, length 20, maximum diameter 8 mm.

The species differs from the other species in the subgenus found on the west coast in the thinness of the shell and the very deep sutures between the loosely coiled whorls.

**Epitonium (Nitidiscala) sawinae** Dall

Plate 20, figures 9, 10


Shell small, white, thin; nuclear whorls a little over 3, minute, elevated, sculptured with microscopic axial striations, the sculpture changing abruptly to that of the normal whorls; normal whorls about 8 in the adult, well rounded and separated by a deep suture, regularly increasing in size, forming a slender turreted spire; ornamented with numerous, low, sharp, nearly erect varices, which vary in number on the different whorls as well as on different specimens, but average about 20; varices not always meeting in the sutures but, when they do, fusing and ascending the spire in a line approximately parallel with the right side of the shell; at the shoulder of the whorls there is sometimes developed an expanded angle or even a small, sharp spine; on the base the varices continue without change to the base of the columellar lip; spiral sculpture entirely absent; aperture nearly circular; columellar lip thin, sharp, curved, flatly reflected toward the junction with the basal lip, the reflection more or less completely concealing a minute umbilical perforation, and extending posteriorly to a junction with the outer lip, which is thickened by the last varix.

The type, which is figured, was dredged near Avalon, Catalina Island, California, and measures, length 10.5, maximum diameter 4 mm.

The large number of sharp varices makes the species quite distinct among the west coast species in the subgenus.

Epitonium (Nitidiscala) californicum Dall

Plate 20, figures 11, 12a, 12b


Shell small, white, thin; nuclear whorls about one and a half, forming a flattened point to the sharp apex; normal whorls about 9 in the adult, well rounded and separated by a deep suture, regularly increasing in size, forming a slender turreted spire; ornamented with 9 or 10 thin varices which meet and fuse in the sutures and ascend the spire in a continuous line approximately parallel with the right side of the shell; the varices are strongly reflected and the edges of the layers of cell-structure separate to form deep axial striations; just below the suture the varices are suddenly contracted, leaving a sharp angle or spine coronating the shoulder of the whorls; on the base the varices continue to the raised columellar lip under which they dip; spiral sculpture entirely absent; aperture nearly circular; columellar lip curved, becoming expanded and striated anteriorly, and extending posteriorly to the junction with the outer lip, which is thickened by the last varix.

The specimen figured, No. 346 S.D.S.N.H., comes from Alamitos Bay, Los Angeles County, California, and measures, length 10, maximum diameter 4 mm.

This species resembles Epitonium tinctum (Carpenter) in many ways, but differs in the more slender form, fewer and more reflected varices and in the lack of the color band.
PLATE 20

Fig. 1. *Epitonium* (*Nitidiscala*) *indianorum* (Carpenter). Type, No. 15,521 in the U. S. National Museum, from Neah Bay, Washington. Carpenter describes the species as having 10 whorls and measuring, length 26, diameter 9 mm.


Fig. 3. *Epitonium* (*Nitidiscala*) *tinctum* (Carpenter). Specimen No. 19,510 in the U. S. National Museum, labelled "*Scalaria indianorum* variety." It was collected by Cooper at San Pedro, California, and probably is the specimen cited by Carpenter in his original description of variety *tincta*. The figure is from a U. S. National Museum photograph stated to be twice natural size.

Fig. 4. *Epitonium* (*Nitidiscala*) *tinctum* (Carpenter). Specimen No. 13,830b in the U. S. National Museum, from the lot marked "Type of *E. subcoronatum* Cpr." The specimen came from Monterey, California, and the measurements are given in the original description as length 11, diameter 5.5 mm.

Figs. 5a, 5b. *Epitonium* (*Nitidiscala*) *tinctum* (Carpenter). Plesiotype, No. 344, S.D.S.N.H., from Point Vincent, near San Pedro, California. Length 12, diameter 5.5 mm.

Figs. 6a, 6b. *Epitonium* (*Nitidiscala*) *cooperi* Strong, n. s. Type, No. 345, S.D.S.N.H., from San Pedro, California. Length 20, diameter 8 mm.

Fig. 7. *Epitonium* (*Nitidiscala*) *cooperi* Strong, n. s. Specimen No. 46,222, a paratype, in the U. S. National Museum, labelled "*E. hindsii* = *fallaciosum* Dall from San Pedro."

Figs. 8a, 8b. *Epitonium* (*Nitidiscala*) *cooperi* Strong, n. s. Specimen No. 56,052, a paratype, in the U. S. National Museum, labelled "*E. indianorum tinctum* Cpr., Monterey, identified by Dall." Length 14, diameter 6 mm.

Fig. 9. *Epitonium* (*Nitidiscala*) *sawinae* Dall. Type, No. 109,309 in the U. S. National Museum. It was dredged near Avalon, Catalina Island, California, and the measurements are given as length 10.5, diameter 4 mm.

Fig. 10. *Epitonium* (*Nitidiscala*) *sawinae catalinense* Dall. Type, No. 109,502 in the U. S. National Museum. It was dredged off Catalina Island, California, and the measurements are given as length 13.5, diameter 6 mm.

Fig. 11. *Epitonium* (*Nitidiscala*) *californicum* Dall. Type, No. 201,202 in the U. S. National Museum. The type locality is given as San Miguel Island, California, and the measurements as length 10.5, diameter 4 mm.

Figs. 12a, 12b. *Epitonium* (*Nitidiscala*) *californicum* Dall. Plesiotype, No. 346, S.D.S.N.H., from Alamitos Bay, Los Angeles County, California. Length 10, diameter 4 mm.
TWO NEW SUBSPECIES OF BIRDS FROM SONORA

BY

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Further study of the Sonora bird skins recently acquired by the Dickey collection from Mr. Griffing Bancroft has revealed the existence of two more geographic races, in this instance pale colored representatives of Tropical Zone species which here reach their northern limits. These are formally described below.

*Columba flavirostris restricta* subsp. nov.

*Type.*—Male adult; no. 27,889, collection of Donald R. Dickey; Tecoripa, Sonora, Mexico; March 5, 1929; collected by J. T. Wright, original number 2677.

*Subspecific characters.*—Coloration throughout paler than that of *Columba flavirostris flavirostris* Wagler of eastern and southern Mexico and northern Central America, with the gray areas more extended and the red areas, particularly on the wing coverts and underparts, more restricted; greater wing coverts more noticeably edged with grayish white.

*Range.*—Central and southern Sonora and probably most of Sinaloa, Mexico.

*Remarks.*—W. DeWitt Miller (Bull. Amer. Mus. Nat. Hist., 21, 1905, p. 344) noted the peculiarities shown by five specimens of the Red-billed Pigeon from Esquinapa, southern Sinaloa, and it is certain from his remarks that if birds from that locality are not actually *restricta* they are at least intergrades with strong tendencies in that direction.

Throughout the range of true *flavirostris* there is remarkably little geographic variation. There appear to be no differences between specimens from such widely separated points as Texas, Vera Cruz and El Salvador, save that Texas birds may, on the basis of published measurements, average very slightly the largest. The two Texas birds and the two from Vera Cruz examined in the present connection are certainly indistinguishable by any standards of either measurement or color from the El Salvador series.
As the type locality of Wagler's *Columba flavirostris* is no more definite than "Mexico," I suggest that it be restricted to the State of Vera Cruz.

Specimens examined.—*Columba flavirostris flavirostris*: Texas, 2; Vera Cruz, 2; El Salvador, 12. *Columba flavirostris restricta*: Sonora (Tecoripa, Chinobampo, Guirocoba), 4.

**Myiozetetes similis primulus** subsp. nov.

*Type.*—Male adult; no. 29,590, collection of Donald R. Dickey; Tesia, Sonora, Mexico; December 4, 1929; collected by J. T. Wright, original number 4602.

*Subspecific characters.*—Most nearly resembling *Myiozetetes similis superciliosus* (Bonaparte) of Central America and southern Mexico, but coloration paler throughout; underparts "citron yellow"1 or "primrose yellow" instead of canary or "lemon yellow"; upperparts more ashy (less greenish) olive; wing coverts noticeably margined with pale edgings; general size slightly larger, with relatively longer tail. The measurements of the type, which represents the racial average in size as well as color, are: wing, 96 mm., tail, 80 mm.

*Range.*—Southern Sonora, south at least to northern Sinaloa.

*Remarks.*—The relatively prominent edging on the wing coverts is a pronounced character and presents a certain parallel in this respect to *Myiozetetes similis columbia* of southwestern Costa Rica, Panama and Colombia. This condition is practically obsolete in *superciliosus*.

Although there is a steady increase in size from Costa Rica northward it is only in northwestern Mexico that there appears to be any change in coloration. Specimens from Alta Mira, Tamaulipas, on the gulf coast of Mexico, are scarcely, if at all, distinguishable in color from El Salvador examples (which are essential topotypes of *superciliosus*), but are fully as large as *primulus*.

Specimens examined.—*Myiozetetes similis superciliosus*: Costa Rica, 5; El Salvador, 18; Mexico (Tamaulipas), 5. *Myiozetetes similis columbia*us: Costa Rica, 4. *Myiozetetes similis primulus*: Sonora (Tesia), 19; Sinaloa (San Blas), 2.

In connection with the present work I wish to thank the authorities of the Museum of Comparative Zoology at Cambridge, Massachusetts and the Natural History Museum at San Diego for the loan of specimens required for comparisons.

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1 Ridgway. Color standards and color nomenclature, 1912.
THE RACES OF AURIPARUS FLAVICEPS (SUNDEVALL)

BY

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California Institute of Technology

For some years the gradually accumulating series of verdins in the Dickey collection at the California Institute of Technology has made increasingly apparent the necessity for revisionary work. The current arrangement whereby all the verdins from the northern portion of the range, from the Gulf of Mexico to California are considered to be one form while those from Lower California and southern Sonora are “lumped” under another becomes, in the light of new material, not only untenable because of the differences displayed by the birds themselves, but presents decided incongruities if faunal areas are given any consideration.

Briefly the essential highlights in the nomenclatural history of the verdin are as follows: Sundevall (Ofversigt Vet. Ak. Förh., 7, 1850, 129) first named the species Aegithalus flaviceps giving as the type locality “Sitka or California”; Lawrence two years later, (Ann. Lyc. Nat. Hist. New York, 5, 1852, 112, pl. 5, fig. 1) undoubtedly unaware of Sundevall’s prior work, described and figured the verdin from “The Rio Grande in Texas” as Conirostrum ornatum; Baird (Rev. Amer. Birds, 1858, 85) recognized the fact that the species was subject to geographic variation, but Bryant (Zoe, 1, 1890, 150) was the first to propose a name, Auriparus flaviceps ornatus, for the “pale western bird”. Unfortunately Bryant’s name could not be used, for not only is it preoccupied by ornatum of Lawrence but is a strict synonym of Sundevall’s flaviceps. It remained for
Oberholser (Auk, 14, 1897, 391) to make the first acceptable division of the species into two geographic races and formally to name the Lower California bird *Auriparus flaviceps lamprocephalus* with Cape San Lucas as the type locality. Ridgway (Bull. U. S. Nat. Mus., 50, pt. 3, 1904, pp. 420-423) followed, for the most part, the arrangement of Oberholser but included Sonora in the range of the Lower California race. Thus matters have rested for the past twenty-four years. The present writer is able to recognize four geographic variants, synopses of which are given below.

**Auriparus flaviceps flaviceps** (Sundevall)

*Aegithalus flaviceps* Sundevall, Ofversigt Vet. Ak. Förh., 7, 1850, 129 ("Sitka or California". [As the first mentioned locality is an obvious absurdity and as no previous reviser has restricted the type locality I designate Fort Yuma, California as appropriate]).

**Subspecific characters.**—Coloration palest of the races of *Auriparus flaviceps*; in fresh plumage close to "grayish olive"¹ or "deep olive-gray" dorsally; dull, pale "wax yellow" on chin and throat, the yellow rarely suffusing the rest of the body plumage. Size slightly smaller than *ornatus* but decidedly larger than *lamprocephalus* and *fraterculus*. Average of 20 adult males: wing, 51.3; tail, 46.1 mm.

**Range.**—Lower Sonoran Deserts of the Colorado River drainage north to Inyo County, California; Las Vegas, Nevada and south-western Utah; west to or slightly beyond the eastern slopes of the desert-bounding ranges in California and Lower California; south to about latitude 31° in Lower California and north-western Sonora and east for an undetermined distance (probably about longitude 112° W.) in Sonora and Arizona.

**Remarks.**—Although Bryant definitely recognized the differences between Texas and California and also between Lower California and California specimens, his remarks on the subject have been ignored except by Oberholser who, in his critical analysis of the species, commented on Bryant's statements. However, in view of the limited material at Oberholser's disposal (he had but three specimens from California) he was obliged to include everything from Texas to California under one name.

I have been unable to examine specimens from south-western Utah (A.O.U. Check-list, 1910, 354) but have included that territory in the range of *flaviceps* on geographic probabilities.

**Specimens examined.**—Lower Colorado River Valley in Arizona, and California, 57 (many localities); California, 5 (Mecca, Riverside County; Newberry Springs, San Bernardino County; La Puerta Valley, San Diego County); Nevada, 1 (Las Vegas); Mexico: Sonora, 6 (El Doctor; San Felix Mine); Lower California, 8 (San Felipe; El Rosario; Cañón San Juan de Dios; San Fernando [not typical]). Total 77.

¹ Ridgway. Color standards and color nomenclature, 1912.
Auriparus flaviceps ornatus (Lawrence)


Subspecific characters.—Darkest of all the races in general coloration; back “deep grayish olive” to “dark olive-gray”; yellow of head averaging darker than in flaviceps. Size largest. Average of 10 adult males from Texas and Coahuila: wing, 53.6; tail, 49.1.

Range.—Deserts of the Upper and Lower Sonoran Zones, from the lower Rio Grande Valley west to the vicinity of Tucson, Arizona and Saric, north-central Sonora; south to about latitude 29° west of the Sierra Madre in Sonora (where intergrading with fraterculus) and to latitude 24° east of the Sierra Madre in Durango; north to south-central Texas, southern New Mexico and south-eastern Arizona.

Remarks.—Arizona specimens from the vicinity of Fort Lowell and Tucson are intermediate in size and color toward flaviceps, but seem to me to be better referable to the Rio Grande race. Byant has previously commented on the intermediate characters of birds from this very region but considered them to be nearer to the California race. For further remarks on this subject see also Oberholser (ibid., p. 393). It is not unlikely that what Swarth (Proc. Calif. Acad. Sci., 4th Ser., 18, 1929, 270) has designated as the “eastern plains area” of south-eastern Arizona marks the north-western limit of ornatus in typical form. Just where, west of that area, to draw the line between ornatus and flaviceps it is not now possible to determine. Specimens from Saric in north-central Sonora are good ornatus, but that place is higher, zonally speaking, than is Tucson, a circumstance which probably has a definite bearing on the subject.

Specimens examined.—Texas, 8 (Fort Lancaster; Boquillas; Sequim; Franklin Mts.; El Paso); New Mexico, 1 (Las Cruces); Arizona, 6 (Fort Lowell; Tucson); Mexico: Tamaulipas, 1 (Mier); Coahuila, 10 (Sabinas); Durango, 2 (Durango); Sonora, 16 (Saric; Pesqueira). Total 44.

Auriparus flaviceps fraterculus subsp. nov.

Type.—Male adult; no. 30,499, collection of Donald R. Dickey; Chino-bampo, southern Sonora, Mexico; February 18, 1930; collected by J. T. Wright; original number 5054.

Subspecific characters.—Decidedly smaller and yellow of head very much brighter (more orange) and more extensively yellow than either A. f. flaviceps or A. f. ornatus, in both of these respects very similar to A. f. lamprocephalus although averaging more olivaceus (less grayish) on wings and upperparts and less brilliantly yellow on the head than in that form. Juveniles very different from the juveniles of lamprocephalus; darker than, but closely resembling, the grayish juveniles of flaviceps and ornatus, and not at all like the grayish “olive-yellow” young of the Lower California race. Measurements of type, which is also the
racial average for males: wing, 49; tail, 43; exposed culmen, 9.0; tarsus, 14.0; middle toe minus claw, 8.5 mm.

Range.—The Arid Tropical Zone in central and southern Sonora, north to San Estéban and Tiburón Islands coastwise and to San Javier and Tecoripa in the interior.

Remarks.—Specimens from Pesqueira, a short distance north of Hermosillo, are intermediates but closer to ornatus. Slight variations from the normal are seen in the San Estéban and Tiburón Islands skins which average very slightly paler than mainland examples, but which individually can be matched exactly.

The very close resemblance of fraterculus to lamprocephalus in the post-juvenal stages can, I think, be cited as an example of converging characters. Certainly the evidence of the juveniles places fraterculus in the ornatus-flaviceps series and of relatively distant relationship to lamprocephalus. Whether this convergence is coincidence or the result of the occupation of areas of very similar climatic conditions I do not presume to say. I do, however, point out that these races in typical form occupy the Arid Tropical Zone (in contra-distinction to the Sonoran habitats of ornatus and flaviceps), lamprocephalus being a differentiate of the Cape District and fraterculus of the Alamos District on the opposite side of the gulf.

**Auriparus flaviceps lamprocephalus** Oberholser

*Auriparus flaviceps lamprocephalus* Oberholser, Auk, 14, 1897, 391 (Cape San Lucas, Lower California).

Subspecific characters.—Resembling *A. f. fraterculus* in small size and brilliant coloration but upper parts more grayish (less olive) and head coloration even brighter. Juveniles with plumage suffused with olive-yellow, particularly on head and under tail coverts. In all other races the juveniles are ashy gray below and "mouse gray" (of varying shades) above, with only a trace of concealed yellow on crown. Average of 13 adult males: wing, 49.0; tail, 42.5.

Range.—Lower California, north to about latitude 30°.

Remarks.—The plumage of adults of lamprocephalus from the Cape region and to a lesser degree of fraterculus is usually strongly suffused with yellow beneath the gray tipping. In considering Lower California birds I mention the Cape region particularly because north of there occurs a very dark series of verdins which come from a range corresponding closely to Grinnell's "San Ignacio District." These, I believe should be distinguished from lamprocephalus proper and only the fact that juveniles from the San Ignacio District are not at present available for study prevents me from proposing still another race at this time.

Specimens examined.—Lower California, 31 (Cape San Lucas, north to Santa Teresa Bay at latitude 28° 22', many localities and off shore islands).

For the loan of specimens I wish to thank Mr. Griffing Bancroft, the Bureau of Biological Survey, Mr. Laurence M. Huey, and the San Diego Society of Natural History.
COMMENT ON THE MARSH SPARROWS OF SOUTHERN AND LOWER CALIFORNIA, WITH THE DESCRIPTION OF A NEW RACE

BY
LAURENCE M. HUEY
Curator of Birds and Mammals, San Diego Society of Natural History

The marsh sparrows of the genus Passerulus of the coast of southern California and Lower California have long offered problems to the systematist and their correct status has been a source of discussion. Oberholser, in his "Revision of the Subspecies of Passerulus rostratus (Cassin),"\(^1\) appeared to have them straightened out, but due to a good collection of breeding birds now available from the lagoons along the Pacific coast of the peninsula of Lower California the present writer is of the opinion that changes are again necessary.

With these marsh sparrows, as in other groups of passerine birds, notably peculiar habits are present; for instance, in the three forms of *rostratus* recognized by Oberholser, two (*Passerulus rostratus rostratus* and *Passerulus rostratus guttatus*) have decidedly erratic migratory movements and the third (*Passerulus rostratus halophilus*) is almost sedentary. It is with this sedentary form and its allies that this paper chiefly deals, and discussion of greater length regarding their taxonomic position will be found under "Remarks."

Study of the specimens from the central west coast of Lower California revealed the presence of an unnamed form of marsh sparrow which may be known as:

\(^1\) A revision of the subspecies of *Passerulus rostratus* (Cassin): Ohio Journal of Science, Vol. 19, No. 6, April, 1919, pp. 344-354.
San Diego Society of Natural History

Passerculus rostratus anulus,\(^2\) subsp. nov.

Scammon Lagoon Marsh Sparrow.

Type.—From south side of entrance to Scammon Lagoon, Lower California, Mexico, lat. 27° 54' north, long. 114° 18' west; no. 10523, collection of the San Diego Society of Natural History; adult male, breeding; collected by Laurence M. Huey, May 21, 1926.

Subspecific Characters.—In coloration, dorsally, the olive wash is lighter than on either Passerculus rostratus beldingi\(^3\) or Passerculus rostratus halophilus. Black markings, narrower and more penciled than on either of the above forms. Light emargination of feathers on back as in beldingi, while bill and general size more nearly like those of halophilus. The breast, sides, throat and yellow interorbital stripe are alike in all three races above mentioned. In other words, anulus is indeed a connecting link between beldingi and halophilus. The measurements which follow clearly show its relationship in this respect.

Measurements.—The average measurements of ten adult males of the three forms under discussion are shown in the following table. Only topotype specimens, in as near comparable plumage as possible, have been used.

<table>
<thead>
<tr>
<th>Subspecies</th>
<th>Wing</th>
<th>Tail</th>
<th>Tarsus</th>
<th>Claw</th>
<th>Culmen</th>
<th>Bill</th>
<th>Depth</th>
<th>Locality</th>
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<tr>
<td>P. r. beldingi</td>
<td>65.5</td>
<td>46.4</td>
<td>20.4</td>
<td>15.6</td>
<td>11.9</td>
<td>5.5</td>
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<td>San Diego, Calif.</td>
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<tr>
<td>P. r. anulus</td>
<td>66.5</td>
<td>45.3</td>
<td>21.2</td>
<td>15.9</td>
<td>12.5</td>
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<td>Scammon Lagoon,</td>
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<td>Mexico.</td>
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<tr>
<td>P. r. halophilus</td>
<td>67.6</td>
<td>49.1</td>
<td>21.8</td>
<td>16.6</td>
<td>13.4</td>
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<td>Mexico.</td>
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</tbody>
</table>

Range.—So far as known, Scammon Lagoon on the east shore of Viscaino Bay, Lower California, Mexico.

Remarks.—It will be clearly seen by the above description that the new race anulus directly connects the marsh sparrows of southern California (beldingi) with those of central Lower California (halophilus). Inasmuch as the characters of halophilus are nearer those of Passerculus rostratus rostratus (Cassin), the southern California bird beldingi will, by the connecting link of anulus, be drawn into subspecific position under rostratus.

The name rostratus was applied by Cassin in 1850 and has many years priority over other names used in this group. The rostratus forms would, therefore, now be as follows:

Passerculus rostratus rostratus (Cassin)
Passerculus rostratus guttatus Lawrence
Passerculus rostratus halophilus (McGregor)
Passerculus rostratus beldingi Ridgway
Passerculus rostratus anulus Huey

\(^2\) Anulus, Latin "a link in a chain."

\(^3\) See "Remarks."
A peculiar factor revealed in the study of the Pacific coast races of marsh sparrows, Passerculus rostratus, is that two distinct habit and color groups are present. The birds occupying the tidal marshes from southern California south along the coast of the peninsula to Magdalena Bay are of dark coloration and sedentary habits. These forms are beldingi, anulus and halophilus. The only departure from the sedentary habit is to be found in the few stragglers of the southernmost race of the dark group, halophilus, which leave the breeding ground and move southward toward Cape San Lucas in winter. This movement is very slight and only five winter-taken individuals are known to the writer south of the breeding range. The races guttatus and rostratus are much lighter in color than the preceding and have for several decades offered students the most complex migratory movements to be found in western bird migration. The discovery of the nesting grounds of rostratus along the lower delta of the Colorado River partly solved the problem, yet the question of the migration route of this form is as vague as ever. An apparently unsolved problem still exists with the race guttatus that is even more baffling, for the small area of the San Benito Islands, which is the only known breeding grounds of this race, hardly seems of sufficient size to accommodate the vast population found wintering along the coasts of southern California.

Regarding the dark coloration of the sedentary group, a possible explanation might be found in the fact that the cool Japan ocean current sweeps southward along almost the entire length of these dark birds’ ranges, being dispersed in the warmer waters south of Point San Eugenio. This warmer southern influence might account for the very limited southern movement of the individuals of the race halophilus.

Counteracting thought and theories in this respect is the fact that the San Benito Islands lie within the flow of this cool current, near its southern extreme to be sure, yet they harbor light colored birds.

It is further interesting to note that with the three dark sedentary races the “step” type of relationship exists, while the difference in some individual specimens of guttatus and rostratus is decidedly difficult to see. Analogous conditions as to the “step” type of relationship obtain with the clapper rails (Rallus), which occupy practically the same range and the same niche as the marsh sparrows in their limited environment. This has been nicely shown by van Rossem.4

There is yet one problem concerning the marsh sparrows of California that seems apparent to the writer though material to prove his point is lacking. The unsettled question lies in the fact that the difference between Passerculus sandwichensis bryanti of the San Francisco bay region and Passerculus rostratus beldingi of the San Diegan region is not as great as that which existed between beldingi and halophilus before the discovery of the race anulus. Nor does it seem as great as the existing differences between halophilus and guttatus. Careful collecting of breeding marsh sparrows between Santa Barbara and Monterey might result in all the Pacific coast marsh sparrows being grouped under the specific name sandwichensis.

Acknowledgments.—The writer is greatly indebted to the following institutions and individuals for the loan of material or for helpful criticism, and herewith wishes to express his appreciation of their efforts in his behalf: American Museum of Natural History, Carnegie Museum, Museum of Vertebrate Zoology, United States Bureau of Biological Survey, United States National Museum, the late Dr. Jonathan Dwight, Dr. J. Grinnell, Dr. H. C. Oberholser, Dr. Chas. W. Richmond, Dr. W. E. Clyde Todd, and Mr. A. J. van Rossem.

Specimens examined.—Passerculus sandwichensis bryanti: 6 from Alvarado, Alameda County, California. Passerculus rostratus beldingi: 3 from Newport, Orange County, California; 1 from Anaheim Landing, Orange County, California; 1 from Oceanside, San Diego County, California; 1 from Del Mar, San Diego County, California; 1 from Pacific Beach, San Diego, California; 19 from San Diego, California; 11 from National City, San Diego County, California; 2 from mouth of Tia Juana River, San Diego County, California; 1 from Ensenada, Lower California, Mexico; 10 from Todos Santos Islands, Lower California, Mexico; 1 from Cape Colnett, Lower California, Mexico; 2 from Colnett, Lower California, Mexico; 1 from San Quintín, Lower California, Mexico. 5 Passerculus rostratus anulus, 11 from south side of entrance to Scammon Lagoon, Lower California, Mexico, (including type); 10 from Scammon Lagoon, Lower California, Mexico; 11 from east end of Scammon Lagoon, Lower California, Mexico. Passerculus rostratus halophilus, 19 from Abreojos Point, Pond Lagoon, Lower California, Mexico, (including type); 30 from San Ignacio Lagoon, Lower California, Mexico; 2 from Mangrove Island, Lower California, Mexico; 2 from Magdalena, Lower California, Mexico; 1 from south end of Magdalena Bay, Lower California, Mexico; 4 from Todos Santos, Lower California, Mexico; 1 from San José del Cabo, Lower California, Mexico. Passerculus rostratus guttatus: 16 from Long Beach, Los Angeles County, California; 1 from Mission Beach, San Diego, California; 3 from San Diego, California; 3 from Santa Maria near San Quintín, Lower California, Mexico; 2 from Santa Rosalía Bay, Lower California, Mexico; 45 from San Benito Islands, Lower California, Mexico (including type of Passerculus sanctorum6); 1 from San Ignacio Lagoon, Lower California, Mexico. Passerculus rostratus rostratus: 2 from Newport, Orange County, California; 1 from Pacific Beach, San Diego, California; 2 from Mission Bay, San Diego, California; 5 from San Diego, California; 7 from National City, San Diego County, California; 2 from mouth of Tia Juana River, San Diego County, California; 1 from mouth of San Telmo River, Lower California, Mexico; 1 from Santa Rosalía Bay, Lower California, Mexico; 1 from Mecca, Riverside County, California; 2 from San Felipe, Lower California, Mexico; 1 from Punta Lobos, Sonora, Mexico. Total of 257 birds examined.

5 Specimens from San Quintín, Lower California, Mexico, and vicinity show size tendency toward anulus, thus being somewhat divergent from typical San Diego-collected beldingi, but, according to the writer’s interpretation of this new race, San Quintín birds are more nearly related to beldingi.

6 Passerculus sanctorum, later known as Passerculus rostratus sanctorum, was placed by Oberholser in the synonymy of P. r. guttatus.
NEW SONORA RACES OF TOXOSTOMA AND PHEUGOPEDIUS

BY

A. J. van Rossem

California Institute of Technology

The new races here proposed are from two different faunal areas in Sonora. The thrasher is from the relatively unproductive “Tiburón Island District,” which includes also San Estéban Island, and which to date is known to have produced but one other avian differentiate. The wren, on the other hand, is a product of the “Alamos District,” from which many forms have been described. This latter district although an extremely potent one is, as yet, far from perfectly known either in regard to its exact limits or the number of species which have developed local races therein. Descriptions and further discussion of the present cases follow.

Toxostoma curvirostre insularum subsp. nov.

Type.—Breeding male adult; no. 30,173, collection of Donald R. Dickey; San Estéban Island, Sonora, Mexico; April 17, 1930; collected by A. J. van Rossem; original number, 12,888.

Subspecific characters.—Nearest to Toxostoma curvirostre palmeri (Coues) of Arizona and northern Sonora, but coloration paler throughout and ash-gray instead of buffy gray in tone; underparts more sharply spotted than in palmeri; similar in this latter respect to Toxostoma curvirostre maculatum (Nelson) of southern Sonora, but body color of course very different from that race. Measurements of the type are: wing, 108; tail, 124; exposed culmen, 30.5; tarsus, 33.0; middle toe, minus claw, 25.0.

Range.—San Estéban and Tiburón Islands, Gulf of California, Sonora, Mexico.
Remarks.—The two specimens from Tiburón Island (Bancroft collection) are like the type, but are young of the previous year as shown by the buffy, juvenile greater wing coverts. Their wing and tail measurements are, therefore, somewhat shorter than those of the type. However, they show the same proportionate size as do the one-year-old birds of *maculatum* and *palmeri*, and I have no hesitancy in considering them to be *insularum*.

**Pheugopedius felix sonorae** subsp. nov.

_Type._—Male adult; no. 30,895, collection of Donald R. Dickey; Guirocoba, southern Sonora, Mexico; May 3, 1930; collected by J. T. Wright; original number, 5606.

_Subspecific characters._—Nearest to *Pheugopedius felix pallidus* (Nelson) of central western Mexico, but coloration decidedly paler and more ashy; back, between “hair brown” and “drab” instead of light “olive brown”; lateral underparts grayish “cinnamon-buff” instead of pale “clay-color;” chin and throat pure white, in abrupt contrast with the buffy pectoral area.

_Range._—Hill regions of extreme southern Sonora, Mexico (Guirocoba, 2; Chinobampo, 1).

Remarks.—The relative color tones distinguishing *pallidus* and *sonorae* are precisely analogous to those between *Pheugopedius sinaloa sinaloa* (Baird) and *Pheugopedius sinaloa cinereus* (Brewster) which occupy, respectively, essentially the same regions. There being no topotypes of *pallidus* available, I have used specimens from Nayarit as representative of that race.

Although the species *sinaloa* has usually been placed in *Thryophilus* Baird, that genus appears to rest on such unstable ground that I am unable to recognize it except as a sub-genus of *Pheugopedius*. For that matter, the old *Thryothorus* would accommodate both “*Thryophilus*” and *Pheugopedius*, without doing any great violence to the facts. As between “*Thryophilus*” and *Pheugopedius*, while there is a wide difference between the typical species with open nostrils in one case and heavily operculate nostrils in the other, the two types are completely bridged by intermediate species. In a long series of “*Thryophilus*” *modestus pullus* from El Salvador, for instance, there is such a wide variation in this respect that some specimens could be placed in one “genus” and some in the other.

1 Colors in quotation marks from Ridgway’s “Color Standards and Color Nomenclature,” 1912.
SOME GEOGRAPHIC VARIATIONS IN PIAYA CAYANA

BY

A. J. van Rossem
California Institute of Technology

Although about a dozen races of the red squirrel-cuckoo are currently recognized over its South American range, the entire Middle American population has usually been collectively considered to belong to but a single form. For ten years or more the writer has been aware of constant and very noticeable differences between Costa Rica and El Salvador series, but has deferred taking any action in the hope that some one with more ample material would undertake a general revision of the species over its more northerly range, such as has been done in the case of South America. It now becomes imperative to fix definitely the status of the squirrel-cuckoos occupying the two regions in which I am actively interested at the present time, namely El Salvador, Central America and Sonora, Mexico. This involves descriptions of two new races which I designate as follows:

Piaya cayana stirtoni subsp. nov.

*Type.*—Male adult; no. 16,340, collection of Donald R. Dickey; Mt. Cacaguatique, Dept. San Miguel, El Salvador, 4,000 feet altitude; November 27, 1925; collected by A. J. van Rossem, original number 9414.

*Subspecific characters.*—Tail with under surfaces of rectrices dull reddish black as in *Piaya cayana thermophila* Sclater of southeastern Mexico, but body coloration very much paler, particularly on the underparts and anterior portions of the upper parts. Body coloration very similar to *Piaya cayana mexicana* (Swainson) of central western Mexico, but posterior underparts darker and tail with under sides of rectrices dull rusty black with occasional traces of dull dark red instead of reddish cinnamon clouded basally with dusky.

*Range.*—Extreme northwestern Costa Rica (Punta Piedra, Guanacaste), north on the Pacific slope at least to the El Salvador-Guatemala boundary.

*Remarks.*—Comparison of the El Salvador series of 16 skins has been made primarily with a topotypical series of seven *thermophila* from the State of Vera Cruz, Mexico, kindly loaned to me by the Museum of Comparative Zoology. In addition there are in the Dickey collection ten specimens from nearly as many localities in Costa Rica and Panama. On the basis of this series it is apparent that *thermophila*, in a rather unrestricted sense, extends down the Atlantic coast of
Central America to the Canal Zone and north on the Pacific side at least to Aranjuez, Costa Rica. All of these birds are very similar in color to typical *thermophila*, but average slightly more rufous (less chocolate) brown and have thicker and more highly arched bills. I have little doubt that larger series will demonstrate the advisability of providing the Costa Rica-Panama birds with a distinctive name.

Two specimens from Punta Piedra, Costa Rica, are intermediates and not typical of any race, but are provisionally placed under *stirtoni*. In color one is *stirtoni*, the other nearest *thermophila*, though paler than the average for that form. It is with particular pleasure that I name the El Salvador race for Mr. R. A. Stirton, my companion on two trips to that country and to whose interest and energy the successful prosecution of work there was, in no small measure, due.

In the collection of Sonora birds recently received from Mr. Griffith Bancroft there is a single squirrel-cuckoo which, in view of its pronounced characters, I have finally decided to name

**Piaya cayana extima** subsp. nov.

*Type.*—Male adult; no. 30,817, collection of Donald R. Dickey; Guiro-coba, southern Sonora, Mexico; April 11, 1930; collected by J. T. Wright, original number 5500.

*Subspecific characters.*—Nearest to *Piaya cayana mexicana* (Swainson) of central western Mexico, but coloration even paler; pileum and hind-neck "cinnamon"
1 instead of "cinnamon-rufous"; remiges and upper tail coverts "tawny" instead of "ferruginous"; chin and throat "pale salmon color" instead of "salmon buff"; exposed portions of under surfaces of rectrices proximal to the black subterminal bands with only traces of dusky freckling on inner webs of central pairs; tail longer and bill decidedly smaller than in *mexicana*. Measurements of the type are: wing, 146; tail, 330 (with tips of central rectrices missing); exposed culmen, 24.7; depth at base of exposed culmen, 10.0.

*Range.*—Extreme southern Sonora, Mexico.

*Remarks.*—As between the darkest tailed specimens of *mexicana* and the reddest tailed *thermophila* and *stirtoni* the differences are those of degree and I believe relationships are best expressed by reducing *mexicana* to subspecific rank. So far as body coloration is concerned the palest *stirtoni* from El Salvador are actually paler than the darkest *mexicana* in a series of seven from Nayarit and Jalisco, so that there is certainly intergradation by overlapping characters even though *mexicana* and *thermophila* meet as species (*fide* Ridgway) in southwestern Mexico.

The taking of this species in Sonora constitutes a notable extension of range, central Sinaloa being its previously detected northwestern limit. The propriety of naming any subspecies on the basis of a single specimen may well be questioned. However, in this case the variation is in the "expected" direction and analogies are provided by many other tropical forms which have become differentiated within the Alamos District.

1 *Ridgway*. Color standards and color nomenclature, 1912.
A NEW VERDIN FROM CENTRAL LOWER CALIFORNIA, MEXICO

BY

LAURENCE M. HUEY
Curator of Birds and Mammals, San Diego Society of Natural History

A. J. van Rossem in his paper, "The Races of Auriparus flaviceps (Sundevall)," (Transactions of the San Diego Society of Natural History, Vol. 6, No. 9, pp. 199-202, 1930) called attention to, but through lack of material did not name, a dark race of verdins occupying the area known as the San Ignacio District of Lower California, Mexico. (Grinnell, A distributional summation of the ornithology of Lower California, University of California Publications in Zoology, Vol. 32, No. 1, pp. 1-300, 1928).

Since publication of van Rossem's paper, additional specimens have become available which demonstrate beyond doubt that the verdin of the middle peninsula is well worthy of recognition.

Auriparus flaviceps ignatius subsp. nov.

San Ignacio Verdin

Type.—From San Ignacio, Lower California, Mexico, lat. 27° 17'; adult male; no. 11,886, collection of the San Diego Society of Natural History; collected by Laurence M. Huey, March 8, 1928.

Subspecific characters.—Intermediate in size between flaviceps and lamprocephalus, but decidedly darker and more grayish (less olive or yellowish) than either. The dark back of ignatius stands out boldly when compared in series with the highly colored birds of Cape San Lucas or the very light Colorado desert form; in fact, in color ignatius is closer to ornatus of the Texas area than to any other race, though in size is much smaller. However, the most striking difference between ignatius and lamprocephalus lies with the juveniles. As shown by Ridgway
and later by van Rossem, the young of lamprocephalus are decidedly olive-yellow. The young of ignatius are clear-colored dark mouse gray (Ridgway, Color standards and nomenclature, 1912) of the same type of coloration as the young of flaviceps, although, like the adults, they are very much darker than that race.

**Average Measurements**

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<th>Tail</th>
<th>Specimens</th>
<th>Sex</th>
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**Range.**—The central part of the peninsula of Lower California, Mexico, from the vicinity of Punta Prieta (lat. 28° 56'') south to the vicinity of Magdalena Bay (lat. 24° 35'').

**Remarks.**—In accordance with the views of van Rossem, the present writer believes that the race lamprocephalus should be confined to the Cape District of Lower California. This is well demonstrated in the series of specimens available for the present study. Specimens from the extreme northern part of the area along the Pacific slope of Lower California inhabited by verdins are found to be nearer flaviceps, though not typical. Birds from the Magdalena Bay region are not typical of the race here described, but are nearer ot it than to lamprocephalus.

**Specimens examined.**—*Auriparus flaviceps flaviceps*: Imperial County, California: Potoholes, 5; 3 miles north of Bard, 28; Carrizo Creek, 2. San Diego County, California: La Puerta Valley, 1. Lower California, Mexico: San Felipe, 4; San Fernando, 1; mouth of canyon San Juan de Dios, 1; 8 miles east of El Rosario, 1. *Auriparus flaviceps ignatius*: Lower California, Mexico: Mesquital, 3; Calmali, 1; Santa Teresa Bay, 4; San Ignacio, 9; 12 miles east of San Ignacio, 1; Santa Rosalía, 1; Santa Ana Bay, 1; Magdalena Bay, 1. *Auriparus flaviceps lamprocephalus*: Lower California, Mexico: San José del Cabo, 10; Cape San Lucas, 2; San José Island, 1; San Francisco Island, 3; Espíritu Santo Island, 2. Total, 85 specimens.

For the loan of specimens the writer wishes to thank Messrs. Griffing Bancroft and Donald R. Dickey.

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1 Not typical.
FOUR NEW BIRDS FROM NORTHWESTERN MEXICO

BY
A. J. van Rossem

California Institute of Technology

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FOUR NEW BIRDS FROM NORTHWESTERN MEXICO

BY
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California Institute of Technology

Continuation of the studies of recently acquired Sonora birds has resulted in the definition of two new races and incidentally in two more from Lower California on the opposite side of the Gulf. In describing the new forms I have included criticism of allied western races either because of consequent adjustments in ranges or because of what appear to me to be necessary changes of nomenclature.

Passerculus rostratus

Since Dr. Oberholser's review of Passerculus rostratus appeared some years ago, the large-billed sparrow question has been almost universally accepted as settled. Even the latest reviewer has found no reason to differ with Dr. Oberholser in the latter's conclusions, which were based on adequate series of all the forms involved. The present writer's ideas regarding the situation differ somewhat from those entertained by Oberholser and Huey. They are, however, a matter of interpretation rather than of fact and their acceptance or rejection will depend largely upon one's opinions as to whether racial or individual characters are of first importance.

My initial doubts as to the tenability of Oberholser's arrangement came with the taking of a lengthy, midwinter series of large-billed sparrows on the tidal marshes of southern California in 1919, 1920, and 1921. In this series, at first glance there appeared to be two forms represented, but when determinations of individual birds were attempted difficulties at once arose. At one end of the series were a very few big-billed, light-colored, reddish birds, at the other a few slender-billed, darker-colored birds with almost total absence of any pinkish or reddish tint on the upper parts. While these extremes were obviously very different in all particulars, the very great majority were intergrades of a very puzzling type, for they did not present the gradual transition from one to the other that true inter-

1 Ohio Journal of Science, 19, April, 1919, pp. 344-354.
grades might be expected to show. Characters were present in every conceivable combination. There were large-billed birds of large size and grayish coloration, small birds with reddish coloration and large bills, reddish birds with small bills and so on. In other words, attempts to force by far the greater part of the specimens into one race or the other by any combination of characters was clearly impossible.

On April 23, 1925, I happened to be at the mouth of the Colorado River and, in the hour or more available while waiting for the tidal bore to pass, collected three breeding large-billed sparrows which present the following characters: one large, reddish, large-billed bird with the back obsolesly streaked, one large, grayish, large-billed bird with moderately streaked back and one small sized, small-billed, dark-colored (though distinctly reddish) bird with the back heavily streaked with blackish. Here in three breeding rostratus were represented almost the full range of variation found in the southern California winter birds which were supposed to be of two subspecies, rostratus and guttatus! For lack of further material the matter rested for the time being, although I took occasion when visiting the U. S. National Museum in 1927 to identify the type of guttatus with the dark, slender-billed extreme of the birds found in winter in southern California.

In 1929 thirteen more rostratus, collected in January and February, were received from the Colorado River Delta. These Delta specimens are predominantly of the reddish type but gray birds are also present. Part of the redness in this last named series is obviously due to alkali bleach, for in some of those birds which had started the limited, pre-nuptial moult the new feathers of the dorsum are grayish with heavy, black, median streaks, while in others, again, they are of the more usual, reddish, lightly streaked rostratus type.

What, to me, amounted to final evidence that guttatus was nothing more than the extreme of the normal variation to be found in rostratus was when in mid-February of the present year I collected a series of sixteen breeding birds on the San Benito Islands at a time of year when “guttatus” is wintering commonly everywhere from Cape San Lucas to southern California. Indeed, a week later (February 22 to 24) I took the usual nondescript series of birds at Port San Bartolomé on the mainland shore adjacent to the San Benitos. A few of these birds, individually, bear some resemblance to the San Benito Island specimens, but none of them showed any signs of breeding whatever and none were unequivocally of the San
Benito type in all particulars. At subsequent stops at more southern points and on several islands in the Gulf of California the same conditions were found and it was not until the middle of March that any of these birds commenced to show slight traces of sexual activity.

To summarize the characters shown by the San Benito birds, they are decidedly darker and more grayish than even a selected series of "guttatus" from other points, the bills are more slender and the streaking below is broader and blacker. Oberholser himself has commented on the distinctive characters (ibid., p. 350) shown by San Benito Island specimens. Another noticeable feature is the whitish edgings to the feathers of the back, not present in every individual but giving the series a somewhat frosted appearance. This same hoary cast is still more evident in a series of seven perfectly fresh plumaged birds taken on the San Benitos in mid-August, 1922, and loaned to me by the San Diego Society of Natural History.

All of the foregoing boils down to this—that rostratus is an exceedingly variable race and that "guttatus" is simply the gray, small-billed manifestation of rostratus. Extreme examples of rostratus, of which the type of guttatus is one, are not with certainty to be distinguished from the least typical San Benito birds. Duplication by selection within the sector of overlapping characters is possible in the case of any subspecies, of course, but has no bearing on the validity of the groups under consideration other than to demonstrate that the differences involved are racial and not specific. The variation within rostratus, while great, is no greater than that found in the allied Passerculus beldingi. Our own series of ninety-four specimens of beldingi shows a greater range of variation than does the series of one hundred and twenty-eight rostratus, even using the latter name to include "guttatus." Typical San Benito Island birds appear to be unknown from outside the islands at any season and there is, therefore, the strong probability that the race is permanently resident. Ridgway's name of Passerculus sanctorum is of course available.

To review some of the other races more briefly, Huey's (ibid., p. 204) new race anulus makes it impossible to regard beldingi other than as conspecific with halophilus. I have carefully examined all of Huey's material and consider anulus to be perfectly valid and with characters as given by the describer. In other words, one may differentiate it as a small, brightly colored halophilus, or as a large, dull colored beldingi. To go further northward, there appears to be no reason for attempting to maintain

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specific distinctness between *beldingi* of southern California and *Passerculus sandwichensis bryanti* of central California, other than that the respective colonies are isolated. However, the several races comprising the *rostratus* group are isolated one from the other also, some of them by distances greater than separate *beldingi* and *bryanti*, so that this factor has no bearing on the subject. Both *beldingi* and *bryanti* are extremely variable (just as is *rostratus*) and intergradation occurs by overlap of characters. To consider the *rostratus* group as geographic races of *Passerculus sandwichensis* seems to me to be very much more in accordance with the facts than to suggest, by the use of binomials, a complete separation where none, other than racial, actually exists.

A race remaining to be described, the most southerly form of all, was one of the totally unexpected results of a short cruise along the southern Sonora coast in the spring of the present year. It was found to be an abundant breeder in the salicornica-mangrove association at all suitable spots touched and how it has escaped detection up to the present time is somewhat of a mystery. The distinguishing characters are described below.

*Passerculus sandwichensis atratus*, subsp. nov.

*Type.*—Breeding male adult; no. 30,288, collection of Donald R. Dickey; Tobari Bay (variously spelled Tobari, Tovari, and Taburi), southern Sonora, Mexico; April 30, 1930; collected by A. J. van Rossem; original number 13,003.

*Subspecific characters.*—This race belongs to the *rostratus* group of savannah sparrows. In size it is equal to or even larger than *Passerculus sandwichensis rostratus* (Cassin) of the Colorado River Delta and has an even larger and more tumid bill. In coloration it is very much darker (some specimens are almost brownish black dorsally) both above and as regards the streaking below than any heretofore known race; furthermore, the ventral streaking is denser and wider and in all but a few individuals occupies decidedly more space on the breast and flanks than does the white ground color. The superciliary streak and pale markings on the head are narrower, sometimes almost obsolete, and are grayish or creamy white instead of, as in all the other races of this group, tinged or strongly suffused with yellow. Measurements of the type in millimeters are: wing, 71; tail, 55; exposed culmen, 14.1; depth of bill at base, 7.7; tarsus, 22.0; middle toe minus claw, 16.0.

*Range.*—Coast of central and southern Sonora, Mexico, from opposite the north end of Tiburón Island, south to Tobari Bay.

*Remarks.*—The several allocations of Guaymas specimens to *rostratus* evidently all pertain to winter birds belonging to that race. They can scarcely apply to *atrus* for the latter form is so very different from *rostratus* that confusion is impossible, even without direct comparison. Indeed *atrus* is so very much blacker than any heretofore described form that I have been tempted, in
spite of the obvious relationship shown by the size and markings, to propose it is a species. Were rostratus and atratus the only forms involved there would be no other course open, but the intermediately colored sanctorum, although far distant in a geographical sense, bridges the wide gap and therefore a trinomial must be employed. Twenty-three specimens of atratus have been examined, six of them from the Bancroft collection. The following stations on the Sonora coast are represented: mainland opposite north end of Tiburón Island; Kino Bay; Guasimas Lagoon; Tobari Bay. Birds from the two first mentioned localities are paler and browner and suggest an approach toward rostratus.

The several races comprising the rostratus group should, in my belief, be designated as follows:

*Passerculus sandwichensis anulus* Huey.
Scammon Lagoon, Lower California. Resident.

*Passerculus sandwichensis halophilus* McGregor.
Abreojos Point south to Magdalena Bay, Lower California, straggling south in winter to the Cape Region.

*Passerculus sandwichensis sanctorum* Ridgway.
San Benito Islands, west central Lower California. Resident.

*Passerculus sandwichensis rostratus* (Cassin).
Delta of the Colorado River in Lower California and Sonora. Widespread in winter and ranging from Santa Cruz, California, south along both coasts of Lower California to Cape San Lucas and on the coast of Sonora to Guaymas. Casual (?) inland as at Yuma, Arizona, and at Mecca and Salton Sea, southeastern California.

*Passerculus sandwichensis atratus* van Rossem.
Coast of central and southern Sonora, from opposite the north end of Tiburón Island and Kino Bay, south to Tobari Bay. Resident.

**Amphispiza bilineata**

The first recognition of geographic variation in *Amphispiza bilineata* (Cassin)\(^4\) was when Nelson\(^5\) distinguished a larger and darker race from the Mexican tableland. Within the scope of the present paper Ridgway\(^6\) soon after named a subspecies from Tucson, Arizona, but including in the

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6*Amphispiza bilineata deserticola* Ridgway, Auk, 15, July, 1898, p. 229 [separates issued May 13 or 14, 1898], (Tucson, Arizona).
range of his new form most of the southwestern United States, northwestern Mexico and (though only tentatively) Lower California. Nelson soon followed with a race from southern Sonora, which Ridgway in Part 1 of "Birds of North and Middle America" (1901, p. 265) synonymized with deserticola. Although Ridgway in this latter work recognized but the one western subspecies, he suspected the existence of a southern Lower California race which Grinnell, with additional material at his disposal, eventually named. Thus, to date, five variations of the Black-throated Sparrow have been named, four of which are currently recognized. To these I have two more to add, both of them insular forms from previously unexplored (ornithologically speaking) territory.

In the early spring of the present year the opportunity arose to accompany Mr. Griffing Bancroft on a three months' trip along the southern coasts of Lower California and parts of Sonora, and also to most of the islands in the southern part of the Gulf. Black-throated sparrows were found to be present at practically every point touched, indeed on the islands they were usually the commonest land birds present. A few were taken here and there in the routine of collecting, with the result that a very representative series was finally accumulated. On landing on Tortuga Island one of the first impressions gained was the abundance of this species, which was present in really extraordinary numbers. These birds were recognized even in the field as representing something very different from what had been taken previously on the Lower California mainland and the islands lying close to its shore. Consequently a good series was collected. Later in the trip, during a two day stop at San Esteban Island in Sonora territory, nine black-throated sparrows were collected. These proved also to belong to an unnamed race whose characters, although not so prominent as those shown by the Tortuga Island birds, are nevertheless sufficiently outstanding to be easily recognizable on direct comparison. As the description of the new races has involved examination of the species over the entire western section of its range, a synopsis of the differential characters is here given.

None of the western races of Amphispiza bilineata vary to any significant extent, one from the other, in the size of the white spots on the lateral rectrices. In this regard they are all set off sharply from typical

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8 Amphispiza bilineata bangsi Grinnell, Auk, 44, Jan., 1927, p. 71, (La Paz, Lower California, Mexico).
bilineata of southeastern Texas and northeastern Mexico, which has these feathers very extensively tipped with white—in extreme cases for nearly half of the exposed length on the inner webs. The western forms vary, individually, to an extraordinary degree, for the amount of white in specimens from the same locality may range from nearly a third of the exposed length to a narrow dark gray edging which gives the impression of a totally black-tailed bird.

**Amphispiza bilineata deserticola** Ridgway

In size the largest of all the western subspecies. Coloration paler and browner than bangsi and tortugae; paler than pacifica and decidedly more brownish than cana. Thus the distinguishing characters of deserticola are large size combined with a relatively pale brownish dorsal coloration and brown tinged flanks.

**Range.**—Southwestern United States in general, except the extreme Pacific Coast, south in Lower California (both coasts) to about latitude 27° and in Sonora to about 29°. The southern limits thus coincide closely with the southern limits, coastally, of the Lower Sonoran Zone.

**Amphispiza bilineata pacifica** Nelson

Size somewhat smaller than that of deserticola, particularly in length of tail; coloration dorsally a distinctly darker shade of brown compared with deserticola; darker and decidedly browner than cana; very similar to bangsi in relative darkness, but size larger and coloration less slaty.

**Range.**—The Arid Tropical Zone in southern Sonora, north at least to Kino Bay (latitude 29°) on the coast and probably a little further up the Yaqui River valley inland. This is not a strongly marked race but nevertheless appears to be a perfectly valid one and I see no reason for synonymizing it with deserticola. The comparative characters are those given by the original describer, except that the smaller tail spots claimed for it do not appear to have any diagnostic value.

**Amphispiza bilineata bangsi** Grinnell

Smallest of all the races of Amphispiza bilineata. Coloration slightly darker and more slaty on upper parts and flanks in comparison with deserticola, decidedly darker than cana, very much paler than tortugae and more slaty (less brownish) than pacifica. Coloration aside, this race is distinguishable by its small size alone.

**Range.**—Lower California and adjacent islands north to about latitude 27°. The belt of intergradation between bangsi and deserticola is a broad one and just where to place the dividing line is a matter of choice. The northern limits of bangsi, at least coastwise, are probably coincident with the northern limits of the Arid Tropical Zone. The evidence of a relatively few specimens supports this view.

It is to be remarked that the color characters originally ascribed to bangsi are the reverse of those given above as regards relative darkness in comparison with deserticola. Material before me shows plainly that this is one of the many
grayish colored species the plumage of which turns paler and redder with age, and to appreciate the proper color tones one must limit his comparison to more recently collected material. In the present case I have compared the twenty-two bangsi (collected with one exception during the present year) with about twice that number of deserticola collected subsequent to 1921.

**Amphispiza bilineata tortugae**, subsp. nov.

*Type.*—Breeding male adult; no. 30,105, collection of Donald R. Dickey; Tortuga Island, Gulf of California, Lower California, Mexico; April 2, 1930; collected by A. J. van Rossem; original number 12,820.

*Subspecific characters.*—Compared with *Amphispiza bilineata bilineata* of the lower Rio Grande Valley the dorsal coloration is slightly darker and more slaty, the tail spots are smaller and the underparts, instead of being extensively white with only a tinge of grayish brown on the sides and flanks, are “neutral gray” with the white reduced to a narrow median area extending from the black throat patch to the under tail coverts. Size similar to *bilineata* but with relatively shorter wing.

*Range.*—Tortuga Island, Gulf of California, Lower California, Mexico.

*Remarks.*—Comparison is made with the dorsally dark colored Rio Grande race as it more closely approaches tortugae than do any of the western subspecies. However, the dark, lateral underparts set tortugae off from any other race, with the possible exception of grisea of southeastern Mexico, the only subspecies of *bilineata* not seen by me.

A factor of major interest is that by virtue of an endemic race, Tortuga Island, small though it is, must be designated (which I here do as the Tortuga Island District) as a new avian differentiation area of Lower California. Ten have previously been dealt with by Grinnell, and for an analysis of their characters and their individual influences on the avifauna of the peninsula I refer the reader to that author's “Distributional Summation of the Ornithology of Lower California.”

Tortuga Island lies in the Gulf of California approximately 21 miles from the nearest point on the Lower California peninsula. Its position is about 27° 27' N. and 111° 50' W. It is only some two miles long by a mile wide at the widest point, is rocky and precipitous for the most part, although there is some rolling, relatively level ground in places, and is exclusively volcanic in origin. There are occasional patches of several smaller species of cactus, as well as some giant cactus (*Pachycereus*) and a sparse growth of grass and low, sage-like shrubs. So far as its general features and waterless condition are concerned, Tortuga differs not at all from most of the other gulf islands of similar size. There is scarcely a possibility that it was ever a part of Lower California, for the peninsula at that
point is made up of clearly stratified sedimentary rocks while Tortuga is, as above stated, purely volcanic. Land birds of but few species have gained a foothold, for the number of ecologic niches is, of course, small. A list of the land birds seen or collected there on April 1 and 2, 1930, is a short one. It is as follows:

1. *Circus hudsonius*.
2. *Falco peregrinus anatum*.
3. *Mimus polyglottos leucopterus*.
4. *Salpinctes obsoletus obsoletus*.
5. *Corvus corax sintiatus*.
6. *Auriparus flaviceps ignatius*.
7. *Carpodacus mexicanus subsp.?*
8. *Amphispiza bilineata tortugae*.

Of these eight only three, the verdin, linnet and black-throated sparrow present possibilities in the way of local variation, for the mockingbird and rock wren are notoriously “non-plastic” over the Pacific southwest. The duck hawk and raven are birds of long flight, while the marsh hawk is a migrant. Only a half dozen linnets were seen, all of them extremely wild and no specimens were collected. A single verdin nest containing small young was found in a cactus bush and so only one specimen was taken. This is, perhaps significantly, slightly darker than any specimen from the adjacent mainland, but from lack of material I tentatively call it *ignatius*. It certainly is not *lamprocephalus*.

In addition to the single known endemic bird, Tortuga Island is the home of a very distinct species of mammal, a mouse of the genus *Pero-

*Amphispiza bilineata cana* subsp. nov.

*Type*.—Breeding male adult; no. 30,180, collection of Donald R. Dickey; San Esteban Island, Gulf of California, Sonora, Mexico; April 17, 1930; collected by A. J. van Rossem; original number 12,895.

*Subspecific characters.*—Palest and grayest of the races; most closely resembles *Amphispiza bilineata deserticola* but size smaller, particularly in tail length; coloration paler and more ash-gray (less brownish) on upper parts and flanks. Compared with the geographically adjacent *pacific* of the Sonora coast, the size is similar but the coloration is very much more ashy (less brownish) as well as paler.
Range.—San Estéban Island, Gulf of California, Sonora, Mexico.

Remarks.—The contrast between cana, the pale extreme, and tortugae, at the dark end of the series, provides interesting comparison. Here are the extremes of coloration within the species occupying islands a trifle under one hundred miles apart, both lying within the Arid Tropical Zone and on both of which essentially similar conditions, both as to topography and flora obtain. San Estéban is somewhat larger than Tortuga and has one intersecting valley in which growth is more abundant than anywhere on the latter island. However, the cover is of a practically identical type—several species of cactus and low scrubby brush. Neither island harbors, so far as is known, any predatory mammals nor for that matter any predatory birds other than duck hawks or an occasional migrating marsh hawk. The former have too plentiful a supply of small sea birds to be interested in such fry as sparrows and the latter is of too casual an occurrence to be a factor of any importance. The point is that here are two strictly resident colonies of sparrows living under essentially the same conditions and with no control other than that imposed by the period of minimum food supply, which operates on both alike. Thus it would seem apparent that isolation, with resultant divergence, appears to have been the major factor in the development of these island races rather than climate or "natural selection”.

Average Measurements of Adult Males in Millimeters.

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Specimens examined.—Amphispiza bilineata bilineata: 14 from Texas and Coahuila. Amphispiza bilineata deserticola: 84 from Nevada; Arizona; New Mexico; California; Lower California (Natividad Island; port San Bartolomé; San Francisquito Bay; Santa Teresa Bay) and Sonora (Saric; 12 miles west of Magdalena). Amphispiza bilineata bangsi: 22 from Lower California (San Ignacio Lagoon; Jesús María Cañon, east of San Ignacio Lagoon; San Lucas, on the Gulf; Carmen Island; San Francisco Island; Espíritu Santo Island; Magdalena Bay. Amphispiza bilineata pacifica: 7 from Sonora (Kino Bay; Guaymas). Amphispiza bilineata cana: 9 from Sonora, (San Estéban Island). Amphispiza bilineata tortugae: 22 from Lower California (Tortuga Island).

Heleodytes brunneicapillus

In 1925 the writer collected a single cactus wren at San Francisquito Bay on the Gulf coast of Lower California which, for want of a better name, was labelled Heleodytes brunneicapillus bryanti. There were at that time no actual bryanti available and the identification was based on a com-
parison with a series of *Heleodytes brunneicapillus affinis* from the Cape District. During the past year there has been opportunity to collect further specimens not only from the San Ignacio District but also from the Cape. The combined series of all of the Lower California cactus wrens in the Dickey collection, the San Diego Society of Natural History, the Bancroft collection and 15 from the Museum of Vertebrate Zoology shows that still another form is to be recognized from Lower California. Incidentally the definition of this new race increases by one the number of birds which are confined to that rather restricted region known as the Cape District and which do not range north over the San Ignacio District, as formerly supposed. I here use the terms for the various faunal areas in the same sense that they are employed by Grinnell in his recent "Distribu-
tional Summation of the Ornithology of Lower California."

**Heleodytes brunneicapillus purus** subsp. nov.

*Type.*—Male adult; no. 30,079, collection of Donald R. Dickey; Santa Agueda Reservoir, 11 miles west of Santa Rosalía, 27° 20' N. on the Gulf coast of Lower California, Mexico; March 31, 1930; collected by A. J. van Rossem; original number 12,794.

*Subspecific characters.*—Differs from all of the known races of *Heleodytes brunneicapillus* in possessing, when in relatively unworn plumage, pure black and white underparts with only very rarely the slightest traces of brown or buffy on the flanks. Differs from *Heleodytes brunneicapillus affinis* Xantus of the Cape region in lacking the strong buffy suffusion on the underparts and in having decidedly grayer (less reddish) upperparts. Differs from *Heleodytes brunne-
capillus bryanti* Anthony of the San Pedro Mártir District in less buffy under-
parts, broader dorsal streaking and from both *affinis* and *bryanti* in slightly smaller general size and in decidedly smaller bill.

*Range.*—Middle portion of the peninsula of Lower California, Mexico, from Dolores Bay (25° 05' N.) north to Mesquital (28° 30' N.) and Punta Prieta (28° 56' N.). Specimens from the two latter localities are variously mediate toward *bryanti*.

*Remarks.*—A moderate amount of wear does not, to any appreciable extent, appear to affect the color, tone or markings of this species, except that the spot-
ting and dorsal streaking tend to be sharpened and more clearly defined. A series of 21 *affinis* from the immediate vicinity of the Cape, all collected prior to April 18, does not differ in the slightest as regards color tones from three absolu-
tely fresh plumaged specimens taken in October and November. In three out of four other specimens of *affinis* taken in late June the buff has largely dis-
appeared, but for that matter so have the terminal portions of the individual

feathers! In *bryanti* the buff of the posterior underparts is less pronounced than in *affinis* and has largely disappeared by April 1. Worn *bryanti*, therefore, often have nearly colorless black and white underparts, but are distinguishable from
purus by the longer bill and much less conspicuously (more sparsely and narrowly) streaked back.

Average measurements (in millimeters) of males of the three forms involved are as follows. That of the bill appears to be of chief diagnostic value. Our method of measuring the “exposed culmen” is to measure from the tip of the bill to the point where the culmen is covered by the skin of the forehead. This is a much more uniform and accurate method than is possible by measuring to the point where the feathers obscure the culmen. In the latter case, birds in worn plumage give greater measurements than do fresh plumaged specimens. Furthermore by measuring to the edge of the skin the “make” does not have to be considered.

<table>
<thead>
<tr>
<th></th>
<th>Wing</th>
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<th>Exposed culmen</th>
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<tr>
<td>22 affinis</td>
<td>85.3</td>
<td>77.9</td>
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</tr>
<tr>
<td>12 bryanti</td>
<td>85.7</td>
<td>77.6</td>
<td>25.4</td>
</tr>
<tr>
<td>19 purus</td>
<td>83.6</td>
<td>74.6</td>
<td>23.3</td>
</tr>
</tbody>
</table>

Specimens examined.—Heleodytes brunneicapillus affinis, 32 from the following localities in the Cape District: Cape San Lucas, San José del Cabo, Agua Caliente, Todos Santos and La Paz. Heleodytes brunneicapillus purus, 39 from the following localities in the San Ignacio District: Dolores Bay, Concepción Bay, Santa Ana Bay, Santa Rosalía, Santa Agueda Reservoir (11 miles west of Santa Rosalía), San Ignacio, San Bruno, San Lucas (25 miles S. of Santa Rosalía), San Francisco Bay, Campo Los Angeles, Mesquital, Punta Prieta. Heleodytes brunneicapillus bryanti, 17 from the following localities in the San Pedro Mártil District: Cañon San Juan de Dios, Santa Catarina Landing and vicinity, San Telmo, Aguaita, El Rosario and vicinity, San Quintin and vicinity.
A NEW LEAST BITTERN FROM SONORA

BY

A. J. van Rossem

California Institute of Technology

The discovery, during a recent collecting trip along the coast of southern Sonora, of a strongly characterized local race of the Least Bittern was one of the totally unexpected finds which provide added incentive for the carrying on of necessary but often monotonous field work. At Tobari Bay a pair of least bitterns, the female of which contained an egg ready to be laid, was taken in the mangrove scrub surrounding a tidal pool in the center of one of the numerous sand islands. These birds were so very different in appearance from anything I had ever seen that an effort was made to secure more specimens. One other pair was located, only the female of which was taken but she, like the first, was also a laying bird. These, except for a perfectly typical Western Least Bittern which was obviously a migrant, were the only representatives of the species found at Tobari Bay. In addition to the Tobari Bay specimens six more were subsequently taken by Mr. Griffing Bancroft, the well known egg collector, and his assistant, Mr. J. E. Greene, at various points along the coast. I am indebted to Mr. Bancroft for allowing me to use these six specimens in connection with the description of this race, which may be described as

Ixobrychus exilis pullus subsp. nov.

Type.—Laying adult female; no. 30,322, collection of Donald R. Dickey; Tobari Bay, Sonora, Mexico; May 1, 1930; collected by A. J. van Rossem; original number 13,037.

Subspecific characters.—Size small, decidedly smaller than Ixobrychus exilis hesperis Dickey and van Rossem of the western United States and very similar in this respect to Ixobrychus exilis exilis (Gmelin) of the West Indies and the
Eastern United States. Coloration very different from any other race; upper parts in both sexes uniformly and decidedly darker than either exilis or hesperis, the rufous of the hind neck being almost chocolate brown and the wing coverts dark, brownish gray almost concolor with the rest of the wing, instead of being conspicuously contrasted as in the other two northern races; underparts with the ground color white, grayish white or white tinged with grayish clay color; females broadly and boldly streaked ventrally from bill to tail with dark brownish gray, these markings broken up into mottling posterior to the breast, but everywhere occupying more space than the ground color; males much less conspicuously marked ventrally than the females, but variously clouded and streaked with gray or brownish gray on neck, chest, and flanks.

Range.—Coastal mangrove swamps of the Arid Tropical Zone of southern Sonora, Mexico, from Kino Bay, south at least to Tobari Bay.

Remarks.—The eight specimens from Miramar (near Guaymas), Guasimas Lagoon, Lobos Island and Tobari Bay are radically different from any least bitterns I have ever seen. The Kino Bay birds are males, both taken on May 16 and therefore presumably breeding. One of them is typical hesperis in color and size while the other is a typical pullus in all respects save that the wing coverts and pectoral region have a definite buffy or yellowish tone showing an approach in these particulars to hesperis. Further material may well show that the two are in fact distinct species, and that both breed at Kino Bay and possibly other points.

The fact that hesperis and pullus have decided size differences and that color is not the only character by which they may be distinguished militates against any supposition that pullus is simply a color phase such as the melano-erythristic “neoxenus” of the eastern United States appears to be.

**Measurements of Males in Millimeters**

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<thead>
<tr>
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<tr>
<td>17 exilis</td>
<td>106-119</td>
<td>38.0-47.5</td>
<td>41.0-46.3</td>
<td>37.0-42.7</td>
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<tr>
<td></td>
<td>(114)</td>
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<td>(44.5)</td>
<td>(39.8)</td>
<td>(37.0)</td>
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<tr>
<td>14 hesperis</td>
<td>120-131</td>
<td>42.5-47.0</td>
<td>44.7-52.2</td>
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<tr>
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<td>(45.6)</td>
<td>(48.2)</td>
<td>(41.8)</td>
<td>(39.7)</td>
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<tr>
<td>6 pullus</td>
<td>111-114</td>
<td>37.0-42.0</td>
<td>45.1-47.6</td>
<td>39.0-41.0</td>
<td>37.0-38.7</td>
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<tr>
<td></td>
<td>(112)</td>
<td>(39.5)</td>
<td>(46.1)</td>
<td>(40.0)</td>
<td>(37.7)</td>
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**Females**

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<td>107-117</td>
<td>37.5-42.5</td>
<td>43.0-47.3</td>
<td>37.5-42.0</td>
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<td></td>
<td>(112)</td>
<td>(40.2)</td>
<td>(44.8)</td>
<td>(39.0)</td>
<td>(36.5)</td>
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<tr>
<td>13 hesperis</td>
<td>114-129</td>
<td>41.5-45.5</td>
<td>44.3-50.2</td>
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<td></td>
<td>(125)</td>
<td>(43.8)</td>
<td>(46.9)</td>
<td>(41.2)</td>
<td>(39.1)</td>
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<tr>
<td>3 pullus</td>
<td>108-109</td>
<td>37.0-39.0</td>
<td>43.0-47.2</td>
<td>38.2-40.5</td>
<td>35.5-36.4</td>
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<tr>
<td></td>
<td>(108.5)</td>
<td>(38.0)</td>
<td>(44.9)</td>
<td>(39.0)</td>
<td>(36.0)</td>
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</table>
A NEW RACE OF BELL SPARROW FROM
LOWER CALIFORNIA, MEXICO

BY

LAURENCE M. HUEY
Curator of Birds and Mammals, San Diego Society of Natural History

The study of an accumulation of specimens of Amphispiza belli from
different points along the Pacific coast of central and northern Lower
California, Mexico, reveals the presence of an undescribed race. It may
be known as:

Amphispiza belli xerophilus subsp. nov.

COASTAL BELL SPARROW

Type.—From Santa Catarina Landing, Lower California, Mexico, lat.
29° 30' north, long. 115° 16' west; no. 13,563, collection of the San Diego
Society of Natural History; adult female; collected by Laurence M. Huey,
October 31, 1930.

Subspecific characters.—In color, as well as in geographic position, this form
is intermediate between Amphispiza belli belli and Amphispiza belli cinerea. The
head and nape are “neutral gray,”1 while the tone of the back is “slate gray.”
Dorsally this bird differs from either of the above races in having its head and
back more nearly uniform in color. The back of xerophilus lacks the warmer
brownish color of belli, and yet is of a cold dark color when compared with
cinerea. The throat stripes are dark, as are those of belli, but much narrower, not
unlike cinerea in this respect.

The brownish cast of the flanks in xerophilus is considerably lighter than in
belli, and the black flank stripes are heavier and broader. They thus stand out in

1 Colors in quotation marks from Ridgway’s “Color Standards and Color Nomenclature,”
1912.
marked contrast with the lightly washed, almost stripeless, flanks of *cinerea*. These characters alone would be sufficient to set the three forms apart subspecifically.

The yellowish shoulders, so conspicuously bright in *cinerea*, are more brownish in *xerophilus* and almost lacking in *belli*. This marking must not be confused with the yellow edge of the wing, which is present in all the races of *belli*.

The mensural comparison of the three races shows no marked variation, though there is a tendency toward longer wings in *cinerea*. By odd coincidence, the females show greater variation in measurements than do the males, though the colors are alike in both sexes.

Range.—Known only from the type locality, Santa Catarina Landing, Lower California, Mexico.

Remarks.—It is interesting, when plotting the ranges in Lower California of the three resident forms of *Amphispiza bellii*, to note the proximity to the sea of the two southern races. It is evident that they are not cactus tolerant and are not to be found beyond the range of certain types of coastal Lower Sonoran brush. For the southern races these seem to be chiefly plants of the genus *Lycium*, commonly called Frutilla; but over the more inland range of *A. bellii bellii*, at least as far as the southern extreme of the chaparral on the western foot-hills of the Sierra San Pedro Martir, *Adenostoma fasciculatum*, or Chamiso, seems to be the choice association.

Specimens examined.—*Amphispiza bellii bellii*: 1 from San Bernardino, San Bernardino County, California; 1 from Colton, San Bernardino County, California; 1 from Riverside, Riverside County, California; 7 from San Clemente Island, San Diego County, California; 3 from Ocean Beach, San Diego, California; 5 from San Diego, California; 3 from near San Diego, San Diego County, California; 1 from La Mesa, San Diego County, California; 2 from Hillsdale near El Cajon, San Diego County, California; 1 from mouth of Tia Juana River, San Diego County, California; 1 from north side of Descanso Bay, Lower California, Mexico; 1 from Ensenada, Lower California, Mexico; 2 from Ojos Negros, Lower California, Mexico; 1 from Sangre de Cristo, Lower California, Mexico; 15 from 10 miles southeast of Alamo, Lower California, Mexico; 2 from Santo Domingo (lat. 30° 45'), Lower California, Mexico; 6 from San Martín Island, Lower California, Mexico; 2 from San Quintín, Lower California, Mexico; 2 from Santa María near San Quintín, Lower California, Mexico. *Amphispiza bellii xerophilus*: 10 from Santa Catarina Landing, Lower California, Mexico. *Amphispiza bellii cinerea*: 7 from Santa Rosalía Bay, Lower California, Mexico; 16 from La Lomita María, Lower California, Mexico; 1 from Scammon Lagoon, Lower California, Mexico. Total of 91 birds examined.
TWO NEW POCKET MICE OF THE SPINATUS GROUP AND ONE OF THE LONGIMEMBRIS GROUP

BY

LAURENCE M. HUEY

Curator of Birds and Mammals, San Diego Society of Natural History

For several years the writer has known of a variation existing between specimens of *Perognathus spinatus* taken on the desert mountains in the vicinity of the Colorado River at Bard, Imperial County, California, and those taken on the desert slopes of the coast range to the westward. The study of an assemblage of specimens from the above mentioned regions and from a number of localities in Lower California, Mexico, now reveals the presence of two unnamed races, which are described herewith. The description is also given of a new *Perognathus longimembris* from Lower California.

*Perognathus spinatus rufescens*, subsp. nov.

**Western Spiny Pocket Mouse**

*Type.*—From the mouth of Palm Canyon, Borrego Valley, San Diego County, California; no. 7446, collection of the San Diego Society of Natural History; adult male; collected by Laurence M. Huey, November 10, 1929.

*Characters.*—As compared with *P. s. spinatus*, *rufescens* is smaller both in body and cranial measurements. In color it is decidedly lighter and inclines toward rufous rather than gray. In this respect its affiliation tends toward *P. s. peninsulae* of southern Lower California. Cranially, *rufescens* has the smallest skull of any of the forms mentioned in this paper. The brain cases of *spinatus* and *rufescens* are rounder than those of the peninsular races, and *rufescens* has the highest curve of all and therefore the roundest brain case. This character is plain when the skulls are viewed anteriorly. This convexity is also shown prominently in the interparietals of both *spinatus* and *rufescens*, though the interparietal of *rufescens* is much shorter and wider than that of *spinatus*. 
Measurements.—Type: Total length, 180; tail, 103; hind foot, 20; ear, 5.

Skull (type): Greatest length, 23.7; width across bullae, 11.8; interorbital constriction, 6.3; nasals, 9.1; tooth row,— (last molars lost).

Range.—Desert slopes of the coast range mountains from the vicinity of Palm Springs, Riverside County, California, south to the Mexican boundary. No doubt this form extends southward in Lower California to the region of the Sierra San Pedro Martir, but specimens to verify this statement are not available.

Perognathus spinatus prietae, subsp. nov.

Mid-Peninsula Spiny Pocket Mouse

Type.—From 25 miles north of Punta Prieta, Lower California, Mexico, lat. 29° 24' north, long. 114° 24' west; no. 8450, collection of the San Diego Society of Natural History; adult male; collected by Laurence M. Huey, October 26, 1930.

Characters.—As compared with spinatus, larger both in body and cranial measurements. In color it is much darker, with a gray cast as in spinatus, grizzled somewhat like peninsulae to the southward. Cranially, prietae is more nearly like peninsulae in several characters, though it has a rounder brain case, approaching that of spinatus. However, the interparietals are flat, as in peninsulae. Compared with peninsulae in color, prietae is grizzled rather than brown and not so heavily grizzled.

Measurements.—Type: Total length, 194; tail, 112; hind foot, 21; ear, 5.

Skull (type): Greatest length, 25.2; width across bullae, 12.3; interorbital constriction, 5.9; nasals, 9.5; tooth row, 3.3.

Range.—Probably throughout suitable localities in central northern Lower California. Specimens are available from lat. 30° south to the type locality, lat. 29° 24'.

Remarks.—The accompanying table gives the average measurements of male specimens used in the preparation of this paper, and it will be seen that there is a size increase from north to south.

<table>
<thead>
<tr>
<th>Species</th>
<th>Total Length</th>
<th>Hind Foot</th>
<th>Ear</th>
<th>Width Bullae</th>
<th>Interorbital Length</th>
<th>Condylo-Basal Length</th>
<th>Nasals</th>
<th>Tooth Row</th>
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<tbody>
<tr>
<td>P. s. rufescens¹</td>
<td>173.2</td>
<td>99.0</td>
<td>21.3</td>
<td>5.6</td>
<td>24.0</td>
<td>11.9</td>
<td>6.3</td>
<td>9.0</td>
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<tr>
<td>P. s. spinatus²</td>
<td>184.8</td>
<td>106.4</td>
<td>22.2</td>
<td>5.0</td>
<td>24.4</td>
<td>12.2</td>
<td>6.2</td>
<td>9.2</td>
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<tr>
<td>P. s. prietae³</td>
<td>188.0</td>
<td>109.0</td>
<td>21.0</td>
<td>5.0</td>
<td>25.0</td>
<td>12.2</td>
<td>6.2</td>
<td>9.2</td>
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<tr>
<td>P. s. peninsulae⁴</td>
<td>195.2</td>
<td>111.7</td>
<td>21.3</td>
<td>5.1</td>
<td>25.5</td>
<td>12.3</td>
<td>6.5</td>
<td>9.9</td>
</tr>
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</table>

It will also be noted, if Osgood's⁵ table of measurements is compared with the above, that the peninsulae from San José del Cabo shows a larger skull average

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¹ 8 specimens from San Felipe Canyon, La Puerta and vicinity, San Diego County, California.

² 5 specimens from 3 miles north of Bard, Imperial County, California.

³ 6 specimens from Catavina and Punta Prieta, Lower California, Mexico.

⁴ 12 specimens from San Ignacio, Lower California, Mexico.

⁵ North American Fauna, No. 18, 1900, p. 63.
than do the specimens from San Ignacio. His measurements of the skins are hardly comparable, owing to possible difference in methods.

Specimens examined.—*Perognathus spinatus rufescens*: Riverside County, California, 1 (Palm Springs); San Diego County, California, 12 (2 from mouth of Palm Canyon, Borego Valley; 3 from San Felipe Canyon; 6 from La Puerta Valley; 1 from Vallecito). *Perognathus spinatus spinatus*: Imperial County, California, 8 (3 miles north of Bard). *Perognathus spinatus prietae*: Lower California, Mexico, 14 (1 from San Agustín; 1 from Cataviña; 12 from 25 miles north of Punta Prieta). *Perognathus spinatus peninsulae*: Lower California, Mexico, 16 (15 from San Ignacio; 1 from Llano de San Bruno). Total, 51 specimens examined.

**Perognathus longimembris venustus**, subsp. nov.

**San Agustin Silky Pocket Mouse**

*Type.*—From San Agustín, Lower California, Mexico, lat. 30° north, long. 115° west; no. 8196, collection of the San Diego Society of Natural History; adult female; collected by Laurence M. Huey, October 4, 1930.

*Characters.*—As compared with *Perognathus longimembris aestival*, much darker in color and has a decidedly bi-colored tail, the black tail-stripe running the full caudal length, terminating with a black tip. The pinna is also covered with black hairs. Cranially, *venustus* has a longer tooth row, and the frontals are slightly higher and rounder. This latter character does not seem to bear relation to age. The mastoid bullae are more rounded and do not extend as far posteriorly, while the auditory bullae are more attenuated and not as heavily inflated, basally.

The only character in which *venustus* approaches *Perognathus longimembris panamintinus* is in dorsal color. In this, *venustus* has a more grayish tinge to the buff than is the case with either *panamintinus* or *aestival*.

*Measurements.*—*Type*: Total length, 130; tail, 78; hind foot, 19; ear, 5. *Skull* (type): Greatest length, 21.8; width across bullae, 12.3; interorbital constriction, 5.0; nasals, 7.9; tooth row, 3.3.

*Range.*—Known only from the type locality, San Agustín, Lower California, Mexico, which is the southernmost point at which any form of *P. longimembris* has been taken.

*Remarks.*—It was with surprise that the writer saw the first specimen of this small Silky Pocket Mouse brought from the trap. Already the immediate region of San Agustín had produced representatives of the following groups of *Perognathus*: *baileyi*, *spinatus*, *fallax*, *arenarius* and *formosus*. With the new form added, a total of six species of *Perognathus* was shown to occur within a radius of one-half mile. This constitutes a number unprecedented in the writer’s experience for one locality.

Specimens examined.—*Perognathus longimembris panamintinus*: Riverside County, California, 50 (Cabazon). *Perognathus longimembris aestival*: Lower California, Mexico, 15 (Sangre de Cristo). *Perognathus longimembris venustus*: Lower California, Mexico, 3 (San Agustín).
A NEW CLAPPER RAIL FROM SONORA

BY

DONALD R. DICKEY

California Institute of Technology

Among the specimens collected by Mr. A. J. van Rossem on his recent trip to Sonora were 16 clapper rails which obviously belong to an undescribed race of the Rallus obsoletus series. In addition there are three specimens available from the Bancroft collection. These birds were found to be not uncommon in the mangrove-salicornia association from Guaymas south to the Sinaloa line and one cannot but be surprised that no examples have heretofore been taken by the several collectors who, in earlier days, visited Guaymas and other parts of the Sonora coast. The series collected represents breeding birds and there is no reason to suppose them to be other than permanently resident on the coast of central and southern Sonora. A description of the new race follows.

**Rallus obsoletus rhizophorae** subsp. nov.

_Type._—Male adult; no. 30,258, collection of Donald R. Dickey; Tobari Bay, southern Sonora, Mexico; April 28, 1930; collected by A. J. van Rossem; original number 12,973.

_Subspecific characters._—Ventrally (except for the flanks) indistinguishable from *Rallus obsoletus yumanensis* Dickey of the lower Colorado River Valley. Otherwise *rhizophorae* differs from *yumanensis* in the decidedly darker and very much grayer upper parts and grayer flanks. This grayness distinguishes *rhizophorae* from all of the other western races with the possible exception of *Rallus obsoletus nayaritensis* McLellan, of which only the type is known.

_**Range.**_—The mangrove-salicornia association from the Sonora-Sinaloa boundary, north along the coast at least to Guaymas and probable to the northern limit of mangroves a short distance north of that point.
Remarks.—Through the courtesy of Mrs. M. E. McLellan Davidson of the California Academy of Sciences, the type of *Rallus nayaritensis* McLellan (Proc. Calif. Acad. Sci., 4th Ser., 16, 1927, 9) is available for comparison. Although very close to *rhizophorae* in relative darkness of coloration the upper parts of the type are more olivaceous, a circumstance possibly due to its being in fresher plumage. The chief differences between the two races are the very differently colored underparts, for *nayaritensis* has the avellaneous reduced in area until it has the appearance of a broad, ill defined pectoral band, with the foreneck, lower breast and abdominal region very much paler. It is obvious, however, that *nayaritensis* is a race of the *Rallus obsoletus* series (for a discussion of which see van Rossem, Condor, 31, 1929, pp. 213-215) and should stand as *Rallus obsoletus nayaritensis*.

The old Grayson record of "*Rallus elegans*" from Mazatlan (see Lawrence, Mem. Bost. Soc. Nat. Hist., 2, 1874, 311) is much more likely to pertain to *nayaritensis* than to *rhizophorae*. It is extremely improbable that its citation under "*Rallus tenuirostris*" by the authors of the 'Biologia' and others is correct. Four specimens of *tenuirostris* from the Valley of Mexico loaned to me by the Museum of Comparative Zoology show *tenuirostris* to be a rich brown form, having nothing to do with any Pacific Coast race.

Clapper rails are so variable in size that measurements of individual specimens are of very doubtful value in making determinations. In size *rhizophorae* appears to average a little shorter in most measurements than the more northern Pacific forms, showing in most respects an approach to *nayaritensis*. 
TRANSACTIONS

OF THE

SAN DIEGO SOCIETY OF NATURAL HISTORY

Volume VI, No. 19, pp. 237-304, map

REPORT ON A COLLECTION OF LAND BIRDS FROM SONORA, MEXICO

BY

A. J. van Rossem

California Institute of Technology

SAN DIEGO, CALIFORNIA

Printed for the Society
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Vol. IV, No. 1, 1924. Pp. 1-158, plates 1, 2..................$1.60
Palaeozoic Crustacea.
Part I—Bibliography of Palaeozoic Crustacea
Part II—List of the Genera and Subgenera of the Trilobita
Part III—Historical Summary of the Ordovician Genus
Cybele Loven..........................................................by Anthony Wayne Vogdes

A Discussion of the Zonal Status of the Sierra San Pedro Martin, Lower California, Mexico, with Descriptions of a New Kangaroo Rat and a New Woodpecker from that Region.........................................................by Laurence M. Huey

Birds Recorded in Spring at San Felipe, Northeastern Lower California, Mexico, with the Description of a New Woodpecker from that Locality..............................by Laurence M. Huey
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REPORT ON A COLLECTION OF LAND BIRDS
FROM SONORA, MEXICO

BY
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California Institute of Technology

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During the past two years a very fair representation of the avifauna of certain parts of Sonora has found its way into the Dickey collection at the California Institute of Technology. These birds have been secured principally through the field work of Mr. J. T. Wright who, in spite of unsettled conditions, has worked almost continuously in Sonora for the past two years and to whom is due great credit for obtaining such an amount of fine material under the most trying conditions. The birds and mammals taken by Mr. Wright were all collected originally for Mr. Griffing Bancroft of San Diego, but they have, with a few exceptions, since been incorporated into the Dickey collection. In addition there are some 300 specimens taken by the writer between April 17 and May 15, 1930, all from coastal localities not touched by Mr. Wright, another lot of about 100 skins, also personally taken, from the northern part of the Gulf of California in April, 1925, and a dozen skins taken by the late W. Leon Dawson, principally from Magdalena and Guaymas. There are also a few Stephens, Bancroft and Anthony taken skins in the collection of the San Diego Society of Natural History, some of which, by permission of that institution, are listed here. Altogether nearly 4,000 specimens have been examined.

Mr. Bancroft, whom I accompanied on the trip to the Gulf in 1925, and also for part of the time he was on the Sonora coast in the spring of 1930, has undertaken a survey of the seabirds of the Gulf and in view of this fact the so called “water birds” represented in the collections have not been listed here. On the other hand all of the land birds in the Bancroft collection have been turned over to me for identification and recording. This arrangement of course avoids the duplication of effort and record which would otherwise ensue.

It is not to be inferred that ornithological work in Sonora is even approximately completed, indeed there are great areas, principally in the northwestern and eastern portions of the state, which are totally unrepresented in the collections here reported upon and which are practically
unknown ornithologically. Until these gaps are filled in any attempted general survey of the ornithology of this very interesting state would be premature and inconclusive. I have, therefore, made no attempt to make this paper include anything beyond the material which has passed through my hands. To further complicate matters there are three provisional boundaries between Sonora and Chihuahua. It appears to be not improbable that the many “Chihuahua” records from the ornithologically famous “Hacienda de San Rafael” and less likely that others from Carmen, etc., will have to be transferred from Chihuahua to Sonora. I understand that none of these boundaries is as yet official.

The assembling of a bibliography of Sonora ornithology, a task which has occupied much of my spare time for the past year and which is, as yet, far from complete, has served nevertheless to emphasize the spotty nature of the available data. At least five years of field work will be necessary before a comprehensive knowledge of the manner of distribution of many species or races can be obtained.

The faunal districts (or “differentiation areas”) of Sonora are apparently four in number, although it is entirely possible that with further field work others will be brought to light. In the northwest is the Colorado Desert District extending eastward approximately halfway across the state. The northeastern upland area is simply the southward extension of the “Eastern Plains Area” as conceived by Swarth (The Faunal Areas of Southern Arizona, 1929). It extends east into New Mexico and Chihuahua, but until its approximate boundaries are established in that direction there would seem to be little point in coining a name for it. A few of its characteristic races are *Junco phaeonotus palliatus*, *Dryobates villosus icastus*, *Aphelocoma sieberii arizonae*, *Penthestes selateri eidos*, *Cyrtonyx montezumae mearnsi* and *Geothlypis trichas chryseola*. The Tiburón Island District which includes San Estéban Island is poorly characterized as regards endemic bird life. It lies close to the borderline between the Colorado Desert and Alamos Districts and the three known differentiates are sedentary forms whose divergences from the allied mainland races are more probably the result of isolation than of climate. Most southerly of all is the Alamos District of southern Sonora, southwestern Chihuahua and northern Sinaloa. Within it a great number of resident land birds as well as several littoral species have developed more or less strongly characterized local races. Of major interest is the fact that the avian population which has been affected
is made up of three distinct elements in relative abundance in the order named: terminals of southern derivation, local representatives of wide-ranging species, and terminals of northern derivation. Compare these conditions with those present in the same latitude on the opposite side of the Gulf where only one of the species (*Hylocharis xantusii*) is of southern affinities.

The approximate boundaries of the four districts, so far as Sonora is concerned, are outlined on the accompanying map, but it must be understood that these outlines are *only* approximate for the greater part. At some points, both coastwise and in the central portions of the state, however, the line is believed to be drawn fairly accurately. On the coast the northern limits of the Alamos District are clearly coincident with the limits of the Arid Tropical Zone. The Wright collections are predominantly “northern” at Pesqueira and almost wholly “Alamos” at Tecoripa and San Javier, thus pretty definitely establishing the boundaries as midway between them. Brewster's Oposura records, or such of them as have been published, indicate a northern arm of the Alamos District at least to that point up the Yaqui River Valley and its tributaries. The records of Thayer and Bangs from La Chumata and Opodepe show that region to be most closely connected with the northeastern area.

Record stations mentioned in the present report are located on the map not only as a convenience, but in order to fix definitely the particular “Alamos,” “San Javier,” “Agiabampo,” etc., at which the specimens were collected. This is prompted by the difficulties which have been encountered by citations such as “San Pedro,” of which there are by conservative estimate some twenty towns within the boundaries of the state.

**Cathartes aura septentrionalis** Wied

*Cathartes septentrionalis* Wied, Reise Nord America, 1, 1839, 162 (Near New Harmony, Indiana.)

Turkey vultures were found to be fairly common at Guaymas and Tóbari Bay. Wright noted them as follows: El Doctór, January-February, 1929; Pesqueira, February, 1929, common; Tecoripa, March, 1929, common; San Javier, April, 1929, common; Saric, May-September, 1929, common, nesting July; Obregón, October-November, 1929, plentiful; Tésia, November-December, 1929, January and June, 1930, common; Chinobampo, February, 1930, common; Guirocoba, May, 1930, common.
Coragyps atratus atratus (F. A. A. Meyer)


The Black Vulture was common about Guaymas, but was personally seen nowhere else in the state. Wright found them to be more or less common at Saric from May to September, 1929; Pesqueira in February, 1929; Obregón in October and November, 1930, and at Tésia in November, 1929, and in June, 1930.

Accipiter cooperii mexicanus Swainson

Accipiter mexicanus Swainson, Fauna Bor. Am., 2, 1831, 45, footnote (Real del Monte, Mexico).

Dickey collection.—Saric, 3 (July 14, 1929); Chinobampo, 1 (February 14, 1930).

The three Saric specimens are nestlings, thus establishing the species as breeding within the state.

So far as birds in the streaked, immature plumage are concerned, the differences between eastern and western specimens of Accipiter cooperii parallel very closely the characters shown by the corresponding races of Astur. In other words, I believe Ridgway (Proc. U. S. Nat. Mus., 11, 1888, 92) and Swann (Mon. Acc., 5, 1926, 292) to have been justified in admitting mexicanus, even though the chief (and perhaps only) distinguishing feature of mexicanus is the dark, broadly streaked underparts of the immature birds.

Accipiter velox (Wilson)

Falco velox Wilson, Amer. Orn., 5, 1812, 116, pl. 45, fig. 1 (Bank of Schuylkill River, near Philadelphia, Pa.).

Dickey collection.—Tecoripa, 1 (March 2, 1929); Saric, 1 (September 24, 1929); Tésia, 2 (December 29, 1929; March 23, 1930).

Parabuteo unicinctus harrisi (Audubon)

Buteo harrisi Audubon, Birds Amer., folio, 4, 1837, pl. 392 (Between Bayou Sara and Natchez, Mississippi).

Dickey collection.—Tésia, 1 (December 5, 1929).

A pair was found nesting 10 miles north of Guaymas on May 9, 1930.

Buteo borealis calurus Cassin


A pair of adult red-tailed hawks was seen not infrequently in late
April and May in the giant cactus forest on the road between Guaymas and Empalme. Noted by Wright at El Doctór in January, 1929.

**Buteo swainsoni** Bonaparte

*Buteo swainsoni* Bonaparte, Geog. & Comp. List, 1838, 3 (Near Columbia River).

Bancroft collection.—El Alamo [29 mi. N. W. of Magdalena], 1 (June 30, 1928).

**Buteo albonotatus albonotatus** Kaup

*Buteo albonotatus* Kaup, Isis, 1847, col. 329 (Mexico).

Dickey collection.—Obregón, 1 (November 19, 1929).

**Asturina plagiata maxima** van Rossem

*Asturina plagiata maxima* van Rossem, Condor, 32, November, 1930, 303 (San Javier, Sonora, Mexico).

Dickey collection.—San Javier, 2; Saric, 1; Chinobampo, 1; Guirocoba, 2; Magdalena, 1.

This species is apparently permanently resident in the lowlands and foothills throughout the state.

**Circus hudsonius** (Linnaeus)

*Falco hudsonius* Linnaeus, Syst. Nat., ed. 12, 1, 1766, 128 (Hudson Bay).

Dickey collection.—Tecoripa, 1 (March 8, 1929).

**Pandion haliaëtus carolinensis** (Gmelin)

*Falco carolinensis* Gmelin, Syst. Nat., 1, i, 1788, 263 (Carolina).

Ospreys were noted at San Pedro Nolasco Island, Guaymas and Tóbari Bay. The species is much less common than on the Lower California side of the Gulf.

**Polyborus cheriway auduboni** Cassin


Dickey collection.—Tésia, 1 (March 27, 1930).

Bancroft collection.—25 mi. S. E. of Guaymas, 1 (June 18, 1928); San José de Guaymas, 1 (May 14, 1930).

In addition to the specimens recorded above, caracaras were observed commonly at Tóbari Bay from April 26 to May 1, 1930. Wright noted them as follows: Tecoripa, March, 1929, few; San Javier, April, 1929, few; Pesqueira, February, 1929, rare; Guirocoba, May, 1930, common.
Falco peregrinus anatum Bonaparte


Dickey collection.—Tecoripa, 1 (March 2, 1929); San Pedro Martir Island, 1 (April 20, 1930 [breeding]).

Seen also at San Esteban Island (April 17, 1930).

Falco sparverius sparverius Linnaeus

Falco sparverius Linnaeus, Syst. Nat., ed. 10, 1, 1758, 90 (Carolina).

Dickey collection.—30 mi. S. W. of Magdalena, 1 (April 24, 1925); Obregón, 2 (November 2, 1929); Tésia, 1 (December 15, 1929).

A winter visitant. The specimen from Magdalena was picked up dead. Injury or sickness probably accounts for the extremely late date.

Falco sparverius phalaena (Lesson)

Tinnunculus phalaena Lesson, Echo du Monde Savant, 12e ann., June 19, 1845, 1086 (San Blas and Acapulco, Mexico).

Dickey collection.—El Doctór, 2 (January 20, 27, 1929); Tecoripa, 2 (March 2, 29, 1929); Obregón, 1 (November 2, 1929); Guaymas, 2 (April 24, May 3, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 3 (February 25, 1929); 15 mi. S. of Nogales, 2 (February 17, 1929).

I entirely agree with Griscom (Am. Mus. Novit., 414, March 24, 1930, 1) that phalaena is restricted to the desert regions of the southwestern United States and northwestern Mexico, and that the typical race sparverius extends to the Pacific coast. So far as I can judge from the material at hand, which is quite extensive, phalaena is a permanent resident of the Lower Sonoran Zone in the deserts of southeastern California, southern Arizona and south into Mexico. The more northerly sparverius is a migratory race and occurs commonly in winter over the range of phalaena.

Ortalis wagleri (Gray)

Ortalida wagleri Gray, List Gallinae Brit. Mus., 1867, 12 (Western Mexico).

Wright informs me that the Chestnut-bellied Chachalaca is not uncommon about Guirocoba and Chinobampo. He shot one with a high-powered rifle at the former place, but did not save the remains.
Colinus virginianus ridgwayi Brewster
Colinus ridgwayi Brewster, Auk, 2, 1885, 199 (18 mi. S. W. of Sásabe, Sonora).
Dickey collection.—Magdalena, 1 (July 12, 1928); 90 mi. S. of Nogales, 1 (March, 1929).
Bancroft collection.—90 mi. S. of Nogales, 5 (“February and March, 1929”).

Lophortyx gambelii gambelii Gambel
Dickey collection.—El Doctór, 9; Pesqueira, 5; Tecoripa, 6; Saric, 1; Guaymas, 3.
Bancroft collection.—“Central Sonora”, 2; 12 mi. W. of Magdalena, 2; Guaymas, 1; 6 mi. N. of Guaymas, 2.
San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 5; Sásabe Valley, near International Boundary, 9.

Lophortyx gambelii fulvipectus (Nelson)
Callipepla gambeli fulvipectus Nelson, Auk, 16, January, 1899, 26 (Camoa, Rio Mayo, Sonora).
Dickey collection.—Obregón, 4; Tésia, 1; Tóbari Bay, 4.
Bancroft collection.—25 mi. S. [E.] of Guaymas, 1; Cajeme [= Obregón], 1; Agiabambo, 1.
The meeting place, coastwise, of the two races of Gambel quail is pretty definitely fixed as just south of Guaymas, for while specimens from Guaymas are gambelii they show definite tendencies toward fulvipectus. The appearance of specimens of gambelii from Tecoripa leads me to suspect that intergradation with fulvipectus occurs only a short distance south of there.
The race fulvipectus is an excellent one, showing dark, rich coloration in both sexes.

Lophortyx douglasii douglasii (Douglas)
Dickey collection.—Tésia, 15, Chinobampo, 7; Guirocoba, 5.
Lophortyx douglasii bensoni (Ridgway)

_Callipepla elegans bensoni_ Ridgway, _Forest and Stream_, 28, no. 6, March 3, 1887, 106 (18 miles N. of Cumpas, Sonora, Mexico).

Dickey collection.—Pesqueira, 3; Tecoripa, 17; San Javier, 6; Guaymas, 1.

Bancroft collection.—90 mi. S. E. of Nogales, 8.

The differences between _bensoni_ and _douglasii_ are sufficiently pronounced in series to make the former a perfectly valid race. The differences are much the same as separate gambelii from fulvipectus, namely, the generally pallid coloration of the northern race. In addition the male of _bensoni_ has, normally, a very much paler crest, and there is more light rufous in the form of shaft streaks and ill defined spots on the chest and flanks. Such markings when present in _douglasii_ are almost obsolete. Characters such as the relative amounts of white and black in the throat patches of the males and the color of the crest of the females prove to be individual in nature and, while interesting, are of no value in discriminating the two races.

Although in the original description and in subsequent citations the type locality of _bensoni_ is given as "Campos," Dr. Richmond informs me that the actual type locality is, as stated by Lieut. Benson in a letter to Robert Ridgway dated February 11, 1887, 18 miles north of Cumpas.

An interesting occurrence was the taking of a mated pair of quail at Guaymas, the male of which was _gambelii_ and the female _bensoni_. This is furthermore the only Sonora station of record for _bensoni_ (or _douglasii_ either) at or near a coastal locality. The main habitat of the species is evidently the broken, lower hill-country inland and it appears to be rare on the coastal plain.

_Cyrtonyx montezumae montezumae_ (Vigors)


Dickey collection.—Guirocoba, 2 (May 2, 1930).

Both of these specimens are typical _montezumae_. Just how far _montezumae_ extends north of the Alamos District, using that term in its most restricted sense, is something for future field work to determine. The analogies of _Lophortyx gambelii_ and _Lophortyx douglasii_ would accord to _montezumae_ a relatively restricted range in Sonora.
Crytonyx montezumae mearnsi Nelson

Crytonyx montezumae mearnsi Nelson, Auk, 17, 1900, 255 (Fort Huachuca, Arizona).

Dickey collection.—Saric, 2 (June 27, 1929).

✓ Ara militaris mexicana Ridgway


Dickey collection.—Chinobampo, 2 (March 1, 1930).

Wright states that macaws were common at Guirocoba also, and that they are evidently resident in both localities.

✓ Psittacula cyanopygia pallida Brewster

Psittacula cyanopygia pallida Brewster, Auk, 6, April, 1889, 85 [Separates issued January 31, 1889] (Alamos, Sonora).

Dickey collection.—Guirocoba, 4 (April 22, 1930).

Wright found these birds to be present, but rare, at Chinobampo in February, 1929.

Amazona finschi (Sclater)


Dickey collection.—Guirocoba, 1 (May 21, 1930).

✓ Amazona albilfrons saltuensis Nelson


Dickey collection.—Tésia, 3 (December 16, 19, 1929; January 30, 1930); Chinobampo, 4 (February 8, 11, 1930); Guirocoba, 1 (May 3, 1930); Guaymas, 9 (April 24 to May 3, 1930; breeding).

Noted also at Obregon by Wright in November, 1929.

There is also in the Dickey collection a specimen of saltuensis from San Blas in northern Sinaloa.

Columba fasciata fasciata Say

Columba fasciata Say, in Long’s Exped., 2, 1823, 10, note (Plum Creek, near Castle Rock, Douglas County, Colorado).

Dickey collection.—Saric, 4 (May 30 to June 27, 1929).

Wright found band-tailed pigeons breeding at Saric and also noted a small flock at 3500 feet altitude near San Javier on April 20, 1929.
Columba flavirostris restricta van Rossem


Dickey collection.—Tecoripa, 2 (March 5, 1929); Chinobampo, 1 (March 1, 1930); Guirocoba, 1 (April 29, 1930).

Bancroft collection.—Agiabampo, 2 (June 9, 1930 [full-grown juvs.]).

According to Wright a “plentiful” species at the localities listed above.

Zenaida macroura marginella (Woodhouse)


Dickey collection.—Tecoripa, 3 (March 21, 29, 1929); San Pedro Martir Island, 1 (April 18, 1925).

Bancroft collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Mourning doves were also seen at Tóbari Bay (April 26 to May 1, 1930).

Melopelia asiatica mearnsi Ridgway


Dickey collection.—Pesqueira, 1 (February 23, 1929).

Bancroft collection.—Guaymas, 1 (June 24, 1928); El Alamo [29 mi. N. W. of Magdalena], 1 (July 1, 1928).

An extremely common, locally abundant, species everywhere on the mainland. Specific locality records where personally seen are Guaymas, Miramar, Empalme, Tóbari Bay and San Esteban Island.

Columbigallina passerina pallescens (Baird)


Dickey collection.—San Javier, 1 (April 25, 1929); Saric, 2 (June 24, 28, 1929).

Bancroft collection.—15 mi. S. W. of Nogales, 2 (January 13, 1928); Guaymas, 2 (June 23, 28, 1928); El Alamo, 1 (July 3, 1928).

Ground doves were also seen, mostly in pairs, at Tóbari Bay (April 26 to May 1, 1930). Wright found this species nesting at Saric in June, 1929, and at Guirocoba in May, 1930.
Scardafella inca (Lesson)
*Chamaepelea inca* Lesson, Compl. Oeuvres Buffon, 20, 1847, 211 (Mexico).
Dickey collection.—Tecoripa, 4 (March 12, 17, 1929); Saric, 1 (May 21, 1929); San José de Guaymas, 1 (May 8, 1930).
Bancroft collection.—Guaymas, 2 (June 28, 1928); Cajeme [=Obregón], 2 (June 20, 1928).

Noted by Wright at San Javier in April, 1929.

Leptotila verreauxi angelica Bangs and Penard
Dickey collection.—San Javier, 1 (April 22, 1929).

✓ Coccyzus americanus occidentalis Ridgway
*Coccyzus americanus occidentalis* Ridgway, Man. N. A. Birds, 1887, 273 (Santa Rita Mts., Arizona).
Dickey collection.—Saric, 16 (June 15 to September 22, 1929).
Bancroft collection.—Guaymas, 1 (June 22, 1928); Agiabampo, 1 (June 9, 1930).

A common summer visitant to suitable associations everywhere, breeding certainly at Saric and Guaymas.

In my opinion *occidentalis* is a valid race with characters (as given by the original describer) readily apparent in the great majority of specimens.

✓ Piaya cayana extima van Rossem
Dickey collection.—Guirocoba, 1 (April 18, 1930).
Wright saw one other bird at Guirocoba, but was unable to collect it.

✓ Geococcyx californianus (Lesson)
*Saurothera californiana* Lesson, Compl. Oeuvres Buffon, 6, 1829, 420 (California).
Dickey collection.—San Javier, 3; Saric, 3; Obregón, 1; Tésia, 1.
Bancroft collection.—40 mi. S. of San Luis, 1; Guaymas, 3; Cajeme [=Obregón], 1.

✓ Crotophaga sulcirostris sulcirostris Swainson
*Crotophaga sulcirostris* Swainson, Philos. Mag., new ser., 1, 1827, 440 (Temes-caltepec, Mexico).
Dickey collection.—Guirocoba, 1 (May 6, 1930 [“laying”]).
This specimen is identical with Central American examples of this species, a noteworthy fact considering the differences shown by Lower California birds. In this latter connection I am not altogether convinced that the characters of *pallidula* are not the result of a post-mortem color change, possibly induced by some preservative, for it is almost inconceivable that Brewster would have failed to notice in his Lower California series what is now so readily apparent. For further remarks on this subject see under *Stelgidopteryx ruficollis serripennis* and *Euthlypis lachrymosa tephra*.

**Tyto alba pratincola** (Bonaparte)

*Strix pratincola* Bonaparte, Geog. and Comp. List, 1838, 7 (Southeastern United States).

Dickey collection.—Tecoripa, 1 (March 14, 1929); Saric, 2 (July 10, 24, 1929).

The Tecoripa specimen is indistinguishable on any basis from El Salvador skins of extreme *guatemalae*. I am inclined to suspect that *guatemalae* is in reality only the extreme dark phase of *pratincola*, but for the present, considering the fact that only dark specimens are known from the range of *guatemalae*, continue to recognize western Central American birds as distinct.

**Otus asio cineraceus** (Ridgway)

*Megascops asio cineraceus* Ridgway, Auk, 12, October, 1895, 390 (Fort Huachuca, Arizona).

Bancroft collection.—El Alamo, 1 (July 1, 1928).

This specimen is typical of the Arizona upland race.

**Otus vinaceus** (Brewster)

*Megascops vinaceus* Brewster, Auk, 5, 1888, 88 (Durasno, Chihuahua).

Dickey collection.—Guirocoba, 1 (April 22, 1930 [laying]).

This second known specimen of *vinaceus* represents the bright rufous phase. Its measurements (wing, 151; tail, 84) closely correspond with those of the type, which is also a female.

In the scantily bristled toes, pattern of markings and general appearance, *vinaceus* strongly resembles *Otus cooperi* Ridgway of southern Mexico and Central America. The chief point of difference is the tremendously large and heavy feet of the latter, indeed the dissimilarity is so great in this respect that on this character alone the two must continue to stand as distinct species.
Bubo virginianus pallescens Stone


Dickey collection.—El Doctór, 2 (January 21; February 5, 1929); Obregón, 1 (November 17, 1929); Tésia, 1 (December 16, 1929). The two southerly specimens are darker than those from El Doctór. They are, however, exactly like eastern Arizona *pallescens*. According to the rather limited material in the Dickey collection there are grounds for suspecting the existence of a definable race of horned owl in the lower Colorado River Valley.

Glaucidium brasilianum ridgwayi Sharpe


Dickey collection.—Magdalena, 2 (April 28, 1925; breeding); Obregón, 2 (November 1, 2, 1929); Guaymas, 2 (April 24, 1930; breeding).

Bancroft collection.—Miramar, 1 (May 11, 1930); San José de Guaymas, 1 (May 8, 1930); Agiabampo, 1 (June 9, 1930).

San Diego Society of Natural History collection.—Caborca, 2 (August 24, 1884).

Micropallas whitneyi whitneyi (Cooper)


Dickey collection.—Magdalena, 1 (May 14, 1925).

Speotyto cunicularia hypugaea (Bonaparte)

*Strix hypugaea* Bonaparte, *Amer. Orn.*, 1, 1825, 72, note (Western United States).

Dickey collection.—Obregón, 1 (November 15, 1929); Tésia, 2 (December 9, 10, 1929).

✓ Antrostomus ridgwayi ridgwayi Nelson


Dickey collection.—Chinobampo, 2 (February 18; March 8, 1930; Guirocoba, 8 (April 24 to May 24, 1930).

These 10 specimens have been compared with the types of *Antrostomus ridgwayi* Nelson and *Antrostomus goldmani* Nelson. In color the Sonora birds range from even darker than typical *ridgwayi* to typical
"goldmani," thus showing the latter to be a strict synonym of ridgwayi. As is well known, Antrostomus Vociferus has a wide range in color and size, particularly in the case of eastern United States specimens. There appears to be an equally wide latitude in ridgwayi. Measurements of the series are as follows:

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<th>Wing</th>
<th>Tail</th>
<th>Spot on inner web of lateral rectrices</th>
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<tr>
<td>7 males</td>
<td>153-158</td>
<td>111-123</td>
<td>35-59</td>
</tr>
<tr>
<td>3 females</td>
<td>148-159</td>
<td>112-118</td>
<td>...........................................</td>
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The validity of Antrostomus ridgwayi troglodytes (Griscom), described from a single specimen from Guatemala (Am. Mus. Novit., 379, October 17, 1929, 10, and Auk, 47, 1930, 85) would appear, in view of the size variation of ridgwayi, to be subject to verification.

Phalaenoptilus nuttallii nuttallii (Audubon)

Caprimulgus nuttallii Audubon. Birds Am., 7, 1844, 350, pl. 495 (Upper Missouri, between Fort Pierre and mouth of Cheyenne River, South Dakota).

Dickey collection.—Saric, 9 (May 31 to June 21, 1929).
Bancroft collection.—El Alamo, 1 (July 3, 1928).

Chordeiles minor henryi Cassin

Chordeiles henryi Cassin, Illustr. Birds Calif., etc., 1855, 239 (Fort Webster, New Mexico).

Dickey collection.—Saric, 1 (July 15, 1929).

Chordeiles acutipennis texensis Lawrence


Dickey collection.—Tecoripa, 6 (March 8, 21, 29, 1929); Saric, 7 (May 27, 28; July 11; September 20, 1929); Obregón, 4 (November 1, 1929); Tésia, 4 (March 15, 16, 1930).
Bancroft collection.—Guaymas, 1 (June 28, 1928); Cajeme [=Obregón], 3 (June 20, 1928); El Alamo, 2 (July 3, 1928); Agiabampo, 2 (June 8, 1930).

Chaetura vauxi (J. K. Townsend)


Dickey collection.—10 mi. N. of Guaymas, 1 (May 9, 1930).
Archilochus alexandri (Bourcier and Mulsant)
*Trochilus alexandri* Bourcier and Mulsant, Ann. Soc. Agric. Lyons, 9, 1846, 330 (Sierra Madre, Mexico).
Dickey collection.—San Javier, 1 (April 19, 1929); Saric, 1 (May 29, 1929).

**Calypte costae** (Bourcier)
Dickey collection.—Tésia, 1 (November 29, 1929).
San Diego Society of Natural History collection.—Port Lobos, 1 (August 24, 1884).

Seen at San Estéban Island (April 17 to 19, 1930; common) and about Guaymas (April 24, 1930; common).

Selasphorus rufus (Gmelin)
*Trochilus rufus* Gmelin, Syst. Nat., 1, i, 1788, 497 (Nootka Sound, Vancouver Island, B. C.).
Dickey collection.—Tésia, 4 (March 20, 21, 1930); San Estéban Island, 1 (April 18, 1930).

Selasphorus platycercus platycercus (Swainson)
*Trochilus platycercus* Swainson, Philos. Mag., new ser., 1, 1827, 441 (Mexico).
Dickey collection.—Saric, 1 (May 12, 1929).

Amazilis verticalis (Lichtenstein)
Dickey collection.—Guirocoba, 3 (April 22, 24; May 26, 1930).

Two of these three specimens are adult females, the third an immature male. While they are listed as *verticalis* I am not at all sure that such is their proper disposition. One of the females seems to be nearly typical of that form, but the other female and the male appear to be more or less intermediate toward *Amazilis salvini* (Brewster). In these latter two specimens the blue of the crown extends more or less brokenly onto the interscapular region, the sides of the neck are spotted with blue and there are isolated blue feathers on the sides of the chest. It may well be that intergradation between *salvini* and *verticalis* takes place in southern Sonora. On the other hand the type of *salvini* may be nothing more than the extreme individual accentuation of the tendencies observable in two out of the three Guirocoba birds. In this latter case all of the Sonora
(and the single known Arizona) specimens would bear the name of *Amazilis verticalis salvini*. However, until further examples are collected the matter cannot be disposed of finally.

**Cynanthus latirostris** Swainson

*Cynanthus latirostris* Swainson, Philos. Mag., new ser., 1, June, 1827, 441 (Mexico).

Dickey collection.—Magdalena, 1 (May 14, 1925); Pesqueira, 4 (February 21, 24, 26, 1929); Tecoripa, 2 (March 9, 16, 1929); San Javier, 3 (April 3, 19, 1929); Saric, 6 (May 15 to August 23, 1929); Tésia, 3 (December 4, 7, 1929; March 20, 1930).

Bancroft collection.—6 mi. N. of Guaymas, 2; 25 mi. S. E. of Guaymas, 1; 25 mi. S. W. of Cajeme [=Obregón], 1.

**Trogon elegans ambiguus** Gould


Dickey collection.—San Javier, 5 (April 5, 7, 9, 1929); Chinobampo, 2 (February 21, 26, 1930); Guirocoba, 4 (April 18 to May 4, 1930).

**Megaceryle alcyon caurina** (Grinnell)


Dickey collection.—Chinobampo, 1 (February 9, 1930).

Noted by Wright at Saric in August, 1929, and at Tésia, January, 1930.

**Chloroceryle americana septentrionalis** (Sharpe)


Dickey collection.—Tecoripa, 2 (March 4, 9, 1929); Saric, 3 (July 30; August 2, 14, 1929); Guirocoba, 2 (April 20; May 9, 1930).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929); Agiabampo, 1 (June 8, 1930).

**Momotus mexicanus** Swainson

*Momotus mexicanus* Swainson, Philos. Mag., new ser., 1, 1827, 442 (Temascaltepec, Mexico).

Dickey collection.—Chinobampo, 2 (March 6, 1930).

These two specimens are slightly paler in general coloration, have more extensively whitish chins and the upper surfaces of the rectrices are decidedly greener (less bluish) than are any birds in a series of 24 from
Oaxaca, Jalisco, Colima and Nayarit. However, individual variation in this species is such that until the above mentioned differences are verified by further specimens the naming of a new race would not be justified.

**Colaptes chrysoides tenebrosus** van Rossem


Dickey collection.—Tecoripa, 7; San Javier, 1; Obregón, 2; Tésia, 1; Guirocoba, 2; Guaymas, 2.

Bancroft collection.—25 mi. S. of Guaymas, 1; 6 mi. N. of Guaymas, 1.

**Colaptes cafer collaris** Vigors


Dickey collection.—El Doctor, 1 (January 31, 1929); Tecoripa, 5 (March 4, 14, 16, 25, 1929); San Javier, 1 (April 4, 1929).

Bancroft collection.—15 mi. S. of Nogales, 2 (February 25, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 3 (January 13, 1928).

**Centurus uropygialis uropygialis** Baird


Dickey collection.—Saric, 14; Pesqueira, 1.

Bancroft collection.—15 mi. S. of Nogales, 4; 12 mi. W. of Magdalena, 1; Tiburón Island, 2.

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 4; Sásabe Valley, near International Boundary, 1.

Specimens from interior northern Sonora are darker in color than typical *uropygialis* and average considerably larger than either typical *uropygialis* or *sulfuriventer*. The same tendencies are observable in a series from the vicinity of Fort Lowell, Arizona. Birds showing the extreme characters of *uropygialis* are apparently confined to the lower Colorado River Valley and the lower Gila and Bill Williams Rivers.

Comparative measurements are as follows:

**C. u. uropygialis** from the lower Colorado River Valley.

10 ad. males: Wing, 126.7; Tail, 79.1; Exposed culmen, 30.2.

**C. u. uropygialis** from Tucson and northern Sonora.

10 ad. males: Wing, 133.6; Tail, 83.0; Exposed culmen, 31.8.
C. u. sulfuriventer from southern Sonora.

10 ad. males: Wing, 125.9; Tail, 77.7; Exposed culmen, 28.9.

Two examples from Tiburón Island in the Bancroft collection are paler colored and more like Colorado River uropygialis and therefore more typical than northern interior birds.

**Centurus uropygialis sulfuriventer** Reichenbach

*C[enturus] sulfuriventer* Reichenbach, Handb. Scansores, Picinae, October, 1854, 410, pl. 664, figs. 4411, 4412 (“Mexico” [I designate Guaymas, Sonora]).

Dickey collection.—Tecoripa, 7; San Javier, 4; Tésia, 4; Obregón, 3; Chinobampo, 4; Guaymas, 3; Guirocoba, 4.

The Gila woodpecker of southern Sonora is so strikingly different in color from *uropygialis* that how it ever could have been included in that race is puzzling. It is distinguished from *uropygialis* by darker and richer coloration throughout, the black bars are wider and the white ones narrower, the head and underparts are “buffy brown” instead of “drab-gray” and the belly is “mustard yellow” instead of “straw yellow” or “light saffron yellow.” The body color also tinges the white barring (often very strongly) on the back and under surface of the tail.

While Reichenbach’s description and plate certainly are those of a Gila woodpecker it is impossible to be certain as to which race his name applies. However, as his presumed type locality was “Mexico” the name may appropriately be utilized for the dark colored southern form.

**Balanosphyra formicivora aculeata** (Mearns)

*Melanerpes formicivorus aculeatus* Mearns, Auk, 7, 1890, 249 (Squaw Peak, central Arizona).

Dickey collection.—Saric, 10 (May 11 to June 18, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

**Asyndesmus lewisi** Riley


San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 3 (January 13, 1928).
Sphyrapicus varius nuchalis Baird


Dickey collection.—Saric, 1 (September 19, 1929); Tésia, 2 (November 30, 1929; January 28, 1930).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Dryobates scalaris cactophilus Oberholser


Dickey collection.—El Doctór, 1; Saric, 6; San Estéban Island, 1.

Bancroft collection.—15 mi. S. of Nogales, 1.

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1.

Dryobates scalaris agnus Oberholser


Dickey collection.—Tecoripa, 3; San Javier, 2; Obregón, 2; Tésia, 3; Chinobampo, 3; Guirocoba, 2; Tóbari Bay, 1; Guaymas, 1.

The race *agnus* differs from *cactophilus* in its darker coloration and smaller size. It ranges much farther north than heretofore supposed, for although birds from San Javier and Tecoripa are not typical they are certainly closer to *agnus* than to *cactophilus*. The single Guaymas bird examined by me is typical *agnus*.

Dryobates arizonae arizonae (Hargitt)

*Picus arizonae* Hargitt, Ibis, April, 1886, 115 (Santa Rita Mts., Arizona).

Dickey collection.—Saric, 1 (June 26, 1929).

Xiphorhynchus flavigaster tardus Bangs and Peters


Dickey collection.—Guirocoba, 2 (May 2, 21, 1930).

As compared with Nayarit specimens of *mentalis* these two show well the pallid coloration which the describers designated as one of the characters of *tardus*. As the form has previously been known only from the two specimens from Chihuahua in the Brewster collection, measurements of the two Sonora males are appended. Size is so variable in this
species that a larger series than is at present available will have to be measured before its value in the present case can be demonstrated.

<table>
<thead>
<tr>
<th>Wing</th>
<th>Tail</th>
<th>Exposed Culmen</th>
<th>Tarsus</th>
</tr>
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<tbody>
<tr>
<td>109-116</td>
<td>89-98</td>
<td>38.5-39.6</td>
<td>22.0-23.2</td>
</tr>
</tbody>
</table>

**Platypsaris aglaiae richmondi** van Rossem


Dickey collection.—Saric, 6 (May 14 to June 24, 1929); Tésia, 1 (December 21, 1929); Chinobampo, 2 (February 14, 21, 1930); Guirocoba, 8 (May 6 to 26, 1930).

Although apparently of state-wide distribution in the lower hill country during the summer there is no winter record for this species north of Tésia in the Mayo River Valley.

**Tyrannus verticalis** Say

*Tyrannus verticalis* Say, in Long’s Exped., 2, 1823, 60, note (Near La Junta, Colorado).

Dickey collection.—San Javier, 1 (April 8, 1929); Saric, 3 (August 18, 22; September 8, 1929); Guirocoba, 2 (May 4, 8, 1930).

**Tyrannus vociferans** Swainson


Dickey collection.—Tecoripa, 5 (March 1 to 14, 1929); Saric, 10 (May 15 to September 11, 1929); Obregón, 1 (November 19, 1929); Tésia, 2 (December 31, 1929; April 3, 1930); Chinobampo, 1 (March 5, 1930).

**Tyrannus melancholicus occidentalis** Hartert and Goodson

*Tyrannus melancholicus occidentalis* Hartert and Goodson, Novit. Zool., 24, August 31, 1917, 412 (San Blas, Tepic [⇒Nayarit], Mexico).

Dickey collection.—Tóbari Bay, 2 (April 26, 27, 1930); San José de Guaymas, 12 (May 7, 1930); 10 mi. N. of Guaymas, 1 (May 10, 1930); Guirocoba, 1 (May 12, 1930).

Bancroft collection.—Guaymas, 6 (June 15 to 23, 1928); Agiabampo, 3 (June 7 to 9, 1930).

Whether this species is a resident or only a summer visitant is questionable. At any rate the Tóbari Bay specimens represent the first individuals to be noted. While none were found about Guaymas on
April 22 and 24, they were abundant and commencing to build nests in that locality on May 7.

**Tyrannus crassirostris pompalis** Bangs and Peters


Dickey collection.—Saric, 5 (June 11, 24; July 7; September 11, 1929); Tésia, 1 (December 21, 1929); Guirocoba, 10 (April 19 to May 24, 1930).

All of these examples show well the characters ascribed to this race. The Dickey collection also contains a typical example of *pompalis* from San Blas in northern Sinaloa.

Saric is so close to the Arizona line (about 25 miles) that it would appear surprising that the species has not, to date, been added to the avifauna of that state, particularly as it breeds and is apparently not uncommon about Saric.

**Pitangus sulfuratus derbianus** (Kaup)


Bancroft collection.—Agiabampo, 2 (June 9, 1930).

**Myiodynastes luteiventris swarthi** van Rossem


Dickey collection.—Saric, 8 (June 18, 23; August 3, 10; September 10, 1929); Guirocoba, 9 (May 2 to 26, 1930).

The range of *swarthi* is now known to extend southward to southern Chihuahua (Bangs and Peters, Bull. Mus. Comp. Zool., 68, 1928, 394) and the above recorded specimens take it to the Sonora-Sinaloa boundary. The meeting place of *swarthi* and *luteiventris* on the Pacific slope is predictable as central Sinaloa, for two specimens in the Dickey collection from Tepic, Nayarit, are typical *luteiventris*. The characters of *swarthi* are most pronounced in southern Arizona and northern Sonora.

**Myiozetetes similis primulus** van Rossem


Dickey collection.—Tésia, 19 (November 11 to December 30, 1929; February 18; March 18, 1930).
Myiarchus tyrannulus magister Ridgway


Dickey collection.—Saric, 18 (May 10; August 3, 1929); Guaymas, 1 (May 3, 1930); Guicrocoba, 6 (May 9 to 21, 1930).

The Arizona Crested Flycatcher appears to be only a summer visitor in Sonora. The Guaymas record represents the date of first arrival for the species in that locality, after which time it became relatively common.

Myiarchus cinerascens cinerascens (Lawrence)


Dickey collection.—Pesqueira, 1 (February 24, 1924); San Javier, 8 (April 4 to 15, 1929); Saric, 12 (June 6 to 30; July 24; September 12, 21, 1929); Tésia, 1 (December 30, 1929); San Estéban Island, 5 (April 17, 18, 1930); 10 mi. N. of Guaymas, 2 (May 9, 1930); Guicrocoba, 2 (April 15, 17, 1930).

Bancroft collection.—El Alamo, 1 (July 3, 1928); 10 mi. W. of Magdalena, 1 (February 25, 1929); Guaymas, 1 (June 25, 1928); Tiburón Island, 3 (May 22, 1930); Kino Bay, 2 (May 15, 1930).

The breeding range of the Ash-throated Flycatcher extends south to at least El Alamo in the interior and to Guaymas coastwise. The winter distribution is much more general and extends south over the range of inquietus.

Although here listed under cinerascens, all of the island and coastal specimens are really intergrades with inquietus. Generally speaking they are intermediate in size, the general coloring is that of cinerascens and the tail characters are variable, but for the most part are nearest to cinerascens.

Myiarchus cinerascens inquietus Salvin and Godman


Dickey collection.—Pesqueira, 3 (February 23, 25, 1929); San Javier, 9 (April 4 to 24, 1929); Tésia, 1 (November 29, 1929); Chinobampo, 6 (February 8 to March 9, 1930); Guicrocoba, 2 (May 2, 1930; mating).

The details of the summer distribution of inquietus are at present obscure, for all of the specimens were taken in winter and spring, the latest date being May 2 (apparently a breeding date) at Guicrocoba. At any
rate, the 21 specimens recorded above are, as a whole, certainly referable
only to *inquietus*. They are for the most part identical with Michoacan
and Guerrero birds (Biol. Surv. collection), but in some examples tail
markings and size link them with *cinerascens*. This is particularly true of
the three Pesqueira specimens which if resident, as I suspect them to be,
mark about the northern limit of *inquietus* in the interior at that point.

Extensive intergradation between *inquietus* and *cinerascens* in size,
color and tail markings established, the forms of *nuttingi* of course take
the prior specific name of *cinerascens*. Average measurements for the
various races are as follows, males only being listed.

25 *M. c. cinerascens* from California, Arizona, and Coahuila.
   Wing, 99.6; Tail, 91.5; Culmen from base, 24.3.

7 *M. c. cinerascens*—intergrades × *inquietus* from central Sonora.
   Wing, 96.1; Tail, 89.6; Culmen from base, 22.8.

7 *M. c. pertinax* from Lower California.
   Wing, 94.0; Tail, 88.0; Culmen from base, 24.2.

9 *M. c. inquietus* from Sonora, Guerrero and Michoacan.
   Wing, 88.8; Tail, 83.2; Culmen from base, 21.9.

7 *M. c. nuttingi* from El Salvador.
   Wing, 84.1; Tail, 81.6; Culmen from base, 20.9.

2 *M. c. nuttingi* from Costa Rica.
   Wing, 83.5; Tail, 77.7; Culmen from base, 19.6.

I cannot subscribe to Bangs' and Peters' opinion (Bull. Mus. Comp.
Zool., 68, 1928, 395) that *inquietus*, as compared with *nuttingi*, is a
"poorly marked form." Not only do the tail markings average very much
more dusky on the inner webs, but the size is also decidedly greater. True
*nuttingi* is confined to western Costa Rica and western Nicaragua. El Sal-
vador birds are nearest to *nuttingi*, but with definite tendencies toward
*inquietus*. The dividing line between *nuttingi* and *inquietus* would appear
to be the Isthmus of Tehuantepec and specimens from there would natur-
ally show mixed characters.

**Myiarchus tuberculifer olivascens** Ridgway

(Santa Efigenia, Oaxaca).

Dickey collection.—San Javier, 2 (April 16, 18, 1929); Saric, 13 (May
24 to August 19, 1929); Tésia, 2 (December 12, 1929; January 28,
1930); Chinobampo, 5 (February 15 to March 5, 1930); Magdalena, 1 (April 27, 1925); Guirocoba, 2 (April 17, 1930).

Bancroft collection.—Agiabampo, 1 (June 9, 1930).

The distribution of this flycatcher in the extreme northern section of its range (southern Arizona) is narrowed down to a relatively restricted habitat in the Upper Sonoran Zone. In southern Sonora, however, it appears to be very generally dispersed, not only in the lower mountains, but also on the coastal plain to the seacoast.

**Sayornis saya saya** (Bonaparte)


Dickey collection.—El Doctór, 6 (January 21, 23, 1929); Saric, 1 (September 15, 1929); Obregón, 2 (November 22, 1929); Tésia, 2 (February 1, 1930).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 25, 1929).

San Diego Society of Natural History collection.—San Luis, 1 (December 31, 1922).

**Sayornis saya quiescens** Grinnell

*Sayornis sayus quiescens* Grinnell, Condor, 28, July, 1926, 180 (San José, 45 mi. N. E. of San Quintín, Lower California).

Dickey collection.—El Doctór, 4 (January 24, 25, 30, 1929).

The Lower California Say Phoebe apparently occurs as a not uncommon mid-winter visitant in the Delta region. On the other hand *saya* is of general winter distribution over the foothills and lowlands throughout the state.

It may be permissible to record here the taking of a laying female of *quiescens* at Port San Bartolomé (at 27° 40' N. on the Pacific side), Lower California, on February 22, 1930. In addition to being an extraordinary nesting date, the occurrence is considerably south of any published station for this form. Typical *saya* was present there as a winter visitor.

**Sayornis nigricans semiatra** (Vigors)


Dickey collection.—El Doctór, 3 (January 27, 1929); Pesqueira, 1 (February 25, 1929); Tecoripa, 6 (March 1 to 28, 1929); Saric, 8
(December 1929; September 19, 1929; Obregón, 3 (November 21, 22, 1929); Tésia, 5 (December 16 to 26, 1929); Chinobampo, 1 (February 17, 1930). Also seen at San José de Guaymas (May 3, 1930).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 2 (January 13, 1928); San Luis, 1 (December 31, 1922).

In a recent paper Swarth (Proc. Calif. Acad. Sci., 4th ser., 18, no. 12, 1929, 306) has summarized the situation with regard to the black phoebes of the Pacific southwest. While I agree with him in his contention that all of the black phoebes from the western United States and Lower California (including "brunnescens" and "salictaria") should be considered as of one race, I cannot agree that the name of that race is nigricans. Briefly, my reasons are as follows: Sayornis nigricans, as a species, ranges from Panama to Oregon, changing gradually from a bird with an extremely restricted, central, abdominal patch of white and uniformly blackish under tail coverts to one whose posterior underparts are extensively white and whose under tail coverts are usually, but not always, pure white also. Just how many races one wishes to carve out of this gradual transition is a matter of personal preference. The type locality of nigricans is simply the "table land of Mexico," most probably from somewhere in Hidalgo or near Temascaltepec. From these average birds, that is those with moderately restricted abdominal patch and streaked under tail coverts, two extremes may well be recognized, the southern one Sayornis nigricans aquatica Sclater and Salvin (type locality, Dueñas, Guatemala) ranging from Guatemala to western Panama, and the northwestern one Sayornis nigricans semiatra (Vigors) extending from northwestern Mexico north into the United States. Frankly, I have not seen sufficient material to be specific as to the latitude of the northern limit of the range of nigricans. However, semiatra certainly goes south on the Pacific slope of Sonora and Chihuahua to at least the northern part of Sinaloa.

My reasons for not recognizing Sayornis nigricans amnicola Bangs of western Panama may be inferred from the above, but will be detailed specifically in another report.

Empidonax difficilis difficilis Baird


Dickey collection.—Tecoripa, 5 (March 15 to 28, 1929); San Javier, 4 (April 13 to 22, 1929); Saric, 17 (May 15 to September 24, 1929); Tésia, 4 (December 15 to 29, 1929; March 23, 1930); Chinobampo,
5 (February 15 to March 5, 1930); Guirocoba, 5 (April 17 to May 17, 1930).

Although present throughout the summer and breeding at Saric the other records are more probably those of migrants and winter visitants.

In this series of western flycatchers there are two forms represented. One is the smaller, more greenish race breeding along the Pacific coast north to Alaska, the other is the larger, duller colored, interior bird which occurs in the southern Rocky Mountains and the Modoc region of California. While the two are easily discriminated when in typical form, the complications of age characters and color phases, coupled with lack of knowledge of the geographic behavior of the species in the mountains of northern Mexico make formal subdivision inadvisable at present. The whole difficilis group of flycatchers is sadly in need of revision, but the scarcity of specimens definitely known to be breeding birds puts difficulties in the path of such an undertaking at this time. This species is a late migrant and even so late a date as June 1 may be open to the suspicion that one has in hand a migratory rather than a resident individual.

In this connection I wish to go on record as convinced of the validity of the Santa Barbara Islands race Empidonax difficilis insulicola. If only specimens known to be breeding are considered the subspecies is recognizable on the characters (particularly of coloration) ascribed to it by Dr. Oberholser in the Auk, 14, 1897, 300.

**Empidonax traillii brewsteri** Oberholser  

Dickey collection.—Saric, 6 (May 25; August 15 to 30; September 9, 1929); Guirocoba, 1 (May 22, 1930).

Bancroft collection.—N. end of Tiburón Island, 1 (May 22, 1930).

**Empidonax wrightii** Baird  

Dickey collection.—Tecoripa, 2 (March 1, 27, 1929); San Javier, 2 (April 12, 17, 1929); Saric, 2 (August 13, 21, 1929); Obregón, 1 (November 16, 1929); Tésia, 3 (November 30; December 12, 22, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).
Empidonax griseus Brewster


Dickey collection.—Tecoripa, 7 (March 1 to 31, 1929); San Javier, 1 (April 17, 1929); Obregón, 4 (November 3 to 22, 1929); Tésia, 3 (December 21, 22, 1929; March 22, 1930); Chinobampo, 2 (February 9, 18, 1930).

Empidonax fulvifrons pygmaeus Coues

_Empidonax pygmaeus_ Coues, Ibis, October, 1865, 537 (Fort Whipple, Arizona).

Dickey collection.—Tésia, 1 (December 28, 1930).

Myiochanes pertinax pallidiventris (Chapman)

Contopus pertinax pallidiventris Chapman, Auk, 14, July, 1897, 310 (Pima County, Arizona).

Dickey collection.—Saric, 1 (August 25, 1929); Chinobampo, 3 (February 15; March 4, 1930).

Myiochanes richardsonii richardsonii (Swainson)

_Tyranntula richardsonii_ Swainson. Fauna Bor.-Am., 2, 1831, 146, pl. 46, lower fig. (Cumberland House, Saskatchewan, Canada).

Dickey collection.—Saric, 33 (May 29 to September 18, 1929); San Javier, 1 (April 23, 1929); Guircoba, 1 (May 6, 1930); Guásimas Lagoon, 1 (May 12, 1930); San José de Guaymas, 1 (May 7, 1930).

There are two distinct types of wood pewees present in the above series. The breeding type (Saric) is very pale and slightly smaller than _richardsonii_ of the Pacific coast. Slightly larger and very much darker birds, recognizable in both the adult and juvenile states, appear in mid-August after which date both forms are present. The Dickey collection contains four breeding specimens (June 10 to July 14) from Colonio Pacheco, Chihuahua, which are of the same pale type as the Saric breeding birds. Whether this race is really _Myiochanes richardsonii veliei_ of Coues as suggested by Ridgway (Birds No. & Mid. Amer., pt. 4, p. 522 footnote) I do not know.

Just as in the case of _Empidonax difficilis_ the recognition or description of an additional subspecies will not clarify, but rather confuse, the situation. Only a thorough revision of the species as a whole by someone with the necessary experience and perception to follow the intricacies of
sex, age, color phase and late migration will clear up the problems presented.

**Pyrocephalus rubinus mexicanus** Sclater


Dickey collection.—El Doctór, 1 (January 27, 1929); Pesqueira, 2 February 24, 25, 1929); Tecoripa, 5 (March 1 to 20, 1929); San Javier, 1 (April 6, 1929); Saric, 11 (May 10; August 31, 1929); Obregón, 1 (November 22, 1929); Tésia, 1 (December 12, 1929). Noted at Tóbari Bay (April 26 to May 1) and at Guaymas (April 22 to May 14).

Bancroft collection.—El Alamo, 2 (July 3, 1928); Agiabampo, 1 (June 9, 1930).

San Diego Society of Natural History collection.—San Luis, 3 (December 31, 1922).

**Camptostoma imberbe ridgwayi** (Brewster)


Dickey collection.—San Javier, 2 (April 10, 21, 1929); Saric, 7 (May 9 to August 27, 1929); Chinobampo, 2 (March 4, 1930); Guirocoba, 1 (April 19, 1930).

**Otocoris alpestris adusta** Dwight

*Otocoris alpestris adusta* Dwight, Auk, 7, April, 1890, 148 (Fort Huachuca, Arizona).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

**Tachycineta thalassina thalassina** (Swainson)

*Hirundo thalassinus* Swainson, Philos. Mag. new series, 1, 1827, 366 (Real del Monte, Hidalgo, Mexico).

Dickey collection.—Tecoripa, 1 (March 26, 1929); Tésia, 1 (March 26, 1930).

These two specimens are far larger than any of a long series of *lepidida* from the western United States. In addition one of them, the adult male from Tésia, has the back strongly purplish and the upper tail coverts with green predominant over purple. Similar examples are at hand from Pacheco, Chihuahua. While none of these are typical *thalassina*, they are
evidently best referable to that race. It is not improbable that the northern
plateau birds are separable from *thalassina* proper.

Tésia: Male, Wing, 120; Tail, 52.
Tecoripa: Female, Wing, 117; Tail, 45.

**Tachycineta thalassina lepida** Mearns

(Laguna Mts., San Diego County, California).

Dickey collection.—El Doctór, 1 (February 10, 1929); Tecoripa, 3
(March 2, 23, 1929); Tésia, 8 (March 16 to 18, 1930); Guirocoba,
1 (May 10, 1930).

The Northern Violet-Green Swallow appears to be a generally
distributed migrant and a less common mid-winter visitant. The El
Doctór record is the second occurrence to be recorded in winter from the
[doubtful]) and it is not unlikely that this region is regularly a wintering
ground for a certain number of individuals (see also van Rossem, Condor,
13, 1911, 133).

**Tachycineta thalassina brachyptera** Brewster

*Tachycineta thalassina brachyptera* Brewster, Bull. Mus. Comp. Zool., 41, 1902,
167 (Sierra de la Laguna, Lower California).

Dickey collection.—Tésia, 1 (March 16, 1930); Guaymas, 2 (April 24;
May 3, 1930).

These beautiful little swallows were found to be breeding not un-
commonly in old woodpecker holes in the giant cactus about Guaymas.
They appear to be exactly like Lower California examples and thus present
a distribution more or less analagous to that of the Western Martin. Just
what the exact breeding ranges of *brachyptera* and *thalassina* are, in
Sonora, will require further field work. The probabilities are, however,
that *brachyptera* occupies the Arid Tropical lowlands and *thalassina* the
plateau country inland. Both forms were taken at Tésia, but the presence
of the two in one locality may be due, in the case of *thalassina*, to the
vagaries of migration. Measurements of the Sonora specimens of
*brachyptera* are:

2 males: Wing, 103-105; Tail, 40-42.
1 female: Wing, 102, Tail, 41.
**Iridoprocne bicolor** (Vieillot)

*Hirundo bicolor* Vieillot, Ois. Amer., September 1, 1807 (1808), 61, pl. 31 (Middle eastern United States).

Dickey collection.—El Doctóř, 2 (February 10, 1929).

**Iridoprocne albilinea** (Lawrence)


Dickey collection.—Tóbari Bay, 3 (April 27, 30, 1930).

Bancroft collection.—Agiabampo, 1 (June 9, 1930); Lobos Island, 2 (May 30, 1930); Guásimas Lagoon, 2 (May 12, 1930).

Compared with Costa Rica and El Salvador examples of the same season, Sonora birds average slightly more bluish (less greenish) and have slightly wider, white supra-loral streaks. However, these differences are very inconstant and some of the above specimens can be duplicated by Central American birds. In both *alfilinea* and *bicolor* the plumage is very much greener when freshly acquired and assumes a steely bluish hue with wear.

**Stelgidopteryx ruficollis serripennis** (Audubon)

*Hirundo serripennis* Audubon, Orn. Biog., 4, 1838, 593 (Charleston, South Carolina).

Dickey collection.—Saric, 1 (July 26, 1929); Tésia, 7 (March 14 to 18; April 5, 1930); Guaymas, 1 (May 7, 1930).

Bancroft collection.—San José de Guaymas, 1 (May 8, 1930).

The series upon which Griscom’s Sonora race, *psammochrous* (Proc. New Eng. Zool. Club, 11, December 14, 1929, 72), was based was collected in 1887-8. While the four specimens of that series which are before me are certainly different in color from any in a long series of *serripennis* I have no slightest doubt that post-mortem fade is entirely responsible for the alleged characters. None of the recently taken examples listed above are in any way separable from typical *serripennis*. The two breeding birds from Guaymas are, if anything, slightly darker than average California and Arizona specimens.

**Hirundo erythrogaster** Boddaert

*Hirundo erythrogaster* Boddaert, Table Pl. Enl., 1783, 45 (Cayenne).

Barn Swallows were noted as migrants at Guaymas, April 24, 1930, and at Tóbari Bay on April 28, 1930.
Petrochelidon albinfons albinfons (Rafinesque)

_Hirundo albinfons_ Rafinesque, Kentucky Gazette, February 14, 1822, 3, col. 4 (Newport, Kentucky).

Dickey collection.—Tésia, 1 (March 14, 1930).

_Progne subis hesperia_ Brewster

_Progne subis hesperia_ Brewster, Auk, 6, April, 1889, 92 [separates issued January 31, 1889] (Sierra de la Laguna, Lower California).

Dickey collection.—Saric, 22 (June 3 to August 16, 1929); Tóbari Bay, 3 (April 26, 1930).

Bancroft collection.—El Alamo, 7 (July 3, 1928); N. end of Tiburón Island, 2 (May 22, 1930).

All of the Sonora specimens are typical of _hesperia_, with a Lower California series of which (Mus. Vert. Zool.) they have been carefully compared. I agree with Grinnell (Condor, 30, 1928, 122) that so far as the Pacific coast is concerned, the name _subis_ is the best one to apply to birds from north of the Lower California boundary and conversely that _hesperia_ should be used for all Lower California breeding martins. That typical _hesperia_ does occur north of the Arizona-Sonora line is shown by a series of 9 May and June specimens (Dickey collection) from Tucson. These are supposedly breeding birds. At the same time four breeding birds from the Chiricahua Mountains are good _subis_. Whether this same manner of distribution (i.e., _subis_ in the highlands and _hesperia_ in the lower hill country and lowlands) extends into Sonora remains to be shown, although such is to be predicted. Wright notes that the Saric series was taken from a colony breeding in old woodpecker holes in the giant cactus at an altitude of 3700 feet.

_Cyanocitta stelleri diademata_ (Bonaparte)

_Cyanogarrulus diadematus_ Bonaparte, Consp. Avium, 1, 1850, 377 (Zacatecas, Mexico).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

Wright also observed this jay at Saric on June 9, 1929.

_Aphelocoma sieberii arizonae_ (Ridgway)

_Cyanocitta ultramarina_ var. _arizonae_ Ridgway, Bull. Essex Inst., 5, December, 1873, 199 (Old Fort Buchanan, Pima County, Arizona).

Dickey collection.—Nogales, 1 (February 17, 1929); Saric, 6 (June 6 to 26, 1929).
Cissilopha beecheii (Vigors)


Dickey collection.—Chinobampo, 6 (February 11 to March 9, 1930); Guirocoba, 1 (May 2, 1930).

In spite of Ridgway’s comments on the shape of the bills of some Sonora specimens, I am unable to detect the slightest difference between the seven Sonora examples at hand and three from San Blas, Nayarit, (Calif. Acad. Sci.) in size or shape of bill or in the shade or intensity of the blue on the upper parts.

Although there is no question that the young of this species have yellow bills there is good reason to suppose that in fully mature specimens the bills of some never become black, but remain yellow throughout life. The bills of the related *Cissilopha melanocyanea* are yellow in the immature stages, but become dead black (in apparently all cases) when the birds are about a year old.

Callucitta colliei (Vigors)


Dickey collection.—Chinobampo, 6 (February 8 to 23, 1930).

Noted by Wright at San Javier, April 22, 1929; Guirocoba, April and May, 1930; in the latter locality very commonly.

Corvus imparatus Peters


Dickey collection.—Tésia, 9 (December 15 to 28, 1929). Also “plentiful” at Chinobampo from February to March, 1930, and at Guirocoba in April and May, 1930 (Wright).

Bancroft collection.—Agiabampo, 2 (June 8, 9, 1930).

Careful comparison with an east coast (Tamaulipas) series of five skins (Mus. Comp. Zool.) fails to disclose any geographic differences whatever.

Meinertzhagen (Novit. Zool., 33, October, 1926, 87-88) considers the Mexican Crow conspecific with the Fish Crow of the eastern United States, but I fail to see the slightest reason for so doing.
Corvus cryptoleucus Couch


Bancroft collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Noted by Wright as “fairly common” at Saric from May to September, 1929.

Corvus corax sinuatus Wagler

*Corvus sinuatus* Wagler, Isis, 22, 1829, 748 (Mexico).

Dickey collection.—Tecoripa, 1 (March 1, 1929); Tesia, 1 (March 27, 1930).

Noted at San Pedro Martir Island; San Estéban Island; San Pedro Nolasco Island; and nesting (late April) at all three localities. Common about Guaymas in late April and early May, but nesting data are lacking. Wright records them from Chinobampo in March, Guirocoba in April and May, San Javier in April and Obregon in October and November.

The status of the insular ravens both on the Pacific side and in the Gulf remains to be determined. A single specimen from the San Benito Islands and one from San Lorenzo Island in the Gulf both appear to be indistinguishable from Clarion Island birds.

Baeolophus wollweberi annexus (Cassin)


Dickey collection.—Saric, 8 (May 14 to June 26, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Auriparus flaviceps flaviceps (Sundevall)


Dickey collection.—El Doctór, 5.

San Diego Society of Natural History collection.—San Felix Mine, 1.

Auriparus flaviceps ornatus (Lawrence)


Dickey collection.—Saric, 12; Pesqueira, 4.
Auriparus flaviceps fraterculus van Rossem


Dickey collection.—Tecoripa, 2; San Javier, 1; Tésia, 1; Chinobampo, 3; San Estéban Island, 3; Obregon, 3; Guaymas, 4; Tóbari Bay, 2.

Bancroft collection.—San Estéban Island, 2; Tiburón Island, 1; Tóbari Bay, 1.

**Sitta carolinensis nelsoni** Mearns


Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

**Troglodytes aëdon parkmanii** Audubon


Dickey collection.—Tecoripa, 2 (March 7, 21, 1929); Obregón, 3 (November 12, 15, 1929); Tésia, 3 (December 28, 29, 1929; March 20, 1930); Chinobampo, 1 (March 3, 1930).

**Thryomanes bewickii eremophilus** Oberholser

*Thryomanes bewickii eremophilus* Oberholser, *Proc. U. S. Nat. Mus.*, 21, 1898, 427 (Big Hatchet Mountains, Grant County, New Mexico).

Dickey collection.—Saric, 18 (May 11 to September 24, 1929).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

**Pheugopedius felix sonorae** van Rossem


Dickey collection.—Chinobampo, 1 (February 10, 1930); Guirocoba, 1 (May 3, 1930).

**Pheugopedius sinaloa cinereus** (Brewster)

*Thryophilus sinaloa cinereus* Brewster, *Auk*, 6, April, 1889, 96 (Alamos, Sonora, Mexico).

Dickey collection.—San Javier, 1 (April 5, 1929); Guirocoba, 6 (April 23 to May 21, 1930).
Heleodytes brunneicapillus brunneicapillus (Lafresnaye)


Dickey collection.—Tecoripa, 6; San Javier, 8; Obregón, 4; Tésia, 3; Chinobampo, 4.

Bancroft collection.—6 mi. N. of Guaymas, 1; 25 mi. S. W. of Obregón, 1; Agiabampo, 1; Tiburón Island, 1.

The Tiburón Island specimen is placed under *brunneicapillus* only provisionally. Both it and another example from the same locality (Amer. Mus. Nat. Hist. coll.) are extremely gray dorsally and the posterior underparts are only very faintly tinged with buff. In size and in the large spotting on the flanks the closest resemblance is to *brunneicapillus*. It appears probable that a series of birds from Tiburón Island would show the advisability of recognizing still another race.

Heleodytes brunneicapillus couesi (Sharpe)

*Campylorhynchus couesi* Sharpe, Cat. Birds Brit. Mus., 6, 1881, 196 (Laredo, Texas).

Dickey collection.—Saric, 5; Pesqueira, 4.

Bancroft collection.—12 mi. W. of Magdalena, 3.

San Diego Society of Natural History collection.—Sásabe Valley, near International Boundary, 1; San Felix Mine, 2.

Heleodytes gularis (Sclater)


Dickey collection.—Guirocoba, 1 (May 19, 1930; “mating”).

Telmatodytes palustris aestuarinus Swarth

*Telmatodytes palustris aestuarinus* Swarth, Auk, 34, 1917, 310 (Grizzly Island, Solano County, California).

Dickey collection.—El Doctór, 1 (January 27, 1929).

Catherpes mexicanus mexicanus (Swainson)

*Thryothorus mexicanus* Swainson, Zool. Illustr., 2nd ser., 1, 1829, pl. 11 (Real del Monte, Hidalgo, Mexico).

Dickey collection.—Chinobampo, 2 (February 27; March 8, 1930).

The name “polioptilus” Oberholser (Auk, 20, 1903, 197) is, as Ridgway remarks, not the designation for a stable form, but rather of a series of variable intergrades connecting *mexicanus* with *albifrons*, con-
persus and punctulatus. This being the case its recognition is open to serious question.

The two specimens from Chinobampo are decidedly closer to typical mexicanus than to any other race. In color they are very nearly typical, but are slightly smaller in size.

Catherpes mexicanus conspersus Ridgway
Catherpes mexicanus, var. conspersus Ridgway, Amer. Nat., 7, October, 1873, 603 (Fort Churchill, Nevada).

Dickey collection.—San Javier, 2 (April 3, 1929).

One of these birds is typical conspersus, the other an intermediate toward mexicanus.

Salpinctes obsoletus obsoletus (Say)
Troglodytes obsoleta Say, in Long’s Exped., 2, 1823, 4, note (Northern Douglass County, Colorado).

Dickey collection.—El Doctór, 1 (January 21, 1929).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Mimus polyglottos leucopterus (Vigors)
Orpheus leucopterus Vigors, in Zool. Beechey’s Voyage, 1839, 17 (West coast of America).

Dickey collection.—Pesqueira, 6; Tecoripa, 2; San Javier, 1; Saric, 1; Obregón, 3; Tésia, 2; Chinobampo, 3; Guirocoba, 1.

Bancroft collection.—El Alamo, 1; 12 mi. W. of Magdalena, 1.

San Diego Society of Natural History collection.—Sásabe Valley, near International Boundary, 1.

Melanotis caerulescens effuticus Bangs and Penard

Dickey collection.—Chinobampo, 1 (February 28, 1930).

Toxostoma curvirostre maculatum (Nelson)
Harporhynchus curvirostris maculatus Nelson, Auk, 17, 1900, 269 (Alamos, Sonora).

Dickey collection.—Tecoripa, 3; Obregón, 5; Tésia, 4; Chinobampo, 2; Tóbari Bay, 3; Guirocoba, 4.
Bancroft collection.—Cajeme [= Obregón], 1.

The range of this race is a relatively restricted one and closely parallels the cases of the two species of *Lophortyx*. In other words, the lower Yaqui Valley appears to be the most northwesterly region of occurrence.

The race *maculatum* is not a very strongly marked one and the high degree of variability to which this species is subject makes the determination of single specimens at times a difficult matter. In size the form is really an intermediate one connecting *occidentale* with *palmeri*, but as a whole possesses sufficiently stable color characters over a definite area to make its recognition well worth while. In addition to the deeper coloration *maculatum* may be distinguished from typical *palmeri* by the longer tail. One year old birds average decidedly smaller than adults in all dimensions.

10 adult male *palmeri* from Fort Lowell, Arizona.
Wing, 106.3; Tail, 116.8.

10 adult male *maculatum* from southern Sonora.
Wing, 106.6; Tail 122.0.

**Toxostoma curvirostre palmeri** (Coues)

*Harporhynchus curvirostris* var. *palmeri* Coues, Key N. A. Birds, 1872, 351 (Tucson, Arizona).

Dickey collection.—Saric, 2; Guaymas, 3; 10 mi. N. of Guaymas, 3; San José de Guaymas, 1; San Javier, 8; Pesqueira, 3.

Bancroft collection.—12 mi. W. of Magdalena, 1; 6 mi. N. of Guaymas, 1.

San Diego Society of Natural History collection.—15 mi. W. of Nogales, 1; Sásabe Valley, near International Boundary, 3; Altar, 1; Pitiquito, 1.

Sonora specimens from the range outlined above are, with the exception of the most northwesterly ones, not typical of any race, but appear to be best referable to *palmeri*. Those from the foothills or localities adjacent to the foothills, such as Saric and San Javier, show definite tendencies toward *curvirostre*, while those from Pesqueira and about Guaymas are variously intermediate toward *maculatum*. The series of eight birds from this latter locality is very much closer to *palmeri* and the citation of that place as a record station for *maculatum* (see Ridgway, Birds No. and Mid. Amer., pt. 4, 1907, 202) would appear to be in error.
Toxostoma curvirostre insularum van Rossem


Dickey collection.—San Esteban Island, 1 (April 18, 1930).
Bancroft collection.—Tiburón Island, 2 (May 22, 1930).

Toxostoma bendirei (Coues)


Dickey collection.—Pesqueira, 1 (February 23, 1929); Tecoripa, 3 (March 1, 9, 15, 1929); Obregón, 1 (November 12, 1929); Tésia, 3 (December 8, 27, 1929; March 17, 1930); Guaymas, 2 (May 10, 1930).

Bancroft collection.—8 mi. N. of Guaymas, 1 (June 25, 1928); 12 mi. W. of Magdalena, 1; Guaymas, 2 (April, 1930).

This species is permanently resident south as far as Guaymas and was found breeding in that locality. Although present in winter and spring in the Mayo River Valley the occurrences there at that season may be due to a southward winter shifting.

Toxostoma lecontei lecontei Lawrence


San Diego Society of Natural History collection.—Port Lobos, 1 (August 19, 1894).

Toxostoma crissale crissale Henry


Dickey collection.—Pesqueira, 1 (February 24, 1929).

A nest containing three eggs which were on the point of hatching was found between Empalme and Guaymas on May 14, 1930. Both parents were seen, but neither could be collected.

Oroscopites montanus (J. K. Townsend)


Dickey collection.—El Doctór, 2 (January 30; February 4, 1929).
**Turdus migratorius propinquus** Ridgway


Dickey collection.—El Doctor, 4 (January 27, 31; February 9, 1929).

Bancroft collection.—15 mi. S. of Nogales, 2 (February 25, 1929).

Three of the four winter-taken robins from the Colorado River Delta belong, without much doubt, to an undescribed race. They are very pale and are ashy gray even on the pileum, and lack entirely the olivaceous tones of winter *propinquus*.

**Turdus rufo-palliatus** Lafresnaye

*Turdus rufo-palliatus* Lafresnaye, Rev. Zool., 1840, 259 (“Monterey, California” [error]).

Dickey collection.—Chinobampo, 2 (February 21, 25, 1930); Guirocoba, 2 (May 20, 25, 1930).

I can appreciate no difference between these four Sonora skins and birds in comparable plumage from Nayarit and Colima.

**Hylocichla ustulata ustulata** (Nuttall)


Dickey collection.—Saric, 3 (May 9 to 22, 1929); Guirocoba, 6 (May 10 to 22, 1930).

**Hylocichla guttata guttata** (Pallas)


Dickey collection.—El Doctor, 1 (January 30, 1929); Tecoripa, 1 (March 23, 1929); Chinobampo, 1 (February 19, 1930).

**Hylocichla guttata slevini** Grinnell

*Hylocichla aonalaschkae slevini* Grinnell, Auk, 18, July, 1901, 258 (Near Point Sur, Monterey County, California).

Dickey collection.—Chinobampo, 2 (March 2, 9, 1930).

**Sialia mexicana bairdi** Ridgway

*Sialia mexicana bairdi* Ridgway, Auk, 11, 1894, 151, 157 (Cactus Pass, Mohave County, Arizona).

Dickey collection.—Nogales, 1 (February 17, 1929).
**Sialia currucoides** (Bechstein)


Dickey collection.—El Doctór, 1 (February 9, 1929).

Bancroft collection.—12 mi. W. of Magdalena, 3 (February 25, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

**Myadestes townsendi** (Audubon)

*Ptilogony's townsendi* Audubon, Birds. Amer. (folio), 4, 1838, pl. 419, fig. 2 (Near Astoria, Oregon).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

**Polioptila melanura lucida** van Rossem

*Polioptila melanura lucida* van Rossem, Condor, 33, January, 1931, 36 (10 mi. N. of Guaymas, Sonora).

Dickey collection.—El Doctór, 1; Pesqueira, 2; Tecoripa, 3; San Javier, 2; Saric, 4; Guaymas, 1; 10 mi. N. of Guaymas, 2.

Bancroft collection.—Guaymas, 1.

The Plumbeous Gnatcatcher appears to be permanently resident south as far as Guaymas coastwise. It overlaps the range of *restricta* at several points.

**Polioptila caerulea amoenissima** Grinnell


Dickey collection.—El Doctór, 1 (February 1, 1929); Pesqueira, 3 (February 21, 24, 26, 1929); Tecoripa, 2 (March 10, 11, 1929); Saric, 2 (September 15, 24, 1929); Tésia, 6 (December 4, 29, 1929; March 20, 1930); Chinobampo, 3 (February 10, 18; March 5, 1930); Obregón, 9 (November 3 to 22, 1929).

None of these specimens represents breeding birds. The winter distribution appears to be quite general.

**Polioptila nigriceps restricta** Brewster

*Polioptila nigriceps restricta* Brewster, Auk, 6, 1889, 97 [Separates issued January 31, 1889] (Alamos, Sonora).

Dickey collection.—Tecoripa, 3; San Javier, 6; Tésia, 2; Chinobampo, 4; Obregón, 2; Tóbari Bay, 1; 10 mi. N. of Guaymas, 2; Guirocoba, 2.
Corthylio calendula cineraceus (Grinnell)
Regulus calendula cineraceus Grinnell, Condor, 6, 1904, 25 (Mt. Wilson, Los Angeles County, California).
Dickey collection.—Nogales, 1 (February 17, 1929); El Doctór, 1 (February 1, 1929); Pesqueira, 3 (February 21, 24, 25, 1929); Tecoripa, 4 (March 27, 28, 1929); San Javier, 1 (April 10, 1929); Tésia, 4 (December 14 to 28, 1929; March 18, 1930).

Anthus spinoletta rubescens (Tunstall)
Dickey collection.—El Doctór, 5 (January 21, 30, 31, 1929).

Bombycilla cedrorum Vieillot
Bombycilla cedrorum Vieillot, Ois. Amer., September 1, 1807 (1808), 88, pl. 57 (Eastern North America?).
Dickey collection.—Saric, 10 (May 17 to 23, 1929); Guirocoba, 1 (April 28, 1930).

Phainopepla nitens lepida Van Tyne
Dickey collection.—Saric, 15 (May 9 to June 25, 1929); Obregón, 1 (November 9, 1929); Tésia, 2 (March 27, 1930); Chinobampo, 2 (February 13; March 9, 1930).
Bancroft collection.—El Alamo, 1 (June 1, 1928); 10 mi. W. of Magdalena, 2 (February 25, 1929).
San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 2 (January 13, 1928).
In addition to the above localities Phainopeplas were not uncommon, and were apparently nesting, near Guaymas in late April and early May, 1930.

Lanius ludovicianus sonoriensis A. H. Miller
Dickey collection.—El Doctór, 5 (January 25, 31; February 1, 5, 1929); Saric, 1 (August 9, 1929); Tésia, 1 (November 29, 1929); Tecoripa, 2 (March 9, 17, 1930).
Bancroft collection.—15 mi. S. W. of Nogales, 2 (January 13, 1928);
15 mi. S. of Nogales, 1 (February 17, 1929); 12 mi. W. of Magdalena, 1 (February 25, 1929).
San Diego Society of Natural History collection.—San Luis, 1 (December 31, 1922).

**Lanius ludovicianus gambeli** Ridgway


Dickey collection.—Obregon, 6 (October 31 to November 19, 1929); Tésia, 12 (January 29 to December 29, 1929; March 17, 1930); Tecoripa, 1 (March 15, 1930).
Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

This race appears to be a common winter visitant on the coastal plain and in the foothills as far south as the lower Yaqui River Valley and, if the relative numbers in the present collections are a true indication, outnumbers at that season the resident *sonoriensis*.

With every desire to recognize *Lanius ludovicianus nevadensis* A. H. Miller I am unable to do so. According to the material at hand, which is quite extensive and includes specimens from various parts of the range of "nevadensis", it is simply an intergrade between *gambeli* and *sonoriensis*. Some of the Sonora winter birds have been identified by Miller as *gambeli* and others as "nevadensis". In the latter case I have included them under either *sonoriensis* or *gambeli* according to the predominance of characters.

**Vireo huttoni stephensi** Brewster

San Diego Society of Natural History collection.—15 mi. S. W. Nogales, 1 (January 13, 1928).

**Vireo bellii arizonae** Ridgway


Dickey collection.—San Javier, 4 (April 10 to 18, 1929); Saric, 10 (May 22 to September 16, 1929); Obregon, 1 (November 15, 1929); Tésia, 2 (December 9, 12, 1929); Chinobampo, 3 (February 14 to March 14, 1930); 10 mi. N. of Guaymas, 2 (May 9, 1930).
Bancroft collection.—Tóbari Bay, 2 (April 27, 1930).
Vireo vicinior Coues

Dickey collection.—Saric, 1 (September 15, 1929).

Vireo solitarius cassini Xantus

Dickey collection.—Tecoripa, 1 (March 23, 1929); Saric, 3 (August 24 to September 18, 1929); Chinobampo, 1 (February 21, 1930).

Vireo solitarius plumbeus Coues

Dickey collection.—Tésia, 4 (December 16, 17, 1929; March 18, 19, 1930); Chinobampo, 3 (February 15 to March 7, 1930).

Vireo gilvus swainsonii Baird

Dickey collection.—Tecoripa, 2 (March 21, 1929); San Javier, 4 (April 9 to 24, 1929); Saric, 5 (May 10 to September 22, 1929); Tésia, 4 (March 18 to 23, 1930); Guirocoba, 3 (May 17 to 23, 1930).
Bancroft collection.—San José de Guaymas, 1 (May 8, 1930).

Vermivora luciae (J. G. Cooper)

Dickey collection.—Tecoripa, 1 (March 27, 1929); Saric, 14 (May 10 to August 29, 1929); Tésia, 1 (March 17, 1930).

Vermivora virginiae (Baird)

*Helminthophaga virginiae* Baird, in Birds N. A., 1860, xi, note, pl. 79, fig. 1 (Fort Burgwyn, New Mexico).
Dickey collection.—Guirocoba, 2 (May 7, 1930).

Vermivora ruficapilla ridgwayi van Rossem

Dickey collection.—San Javier, 6 (April 11 to 25, 1929); Saric, 5
The Chinobampo record indicates winter residence in southern Sonora.

**Vermivora celata celata** (Say)

*Sylvia celatus* Say, in Long’s Exped., 1, 1823, 169, note (Engineer Cantonment, near Omaha, Nebraska).

Dickey collection.—San Javier, 1 (April 19, 1929); Obregón, 1 (November 7, 1929); Tésia, 3 (December 14 to 22, 1929); Chinobampo, 1 (February 14, 1930); Guirocoba, 1 (April 18, 1930).

**Vermivora celata oreastera** Oberholser

*Vermivora celata oreastera* Oberholser, Auk, 22, 1905, 243 (Willis, New Mexico).

Dickey collection.—Tecoripa, 1 (March 1, 1929); San Javier, 5 (April 17 to 23, 1929); Tésia, 3 (December 4, 17, 1929; March 20, 1930).

**Vermivora celata lutescens** (Ridgway)


Dickey collection.—Tecoripa, 3 (March 11 to 30, 1929); San Javier, 1 (April 11, 1929); Saric, 2 (September 16 to 20, 1929); Obregón, 3 (November 3, 7, 21, 1929); Tésia, 3 (December 12, 16, 1929); Chinobampo, 1 (February 28, 1930).

**Compsothlypis pitiayumi pulchra** Brewster

*Compsothlypis pulchra* Brewster, Auk, 6, April 1889, 93 [Separates issued January 31, 1889] (Hacienda de San Rafael, Chihuahua).

Dickey collection.—Guirocoba, 13 (April 20 to May 26, 1930).

**Dendroica erithachorides castaneiceps** Ridgway


Dickey collection.—Tóbari Bay, 10.

Bancroft collection.—Tóbari Bay, 4; Guaymas, 1; Kino Bay, 1; Tepopa Bay, 1.

**Dendroica aestiva rubiginosa** (Pallas)

*Motacilla rubiginosa* Pallas, Zoogr. Rossio-Asiatica, 1, 1826, (1811?), 496 (Kadiak, Alaska).

Dickey collection.—Guaymas, 1 (May 3, 1930).

Bancroft collection.—San José de Guaymas, 1 (May 8, 1930).
Dendroica aestiva morcomi Coale

*Dendroica aestiva morcomi* Coale, Bull. Ridgway Orn. Club, no. 2, April, 1887, 82 (Fort Bridger, Wyoming).

Dickey collection.—Saric, 8 (May 23 to 25; July 31 to September 9, 28, 1929); Guirocoba, 2 (May 5, 7, 1930).

Bancroft collection.—San José de Guaymas, 1 (May 8, 1930).

I believe the Rocky Mountain race of the yellow warbler to be distinguishable from *aestiva* by slightly larger size and duller (less yellowish) green coloration and from *brewsteri* by decidedly larger size and (in the males) by heavier breast streaking. To *morcomi* I would assign the breeding birds from the Great Basin slope of the Sierra Nevada and Cascade ranges. Extreme western localities for *morcomi* as represented in the Dickey collection are Inyo and Mono counties, the Truckee River in Nevada County, California, and Benton County, Washington.

Dendroica aestiva brewsteri Grinnell

*Dendroica aestiva brewsteri* Grinnell, Condor, 5, 1903, 72 (Palo Alto, California).

Dickey collection.—Guirocoba, 2 (May 7, 9, 1930).

Dendroica aestiva sonorana Brewster

*Dendroica aestiva sonorana* Brewster, Auk, 5, April, 1888, 137 [separates issued Feb. 10, 1888] (Oposura, Sonora).

Dickey collection.—Saric, 15 (May 28 to August 24, 1929); Tésia, 1 (March 9, 1930).

*Sonorana* is the only race of yellow warbler known to breed within the state, the three previously listed ones being migrants.

Dendroica coronata hooveri McGregor

*Dendroica coronata hooveri* McGregor, Condor, 1, 1899, 32 (Palo Alto, California).

Dickey collection.—El Doctór, 1 (February 3, 1929); Tecoripa, 1 (March 30, 1929).

Dendroica auduboni auduboni (J. K. Townsend)


Dickey collection.—El Doctór, 9 (January 20, 27, 30; February 3, 1929); Pesqueira, 1 (February 23, 1929); Tecoripa, 5 (March 1 to 30, 1929); Obregón, 7 (November 3 to 21, 1929); Tésia, 5 (November
29 to December 31, 1929); Chinobampo, 2 (February 21, 22, 1930). Bancroft collection.—15 mi. S. of Nogales, 1 (February 25, 1929).
San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 4 (January 13, 1928).

**Dendroica auduboni memorabilis** Oberholser

*Dendroica auduboni memorabilis* Oberholser, Ohio Journ. Sci., 21, no. 7, June 6, 1921, 243 (Ward, Boulder County, Colorado).
Dickey collection.—San Javier, 2 (April 21, 22, 1930).

**Dendroica nigrescens** (J. K. Townsend)

Dickey collection.—San Javier, 5 (April 5 to 24, 1929); Saric, 3 (August 28; September 13, 1929); Tésía, 3 (December 4, 29, 1929; March 18, 1930); Chinobampo, 1 (March 3, 1930); Guirocoba, 2 (April 28, May 1, 1930).

**Dendroica townsendi** (J. K. Townsend)

Dickey collection.—San Javier, 3 (April 23 to 25, 1929).
Bancroft collection.—San José de Guaymas, 2 (May 8, 1930).

**Dendroica occidentalis** (J. K. Townsend)

Dickey collection.—Saric, 1 (May 8, 1929); San Javier, 1 (April 21, 1929).

**Seiurus noveboracensis notabilis** Ridgway

Dickey collection.—Tóbari Bay, 1 (April 26, 1930).

Several water thrushes, other than the single specimen taken, were seen in the mangroves at Tóbari Bay. Presumably they were all of the subspecies *notabilis*.

**Oporornis tolmiei** (J. K. Townsend)

Dickey collection.—San Javier, 2 (April 10, 15, 1929); Saric, 6 (May 22; August 15 to September 16, 1929); Chinobampo, 1 (March 7, 1930); Guirocoba, 2 (April 28; May 9, 1930).

A common fall migrant from August 15 to September 16 and equally common in spring from March 7 to May 9. Specimens taken, but not preserved, at Guaymas on April 22 and 24, 1930, are the only records for a coastal locality. The main migration route apparently follows the foothills inland.

**Geothlypis trichas occidentalis** Brewster


Dickey collection.—Tecoripa, 1 (March 21, 1929); Tésia, 2 (March 24, 1930); Guirocoba, 1 (March 15, 1930).

Detected only as a spring migrant.

**Geothlypis trichas chryseola** van Rossem

*Geothlypis trichas chryseola* van Rossem, Condor, 32, November 1930, 298 (Saric, Sonora, Mexico).

Dickey collection.—Saric, 12 (May 31 to June 25, 1929); Tecoripa, 1 (March 3, 1929).

For details of the manner of occurrence, ranges, etc. of *chryseola* and *modesta* see Condor as above.

**Geothlypis trichas modesta** Nelson

*Geothlypis trichas modesta* Nelson, Auk, 17, July, 1900, 269 (San Blas, Tepic [= Nayarit], Mexico).

Dickey collection.—Guásimas Lagoon, 1; Empalme, 1; Tóbari Bay, 4; Tésia, 1; Obregón, 1.

Bancroft collection.—Agiabampo, 1.

**Icteria virens longicauda** Lawrence


Dickey collection.—Tecoripa, 1 (March 28, 1929); Saric, 13 (May 22 to August 28, 1929); 10 mi. N. of Guaymas, 1 (May 10, 1930).

Bancroft collection.—Guaymas, 1 (April 22, 1930); Agiabampo, 1 (June 9, 1930).

The Saric, Agiabampo and 10 mi. N. of Guaymas records are those of breeding birds.
Wilsonia pusilla pileolata (Pallas)
Motacilla pileolata Pallas, Zoogr. Rosso-Asiatica, 1, 1826, (1811?) 497 (Kadiak, Alaska).
Dickey collection.—Tecoripa, 2 (March 28, 30, 1929); San Javier, 2 (April 11, 24, 1929); Saric, 8 (May 9 to 25; August 16 to 26, 1929); Guirocoba, 2 (April 17, 28, 1930).

Wilsonia pusilla chryseola Ridgway
Dickey collection.—Tecoripa, 5 (March 15 to 29, 1929); San Javier, 4 (April 5 to 24, 1929); Saric, 4 (August 21 to 25; September 22, 1929); Tésia, 1 (November 30, 1929); Chinobampo, 1 (March 2, 1930); Guirocoba, 1 (April 16, 1930).

Myioborus miniatus miniatus (Swainson)
Setophaga miniata Swainson, Philos. Mag., new ser., 1, 1827, 368 (Valladolid, Mexico).
Dickey collection.—Chinobampo, 1 (February 12, 1930).

Setophaga ruticilla (Linnaeus)
Motacilla ruticilla Linnaeus, Syst. Nat., ed 10, 1, 1758, 186 (Virginia).
Dickey collection.—Tóbari Bay, 1 (April 27, 1930).

Euthlypis lachrymosa tephra Ridgway
Dickey collection.—Guirocoba, 1 (May 4, 1930).

I am very much inclined to consider tephra a synonym of lachrymosa for, as in the cases of several other species taken by Frazer and Cahoon in the '80's, fade appears to be responsible, in part at least, for the supposed characters. Two recently taken skins of tephra (one from Sonora, the other from Nayarit) are absolutely indistinguishable in color from lachrymosa, while six of Frazar’s skins taken in 1888 are faded out and are typical tephra. The plumage of this species is subject to relatively rapid post-mortem color change, a fact which Mr. Dickey and the writer did not appreciate when they described Euthlypis lachrymosa schistacea from El Salvador (Condor, 28, 1926, 270). We, at that time, compared our fresh skins with relatively old ones of lachrymosa, which had already
become slightly paler and browner. However, *schistacea* appears to be a perfectly good race on account of its large and heavy bill as compared with both *lachrymosa* and *tephra*, a character which we failed to notice at the time it was described. While I do not feel justified in listing *tephra* as a synonym of *lachrymosa* on the basis of two specimens there is little doubt that such will be its ultimate disposition.

**Basileuterus rufifrons caudatus** Nelson


Dickey collection.—Guirocoba, 2 (April 23, 24, 1930).

**Passer domesticus domesticus** (Linnaeus)


Dickey collection.—Saric, 1 (May 11, 1929).

The English Sparrow has become firmly established in Guaymas and was numerous there in April and May, 1930. The path of ingress has most likely been along the railroad running southward from Nogales.

**Sturnella neglecta** Audubon


Dickey collection.—El Doctó, 9 (January 21 to 30, 1929); Pesqueira, 1 (February 24, 1929); Tecoripa, 1 (March 14, 1929); Tésia, 4 (December 15, 1929; March 17, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 3 (February 25, 1929); 15 mi. E. of Nogales, 2 (February 17, 1929).

San Diego Society of Natural History collection.—Sásabe Valley, near International Boundary, 2 (January 13, 1928).

All of the above specimens are typical of *neglecta* except for the nine from El Doctó in the Colorado River Delta. These latter birds are included under the name *neglecta* only tentatively and until breeding birds from that region become available for study. Their peculiarity lies not so much in the length of the bills as in the odd shape, for these are depressed or flattened for the terminal fourth, or more into almost paper thin and very flexible spatulae. Furthermore in actual length of bill these birds exceed the maximum recorded by Ridgway (*Birds. No. and Mid. Amer.*, pt. 2, 1902, 365). The three males of the series measure 36.7, 38.0, and 38.8 taken (as in Ridgway) from the base of the culmen. In the San
Diego Society of Natural History collection are two birds, known to be a breeding pair, which were taken near Bard, Imperial County, California, on March 28, 1930. The bills of these birds show the same extreme attenuation as do the El Doctór specimens (the male has a culmen of 39.0 mm.), but the bills are entirely normal in shape. There are several winter taken specimens from Imperial County, California, in the Dickey collection which are normal *neglecta*.

**Xanthocephalus xanthocephalus** (Bonaparte)


Dickey collection.—Obregón, 3 (November 1, 21, 1929).

**Agelaius phoeniceus sonoriensis** Ridgway

*Agelaius phoeniceus sonoriensis* Ridgway, Man. N. A. Birds, 1887, 370 (Camp Grant, Arizona).

Dickey collection.—Tecoripa, 2 (March 30, 31, 1929); Obregón, 4 (November 18 to 21, 1929); Tésia, 13 (December 19 to 22, 1929; March 24 to April 5, 1930).

The red-winged blackbird population of southern Sonora evidently centers in the lower Yaqui and Mayo River valleys and although I suspect them to be resident there, there is no certainty that this is the case. At any rate, there are no slightest differences evident between this series of 19 specimens and a much larger one from the far distant Colorado River colony. There are no positive records for *sonoriensis* from anywhere in the northern part of the state, all of the “Sonora” records from that section proving to be from Chihuahua localities.

**Icterus wagleri castaneopectus** Brewster

*Icterus wagleri castaneopectus* Brewster, Auk, 5, 1888, 91 (Oposura, Sonora).

Dickey collection.—San Javier, 3 (April 16, 17, 21, 1929); Chinobampo, 1 (February 12, 1930); Guirocoba, 12 (April 20 to May 26, 1930).

Bancroft collection.—Agiabampo, 2 (June 9, 1930).

In addition to the skins above listed, I have examined the series in the Brewster collection at the Museum of Comparative Zoology and am convinced that *castaneopectus* is a perfectly valid race. There appears to be no sharp division, the characters of *castaneopectus* (chestnut breast-band and slightly larger size) being gradually assumed toward the northern portions of the range. However, specimens from the extremes
of the range of the species are sufficiently distinct to make the recognition of two forms desirable.

**Icterus cucullatus nelsoni** Ridgway


Dickey collection.—San Javier, 4 (April 8 to 21, 1929); Saric, 9 (May 10 to August 16, 1929); Tésia, 6 (November 29, 1929; March 17 to 25, 1930); Chinobampo, 2 (February 15, 21, 1930); Guirocoba, 3 (April 17 to May 20, 1930); Guaymas, 3 (May 3, 1930); San José de Guaymas, 1 (May 7, 1930).

Bancroft collection.—Guaymas, 1 (June 22, 1928); 6 mi. N. of Guaymas, 1 (June 15, 1928); Tóbari Bay, 1 (April 27, 1930); Agiabampo, 2 (June 9, 1930).

The winter range of the Arizona Hooded Oriole apparently does not extend north of the lower Mayo River Valley.

**Icterus pustulatus** (Wagler)

*Ps[arocolius] pustulatus* Wagler, Isis, 22, 1829, 757 (No locality).

Dickey collection.—Tecoripa, 3 (March 12, 15, 28, 1929); San Javier, 2 (April 7, 16, 1929); Tésia, 16 (December 10, 1929 to March 25, 1930); Chinobampo, 6 (February 18 to March 2, 1930); San José de Guaymas, 5 (May 7, 8, 1930); Guirocoba, 3 (April 16 to May 16, 1930).

Bancroft collection.—Guaymas, 2 (June 24, 1928).

**Icterus bullockii bullockii** (Swainson)

*Xanthornus bullockii* Swainson, Philos. Mag., new ser., 1, 1827, 436 (Real del Monte, Hidalgo, Mexico).

Dickey collection.—San Javier, 3 (April 13, 15, 20, 1929); Saric, 13 (July 12 to September 8, 1929); Tésia, 1 (March 19, 1930); Guaymas, 1 (April 24, 1930); Guirocoba, 5 (April 19 to May 12, 1930).

Although breeding at Saric, all of the other records probably pertain to migrants.

**Cassidix mexicanus nelsoni** (Ridgway)


Dickey collection.—Obregón, 1; Tésia, 5; San José de Guaymas, 2; Tóbari Bay, 3; Guirocoba, 1.

Bancroft collection.—Guaymas, 1; 6 mi. N. of Guaymas, 1.
Euphagus cyanocephalus cyanocephalus (Wagler)
Psarocolius cyanocephalus Wagler, Isis, 22, 1829, 758 (Mexico).

Dickey collection.—El Doctór, 1 (January 27, 1929); Tecoripa, 5 (March 9 to 21, 1929); Tésia, 3 (December 19, 22, 1929).

Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1928).

Apparently a migrant and winter visitant only.

Molothrus ater obscurus (Gmelin)
Sturnus obscurus Gmelin, Syst. Nat., 1, 2, 1789, 804 (Mexico).

Dickey collection.—Saric, 14 (May 11 to August 18, 1929); Obregón, 2 (November 21, 23, 1929); Tésia, 10 (December 22 to 31, 1929; February 2, 1930); Guirocoba, 6 (May 3 to 28, 1930).

Bancroft collection.—Guaymas, 3 (June 23, 28, 1928).

Molothrus ater artemisiae Grinnell

Dickey collection.—Saric, 1 (August 10, 1929).

Tangavius aeneus aeneus (Wagler)
Psarocolius aeneus Wagler, Isis, 22, 1829, 758 (Mexico).

Dickey collection.—Saric, 18 (May 11 to August 10, 1929); Obregón, 4 (October 31 to November 21, 1929); Tésia, 1 (December 25, 1929); Guirocoba, 8 (May 1 to 22, 1930).

Bancroft collection.—Guaymas, 1 (June 28, 1928); El Alamo, 2 (July 3, 1928).

Piranga ludoviciana (Wilson)
Tanagra ludoviciana Wilson, Am. Orn., 3, 1811, 27, pl. 20, fig. 1 (Western Idaho).

Dickey collection.—Saric, 19 (May 15 to September 24, 1929); San José de Guaymas, 1 (May 8, 1930); Guirocoba, 7 (April 18 to May 15, 1930).

Present throughout the summer at Saric and presumably breeding there.

Piranga flava oreophasma Oberholser
Piranga hepatica oreophasma Oberholser, Auk, 36, 1919, 74 (Chisos Mts., Texas).

Dickey collection.—San Javier, 2 (April 7, 9, 1929); Saric, 1 (May 12, 1929); Chinobampo, 4 (February 8 to March 9, 1930).
I am unable to follow Zimmer's proposal to synonymize oreophasma with hepatica. While there is no doubt that the range of oreophasma as outlined by the original describer took in too much territory southerly (see Zimmer, Field Mus. Zool. Ser., 17, no. 5, 1922) that does not invalidate the name for extreme northwestern birds. It is unfortunate that the type of oreophasma was not chosen from Arizona or northern Sonora, for the extreme accentuation of characters is manifested there. Atlantic slope specimens, from even as far west as Chloride, New Mexico (Dickey collection) are more or less intermediate toward hepatica. How far south the breeding range of oreophasma extends I am not prepared to say. However, a pair of breeding (June) birds from as far north on the Pacific coast as Tepic, Nayarit (Dickey collection) are typical hepatica in all particulars.

Piranga rubra cooperi Ridgway


Dickey's collection.—Saric, 21 (May 9 to August 31, 1929); Guirocoba, 4 (May 5 to 12, 1930).

Cooper's Tanager appears to be present only as a summer visitant. This race in all probability occurs in the Lower Sonoran Zone in the Colorado River Delta, for it has been taken in summer on the Lower California side. However, actual Sonora specimens from that region seem to be lacking.

Three of the above specimens, two red males and a female, are by no means typical cooperi. They are very small and have short, slender bills which are smaller even than those of eastern rubra. The color is that of cooperi. They were taken at Saric on May 9, 11 and 23 respectively.

Richmondena cardinalis superba (Ridgway)

Cardinalis cardinalis superbus Ridgway, Auk, 2, 1885, 344 (Camp Lowell, Arizona).

Dickey collection.—Saric, 9; Pesqueira, 1.
San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 2.
Bancroft collection.—El Alamo, 1; 12 mi. W. of Magdalena, 2.

Richmondena cardinalis affinis (Nelson)

Dickey collection.—Tecoripa, 5; San Javier, 5; Obregón, 3; Tésia, 3; Chinobampo, 6; Guirocoba, 3; Guaymas, 3; Tóbari Bay, 2.

Bancroft collection.—Guaymas, 1; Kino Bay, 1.

**Pyrrhuloxia sinuata sinuata** (Bonaparte)

*Cardinalis sinuatus* Bonaparte, Proc. Zool. Soc. Lond., 1837 (June 1838), 111 (“Western parts of Mexico” [=Zacatecas]).

Dickey collection.—Tecoripa, 8; San Javier, 1; Saric, 1; Tésia, 13; Chinobampo, 3; Guaymas, 2; Tóbari Bay, 1; Guirocoba, 1.

Bancroft collection.—Guaymas, 5.

San Diego Society of Natural History collection.—Sásabe, 2.

I can appreciate no differences between the above series and an equally comprehensive one from Arizona.

**Zamelodia melanoccephala melanoccephala** (Swainson)

*Guiraca melanoccephala* Swainson, Philos. Mag., new ser., 1, 1827, 438 (Temascaltepec, Mexico).

Dickey collection.—Tecoripa, 3 (March 4 to 18, 1929); San Javier, 9 (April 3 to 24, 1929); Chinobampo, 5 (February 12 to March 9, 1930); Guirocoba, 3 (April 20 to May 2, 1930).

Although two races of the black-headed grosbeak have long been recognized there is unfortunately no unanimity when it comes to the application of names to represent them. In the present case I follow the majority in using the name *melanocephala* for the larger, heavy-billed form, a course which the examination of a limited amount of Mexican material indicates is the proper one.

Although there is every probability that the Rocky Mountain Black-headed Grosbeak breeds in the mountainous districts, the collector of the above series (J. T. Wright) assures me positively that even the specimen taken at Guirocoba as late as May 2, was a migrant.

**Zamelodia melanoccephala maculata** (Audubon)

*Fringilla maculata* Audubon, Birds Amer., folio, 4, 1837, pl. 373, figs. 2, 3, 4 (Columbia River, Oregon).

Dickey collection.—Saric, 13 (May 11 to August 13, 1929); Tecoripa, 1 (March 9, 1929); San Javier, 4 (April 5 to 24, 1929); Tésia, 1 (December 17, 1929); Chinobampo, 1 (March 3, 1930); Guaymas, 1 (May 8, 1930); Guirocoba, 1 (April 18, 1930).

The Saric series is, as a whole, certainly referable to the small-billed
form, although two of the females are, individually, closer to melanocephala. Only those from Saric are breeding birds, the rest being migrants. Even that taken (personally) at Guaymas on May 8, showed no signs of breeding activity.

I use the name maculata for the small-billed race since Oberholser (Auk, 36, 1919, 410) has called attention to the fact that it has the identical application of capitalis and has many years priority. Furthermore Dr. Richmond writes me that Fringilla maculata is properly proposed and is not preoccupied so far as he can determine.

**Pheucticus chrysopeplus** (Vigors)

**Guiraca caerulea interfusa** Dwight and Griscom
Dickey collection.—Saric, 21 (May 25 to September 24, 1929); Guirocoba, 2 (April 15; May 5, 1930).
Bancroft collection.—El Alamo, 1 (June 1, 1928).

A common breeder over the northern part of the state. While one of the Guirocoba (April 15, ♀) specimens is good *interfusa* the same cannot be said of the other (May 5, ♂). The latter, which I suspect may represent the breeding race of southern Sonora, has an extremely heavy, stubby bill, differently shaped than that of any other blue grosbeak I have ever seen.

**Guiraca caerulea salicaria** Grinnell
Dickey collection.—Obregón, 1 (November 19, 1929); Tésia, 6 (December 11, 13, 1929; March 17, 1930).

The Pacific race of the blue grosbeak is apparently a fairly common mid-winter visitant to the lowlands in the southern part of the state, remaining in spring as late as March 17.

**Passerina versicolor pulchra** Ridgway
Dickey collection.—Saric, 6 (June 4 to 27, 1929); Tésia, 2 (November
29; December 28, 1929); Chinobampo, 13 (February 10 to March 9, 1930); Guirocoba, 10 (April 15 to May 21, 1930).

The intermediate character of western Mexican specimens has been mentioned by Ridgway (Birds No. and Mid. Amer., pt. 1, 1901, 592, footnote) and Brewster (Birds of the Cape Region, 1902, 160). I assume that in the former case the author refers in part at least, to Sonora taken birds, although that state is not specifically mentioned.

In the series of 14 adult males from various points in Sonora which have been examined in the present connection, only one exhibits the characters of versicolor. Most of the rest are not distinguishable from pulchra, although a few are variously intermediate. The 17 females and first winter males are very much more buffy than those of typical versicolor in comparable plumage. Brewster (ibid.) states that typical pulchra is even grayer than versicolor. Therefore, it is not impossible that a demonstrable race exists in northwestern Mexico, the distinguishing characters of which are to be found in the females and young.

Passerina amoena (Say)

Emberiza amoena Say, in Long’s Exped., 2, 1823, 47, note (Near Cañon City, Colorado).

Dickey collection.—Tecoripa, 3 (March 3, 25, 1929); San Javier, 6 (April 10 to 25, 1929); Saric, 8 (August 23, 31; September 18, 1929); Tésia, 1 (December 16, 1929); Chinobampo, 1 (February 11, 1930); Guirocoba, 3 (April 16 to May 7, 1930).

While the series of 22 specimens shows the Lazuli Bunting to be present throughout the year, it does not establish the southern limits of the breeding range. Saric birds were breeding, as shown by the presence of juveniles, but the other records are evidently those of winter visitants or migrants.

One of the adult females exhibits a peculiar condition of plumage, the throat being salmon pink instead of buffy.

Carpodacus mexicanus sonoriensis Ridgway


Dickey collection.—Pesqueira, 1; Tecoripa, 5; San Javier, 2; Obregón, 13; Tésia, 11; Chinobampo, 3; Guaymas, 4; San José de Guaymas, 1; 10 mi. N. of Guaymas, 1; Tóbari Bay 1.
Bancroft collection.—Guaymas, 2; Cajeme, [=Obregón] 1; Agiabampo, 1.

The race sonoriensis is very close to ruberrimus, but should, I think, be recognized. Although about intermediate in size between ruberrimus and frontalis this condition is obviously not because of intergradation. Males from southern Sonora average more extensively red and both sexes are slightly darker than ruberrimus when birds of the same season are compared. Birds from Guaymas and northward are variously intermediate toward frontalis.

Although no type nor type locality was mentioned in the original description, I am indebted to Dr. Richmond for the information that the type is an adult male, No. 164,324 of the Biological Survey collection, and that it was collected at Alamos, Sonora, by E. A. Goldman on December 30, 1898.

**Carpodacus mexicanus frontalis** (Say)

*Fringilla frontalis* Say, in Long’s Exped., 2, 1823, 40, note (Near Pueblo, Colorado).

Dickey collection.—El Doctór, 5 (January 27; February 5, 27, 1929); Saric, 19 (May 9 to September 20, 1929); Obregón, 4 (November 9, 22, 1929); Tésia, 2 (November 30; December 4, 1929); Chinobampo, 2 (February 19, 1930); Magdalena, 1 (April 25, 1925); San Pedro Martir Island, 2 (April 18, 1925); San Estéban Island, 3 (April 17, 18, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 2 (February 25, 1929); Tiburón Island, 6 (May 22, 1930).

Although as a breeder the common linnet is confined to the northern portion of the state, there is a certain amount of southerly dispersal over the range of sonoriensis in mid-winter as shown by the eight specimens taken at Obregón, Tésia and Chinobampo between the dates of November 9 and February 19.

**Spinus pinus macropterus** (Bonaparte)

*C. [hrysomitris] macroptera* Bonaparte, Consp. Av., 1, 1850, 515 (Guatemala; Mexico).

Dickey collection.—Saric, 11 (May 15, 1929).

Inland, as on the Pacific Coast, the dividing line between *pinus* and *macropterus* must be arbitrarily drawn. The Saric birds average slightly larger than specimens from north of the United States-Mexican Boundary
and are more narrowly streaked both above and below. The seven males average: Wing, 75.0; Tail, 46.0.

**Spinus psaltria hesperophilus** (Oberholser)


Dickey collection.—El Doctór, 5 (February 1 to 5, 1929); Pesqueira, 1 (February 23, 1929); San Javier, 3 (April 6 to 11, 1929); Saric, 26 (May 9 to September 12, 1929); Chinobampo, 2 (March 1, 3, 1930); Guirocoba, 2 (May 17, 1930).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

There are no males in the collection from any locality south of San Javier. The Guirocoba and Chinobampo records, all of which are females, may therefore really pertain to “mexicanus” [i.e. *psaltria*].

**Spinus lawrencei** (Cassin)


Dickey collection.—Tecoripa, 8 (March 12 to 20, 1929).

Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).

**Oberholseria chlorura** (Audubon)

*Fringilla chlorura* Audubon, Orn. Biog., 5, 1839, 336 (Near Ross Creek, about 20 miles southwest of Blackfoot, Idaho).

Dickey collection.—Pesqueira, 2 (February 24, 1929); Tecoripa, 2 (March 7, 23, 1929); Saric, 1 (May 8, 1929); Obregón, 1 (November 18, 1929); Tésia, 2 (December 4, 30, 1929); Chinobampo, 1 (March 1, 1930). Also seen at Guaymas (April 24, 1930).

**Pipilo maculatus montanus** Swarth


Bancroft collection.—15 mi. S. of Nogales, 2 (February 17, 1929).

**Pipilo fuscus intermedius** Nelson


Dickey collection.—Pesqueira, 2; Tecoripa, 1; San Javier, 2; Tésia, 1; Chinobampo, 2; Guirocoba, 1.

Bancroft collection.—Agiabampo, 1.
Two specimens from Pesqueira are intermediate toward *mesoleucus*. They possess the dark, grayish dorsal coloration of *intermedius*, but the crowns are rufescent as in *mesoleucus*.

**Pipilo fuscus mesoleucus** Baird


Dickey collection.—Saric, 7.

Bancroft collection.—El Alamo, 1.

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 3; Altar, 1; Caborca, 1.

**Calamospiza melanocorys** Stejneger

*Calamospiza melanocorys* Stejneger, Auk, 2, 1885, 49 (Plains of the Platte River).

Dickey collection.—Obregón, 3 (November 3 to 23, 1929); Tésia, 1 (March 15, 1930).

**Passerculus sandwichensis anthinus** Bonaparte

*Passerculus anthinus* Bonaparte, Compt. Rend., 37, December, 1853, 919 (Kadiak, Alaska).

Dickey collection.—Tésia, 1 (February 4, 1930).

For the use of the name *anthinus* for the savannah sparrow of the Pacific northwest, see Swarth, Birds. Brit. Columbia, 1925, 91.

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1 While this report was in press there has been received Dr. H. C. Oberholser's "Notes on a Collection of Birds from Arizona and New Mexico" issued December 31, 1930, by the Cleveland Museum of Natural History. It is regrettable that this publication was not available at the time the present paper was submitted, so that certain of Dr. Oberholser's nomenclatural findings could have been utilized herein. In the matter of Dr. Oberholser's treatment of the races of *Passerculus sandwichensis*, however, such name changing as is involved in the case of *nevadensis* seems to me to be wholly unwarranted. While Bonaparte's description of *alaudinus* is vague in the definition of essential characters, this very vagueness eliminates any necessity for a switching of names. "Griseo, albo, et rufo-olivascence varius" does not "very clearly refer to the paler, more grayish interior race subsequently described as *Passerculus sandwichensis nevadensis*". Neither does the phrase "sans jaune aux sourcils" mean anything unless one knows the time of the year at which Bonaparte's type of *alaudinus* was collected. Under these circumstances I cannot see any advantage in adopting the proposed transfer of a long-established name with the consequent confusion of literature. Neither can I subscribe to the "lumping" of the savannah sparrows of the northwest coast and of the interior. If the coastal race (*anthinus*) is to be merged with any other it must be with *savanna*, but certainly not with *alaudinus*, using the latter name in the sense employed by Swarth and authors in general.
Passerculus sandwichensis nevadensis Grinnell
Dickey collection.—Tésia, 4 (December 9, 1929; February 4 to March 24, 1930).

Passerculus sandwichensis alaudinus Bonaparte
*Passerculus alaudinus* Bonaparte, Compt. Rend., 37, 1853, 918 (California).
Dickey collection.—El Doctór, 13 (January 21 to February 1, 1929); Mouth of Colorado River, 3 (April 23, 1925).
San Diego Society of Natural History collection.—Port Lobos, 1 (August 20, 1884).

Passerculus sandwichensis rostratus (Cassin)
Dickey collection.—El Doctór, 13 (January 21 to February 1, 1929); Mouth of Colorado River, 3 (April 23, 1925).
San Diego Society of Natural History collection.—Port Lobos, 1 (August 20, 1884).

Passerculus sandwichensis atratus van Rossem
Dickey collection.—Tóbari Bay, 14 (April 30 to May 1, 1930); Guásimas Lagoon, 3 (May 12, 1930).
Bancroft collection.—Kino Bay, 2 (May, 1930); Mainland opposite north end of Tiburón Island, 2 (May, 1930).

Ammodramus savannarum bimaculatus Swainson
*Ammodramus bimaculatus* Swainson, Philos. Mag., new ser., 1, 1827, 435 (Tamascaltepec, Mexico).
Dickey collection.—Obregón, 1 (December 7, 1929); Tésia, 7 (December 9, 27, 1929; March 14 to 27, 1930); Chinobampo, 1 (February 26, 1930); Guirocoba, 1 (April 17, 1930).

Pooecetes gramineus confinis Baird
Dickey collection.—Tecoripa, 1 (March 17, 1929); Obregón, 5 (November 15 to 23, 1929); Tésia, 6 (December 4 to 20, 1929); Chinobampo, 1 (March 5, 1930); Tésia, 2 (February 4; March 15, 1930); Guirocoba, 1 (April 16, 1930).
Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).
San Diego Society of Natural History collection.—Sásabe Valley, near International Boundary, 4 (January 13, 1928); San Luis, 1 (December 31, 1922).

**Chondestes grammacus strigatus** Swainson

*Chondestes strigatus* Swainson, Philos. Mag., new ser., 1, 1827, 435 (Tamas-caltepec, Mexico).

Dickey collection.—Saric, 2 (May 8; September 14, 1929); Obregón, 2 (November 11, 22, 1929); Tésia, 6 (November 29 to December 14, 1929; February 2; March 15, 1930); Guirocoba, 1 (May 2, 1930).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 2 (January 13, 1928).

**Aimophila carpalis** (Coues)


Dickey collection.—Pesqueira, 2 (February 21, 27, 1929); Tecoripa, 11 (March 4 to 26, 1929); San Javier, 4 (April 4 to 6, 1929); Saric, 7 (July 21 to September 21, 1929); Obregón, 1 (November 2, 1929); Tésia, 3 (December 14, 15, 1929; March 17, 1930); Chinobampo, 1 (March 6, 1930); Guirocoba, 4 (May 6 to 23, 1930); 10 mi. N. of Guaymas, 2 (May 9, 1930); Guaymas, 1 (May 9, 1930).

Bancroft collection.—El Alamo, 1; Cajeme [= Obregón] 1, Guaymas, 1.
San Diego Society of Natural History collection.—“Between Sásabe and Altar,” 1 (August 12, 1884).

A common, locally abundant resident, which is more numerous in the Alamos District than northerly. The associations most favored by *carpalis* are cholla cactus and mesquite, but it was found about Guaymas in almost every conceivable environment, including truck gardens. Such ready adaptation makes its disappearance from Arizona, which Swarth (Proc. Calif. Acad. Sci., 4th ser., 18, 328) attributes to over-grazing of the grasslands, difficult to explain.

**Aimophila ruficeps scottii** (Sennett)

*Peucaea ruficeps scottii* Sennett, Auk, 5, 1888, 42 (Pinal County, Arizona).

Dickey collection.—Saric, 1 (June 26, 1929).
Aimophila quinquestriata (Sclater and Salvin)
Dickey collection.—Guirocoba, 3 (April 24 to May 23, 1930).

Aimophila cassini (Woodhouse)
Dickey collection.—Saric, 2 (September 21, 1929); Tésia, 1 (March 26, 1930).

Aimophila botterii botterii (Sclater)
Dickey collection.—Guirocoba, 2 (May 8, 16, 1930).

As Mr. Ridgway has pointed out, there is nothing to be gained in attempting to force “Peucaea” into a genus distinct from Aimophila, unless one cares to split Aimophila into five groups. The “Peucaea” series is surely afforded ample recognition by according it sub-generic rank.

Amphispiza bilineata deserticola Ridgway
Amphispiza bilineata deserticola Ridgway, Auk, 15, 1898, 229 (Tucson, Arizona).
Dickey collection.—Saric, 3 (July 7 to August 8, 1929).
Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).

Amphispiza bilineata pacifica Nelson
Amphispiza bilineata pacifica Nelson, Auk, 17, 1900, 267 (Alamos, Sonora, Mexico).
Dickey collection.—Guaymas, 2 (April 24, 1930).
Bancroft collection.—6 mi. N. of Guaymas, 5 (July, 1928).

Amphispiza bilineata cana van Rossem
Dickey collection.—San Estéban Island, 4 (April 17 to 19, 1930).
Bancroft collection.—San Estéban Island, 5 (April 17 to 19, 1930).

Amphispiza bellii nevadensis (Ridgway)
Dickey collection.—El Doctór, 1 (January 22, 1929).
Junco oreganus shufeldti Coale

*Junco hyemalis shufeldti* Coale, Auk, 4, 1887, 330 (Fort Wingate, New Mexico).

Dickey collection.—Saric, 1 (May 12, 1929).

Bancroft collection.—15 mi. S. of Nogales, 1 (February 17, 1929).

Junco mearnsi Ridgway

*Junco mearnsi* Ridgway, Auk, 14, January 1897, 94 (Fort Bridger, Wyoming).

Dickey collection.—Nogales, 1 (February 17, 1929).

San Diego Society of Natural History collection.—15 mi. S. W. of Nogales, 1 (January 13, 1928).

Junco caniceps (Woodhouse)


Dickey collection.—Nogales, 1 (February 17, 1929).

Spizella pallida (Swainson)

*Emberiza pallida* Swainson, Fauna Bor.-Am., 2, 1831 [1832], 251 (Carlton House, Saskatchewan).

Dickey collection.—Saric, 1 (September 15, 1929); Obregón, 6 (November 3 to 22, 1929); Tésia, 10 (November 29 to December 23, 1929; March 21, 1930); Chinobampo, 1 (March 3, 1930); Guirocoba, 2 (April 15, 17, 1930).

Spizella breweri Cassin


Dickey collection.—Tecoripa, 2 (March 8, 17, 1929); Obregón, 2 (October 31; November 18, 1929); Tésia, 4 (November 29; December 12, 20, 1929); Guaymas, 1 (April 22, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).

San Diego Society of Natural History collection.—Sásabe Valley, near International Boundary, 1 (January 13, 1928).

Spizella passerina arizonae Coues

*Spizella socialis* var. *arizonae* Coues, Key No. Amer. Birds, 1872, 143 (Fort Whipple, Arizona).

Dickey collection.—Nogales, 1 (February 17, 1929); Tecoripa, 5 (March 8 to 30, 1929); San Javier, 6 (April 8 to 18, 1929); Tésia,
Bancroft collection.—12 mi. W. of Magdalena, 3 (February 25, 1929).

**Zonotrichia leucophrys** (Forster)

*Emberiza leucophrys* Forster, Philos. Trans., 62, 1772, 426 (Severn River, west shore of Hudson Bay).

Dickey collection.—El Doctór, 2 (January 27, 1929); Tecoripa, 5 (March 1 to 17, 1929); Obregón, 3 (November 3 to 18, 1929); Tésia, 3 (December 9, 21, 1929; March 21, 1930); Chinobampo, 1 (March 5, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).

**Zonotrichia gambelii gambelii** (Nuttall)


Dickey collection.—El Doctór, 3 (January 21; February 1, 1929); Pesqueira, 6 (February 21, 25, 26, 27, 1929); Tecoripa, 2 (March 4, 31, 1929); San Javier, 1 (April 18, 1929); Obregón, 6 (October 31 to November 22, 1929); Tésia, 2 (December 4, 27, 1929).

Gambel's Sparrow is an abundant winter visitant to the lowlands throughout the state. The earliest date of arrival is October 13, and the latest spring dates are April 22 and 24, when numbers were seen about Guaymas.

**Melospiza melodia saltonis** Grinnell


Dickey collection.—Saric, 3 (June 3 to 14, 1929); Magdalena, 2 (May 11, 1925).

The three Saric and the two Magdalena specimens are darker and grayer than the average of typical *saltonis*. In other words, I perceive much the same differences as Swarth (Proc. Calif. Acad. Sci., 4th ser., 18, 1929, 328) has noted as between Colorado River specimens and breeding birds from near Patagonia and Fairbank in southeastern Arizona. However, I do not deem it practicable to propose formal recognition of these differences, for the dark extremes of topo-typical *saltonis* cannot be distinguished from the average of the northern Sonora birds. Moreover a specimen (May 7, 1892) from Hermosillo in the collection of the Biological Survey is as pale as all but the very palest Colorado River
It is of interest to observe that this incipient race of song sparrows occupies an area almost identical with that inhabited by *Geothlypis trichas chryseola*.

**Melospiza lincolni lincolni** (Audubon)

*Fringilla lincolni* Audubon, Birds Amer., (folio), 2, 1834, pl. 193 (Near mouth of Natashquan River, Quebec).

Dickey collection.—El Doctór, 1 (February 10, 1929); Nogales, 1 (February 17, 1929); Tecoripa, 2 (March 7, 27, 1929); Obregón, 1 (November 23, 1929); Tésia, 3 (December 7, 1929; February 4; March 24, 1930); Chinobampo, 1 (March 3, 1930).

Bancroft collection.—12 mi. W. of Magdalena, 1 (February 25, 1929).

**Melospiza lincolni gracilis** (Kittlitz)

*Emberiza (Zonotrichia) gracilis* Kittlitz, Denkw., 1, 1858, 199, in text (Sitka, Alaska).

Dickey collection.—Tecoripa, 1 (March 3, 1929); George Island, 1 (April 20, 1925).
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A NEW SUBSPECIES OF THE CALIFORNIA BOA,
WITH NOTES ON THE GENUS
LICHANURA

BY
LAURENCE M. KLAUBER
Curator of Reptiles and Amphibians, San Diego Society of Natural History

SAN DIEGO, CALIFORNIA
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A NEW SUBSPECIES OF THE CALIFORNIA BOA, WITH NOTES ON THE GENUS LICHANURA

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Curator of Reptiles and Amphibians, San Diego Society of Natural History

Van Denburgh in the "Reptiles of Western North America," 1922, Plate 58, pictures a boa from near Aguila, Maricopa County, Arizona. This strongly striped snake had long remained a puzzle to me, for out of more than two hundred and fifty specimens from southern California and northern Lower California, Mexico, I had never seen so definitely marked an individual. Additional material has lately become available which convinces me that there is a consistent difference between the typical form as it exists in the coastal area centering at San Diego, and the desert or desert mountain individuals from the Mohave Desert (California), western Arizona and north-central Lower California. This new form may be known as

Lichanura roseofusca gracia subsp. nov.

Desert Boa

Plate 21, fig. 1.

Type.—No. 2995 in the collection of L.M.K. Taken at Randsburg, Kern County, California, by Miss Lucile Rector, June, 1930.

Diagnosis.—A subspecies of Lichanura roseofusca differing from the typical form in having three clearly and evenly outlined reddish stripes on a drab background from nose to tip of tail. In roseofusca roseofusca the stripes, if present, are highly irregular in outline and in slight contrast with the ground color. L. trivirgata of the Cape region of Lower California has chocolate brown stripes, with a cream ground color, in even stronger contrast than gracia, and a lower ventral scale count as well. Additional specimens from central Lower California may eventually show both roseofusca and gracia to be subspecies of trivirgata, gracia being intermediate between the other two.

Description of Type.—Young female. Length over all, 375 mm.; length of tail, 45 mm.; ratio of tail to total length, 0.12.

The head is arrow-shaped, flat topped and covered with small scales which are smooth and irregularly disposed. The head dimensions are 18 mm. by $10\frac{1}{2}$ mm. The rostral is high, prominent and recurved. The nasals are divided; the prenasals are large and meet on the median line. The supralabials are 15—15,
the third being tallest. The infralabials are 17—17, the first pair meeting on the median line. The loreals are 3—2 with 3 sublorellals on each side.

The eye is surrounded by a ring of 9 scales on the right and 8 on the left. Two suboculars on each side are in contact with the supralabials. The scales of the body are smooth and in 43 rows. The ventrals number 232 and are narrow; the anal is entire; the caudals are in a single series of 42. The tail tip is blunt.

The pattern consists of three longitudinal stripes, a dorsal and two side stripes, each five scales wide at mid-body and separated by four scale rows. These stripes extend from nose to tail; their color (in alcohol) is Prussian Red¹ and that of the interspaces Pallid Brownish Drab. The red was considerably brighter in life. The dorsal and side stripes are faintly edged with darker. The stripe boundaries, except on the head, adhere quite closely to the edge of a single scale row, thus achieving a serrated appearance. The ground color, low down on the sides, is lighter than between the three primary dark stripes and, except for the first three scale rows below the dark side stripes, is mottled irregularly with brown, as is also the ventral surface.

The three main stripes are of irregular form on the head. The supralabials are almost immaculate; the underside of the head, including the lower labials, is sparsely spotted with brown.

The pupil is vertical. The tongue is black with white tips.

Range.—This subspecies is known to occur in the following localities:

**CALIFORNIA**

Kern County
  Randsburg (Type locality)
San Bernardino County
  Barstow
  Banks of the Mohave River,
  north of Victorville
  Providence Mountains

**ARIZONA**

Maricopa County
  Phoenix
  Aguila
Yuma County
  Harquahala Mountains
  Harcuvar Mountains
  Gila Mountains

**LOWER CALIFORNIA, MEXICO**

6 mi. S. of Socorro (near Lat. 30°)

The latter locality is only tentatively included. Thus the indicated range is the Mohave Desert in California and the mountains of southwestern Arizona, with a possible extension into north-central Lower California. The subspecies has not yet been taken in Riverside, Imperial or San Diego Counties in California, but may occur in the desert mountains, especially in the Chocolates and to the northeast of the Imperial-Coachella-Salton Basin.

¹ The colors are from Ridgway, 1912.
General Description and Remarks.—The following specimens of this subspecies have been examined:

LMK 2995 Randsburg, Kern Co., Calif. (Type)
CAS 35348 Aguila, Maricopa Co., Ariz.
MVZ 10523 Barstow, San Bernardino Co., Calif.
USNM 20643 Harquahala Mts., Ariz.
USNM 20953 Harquahala Mts., Ariz.
USNM 29698 Phoenix, Ariz.
USNM 44317 Providence Mts., San Bernardino Co., Calif.
USNM 60238 Harquahala Mts., Ariz.
SDSNH 15511 6 mi. S. of Socorro, Lower California (tentative)

Through the courtesy of Mr. Chas. M. Bogert, a photograph has been seen of a specimen, which is clearly of this form, from the Mohave River near Victorville.

All specimens which have been available from the Mohave Desert, or Arizona, have fallen into this classification, based on pattern and color; and no specimen of the genus (out of over two hundred seen) from other areas, with the exception of SDSNH 15511, has answered to this description. All available material therefore favors a valid geographical race.

Statistical comparisons with L. trivirgata and L. roseofusca roseofusca are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Trivirgata</th>
<th>Gracia²</th>
<th>Roseofusca</th>
</tr>
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<tbody>
<tr>
<td>Number of Specimens</td>
<td>7</td>
<td>9</td>
<td>38</td>
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<tr>
<td>Scale rows, range</td>
<td>40—43</td>
<td>40—43</td>
<td>35—43</td>
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<tr>
<td>Scale rows, average</td>
<td>41.4</td>
<td>41.3</td>
<td>40.9</td>
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<td>Ventrals, range</td>
<td>218—227</td>
<td>220—236</td>
<td>221—244</td>
</tr>
<tr>
<td>Ventrals, average</td>
<td>222</td>
<td>230</td>
<td>232</td>
</tr>
<tr>
<td>Caudals, range</td>
<td>42—46</td>
<td>42—49</td>
<td>39—51</td>
</tr>
<tr>
<td>Caudals, average</td>
<td>44</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>Supralabials, range</td>
<td>12—13</td>
<td>13—15</td>
<td>12—15</td>
</tr>
<tr>
<td>Supralabials, average</td>
<td>12.8</td>
<td>14.1</td>
<td>14.1</td>
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<tr>
<td>Infrafalabials, range</td>
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<tr>
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<td>9—11</td>
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<td>7—10</td>
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<tr>
<td>Oculars, average</td>
<td>9.7</td>
<td>9.8</td>
<td>9.1</td>
</tr>
</tbody>
</table>

² Does not include SDSNH 15511.
It will be observed that *trivirgata* has a low average in ventrals, caudals and labials and therefore possesses real differences from the others in scutellation; on the other hand *gracia* and *roseofusca* are virtually indistinguishable in scale counts.

**Priority of Names in the Genus Lichanura**

*Lichanura* is an exceedingly variable genus in both lepidosis and coloration and, as a result, a number of species have been proposed from time to time based on characteristics which have failed to prove consistent. The following notes will summarize the situation:


*Lichanura myriolepis* Cope 1868, Proc. Acad. Nat. Sci. Phila., 1868, p. 2. Type locality northern Lower California. This species Cope seems to have differentiated from the preceding based on the large number of scale rows (45) and “three rusty red bands extending throughout the length, but very indistinct on the anterior half of the body.” Stejneger\(^3\) examined the type specimens of *roseofusca* and *myriolepis* and found the scale rows of the latter to be 43, rather than 45 as reported by Cope. He noted the colors to be “not more distinctly marked than all the other specimens found to the north,” that is the four specimens of *roseofusca* from San Diego County which were available to him in 1891. He therefore concluded that the species was invalid. I do not believe this form anticipates *gracia*, as the stripes are stated to be indistinct anteriorly, which is not the case in the new subspecies. Cope’s type of *myriolepis* was a juvenile, and young specimens of *roseofusca* *roseofusca* frequently have rather distinct longitudinal stripes for at least part of the length, but their lateral edges are extremely irregular instead of even as in *gracia*. Had the type of *myriolepis* been as brightly and distinctly marked as the specimens I have referred to *gracia*, Dr. Stejneger would not have observed it to be similar to the San Diego County specimens of *roseofusca*. The first *gracia*, an Arizona specimen, was not added to the National Museum collection until two years after the publication of his paper from which the above quotation is taken.

*Lichanura orcutti* Stejneger 1889, Proc. U. S. Nat. Mus., Vol. 12, p. 96. Type locality Colorado Desert, San Diego Co., Calif. This species was differentiated from *roseofusca* by the low number of scale rows and true loreals. It has since been determined that the characters in the type of *orcutti* are well within the range of *roseofusca*. I have had specimens from the center of *roseofusca* territory with 35 scale rows and 2 loreals. The late C. R. Orcutt informed me that the type specimen of *orcutti* was collected east of Jacumba. I have secured

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several specimens of *roseofusca* from this vicinity; these differed in no uniform character from others in the San Diegan area.

*Lichanura simplex* Stejneger 1889, Proc. U. S. Nat. Mus., Vol. 12, p. 97. Type locality, San Diego, Calif. This species was distinguished by the low number of oculars. With additional material available two years later, Stejneger himself decided (Proc. U. S. Nat. Mus., Vol. 14, p. 511) that this species was invalid.

Thus we find that none of these forms can anticipate *gracia*; they were taken in *roseofusca roseofusca* territory and fall within the range of character variations of that form. Only *myriolepis* is mentioned as having stripes and Stejneger's re-examination of the type and his comparison with *roseofusca roseofusca* are conclusive on this point.

**Color Notes on Lichanura**

*Trivirgata*, as has been stated, has three primary stripes of dark chocolate brown on a light drab background. The central dark stripe varies from 3 to 5 scales in width at midbody and the side stripes from 4 to 6. The interspaces are from 3 to 4 scales wide, and may contain dark edged scales. The boundaries of the three primary dark stripes adhere closely to single scale rows, but have a way of splitting scales diagonally, resulting in a sharply serrated border. Below the dark side stripes the ground color of the sides, and the ventral surface are spotted with black.

*Roseofusca roseofusca* is exceedingly variable in both color and pattern. Fundamentally, the pattern, particularly in the young, is reminiscent of the three primary dark stripes of *trivirgata*, from which, no doubt, it was originally derived, but these stripes are not strongly in evidence for two reasons: First, the ground and pattern colors in *roseofusca roseofusca* are less strongly contrasting, particularly in adult specimens, than in *trivirgata*; and secondly, the stripes, when present, have indefinite and irregular lateral borders, the interspaces between being more or less filled with scattered red brown scales.

The colors of *roseofusca roseofusca* are primarily two, a red brown pattern color and a metallic blue-gray ground color, both of which vary rather widely in tone and hue. The pattern color varies from pink or salmon to a dull brown. The ground color is sometimes a bluish, sometimes a steel or leaden gray; it is lighter in young specimens and those from the desert edge. The pattern color may be relatively distinct in irregular streaks or patches, or it may blend with, or entirely obliterate, the ground color; thus the snake may appear unicolor, being either a dull red brown or gray brown. The smooth scales combined with the color produce, in life, a metallic effect.
Thus, by these changing combinations of the two colors, and an obsolescent pattern, we have a high degree of variability, but never amongst all the specimens of this form that I have seen, from the coastal foothills of the San Bernardino and San Jacinto ranges, and the desert fringes of the latter, have I observed a specimen of the *gracia* type, with even edged, regular and strongly contrasting stripes. It may be noted that, in *roseofusca roseofusca*, specimens will occasionally be found in which the lower edges of the side stripes are evenly and clearly defined, but this will not be the case with the upper edges of these stripes nor the borders of the dorsal stripe.

*Gracia* is a snake having the pattern of *trivirgata* together with the pattern color and scale counts of *roseofusca roseofusca*. The ground color is lighter than *roseofusca*, although approached by desert edge specimens of the latter.

The dorsal stripe is from 4 to 5 scales wide, the interspaces from $3\frac{1}{2}$ to 5 and the side stripes 4 or 5 wide. The lower edges of the side stripes may be uneven. The sides and the ventral surface are mottled with darker. Sometimes the mottling on the sides is sufficiently even to resemble additional pairs of stripes.

The Arizona specimens are somewhat lighter in color than those from California.

SDSNH 15511, from 6 mi. S. of Socorro, Lower California, is an unusual specimen. In ventral scale count it resembles *trivirgata* for the ventrals number 217; the labials are high, however, being 14—14, 16—16. The stripes are quite even; the interspaces between the red primary stripes are steel blue. Thus, this specimen has some of the characteristics of all three forms; superficially it more resembles *gracia* and is tentatively placed in that category. Additional specimens from this vicinity will be awaited with interest. Typical *roseofusca roseofusca* has been collected only 40 miles$^4$ to the north of Socorro; the nearest *triviragata* thus far recorded is from La Paz, over 500 miles to the south, and between these two are territories of a character not likely to be inhabited by boas.

Except for SDSNH 15511, of uncertain status, true intergrades

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$^4$ L. M. Huey informs me that a faunal break is to be expected in this short distance; it is evident in the mammals and birds, the species to the north being San Diegan while those to the south have affinities with Arizona or Lower California forms. The same break occurs amongst the gopher snakes (*Pituophis catenifer annectens* and *Pituophis vertebralis*) and the rattlesnakes (*Crotalus confluence oreganus* and *Crotalus enyo*), the southern forms coming as far north as Catavina and El Marmol.
between *roseofusca* and *gracia* have not yet come to light. They are to be expected along the northern fringe of the San Bernardino Mountains in the vicinity of Hesperia and eastward. Specimens from the lower edges of the desert mountains in San Diego County, particularly in the vicinity of Yaqui Well and The Narrows, may be considered intergrades to the extent of having sharply contrasting colors, but the stripes show no tendency toward regularity or even borders. (Plate 21, fig. 2).

**HABITS AND HABITAT**

*Lichanura* is the most peaceful snake with which I have had experience. Freshly captured specimens seem to be without fear; they are never hurried in their movements nor attempt to bite. When hurt they assume the defensive by rolling into a ball.

Of *trivirgata* I have seen no live specimen and of *gracia* only one (the type). But with *roseofusca* *roseofusca* I have had a considerable field and laboratory experience.

While this subspecies seems to prefer the granite-chaparral association of the coast foothills in San Diego County, it ranges from the ocean shore to the lower fringe of the desert foothills, although probably absent from the intervening mountain peaks above the 4500 ft. contour. Although it is no doubt largely crepuscular or even nocturnal in habit, it is by no means unusual to find it abroad and active in the daytime, particularly in the spring.

Some field notes follow:

April 10, 1923: One was found crossing the road at 10 A. M.; chaparral on both sides.

April 15, 1923: A specimen was braced in a crack between granite boulders directly above, and evidently watching a wood rat’s nest.

May 25, 1924: Found a specimen in a crack in a granite boulder.

March 22, 1925: At 11 A. M. a large specimen was found climbing up the bank of a roadside. Chaparral on one side, rocks on the other.

April 19, 1925: A large individual was located under a flat rock covering a small circular pocket in a large boulder.

March 28, 1926: One was found with head and one third of the body under a flat rock, the rest of the body being in the open.

April 11, 1926: Found one under a small flat rock.

April 20, 1927: Located one in a crack in a granite boulder. Fished it out with difficulty.

June 4, 1927: In the later afternoon a juvenile specimen was found crossing a paved road. Rocks and brush at the roadside.
September 11, 1928: Noted a specimen from Tujunga Canyon, Los Angeles County, which was salmon (almost orange) in color.

April 11, 1931: Saw a specimen from Box Springs Canyon, Riverside County, with irregular orange-yellow stripes.

The late John Burnham, an amateur ornithologist, told me of finding one of these snakes stretched across a hillside trail. He prodded it with his foot, whereupon it gathered itself into a ball. The hillside being steep, it started to roll, and soon gathering momentum was lost to sight in the brush below.

Specimens in captivity spend considerable time in the branches of any available bush. They do not seem to use constriction in killing their prey. Birds and mammals appear to be their favorite food, but they do not feed readily in captivity.

The longest specimen I have seen measured slightly over three feet. The spurs at the vent are sometimes clearly in evidence but again are not apparent. The tail is often exceedingly blunt as if a portion had been lost, and the scale counts occasionally indicate this to be the case.

In an eight year census, boas constituted 3.4 percent. of the snakes collected in San Diego County and ranked ninth in frequency out of the twenty-nine species to be found in the county. Lichanura seems to reach its maximum activity in June, when 31 percent. of the specimens were taken, having a somewhat later peak than most of the species. Forty percent. of the specimens were taken in the foothills, the inland valleys following with 35 percent. Amongst the specimens found dead in the road, crushed by automobiles, 36 percent. were juveniles.

**Ranges**

*Trivirgata* has been taken in the following localities: Cape San Lucas (Type locality), La Paz, Santa Anita, Todos Santos, Eureka, and San José del Cabo. All of these points are in the Cape region of Lower California.

*Roseofusca roseofusca* has been collected at the following points:

**Lower California**

Garcia, Tecate, Lindero, Ensenada, Valle Redondo, 5 mi. S. of Tia Juana, Rancho Chichiuas (17 mi. N. of Ensenada), and 5 mi. W. of San José (Lat.31°). The last is the most southerly station.

**Imperial County**

1 mi. E. of Mountain Spring
From these data it would seem that in San Diego County the species ranges from the coast line eastward to the lower edges of the desert foothills, but excluding the mountains above 4500 ft.

**RIVERSIDE COUNTY**

Banning
Hemet Grade
Cabazon
Palm Canyon
Box Springs Canyon

Palm Springs
Gavilan
San Jacinto
San Jacinto Mts.
SAN BERNARDINO COUNTY
Live Oak Canyon, near Redlands  Cucamonga Canyon
Near San Bernardino  San Bernardino Mts.

LOS ANGELES COUNTY
Tujunga Canyon  Eaton Wash, near Pasadena
Mt. Wilson  San Gabriel Wash, near Azusa
San Gabriel Mts.  Sierra Madre, at 1700, 1900 and
Hollywood Hills  2500 ft.
Arroyo Seco

Gracia:
The collection localities of this subspecies have been given on page
308 above.

KEY
Key to the species and subspecies of Lichanura.
A. Longitudinal stripes, if present, have edges uneven
   (zig-zag) and ill defined.........................................roseofusca roseofusca

AA. Longitudinal stripes are present and with even (but
    serrated) edges.
   B. Longitudinal stripes dark chocolate brown,
      ventrals average 222...........................................trivingata
   BB. Longitudinal stripes red brown; ventrals
      average 230.................................................roseofusca gracia

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For the loan of specimens I wish to thank Dr. L. Stejneger and Miss
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Museum and Mr. Chas. M. Bogert of Los Angeles. Mr. L. H. Cook
made a large number of scale counts for me.
References

COPE, E. D.

STEJNEGER, L.

VAN DENBURGH, J.
Fig. 1. *Lichanura roseofusca gracia*. Desert Boa.
CAS 35348. Collected near Aguila, Maricopa Co., Arizona, May, 1912. (Photograph by courtesy of the California Academy of Sciences)

Fig. 2. *Lichanura roseofusca roseofusca*. California Boa.
LMK 4282. Collected at The Narrows, San Diego Co., California, March 15, 1931. (Desert edge specimen showing tendency, in contrasting colors, toward *L. r. gracia*)

Fig. 3. *Lichanura roseofusca roseofusca*. California Boa.
LMK 4380. Collected at Campo, San Diego Co., California, April 7, 1931. (Coloration typical of coastal specimens)
A MOLLUSCAN SPECIES NEW TO THE RECENT WEST COAST FAUNA

BY

DON L. FRIZZELL

University of Washington

SAN DIEGO, CALIFORNIA

PRINTED FOR THE SOCIETY

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A MOLLUSCAN SPECIES NEW TO THE RECENT WEST COAST FAUNA

BY

DON L. FRIZZELL

University of Washington

A few years ago I was informed by Professor Trevor Kincaid, of the University of Washington, of the existence of an extremely rare bivalve occurring in Puget Sound, apparently intermediate between Venerupis staminea (Conrad) and V. tenerrima (Carpenter), which he suggested might be a sterile hybrid. A short time later, in a collection of fossil mollusks from the marine Pleistocene near Port Blakely, Washington, given to me by Mr. A. A. Weymouth, then of the University of Washington, were found two specimens which appeared to be identical with the rare living form. Further collecting revealed a number of specimens and resulted in the conclusion that a valid species was represented. This was later described as new. Professor Kincaid has since given me a very fine specimen from Puget Sound and I am indebted to him for permission to publish upon its occurrence. The purpose of this notice is three-fold— to record the Recent occurrence of this interesting form, to figure the type and to place the species in its proper genus. I am under obligation to Dr. U. S. Grant IV for looking up an essential reference that was not available to me.

Venerupis (Protothaca) restorationensis (Frizzell)

Plate 22, figs. 1, 2, 3, 4.

Paphia restorationensis Frizzell, Nautilus, Vol. 43, 1930, p. 120.

Holotype No. 386, type collection, San Diego Society of Natural History; from Upper Pleistocene deposits at Restoration Point, near Port Blakely, Washington.

Plesiotype No. 387, type collection, San Diego Society of Natural History; Recent specimen from Little Beef Harbor, near Seabeck, Washington.

Original description.—“Shell large and heavy, subquadrate, convex; surface sculptured by numerous rather fine but conspicuous radiating lines and a few raised, irregular, discontinuous concentric lines, the former markedly wider at both anterior and posterior ends, the latter high and most prominent on the anterior part of the shell; a very thin epidermis
seems to have been present, although almost completely eroded on type; no lunule present; inner margins smooth; hinge long, rather narrow, greatly arched; three teeth in each valve, the posterior two in the right valve and the middle one in the left valve bifid; pallial sinus long, narrow and rounded. Length 96.7, height 74.3, thickness 45.3 mm.”

**Occurrence.**—Fossil specimens are fairly common in the Upper Pleistocene deposits on the north side of Restoration Point, near Port Blakely, Washington. The accompanying fauna represents a shore facies and has not yielded any species not found living in Puget Sound. Some twenty-five molluscan species have been collected from these deposits, almost all of which are found living on the immediately adjacent beach.

A single specimen is known representing this species in the Recent fauna. It was collected by Professor Kincaid at Little Beef Harbor, near Seabeck, Washington, on Hood’s Canal, during the Autumn of 1928, living above extreme low tide, associated with *V. staminea* and *V. tenerrima*.

**Remarks.**—The Recent specimen is very much like the type, having the same sculpture and inner markings and differing only slightly in outline. In this connection it might be said that examination of quite a large series of the forms most nearly related to *V. restorationensis*, *V. staminea* (Conrad) and *V. tenerrima* (Carpenter), shows that each species varies rather widely in outline, grading from relatively low to relatively high individuals. In the specimens of *V. restorationensis* collected to date a corresponding variation in outline has been observed. The following table shows a comparison of the dimensions of the Recent specimen with those of the type.

<table>
<thead>
<tr>
<th>Holotype</th>
<th>length 96.7, height 74.3, thickness 45.3 mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plesiotype</td>
<td>length 78.0, height 61.0, thickness 38.0 mm.</td>
</tr>
</tbody>
</table>
EXPLANATION OF PLATE
PLATE 22

Fig. 1. *Venerupis (Protothaca) restorationensis* (Frizzell), No. 387, Plesiotype, Recent, collected near Seabeck, Washington. Left valve, ($\times 9/10$).

Fig. 2. *Venerupis (Protothaca) restorationensis* (Frizzell), No. 386, Holotype, from Upper Pleistocene near Port Blakely, Washington. Dorsal view, ($\times 8/10$).

Fig. 3. The same. Interior of left valve, ($\times 7/10$).

Fig. 4. The same. Exterior of right valve, ($\times 8/10$).
TRANSACTIONS

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DESCRIPTIONS OF NEW BIRDS FROM THE MOUNTAINS OF SOUTHERN NEVADA

BY

A. J. van Rossem

Pasadena, California

SAN DIEGO, CALIFORNIA

Printed for the Society

June 5, 1931
DESCRIPTIONS OF NEW BIRDS FROM THE MOUNTAINS OF SOUTHERN NEVADA

BY

A. J. van Rossem

Pasadena, California

Southern Nevada, particularly the mountainous parts, is relatively unknown ornithologically. The chief, in fact practically the only, contribution giving a list at all comprehensive in nature is Edmund Jaeger’s “Birds of the Charleston Mountains of Nevada” published in 1927 by the Junior College, Riverside, California. Unfortunately Mr. Jaeger, who was occupied principally with botanical work, did not collect any specimens and therefore was unable to determine in many cases to which subspecies the birds he observed belonged.

In September, 1930, the writer spent most of his vacation in making a two weeks’ reconnaissance trip across the southern end of the state, a brief survey which included the Charleston, Sheep, and Virgin Ranges, together with the intervening Las Vegas and Moapa valleys.

The life zones of the country traversed include all of those to be found within the state, from extreme Lower Sonoran of Colorado Desert affinities in the Moapa Valley to Upper Sonoran at the summit of the Virgin Range, Hudsonian at the summit of the Sheep Mountains, and Arctic-Alpine in the Charleston. The two last-named ranges are, in effect, Boreal islands and although separated from each other only by some forty miles of Lower Sonoran desert are effectually isolated from contact with either the California Sierras, the Death Valley ranges, or the Toyabe Mountains of central Nevada by much greater distances. That this isolation from any coastal influence has prevailed for a long period of time is shown by the fact that the birds of these southern Nevada mountains are very closely related to those of the southern Rockies, while so far as is known at present not one is of coastal affinities. From the data at present available, that is to say where the subspecies have been determined with a fairly certain degree of accuracy, the forms known to breed in the upper zones of the Charleston and Sheep Mountains number six which are of general distribution over the western United States, six which are characteristic of the southern Rocky Mountains region, two which are similar to those of the White Mountains of eastern central California, and
four which are local, though clearly evidencing Rocky Mountains relationship.

The birds of the region under consideration will be dealt with in a general paper when sufficient field work has been done to allow of reasonably complete treatment. That final results will be well worth while is indicated by the fact that even the slight amount of work so far done shows a census of 119 species and subspecies, some of them, of course, migrants. In the meantime such new races as are discovered will be published as they come to light. Four of them are described below.

**Cyanocitta stelleri percontatrix**, subsp. nov.

_Type._—Male in fresh first-winter plumage; no. 31,170, collection of Donald R. Dickey; altitude 8500 feet in the Hidden Forest, Sheep Mountains, Clark County, Nevada; September 18, 1930; collected by A. J. van Rossem; original no. 13,246.

**Subspecific characters.**—Similar in head markings and in general body coloration to Arizona, New Mexico, and Colorado specimens of *Cyanocitta stelleri diademata* (Bonaparte), that is with the supra-orbital region extensively white, the lower eyelid narrowly white and the frontal streaks white or bluish white, but differing from that form in having the back and sides of neck “deep neutral gray” (color terms in quotations from Ridgway, Color Standards and Color Nomenclature, 1912) instead of “mouse gray.” Differs from *Cyanocitta stelleri annectens* Baird of the northern Great Basin in decidedly paler coloration throughout, more extensively white eyelids and longer crest.

**Range.**—Transition Zone in the Sheep and Charleston Mountains, Clark County, Nevada.

**Remarks.**—Although only four specimens of this jay were collected (three from the Charlestons, and one from the Sheep Mountains), they are so uniform in characters and so different from *diademata* that I do not hesitate to describe them as new.

**Sitta pygmaea canescens**, subsp. nov.

_Type._—Male adult; no. 31,111, collection of Donald R. Dickey; yellow pines at 8200 feet altitude, Lee Cañon, Charleston Mountains, Clark County, Nevada; September 14, 1930; collected by A. J. van Rossem; original no. 13,206.

**Subspecific characters.**—Exactly resembling *Sitta pygmaea leuconucha* Anthony of northern Lower California in pale, ashy gray coloration, but size, particularly of bill, decidedly smaller. Similar in size to *Sitta pygmaea melanotis* van Rossem of the Rocky Mountains, but coloration paler and more ashy throughout, particularly on the head. Measurements of the type, which was selected as showing the racial average in size and color, are: wing, 64.0 mm.; tail, 34.0; culmen from base, 15.0.

**Range.**—Charleston and Sheep Mountains, extreme southern Nevada, where resident in the yellow pine association from 7000 to 8500 feet.
Remarks.—When the writer briefly reviewed the races of *Sitta pygmaea* a short time ago (Proc. Biol. Soc. Wash., 1929, 42, 175-178) there were no specimens available from these isolated ranges. The series of 11 *canescens* are all in relatively fresh fall plumage, indeed seven of them had only just completed the annual moult at the time of collection. The color characters are, therefore, true ones and not the result of wear or fade. The eleven specimens were collected at Lee Cañon and Kyle Cañon in the Charlestons and from the Hidden Forest in the Sheep Mountains.

The Lower California race *leuconucha*, the only one resembling *canescens* closely in color, measures on the basis of 10 adult males from the San Pedro Martir Mountains: wing, 68.0 mm.; tail, 36.0; culmen from base, 18.2.

*Certhia familiaris* leucosticta, subsp. nov.

*Type.*—Male in fresh first-winter plumage; no. 31,150, collection of Donald R. Dickey; altitude 8500 feet in the Hidden Forest, Sheep Mountains, Clark County, Nevada; September 17, 1930; collected by A. J. van Rossem; original no. 13,234a.

*Subspecific characters.*—Among the North American races of *Certhia familiaris* this is the palest and grayest. Dorsally the coloration resembles, in the absence of brown tones, *Certhia familiaris albescens* Berlepsch, but is much paler and the streaks are pure white instead of pale gray. Ventrally *leucosticta* is clear pure white, tinged on the flanks with pale gray and on the under tail coverts with pale clay color.

*Range.*—Transition and Alpine Zones in the Sheep and Charleston Mountains, Clark County, Nevada.

*Remarks.*—The five specimens upon which the new form is based are uniform in characters and bear little resemblance to *Certhia familiaris zelotes* Osgood of the Sierra Nevada, or to *Certhia familiaris montana* Ridgway of the Rocky Mountains, with good series of both of which races they have been compared. In the relative amount of white on the dorsal surface there is close agreement between *leucosticta* and *montana*, but while in *montana* light brown tones prevail, *leucosticta* is ashy and practically colorless dorsally except on the rump.

*Junco oreganus mutabilis*, subsp. nov.

*Type.*—Male in complete first-winter plumage; no. 31,126, collection of Donald R. Dickey; Lee Cañon, Charleston Mountains, Clark County, Nevada; altitude 8200 feet; September 14, 1930; collected by A. J. van Rossem; original no. 13,221.

*Description of type.*—Forehead and lores "dusky neutral gray," fading to "dark neutral gray" on ocular region, auriculars, and pileum and to "deep neutral gray" on nape, upper back, sides of neck, throat, and chest; interscapular region between "kaiser brown" and "brick red;" lower back and rump "neutral gray," changing to "deep neutral gray" on longer upper tail coverts; three central pairs of rectrices "dark neutral gray" with paler edgings; fourth pair with a terminal white area 25 mm. long on the inner web next to the shaft, the cor-
responding part of the shaft also white; fifth pair with the white area 45 mm. long on the inner web and 50 mm. long on the outer; sixth (outside) pair entirely white except for a small (mostly concealed) area of dusky at the base of the inner web; lesser and middle wing coverts between “neutral gray” and “deep neutral gray;” greater coverts similar, but more or less edged with reddish, particularly the innermost; remiges “dark mouse gray,” narrowly edged on outer webs of outermost primaries with pale gray and on the innermost secondaries (“tertials”) broadly edged with grayish hazel; sides, posterior to the more or less sharply defined edge of the pectoral region, and flanks tinged with “cinnamon drab;” median underparts white, the under tail coverts with a creamy tint; bill (in life) dull pinkish with tip dusky; iris dark brown; wing, 78 mm.; tail, 68.0; exposed culmen, 11.1; tarsus, 20.5; middle toe minus claw, 14.9.

Subspecific characters.—This race differs from Junco caniceps (Woodhouse) in its darker head and chest, with relatively sharply defined pectoral area, slightly duller colored back and more or less pinkish tinted sides. From its nearest geographically situated black-headed relative, Junco oreganus thurberi Anthony of the Sierra Nevada of California, it differs in possessing a red (not pinkish brown) back, a very much grayer (not black) head and chest, and less extensively colored sides and flanks. The sexes are very similar although the females average decidedly paler.

Range.—Transition Zone in the Charleston and Sheep Mountains, Clark County, Nevada. Winter range unknown.

Remarks.—Of the new race there are available 31 specimens, all taken on their breeding grounds in the Transition Zone in the Charleston and Sheep Mountains. There are 13 worn mid-summer adults, 11 birds of the year and adults in fresh first-winter and post-nuptial plumage, and 7 juveniles, two of which are in moult and which therefore possess some of the characters of full-plumaged birds.

The most constant character in the series is the red back which, making due allowance for wear, appears to vary but little, although averaging slightly paler in the females. In the matter of the color of the head and chest the degree of darkness varies from “dark neutral gray,” very little paler than the lores, to between “neutral gray” and “light neutral gray.” The pinkish sides show the same variability. The least colored specimen is not distinguishable in this respect from some examples of caniceps, while the most brightly colored one is equal to the average thurberi. There is seemingly no correlation whatever between the relative darkness of head and the color of the sides, for the series, both as to head color and side color, shows various combinations of these two characters. Age may be eliminated as a cause of variation, for the full range is common to both adults and birds of the year; in fact the only difference readily apparent between adults and immatures in fresh fall plumage is the prominent brownish edging to the “tertials” which is replaced by gray in the adults.

To account for the variable characters displayed by this isolated colony of juncos which from the nature of the topographical features of the surrounding territory can, of course, have no direct contact with any other race, there are
several explanations open, all with points to support them, but none of them capable of proof.

First, there may be here a blending of races because of the simultaneous occupation of formerly unoccupied territory by two or more distinct types, or else because of an invasion of the range of an established form by radiations from another area.

Second, this unit may represent a remnant of a generalized, unstable race, formerly wide spread, various combinations of the characters of which are now crystallized in other regions.

Third, the unit may be a formerly stable race which is now changing by a series of mutations into another type.

The second of these possibilities seems the least tenable, for, even granting the previous existence of a somewhat generalized type over the Southwest and Lower California, it is scarcely conceivable that the isolated southern Nevada representatives would not have reached a degree of stability of characters comparable to that now shown by the distant colonies on the periphery of the range. The first or third hypotheses offer more reasonable explanations. These mountains show decided southern Rocky Mountains affinities and in not one instance is a coastal form present among the so-called plastic species. This being the case, we may by analogy consider the basic population to have been of southern Rocky Mountains derivation. In other words, this population was probably derived either from Junco caniceps, or the ancestral stock of which caniceps is the present day expression. The dilution of this original stock may have come from thurberi, which is resident in the mountains some 150 miles to the west and which is generally distributed over the southwestern deserts in winter, or from Junco oreganus shufeldti Coale, a distant northern race which is the common wintering one in this region. While on geographical grounds mutabilis could conceivably be the result of a fusion of caniceps with thurberi and while there is evidence of such fusion in the variability of head and side color, the uniformly red backs in both sexes, in which no suggestion of the back color of either thurberi or shufeldti is apparent, rather militates against this supposition.

In favor of the mutational hypothesis we have the evidence of the genus Junco as a whole. Probably no widely distributed genus exists in which the chief divisions are more clearly the result of mutation than in the case of Junco. These mutational (qualitative) differences are all the more emphasized by the normal geographic or climatic (quantitative) variations to be noted within the groups themselves. However, the present case does not seem to be paralleled in any other area inhabited by the genus at the present time, that is to say no isolated colony of juncos known to me shows nearly the amount of individual variation present in this southern Nevada colony. But whether as a result of mixture or mutation, the interesting fact stands out that these juncos constitute a link between the black-headed group and caniceps.

Returning once more to “systematics,” I do not see how such a case can be handled adequately by our present system of names. The trinomial is ideally suited to signify the quantitative differences exemplified by the variations within
such species as *Melospiza melodia*, *Otocoris alpestris* and numberless others, but when forced into duty to express the condition illustrated by the juncos of southern Nevada, regardless of how the condition be interpreted, its employment is open to serious question. Possibly the best way out of the difficulty would be, in this case, to use binomial terms for such transitional forms as *dorsalis*, *connectens*, *annectens*, and *mutabilis*, for by so doing a false implication of close relationship between well defined groups would be avoided.

Through the courtesy of the authorities of the United States National Museum I have been able to examine the type of *Junco annectens* Baird. While clearly the result of a *caniceps-mearnsi* contact the case demands more field work before a decision can be reached as to whether the type is a hybrid, or a transitional form with a definite, though necessarily limited, range. I suspect the latter to be probable, for birds of this type are not uncommon in southeastern Arizona in winter. There are three such in the Dickey collection, one of them an almost exact duplicate of Baird's type.
NOTES ON THE WORM SNAKES OF THE SOUTH-WEST, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES.

BY

LAURENCE M. KLAUBER
Curator of Reptiles and Amphibians, San Diego Society of Natural History

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LOCALITY RECORDS
OF
LEPTOTYPHLOPS HUMILIS
IN
CALIFORNIA, ARIZONA AND
LOWER CALIFORNIA

L. h. humilis •
L. h. cahuilae ○
L. h. slevini □

SCALE OF MILES
NOTES ON THE WORM SNAKES OF THE SOUTHWEST, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES.

BY

LAURENCE M. KLAUBER

Curator of Reptiles and Amphibians, San Diego Society of Natural History

INTRODUCTION

Recently in the course of an investigation of ophidian color variations in the species found along the southern border of California, with particular reference to the differences between coastal and desert specimens, I was struck by the marked and consistent contrast of the worm snakes of the species *Leptotyphlops humilis* as found in the two areas. Following up this suggestive lead has resulted in determining that this worm snake, which occurs in the southwestern United States, and central and northern Mexico, may be classified into at least three subspecies, and others are to be expected when more material is available from Mexico.

SUMMARY OF *Leptotyphlops* (*Siagonodon* Group)

The worm snakes of the genus *Leptotyphlops* may be divided into two groups, or subgenera, those with and those without supraoculars. The first group is evidently the more widespread and probably considerably the more numerous in both species and individuals. The presence (or absence) of supraoculars has often been considered a generic character, the name *Siagonodon* having been proposed by Peters (1881) for those snakes having no supraoculars. But in the present notes I follow such recent authors as Ruthven, Barbour and Loveridge, and do Amaral, and give this character only specific weight.

At this time the following American species without supraoculars are ordinarily recognized as valid:

*Leptotyphlops septemstriata* (Schneider)


(Type locality, not stated).

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1 1907, p. 573.
2 1929, p. 294.
3 1929a, p. 76; 1929b, p. 138.

Habitat: Rio Negro, Amazonas, Brazil (Mertens, 1925).

**Leptotyphlops humilis** (Baird and Girard)

Habitat: Southwestern Texas to the coast of southern California; central and northern Mexico and the peninsula of Lower California.

**Leptotyphlops borrichiana** (Degerboel)

Habitat: Mendoza, Argentina.

These partial synonymies are merely given to summarize the New World forms of the genus, which lack supraoculars (subgenus *Siagonodon*). I make no pretense of discussing all of these forms; in fact these notes are not only restricted to *L. humilis*, but, owing to lack of adequate material from Mexico, must be virtually limited to the forms found in the United States and Lower California. Thus, I cannot make a complete division of the species into subspecies; *dugesii* and possibly
*tenuicultum* as well may be valid subspecies of *L. humilis*; this can only be determined as more material becomes available. From the original descriptions I do not think they anticipate the new subspecies here proposed.

**Material**

The following discussion is based on complete examinations of the specimens of *L. humilis* listed below:

<table>
<thead>
<tr>
<th>Location</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Diego County, California (Coastal)</td>
<td>17</td>
</tr>
<tr>
<td>San Diego County, California (Desert)</td>
<td>7</td>
</tr>
<tr>
<td>Los Angeles County, California</td>
<td>3</td>
</tr>
<tr>
<td>Riverside County, California</td>
<td>1</td>
</tr>
<tr>
<td>Inyo County, California</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total California</strong></td>
<td>29</td>
</tr>
<tr>
<td>Cape Region, Lower California</td>
<td>9</td>
</tr>
<tr>
<td>Central Lower California</td>
<td>2</td>
</tr>
<tr>
<td>Cedros Island</td>
<td></td>
</tr>
<tr>
<td><strong>Total Lower California</strong></td>
<td>12</td>
</tr>
<tr>
<td>Western Desert Area, Arizona</td>
<td>5</td>
</tr>
<tr>
<td>Eastern Plains Area, Arizona</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total Arizona</strong></td>
<td>15</td>
</tr>
<tr>
<td>Texas</td>
<td>1</td>
</tr>
<tr>
<td>Mexico (Mainland)</td>
<td>2</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>59</td>
</tr>
</tbody>
</table>

About 35 specimens have been seen alive, all from California.

For comparative purposes 21 specimens of *Leptotyphlops dulcis* from Texas, Oklahoma, New Mexico, Arizona and mainland Mexico have been available.

**Differential Characteristics**

The scale formulas and arrangements in these worm snakes are so simple that conspicuous differential characteristics are few. The small size, lack of formal pattern and cylindrical shape all render checking and segregation difficult. Many specimens in collections are found to be rather poorly preserved because of the delicacy of the material.

The particular characteristics which I have found of most interest in subdividing *L. humilis* are: The ratio of the length of body to diameter; the number of scales in the median dorsal row from rostral to tip of tail; the depth of color on the dorsal scale rows; and the number of rows so
colored, particularly at mid-body. Of these the number of scales in the median dorsal scale row appears to be the most definite, and does not seem to have been used before. In the worm snakes the dorsals are easier to count than the ventrals, as the latter are particularly small and irregular below the head and neck.

By the use of these characteristics two well defined subspecies are segregated from typical *L. humilis*.

**New Subspecies**

*Leptotyphlops humilis slevini* subsp. nov.

**San Lucan Worm Snake**

*Type.—*No. 53721 in the collection of the California Academy of Sciences. Collected at La Paz, Lower California, Mexico, by J. R. Slevin, June 2, 1921.

*Diagnosis.—*A subspecies of *Leptotyphlops humilis* having a low dorsal scale count, low ratio of length to diameter, and five lightly or moderately colored dorsal scale rows, whereas the typical form has seven dark rows.

*Description of the Type.—*Adult. Length over all 207 mm.; length of tail 9.5 mm. Ratio of total length to tail length 21.8. Diameter of body 4.9 mm. Ratio of length to diameter 42.3. The body is almost cylindrical, the head being little distinct and the tail likewise. The latter terminates in a sharp spine.

The head is slightly depressed with a prominent overhanging snout. The rostral is high, wide and recurved. A large nasal plate touching the median dorsal row is divided behind, but not before, the nasal opening. A large ocular plate extends from the central dorsal row to the mouth on each side. The eye appears as a black dot below the surface of the ocular. There is a supralabial on each side between ocular and nasal, and a second behind the ocular, thus making four scales in contact with the mouth between the rostral and commissure. There is a large parietal and an occipital behind each ocular, both in contact with the median dorsal row. There are four infralabials on each side. The chin shields are small.

The body is covered with 14 rows of hexagonal scales, smooth and markedly imbricate. The ventral row is lightly enlarged, otherwise all dorsal and ventral body scales approach equality in size. The anal is entire. The median dorsal scales number 244 from rostral to tail spine.

The five median dorsal scale rows are light yellow-brown, the color being applied by a multiplicity of dots. Below the color is cream. These notes have reference to a specimen as preserved in alcohol.

*Range.—*This subspecies occurs in the Cape region of Lower California, Mexico. Areas of intergradation are discussed elsewhere.

*Material—Variations.—*The following specimens of this form have been examined, all being from the Cape region of Lower California.
Klauber—Worm Snakes

Specimen Number | Locality            | Dorsals | L/D | Pattern
---              | ---                 | ---     | --- | ---
CAS 53721        | La Paz              | 244     | 42  | 5 med. yellow-brown
(Type)           |                     |         |     | 
AMNH 5576        | Cape San Lucas      | 250     | 46  | 5 med. brown
MVZ 11850        | Eureka              | 251     | 47  | 5 med. brown
MVZ 11851        | Eureka              | 253     | 44  | 5 med. brown
USNM 5292 (A)    | Cape San Lucas      | 259     | 54  | 5 lt. brown
USNM 5292 (B)    | Cape San Lucas      | 246     | 45  | 5 lt. brown; 7 caudal
USNM 12601       | La Paz              | 247     | 48  | 5 med. brown
USNM 64580       | Cape San Lucas      | 257     | 46  | Unicolor (condition?)
Stanford 4118    | San José del Cabo   | 263     | 44  | 5 dark brown

Leptotyphlops humilis cahuilae subsp. nov.

Desert Worm Snake

Type.—No. 2637 in the collection of LMK. Collected at Yaqui Well, San Diego County, California, May 15, 1930, by the County Road Camp.

Diagnosis.—A subspecies of Leptotyphlops humilis differing from the typical form in possessing a higher average dorsal scale count, and by having five lightly punctate dorsal scale rows, instead of seven dark chocolate-brown rows as in L. h. humilis. From L. h. slevini it differs in a conspicuously higher dorsal scale count.

Description of the Type.—Adult. Length over all 232 mm.; length of tail 13.5 mm. Ratio of total length to tail length 17.2. Diameter of body 4.7 mm. Ratio of length to diameter 49.4. The body closely adheres to a cylindrical shape, the head being little distinct from the neck, and the tail but slightly diminished in diameter. It terminates in a sharp spine.

The head is slightly depressed, with a prominent overhanging snout. The rostral is large, wide and recurved. A large nasal plate in each side reaches the median dorsal row and is divided behind, but not before the nasal opening. This is followed on each side by a supralabial which does not contact the median dorsal row. Next comes a large ocular on each side extending from the dorsal row to the mouth; the eye appears as a black dot under the surface. Following the ocular there is another supralabial on each side, thus making four scales in contact with the mouth. Above, behind the ocular and touching the median dorsal row there is a parietal and an occipital on each side. There are four infralabials on each side, the other chin shields being small and irregular.

The body is covered with 14 rows of scales, smooth and imbricate. These rows are practically equal throughout, the median ventral not being enlarged. The anal is entire. The median dorsal scales number 282 from rostral to tail spine.

The five median dorsal scale rows are faintly brownish. The color is applied as punctations in the central area only of each scale. Elsewhere and below the color is cream. This refers to an alcoholic specimen.
Range.—This subspecies occurs in the Colorado and Yuma Deserts of California and Arizona along the lower desert fringes of the Peninsula range and along the banks of the Colorado River. It may occur in the desert between. It will probably be found in northeastern Lower California. Possible areas of intergradation are discussed elsewhere.

Material—Variations.—The following specimens distinctly of this subspecies have been examined:

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Locality</th>
<th>Dorsals</th>
<th>L/D</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMK 2637</td>
<td>Yaqui Well</td>
<td>282</td>
<td>49</td>
<td>5 light brown</td>
</tr>
<tr>
<td>LMK 2635</td>
<td>Yaqui Well</td>
<td>284</td>
<td>52</td>
<td>5 light brown</td>
</tr>
<tr>
<td>LMK 2636</td>
<td>Yaqui Well</td>
<td>300</td>
<td>61</td>
<td>5 faint brown</td>
</tr>
<tr>
<td>LMK 2760</td>
<td>Yaqui Well</td>
<td>280</td>
<td>50</td>
<td>5 light brown</td>
</tr>
<tr>
<td>LMK 2905</td>
<td>Yaqui Well</td>
<td>294</td>
<td>52</td>
<td>5 light brown</td>
</tr>
<tr>
<td>LMK 4102</td>
<td>San Felipe Wash</td>
<td>298</td>
<td>53</td>
<td>5 faint brown</td>
</tr>
<tr>
<td>SDSNH 12496</td>
<td>Agua Caliente Spr.</td>
<td>301</td>
<td>58</td>
<td>5 faint brown (a few on 7)</td>
</tr>
<tr>
<td>USNM 15943</td>
<td>(Ft.) Yuma</td>
<td>279</td>
<td>54</td>
<td>Unicolor (preservation?)</td>
</tr>
<tr>
<td>USNM 26289</td>
<td>(Ft.) Yuma</td>
<td>294</td>
<td>....</td>
<td>Unicolor (preservation?)</td>
</tr>
<tr>
<td>USNM 37114</td>
<td>Ft. Mohave</td>
<td>282</td>
<td>53</td>
<td>5 medium brown</td>
</tr>
</tbody>
</table>

(Note: All LMK and SDSNH specimens are from San Diego County, California; USNM 15943 and 26289 are recorded as being from Fort Yuma, Arizona. Fort Yuma was on the California side of the river, while the town of Yuma was (and is) on the Arizona side, in Yuma County. Thus there may be some doubt as to the side of the river on which these two specimens were collected. Ft. Mohave is in Mohave County, Arizona.)

Comparison of Subspecies

For comparative purposes the following schedule is presented of specimens of *L. h. humilis*, all of which are from San Diego County, California, in the vicinity of the type locality of the typical subspecies:

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Locality</th>
<th>Dorsals</th>
<th>L/D</th>
<th>Color of 7 dorsal rows</th>
<th>Next row each side</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMK 100</td>
<td>San Pasqual</td>
<td>268</td>
<td>56</td>
<td>Dark brown</td>
<td>Heavily mottled</td>
</tr>
<tr>
<td>LMK 860</td>
<td>Santa Fe Ranch</td>
<td>281</td>
<td>52</td>
<td>Dark brown</td>
<td>Half colored</td>
</tr>
<tr>
<td>LMK 861</td>
<td>Santa Fe Ranch</td>
<td>275</td>
<td>47</td>
<td>Dark brown</td>
<td>Part colored</td>
</tr>
<tr>
<td>LMK 1032</td>
<td>San Pasqual</td>
<td>268</td>
<td>52</td>
<td>Dark brown</td>
<td>—</td>
</tr>
<tr>
<td>LMK 1033</td>
<td>San Pasqual</td>
<td>263</td>
<td>53</td>
<td>Dark brown</td>
<td>Heavily mottled</td>
</tr>
<tr>
<td>LMK 1065</td>
<td>San Diego</td>
<td>271</td>
<td>57</td>
<td>Dark brown</td>
<td>Part colored</td>
</tr>
<tr>
<td>LMK 2955</td>
<td>Red Mountain</td>
<td>265</td>
<td>57</td>
<td>Dark brown</td>
<td>Heavily mottled</td>
</tr>
<tr>
<td>LMK 2956</td>
<td>San Diego</td>
<td>281</td>
<td>47</td>
<td>Dark brown</td>
<td>Part mottled</td>
</tr>
</tbody>
</table>
A number of additional specimens have been checked insofar as the number of dark brown dorsal scale rows is concerned; all were found to have seven fully pigmented, with the color usually straying onto the next row on either side.

As far as the three subspecies *L. h. humilis*, *L. h. slevini* and *L. h. cahuilae* are concerned they are quite distinct and easily classified. Not a single specimen has been seen from within the territory of any subspecies which is not clearly and definitely of that subspecies. The important differences are summarized in the following table:

<table>
<thead>
<tr>
<th>Subspecies</th>
<th>No. Specimens</th>
<th>Dorsal Scales</th>
<th>Ratio L/D</th>
<th>Marked Dorsal</th>
<th>Rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humilis</td>
<td>17</td>
<td>263-273-281</td>
<td>47-53-61</td>
<td>7 dark</td>
<td></td>
</tr>
<tr>
<td>Cahuilae</td>
<td>10</td>
<td>279-289-301</td>
<td>49-54-61</td>
<td>5 light</td>
<td></td>
</tr>
<tr>
<td>Slevini</td>
<td>8</td>
<td>244-252-263</td>
<td>42-46-54</td>
<td>5 light-med.</td>
<td></td>
</tr>
</tbody>
</table>

(The outer figures indicate the range; the central figure indicates the average.)

We see that *L. h. humilis* differs from both of the other forms, and particularly from *cahuilae*, in color and pattern. This is no slight difference exaggerated to appear important. So light colored are specimens of *cahuilae* compared to *humilis*, when viewed dorsally, that were it not for intermediate forms from other areas they might well be considered a distinct species. I am rather of the opinion we may find here, as with the gopher snakes *Pituophis catenifer annectens* and *Pituophis catenifer deserticola*, that while the ranges of the two forms are contiguous, and may indeed overlap in eastern San Diego County, there may be no intergradation, which, if it occurs, more probably takes place in another region or through a third subspecies. In alcoholic material the seven dorsal scale rows of *humilis* are colored a dark chocolate-brown, with a marked contrast between the dorsals and the ventrals. The edge of the brown may
closely follow the third scale row on each side of the median dorsal row or, more often, it is broken, engaging part or all of the fourth row, thus coloring a total of nine dorsal rows. Magnification shows the color application to be in the form of punctations so close together as to be virtually confluent.

Superficially *cahuilae* appears to be unicolor, without a dorsal-ventral contrast, but a close examination will reveal scattered light brown dots faintly obscuring the five median dorsal rows.

It must be understood that these color notes apply to preserved specimens, alcoholics in this case. Live specimens are so translucent that the colors are less apparent, but even in these the difference is sufficiently marked to have occasioned the following entry in my diary, upon receipt of the first live desert specimen of the species: "Noted today a worm snake from Agua Caliente Spring that I first thought might by *L. dulcis*, but it proved not to be. Very unusual in color, pink and transparent. Might be an albino, but the eye pigment is present." (Aug. 5, 1929). A corresponding entry for a coastal specimen describes the appearance in life as follows: "The color above is a uniform metallic brown, with the scale edges showing as a tracery of silvery lines. The lower surfaces are translucent white with the viscera showing through as dark patches. The eyes are black dots." (June 4, 1925). Thus there is a noticeable difference in life, accentuated as the colors become more opaque in preservation. It may be mentioned that the specimens of the two subspecies in my collection, having been preserved by a uniform process, are directly comparable.

In addition to the colors, we have, between *humilis* and *cahuilae*, a considerable average difference in dorsal scale counts, with slight overlapping between the maximum of the former and the minimum of the latter. In body form (ratio of length to diameter) there seems to be no difference.

*Slevini* is intermediate between *cahuilae* and *humilis* in pattern and color, being nearer the former in number of pigmented rows and the latter in color. Usually only five rows are punctated and these lightly or moderately, but the brownish dorsal tone is decidedly more in evidence than in *cahuilae*, and occasionally seven rows are engaged posteriorly. However, this Cape form differs from both of the others in the low dorsal scale count, in which character there is overlapping only in one specimen, and in the distinctly heavier body, as shown by the lower ratio of total length to diameter. With reference to the latter characteristic, it should be mentioned that averages, rather than extremes, are to be con-
sidered important, since distortion in preservation is likely to cause an occasional inaccurate figure.

I have stated that all specimens of these three subspecific forms, from within certain territories, fall consistently within the classification of the form inhabiting that area, the three areas being:

L. h. humilis: San Diego County from the coast to the crest of the divide.

L. h. cahuilae: The Colorado desert from the lower desert fringes of the Peninsula range to the east bank of the Colorado River.

L. h. slevini: The Cape region of Lower California.

There is, however, one very important exception, namely, the type of L. humilis itself, upon which it is necessary to comment at some length.

The type locality is given as Valliecitas, California, by Baird and Girard in the original description. This has always been assumed to indicate Vallecito (pronounced in this neighborhood Vya-seé-tó), which was a stage station on the old Butterfield Route in eastern San Diego County. Miss Doris M. Cochran of the National Museum advises me that the original entry in the record book might be "Variecita" or "Varicata," the writing being rather poor. The situation is further complicated by the fact that Vallecitos (Little Valleys) are rather common in California, two others, one near Campo, the other near San Marcos, being located in San Diego County. We have three possible alternatives with reference to the actual locality of collection of this specimen:

1. It was collected at Vallecito, the now abandoned stage station, in eastern San Diego County.

2. It was collected near that point, but not necessarily at the station or even in the same life zone.

3. It was collected at some other Vallecito (or Variecita?) in California.

The importance of these three possibilities is due to the fact that Vallecito is located in a Lower Sonoran area in which, in later years, only L. h. cahuilae has been found, whereas the original description mentioning the "uniform chestnut-brown" dorsal color, admits of no classification other than L. h. humilis.

The type of humilis was collected by Dr. John L. Le Conte in 1850. Dr. Jos. Grinnell has kindly called to my attention one of LeConte's

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4 1853, p. 143.
publications (on Coleoptera) from which there is every evidence that he collected along the line of the then principal route between San Diego and Yuma including "Vallecitas," which leaves little doubt that it was the old stage station that was meant. This eliminates the third possibility. As to the other alternatives, a definite decision can probably never be reached. *L. h. cahuilae* has been taken at Agua Caliente Spring, which is three miles east of Vallecito, in the same dry wash and in the same life zone. *L. h. humilis* might be expected (but has not been actually collected) within five miles to the west of Vallecito, which would be in the Upper Sonoran life zone. Of course if LeConte, or some assisting army officer, had collected the specimen even ten or twenty miles west of Vallecito it would still no doubt have been filed under that locality, since this was the only named point in those days for many miles around.

So we must leave this problem undecided; the territories of *L. h. humilis* and *L. h. cahuilae* may or may not overlap in eastern San Diego County or the two may intergrade. Aside from the type itself, of somewhat uncertain locality, only one other specimen has been reported from the eastern foothills of the Peninsulas, which might logically be expected to be an area of intergradation if the two forms blend. This was Stephens' specimen from Banner,\(^5\) which was in poor condition and has since disappeared. Thus we have every reason to look forward with interest to additional specimens from the desert foothills of this county.

**Other Areas—Intergradations**

We have seen that the snakes from the Cape region of Lower California, San Diego County and the Colorado Desert fall rather definitely into three territorial races. It now remains to classify, with the limited material at hand, the specimens from other areas.

Two specimens are available from central and northern Lower California, MVZ 10667 from San Ignacio with 277 dorsal scales and a length-diameter ratio of 45, and MVZ 9637 from San José (Lat. 31°) with corresponding figures of 274 and 53. Both of these specimens have seven medium brown dorsal rows. In color these snakes are intermediate between the San Diegan and Cape specimens; in numbers of dorsal scales they are above the San Diegan average. In the number of colored rows they resemble the San Diegan rather than the Cape specimens. One specimen is more like the Cape average in bodily form, but this is probably due to

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\(^{5}\) Copeia, No. 54, p. 34, 1918.
swelling from injection of preservative. Thus these specimens from the central and northern sections of the peninsula are best classified as *L. h. humilis* with an intergradative tendency toward *slevini*, as indicated by the light dorsal color.

From Cedros Island there is available a single dried specimen (CAS 8860). The dorsals probably number 254, thus approaching *slevini*; there are seven dorsal dark brown scale rows as in *humilis*. Probably the latter classification should be used. As this specimen is from an island containing several unique reptile forms, this single specimen should not be considered of importance in determining the *humilis*-*slevini* relationship.

From California, north of San Diego County, so few specimens are available that definite conclusions are not to be drawn. The following table gives the data on those which we have:

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Locality</th>
<th>Dorsals</th>
<th>L/D</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMK 98</td>
<td>Snow Creek, Riverside County</td>
<td>272</td>
<td>52</td>
<td>(5 solid brown, plus</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2 moderate, plus 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(faint brown rows</td>
</tr>
<tr>
<td>LA 218</td>
<td>Chatsworth Park, Los Angeles County</td>
<td>263</td>
<td>43</td>
<td>7 dark brown rows</td>
</tr>
<tr>
<td>USNM 56305</td>
<td>Los Angeles County</td>
<td>254</td>
<td>...</td>
<td>7 med. brown rows</td>
</tr>
<tr>
<td>USNM 56306</td>
<td>Los Angeles County</td>
<td>272</td>
<td>51</td>
<td>7 med. brown rows</td>
</tr>
<tr>
<td>USNM 18686</td>
<td>Near Bennett's Well, Inyo County</td>
<td>275</td>
<td>...</td>
<td>7 dark brown rows</td>
</tr>
</tbody>
</table>

It is to be noted that these specimens more nearly resemble *L. h. humilis* in the number of dark dorsal rows and their color; in reduced number of dorsal scales they show a tendency toward *slevini* (rather than toward *cahuilae* as might be more readily expected). It is to be regretted that more exact localities are not available for USNM 56305-6. They were collected by Julius Hurter, and as he is known to have worked in the vicinity of Claremont, it may be assumed that they come from the coastal, rather than the desert side of the mountains. We conclude that these California specimens from areas north of the type locality are to be classified as *L. h. humilis* although less sharply differentiated from the other subspecies than those from coastal San Diego County.

We next come to the Texas and the Arizona specimens, excluding

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6 *Uta concinna, Phrynosoma cerroense, Phrynosoma schmidti, Cnemidophorus multiscutatus, Cnemidophorus labialis, Crotalus exsul.*
those from the east bank of the Colorado, already included under *cahuilae*. These may be enumerated as follows:

<table>
<thead>
<tr>
<th>Specimen Number</th>
<th>Locality</th>
<th>Dorsals</th>
<th>L/D</th>
<th>Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMNH 8596</td>
<td>Fort Clark, Texas</td>
<td>269</td>
<td>55</td>
<td>7 medium brown</td>
</tr>
<tr>
<td>CAS 35325</td>
<td>Tucson</td>
<td>275</td>
<td>57</td>
<td>7 light brown</td>
</tr>
<tr>
<td>CAS 33835</td>
<td>Tucson</td>
<td>256</td>
<td>47</td>
<td>Pinkish. No contrast of dorsal with ventral color.</td>
</tr>
<tr>
<td>CAS 33836</td>
<td>Tucson</td>
<td>271</td>
<td>50</td>
<td>Pinkish. No contrast of dorsal with ventral color.</td>
</tr>
<tr>
<td>USNM 16952</td>
<td>Tucson</td>
<td>273</td>
<td>54</td>
<td>7 medium brown</td>
</tr>
<tr>
<td>USNM 17015</td>
<td>Tucson</td>
<td>276</td>
<td>56</td>
<td>7 medium brown</td>
</tr>
<tr>
<td>USNM 17016</td>
<td>Tucson</td>
<td>268</td>
<td>54</td>
<td>7 light brown</td>
</tr>
<tr>
<td>USNM 17017</td>
<td>Tucson</td>
<td>253</td>
<td>49</td>
<td>7 pinkish. Little contrast</td>
</tr>
<tr>
<td>CAS 33849</td>
<td>Santa Catalina Mts.</td>
<td>268</td>
<td>54</td>
<td>7 light brown</td>
</tr>
<tr>
<td>USNM 62564</td>
<td>Sabino Canyon, Santa Catalina Mts.</td>
<td>270</td>
<td>56</td>
<td>7 light brown</td>
</tr>
<tr>
<td>USNM 62565</td>
<td>Sycamore Canyon, Santa Catalina Mts.</td>
<td>252</td>
<td>....</td>
<td>7 light brown</td>
</tr>
<tr>
<td>AMNH 43439</td>
<td>Santa Rita Mts.</td>
<td>280</td>
<td>52</td>
<td>7 medium brown</td>
</tr>
<tr>
<td>USNM 65637</td>
<td>Cave Creek Dam, near Phoenix</td>
<td>279</td>
<td>51</td>
<td>7 medium brown</td>
</tr>
</tbody>
</table>

Here again we have a group which, in color, is intermediate between *slevini* and *humilis*. All have seven punctuated rows except those in which no dots are visible; this, I am inclined to think, may be due to character of preservation. Several specimens have a lower range of dorsals than is characteristic of *humilis* in San Diego County, while the two westerly specimens are high in number of dorsals, thus indicating a tendency toward *cahuilae*, as might be expected.

But the situation is complicated by not knowing the altitudes and life zones in which the mountain specimens were taken. It is not impossible that some of the Tucson specimens were taken in the adjacent mountains, rather than at Tucson itself. Knowing what a difference a few miles make in San Diego County, we cannot but feel that a large number of specimens from Arizona, with highly accurate locality records, might produce a more logical and definite differentiation than is indicated in the above table.

Altogether I think the Texas and Arizona specimens may be classified at *L. h. humilis*, the easterly specimens from the plains area
showing an affinity toward *L. h. slevini* of the Cape region, or one of the Mexican forms, while those from the westerly desert area have a tendency toward *L. h. cahuilae*. Thus we have a situation comparable to that which exists amongst other reptile forms in the same areas.

From Mexico I have seen only one specimen in a condition of preservation sufficient to permit counting dorsal scales. This is USNM 48537 from Guanajuato with 239 dorsals and a body ratio of 43. The character and number of punctated dorsal rows cannot be determined. Mr. A. Loveridge kindly advises me that the type of Garman's *tenuiculum* from San Luis Potosí has seven light brown rows.

We may presume that the Mexican forms will have low dorsal scale counts, thus showing an affinity to *slevini*, but this is no more than a guess. The status of *dugesii* and *tenuiculum*, their relationships with the forms of *humilis* found in Texas and Arizona, and with *slevini* of the Cape region will have to await more material.

Aside from the differential characteristics which I have employed, I have been unable to determine others of importance. All specimens of *humilis* examined, of whatever subspecies, had fourteen rows of scales, with anal entire and two undivided plates (parietal and occipital) behind the ocular on each side. The lower labials are usually four on each side, but five are occasionally noted. It is so difficult to ascertain whether the nasal is divided in front of the aperture that this is not to be considered a useful character. The ratio of total length to tail length varies from about 17 to 27, averaging 22; this seems to have no subspecific significance.

Initially, having noted the fact that *L. humilis* appears common at the western limit of its range (San Diego County) but seems rare along the eastern boundary (Texas), and that a contrary condition exists with *L. dulcis*, it occurred to me that the presence or absence of supraoculars might be only of subspecific importance, *dulcis* gradually changing into *humilis* from east to west. But I note other differences between these two forms. From an examination of 21 specimens of *dulcis* from Mexico, Texas, Oklahoma, New Mexico, and Arizona, I find *dulcis* to have fewer dorsal scales than *humilis* (min. 209, max. 252, mean 230) and a lower ratio of total body length to diameter (min. 41, max. 53, mean 48). The infralabials are more frequently five than in *humilis*. In *dulcis*, as in Arizona specimens of *humilis*, there are usually seven medium to dark dorsal rows; occasionally there are but five. In *dulcis* the transition from the punctated dorsal rows to the immaculate ventrals is less sudden than in *humilis*. In *humilis* the rostral seems to be more divergent and wider at
the base than in *dulcis*. In *humilis* the first four median dorsal scales are usually wider than the following series, while in *dulcis* they are narrower. With these differences reinforcing the supraoculars it may be concluded that the species are distinct.

**Field Notes—Habits**

In San Diego County *L. humilis* seems to prefer stony rather than sandy areas. It must be largely subterranean, although the fact that two specimens have been found crushed by automobile traffic on the highway would indicate that it occasionally travels abroad. Most of the specimens brought to the San Diego Zoological Society during the past eight years were found under stones or during the course of excavations. In this period 38 worm snakes (*7 cahuilae*, the rest *humilis*) were reported out of a total of 6231 individuals of all species, thus constituting 0.6 per cent of the total and numbering fifteenth in order of frequency amongst the 29 species of snakes found in San Diego County.

The largest specimen measured was one from (Ft.) Yuma, Arizona, which was 337 mm. in length. A specimen from Yaqui Well, San Diego County, measured 304 mm., and one from San Diego (City) 302 mm.; thus *L. h. humilis* and *L. h. cahuilae* probably reach the same length. The smallest specimens measured about 90 mm. long and 1.8 mm. in diameter, being as long as and somewhat thicker than a large darning needle. One specimen contained eggs about 15 mm. long by 4½ mm. in diameter. A specimen 245 mm. in length contained eggs.

This snake when above ground seems to progress with less lateral undulations than do other snakes. On smooth surfaces it attempts to employ the tail spine to aid in its motion. When placed in loose or sandy soil it burrows immediately. It is never peaceful or quiet when above ground, but continually searches for something in which to burrow; it is therefore difficult to photograph.

Some field notes follow:

Oct. 4, 1922: Three specimens were found in digging out the rotted butt of a fence post.

July 8, 1923: A specimen was found in a crack under a granite flake.

March 20, 1926: One was discovered under a rock flake.

March 28, 1926: Found a specimen under a flat rock; earth below, not another rock.

April 20, 1927: Found one under a thick flake leaning on a rock and touching the ground.

The food probably consists of termites and similar insects.
Locality Records

The definite locality records which I have been able to accumulate are given below. They are from the following sources: Locations mentioned in the literature; specimens borrowed from other institutions; localities from which I have collected specimens, or from which specimens have been brought to the Zoological Society of San Diego, the latter being almost exclusively from San Diego County.

*Leptotyphlops humilis humilis*

(This list includes not only specimens of the known typical form, but likewise all which cannot be specifically allocated to either of the two new subspecies. Thus we include all Mexican specimens which may belong to one or more other valid subspecies).

**California**

San Diego County:
- Valliecasitas (= Vallecito?), Type locality
- Red Mountain
- Fallbrook
- San Pasqual
- Bernardo
- Rancho Santa Fe
- Lakeside
- Grossmont
- Lemon Grove
- Sunnyside
- Palomar
- Rincon

Riverside County:
- Snow Creek

San Bernardino County:
- San Bernardino
- Slover Mt. (near Colton)

Los Angeles County:
- Chatsworth Park

Inyo County:
- Bennett’s Well (Death Valley)

**Arizona**

Maricopa County:
- Cave Creek Dam (near Phoenix)

Pima County:
- Santa Rita Mts.
- Tucson
- Santa Catalina Mts.
Sabino Canyon (Santa Catalina Mts.)
Sycamore Canyon (Santa Catalina Mts.)

Texas

Kinney County:
Fort Clark

Lower California
San Ignacio
San José (Lat. 31 deg.)
Cedros Island

Mainland Mexico
Colima, Colima. (Type locality of *dugesii*)
San Luis Potosi, San Luis Potosi. (Type locality of *tenniculunm*)
Guanajuato, Guanajuato
Talpa, Jalisco
Batopilas, Chihuahua
Presidio, Chihuahua?
San Miguel de Horcasitas, Sonora

*Leptotyphlops humilis slevini*
(All localities are in the Cape region of Lower California)
La Paz (Type locality)
Cape San Lucas
Eureka
San José del Cabo
San Francisquito
Sierra Laguna

*Leptotyphlops humilis cahuilae*

California
San Diego County:
Yaqui Well (Type locality)
Sentenac Canyon
San Felipe Wash
The Narrows
Agua Caliente Spr. (near Vallecito)

Imperial County:
Fort Yuma

Arizona
Yuma County:
(Fort) Yuma

Mohave County:
Fort Mohave

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7 USNM 72346 from San Antonio, Texas, catalogued as *humilis*, appears to me to be *dulcis*. 
Tentative Key to Distinguish the Western Subspecies of Leptotyphlops humilis

(Not complete for the entire species)

A. Scales in median dorsal row usually less than 260 and
• average 252; ratio of body length to diameter usually
less than 50; 5 pigmented median dorsal scale rows...slevini

AA. Scales in median dorsal row usually number more than
260; ratio of body length to diameter usually over 50.

B. Seven or more dark brown dorsal scale rows;
dorsal scales usually from 260 to 280 and aver-
age about 273...humilis

BB. Five dorsal scale rows punctated with scattered
light brown dots; dorsal scales usually exceed
280 and average about 289...cahuilae

Conclusions

The worm snakes of the Californias belonging to the species Leptotyphlops humilis, centering in three areas from which adequate material is available, show sharp and definite differences and may be divided into three subspecies. A complete classification of the species must await more material, especially from Mexico.

Acknowledgments

I wish to express my appreciation to the following individuals and institutions for the loan of important material: Dr. Leonhard Stejneger and Miss Doris M. Cochran of the United States National Museum; Dr. B. W. Evermann and Mr. J. R. Slevin of the California Academy of Sciences; Drs. Jos. Grinnell and Jean Linsdale of the Museum of Vertebrate Zoology, University of California; Dr. Thos. Barbour and Mr. A. Loveridge of the Museum of Comparative Zoology, Harvard University; Dr. G. K. Noble of the American Museum of Natural History; Mr. G. S. Myers of Stanford University; and Mr. H. R. Hill of the Los Angeles Museum. Dr. H. Wegeforth and Mrs. Belle Benchley of the San Diego Zoological Society kindly permitted me to use freely the specimens acquired by that institution. Lastly I wish to acknowledge the care exercised by my assistant Mr. L. H. Cook in the tedious process of scale counting.
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STEJNTEGER, L.

STEPHENS, F.

VAN DENBURGH, J.

WERNER, F.
TRANSACTIONS

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CROTALUS TIGRIS AND CROTALUS ENYO, TWO LITTLE KNOWN RATTLESNAKES OF THE SOUTHWEST

BY

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SAN DIEGO, CALIFORNIA

PRINTED FOR THE SOCIETY

JULY 8, 1931
LOCALITY RECORDS
OF
CROTALUS ENYO
AND
CROTALUS TIGRIS

C. enyo
C. tigris

SCALE OF MILES
CROTALUS TIGRIS AND CROTALUS ENYO, TWO LITTLE KNOWN RATTLESNAKES OF THE SOUTHWEST

BY
LAURENCE M. KLAUBER
Curator of Reptiles and Amphibians, San Diego Society of Natural History

INTRODUCTION

Within the past two years I have been fortunate in procuring a number of specimens of Crotalus enyo and Crotalus tigris, some alive and some preserved, and have had the opportunity of comparing them with species with which they are sometimes confused. Specimens extending the previously known ranges have been available. As neither species has been plentifully represented in collections, it will be useful to record the data accumulated. These are based on an examination of 25 specimens of tigris and 30 of enyo. Eight of the latter and about twenty-five of the former have been seen alive.

When referring to tigris I am excluding the form found in eastern California and southern Nevada, which I consider a subspecies of Crotalus confluentus (intermediate between C. c. lutosus and C. c. mitchellii), and which I have described as C. c. stephensi.1 Tigris as it occurs in southern Arizona and northern Mexico is, I think, a distinctive snake, probably more closely allied to enyo than to stephensi. At any rate all present evidence indicates a valid species, quite separate from mitchellii or stephensi.

Similarly enyo, although lately considered a subspecies of confluentus by do Amaral,2 should, I believe, on the evidence here presented, be continued in a specific status.

Seen alive, both tigris and enyo exhibit rather striking characteristics, especially when one’s impressions of typical rattlesnakes are based on the predominant southwestern forms, that is, C. confluentus, C. atrox and their subspecies and allies. For, compared with these, both tigris and enyo have proportionately smaller heads, slender necks and in the case of tigris,

1 Klauber, 1930, p. 106.
2 Do Amaral, 1929-b, p. 93.
larger rattles. The head size of *tigris* is disproportionate in both dimensions, while the *enyo* head is slender but not especially short.

I do not think either species is particularly rare within its habitat; their scarcity in collections and zoological gardens is rather because of the inaccessibility of their ranges. *Tigris* is to be found in the scattered mountain groups of south-central Arizona and Sonora, while *enyo* is restricted to Lower California and certain Gulf of California islands.

Since most descriptions of *Crotalus tigris* have been based on composite *tigris-stephenisi* material, and as new *enyo* material is available, it is deemed desirable to present complete redescriptions of the species, followed by a discussion of their differential characteristics as compared with certain other forms.

**Crotalus tigris** Kennicott

**Tiger Rattlesnake**

Plate 23, fig. 1.


*Lepidosis and Form.*—Size medium among rattlesnakes. Scale rows at mid-body usually 23 (64 per cent), occasionally 22, 24 or 25, average 23.3. Scale rows are dropped in the following order: From 23 the fifth or sixth to 21, and then the fourth or fifth to 19. As is usual amongst the rattlesnakes the order of dropping rows is difficult to determine with accuracy. The scales are keeled, except the first two rows on the sides. Ventrals: males, max. 172, min. 161, av. 166 (16 specimens); females, max. 173, min. 165, av. 168 (4 specimens). Anal entire. Caudals: males 23 to 26, average of 16 specimens 24.7; females 20 in all of 4 specimens. The males usually have from 24 or 25 caudals. The caudals, while generally entire, may be divided at either end of the series.

The supralabials number 11 to 15, being usually 14 (44 per cent), 13 (24 per cent), or 12 (20 per cent), rarely 11 or 15. The infralabials number 11 to 16, being usually 14 (49 per cent), 13 (29 per cent), or 15 (16 per cent).

The rostral is wider than high, and is in contact with the prenasals. The prenasals are normally in contact with the supralabials, but such contact is partially prevented on one side of one of the specimens examined, by the extension, to the rostral, of the small scales anterior to the pit. The internasals (scales in contact with the rostral between nasals, regardless of size or relative position) are 2 in number. The scales on the crown, anterior to the supraoculars, vary from
11 to 25 and average 15.6. The minimum scale rows between supraoculars vary from 3 to 6, averaging 4.8.

Supraocular sutures or indentations are normally absent in this species, there having come to my attention a single specimen with sutures, and in this it is not certain whether these are true sutures or merely folds resulting from the state of preservation. The nasals are 2–2. The loreals are normally 1–1, only 11 per cent of the specimens having 2. The scales along the canthus rostralis, from rostral to supraocular, number from 3 to 5, averaging 3.5; the posterior is generally the largest of the series.

There are usually two preoculars, but occasionally a third is formed by cutting off an upper corner of the normally superior preocular. The upper preocular, which is the larger, is usually not in contact with the postnasal. In 76 per cent such contact is prevented by the contact of the post-canthal with the loreal, in 11 per cent by the presence of a small upper loreal.

The minimum scale rows from labials to orbit number 1 or 2, averaging 1.6. Generally the fifth supralabial is the largest; usually the third and fourth are in contact with the pit borders.

The first infralabial is usually undivided (6.8 per cent divided). Normally 3 or 4 infralabials are in contact with the genials on each side.

The mental is triangular. The genials are in a single pair, relatively short and obtuse. Intergenials are not present.

In shape the head is usually sub-elliptical. The average ratio of body length to head length in 22 adults (over 980 mm. in length) is 26.1, max. 28.8, min. 23.9. This high ratio is one of the most distinctive characteristics of the species. The ratio of head length to head width averages 1.38. The ratio of the distance across the supraoculars to the space between averages 2.6 (range 3.43 to 2.3) in 18 specimens.

The ratio of the length of tail to total body length exclusive of rattle varies from .077 to .092 in the males (average .081) and .065 to .069 in the females (average .067).

The largest specimen examined measured 778 mm. (31 in.) in length. Specimens 665 mm. and 616 mm. in length contained eggs.

The rattles are conspicuously large for the body size.

Pattern and Color.—The first impression of *tigris* is of a ringed or banded snake, more so than any other rattler, but with dull and poorly defined rings, and with both pattern and ground color consisting largely of punctations.

The head markings are obscure and indefinite; there are a few irregular blotches on the head posteriorly. The side marks are less definite than in most rattlesnakes. An obsolescent dark ocular stripe is usually present. Rarely this is bordered above by a postocular light stripe two scales wide and passing backward on the second or third row above the commissure. Supraocular cross dashes are sometimes present, but are rarely conspicuous or even; when present they usually curve inward and forward. The labials are heavily spotted, but otherwise the underside of the head is clear.

3 One specimen only reaches this figure; the next highest is 2.8.
The body pattern consists of a series of cross-bands numbering from 40 to 51 and averaging about 44. These are not complete on the ventral surface. The bands are of indefinite outline and heavily marked with, and in fact consist largely of, dark dots. They are wider along the center of the back than on the sides and are usually more definitely outlined on the posterior half of the body. Dorsally, the blotches are wider than the interspaces. A secondary series of small blotches between the major rings is usually in evidence on the first two or three rows of each side, especially toward the tail. Often scattered scales in the blotches have black tips, a characteristic of *stepsieni* and some other species. Rarely a specimen will be found with definite hexagons anteriorly, which do not become complete bands until toward the posterior end of the body.

In color the blotches are usually dark gray or brown; it is difficult to give definite color values thereto as the surface is so speckled. The ground color between is usually gray, lavender or blue-gray, often with a pink or creamy tinge on the sides. The ground color is lighter toward the tail and thus is in greater contrast with the dark rings. The ventral surface is straw, yellow or pink, heavily mottled and punctuated. Specimens from the Santa Catalina Mountains are pinker than those from other areas.

The tail is crossed with from 5 to 10 dark brown, speckled rings of irregular outline, not complete on the undersurface and with narrower interspaces. The last two or three are less clear. At this point the ground color is often yellow-brown.

The anterior rattle is usually brown or tan, never black.

*Material.*—The description contained herein is based on an examination of the following specimens:

LMK 774, 787, Squaw Peak, near Phoenix, Maricopa Co., Ariz.
LMK 3237, Caballo, near Guaymas, Sonora, Mex.
USNM 471-2, Sierra Verde and Pozo Verde, Arizona-Sonora Boundary. (Type and Paratype)

Total preserved specimens 25. Of the above, 15 specimens were seen alive, together with about 10 others not in this list.

*Localities, Range.*—The verified localities where this species has been taken are the following, specimens having been examined from all except Amole Peak.
ARIZONA: Pima County
Santa Catalina Mts. (Pima, Ventana and Sabino Canyons)
Amole Peak, Tucson Mts.
Sierra Verde and Pozo Verde. (Type Locality) 4
Coyote Mts.
Maricopa County
Squaw Peak. (N. of Phoenix)
Salt River Mts. (S. of Phoenix)
Estrella Mts. (SW. of Phoenix)

SONORA: Caballo, near Guaymas.

I find no other authentic localities in the literature. All California or Nevada records refer to C. c. stephensi, C. c. mitchelli or intergrades between these two. Do Amaral is, I think, incorrect in referring Woodbury's Utah C. concolor to this species. 5 USNM 5271 from Fort Buchanan, Ariz. is C. c. confluentus and USNM 32725 from Grand Canyon is C. c. abyssus. These localities, occasionally mentioned, should therefore be suppressed. Dunn has shown 6 that the specimen from Ventanas, Durango, Mex., referred to this species by Boulenger in his Catalogue, is C. stejnegeri.

Thus the known range may be described as the mountains of south-central Arizona and Sonora, from the vicinity of Phoenix to Guaymas. (See Map)

The range of tigris overlaps that of mitchelli in the vicinity of Phoenix, Arizona, both being found in the surrounding mountains. Tigris and stephensi (which two were once considered identical) do not contact by about 200 miles, and this intervening territory is occupied by mitchelli, with which stephensi intergrades. Thus stephensi and tigris could be related only through mitchelli, but I find no evidence of intergradation between the two latter.

Habits.—Little is known concerning the habits of the species. Its habitat seems to be restricted to the canyons and foothills of the desert mountains. The fact that it has not been taken in such well collected ranges as the Huachucas, the Chiricahuas, etc., would indicate that it is probably not present in all of the southern Arizona mountain groups.

From the specimens seen in captivity, and the presence of unusually long rattle strings, I should assume this to be a relatively even tempered and inoffensive snake.

Two specimens taken in October contain eggs.

F. E. Walker captured a specimen at 9 P. M. on a rainy night in August in Sabino Canyon. Santa Catalina Mts.

R. R. Humphrey told me of finding two specimens in Sabino Canyon at about 7 P. M., one in a bush about two feet above ground, the other under a rock shelf. Both rattled before they were seen.

4 This may be in Sonora. Modern maps show the Sierra Pozo Verde (Mts.) at the south end of the Baboquivari Mts. straddling the International Boundary Line. (Long. 111° 40' W.)

5 Do Amaral, 1930, p. 115; see also Woodbury, 1930, p. 23.

As might be expected, with snakes having such small heads, the fangs are short and delicate. The venom is small in quantity, yields of dried purified venom being as follows:

Lot 197, 1 large specimen, 0.0109 g.
Lot 265, 3 large specimens, 0.0366 g.
Lot 281, 7 large specimens, 0.08 g.

This gives an average yield for a fresh adult specimen of 0.0116 g.

Dr. T. S. Githens and Mr. I. D. George of the Antivenin Institute of America report the M. L. D. of this species (for 350 g. pigeons) to be 0.04 mg. which is relatively powerful amongst rattlesnake venoms, being three and one-half times C. atrox venom. However, because of the small yield and short fangs, this is not to be considered a particularly dangerous snake.

Red mites were found on one specimen and ticks on another.

Diagnostic Characters.—Pattern alone will nearly always distinguish tigris from all other Crotalus species except some of the confluentus forms. From the latter, with the exception of C. c. mitchelli and C. c. stephensi, it may be segregated by the number of internasals, which are 2 in tigris compared with a normal of 3 or more in all confluentus subspecies except these two; also the rostral is normally higher than wide in confluentus (except stephensi and mitchelli), while in tigris it is wider than high.

From mitchelli the tiger rattlesnake can usually be distinguished by the rostral-prenasal contact (which is normally imperfect or entirely prevented in the former), by the lower ventral scale count, simpler scale pattern on the head (as, for instance, an average of 16 scales before the supraoculars in tigris compared with over 30 in mitchelli) and finally by the proportionate head size.

Tigris may be segregated from stephensi by relative head size, ventral plates (which average 10 higher in the latter), and supraocular sutures, which are absent in tigris and nearly always present in stephensi. This latter is a key character which will usually render a determination simple in well preserved specimens.

From enyo, tigris differs in a number of ways, the pattern being most quickly evident, for not only are there blotches with clear outlines on the former and indefinite cross stripes or bands on the latter, but there is also a lower number of blotches on enyo, and the characteristic punctated application of color is less apparent in enyo. Other differences not so useful as key characters will be pointed out in a discussion of the differential characteristics.

**Crotalus enyo** (Cope)

**Lower California Rattlesnake**

Plate 23, fig. 2.


*Lepidosis and Form.*—Size, moderate among rattlesnakes. Scale rows at midbody usually 25 (83 per cent), occasionally 27 (14 per cent), rarely 23 (3 per cent). The order of dropping rows is the sixth or seventh from 25 to 23, the fifth or sixth from 23 to 21, and the fourth or fifth from 21 to 19. The scales are very strongly keeled (more so than *tigris*), only the first row on each side being smooth. Ventrals: males, max. 167, min. 160, av. 164 (13 specimens); females, max. 177, min. 165, av. 170 (10 specimens). Anal entire. Caudals: males 22 to 28, average of 14 specimens 25.1; females 18 to 22, average of 10 specimens 19.3. The males usually have from 23 to 27, and the females from 18 to 20 caudal; while generally entire, there may be a few at either end of the series divided.

The supralabials average 13.4; they usually number 13 (45 per cent), or 14 (38 per cent), occasionally 12 (9 per cent), or 15 (8 per cent). The infralabials average 13.6; they generally number 14 (42 per cent), or 13 (36 per cent), occasionally 15 (14 per cent), or 12 (8 per cent).

The rostral is always wider than high, and is in contact with the prenasals. The prenasals are normally in contact with the supralabials, but such contact is partially or entirely prevented in 12½ per cent of the specimens examined, by the extension to the rostral of the small scales anterior to the pit. The internasals invariably number two. The scales on the crown anterior to the supraocu-lars vary from 13 to 25, the average being 16.5. The minimum scale rows between supraoculars vary from 2 to 6, averaging 4.2. Supraocular sutures are absent. The nasals are 2–2. About 86 per cent of the specimens have two loreals, the rest, one, three, or four; the lower is always the larger. There is an extra scale usually present below the first canthal, between the supraocular and the upper loreal, which might be considered a third loreal, but is not so classified herein. This extra scale is so prevalent as almost to constitute a key character. The scales along the canthus rostralis, from rostral to supraocular, usually number 3, sometimes 2 (17 per cent), or 4 (25 per cent).

The upper preocular, which is the larger, is usually (95 per cent) not in contact with the postnasal. In 7 per cent such contact is prevented by the contact of the post-canthal with the lower loreal, in 88 per cent by the presence of a small upper loreal. The upper preocular is rarely split to form a third preocular.

The minimum scale rows from labials to orbit usually number 2, rarely 3. Generally the fourth supralabial is the largest; usually the third and fourth are in contact with the pit borders.

The first infralabials are undivided. Normally 3 (rarely 2) infralabials are in contact with the genials on each side.

The mental is triangular. The genials are in a single pair, relatively short and obtuse. Intergenials are not present.
In shape the head is (for *Crotalus*) unusually narrow and not particularly
distinct from the neck, thus resembling *polystictus* more than any other species.
The average ratio of body length to head length in 14 adults (over 575 mm. in
length) is 23.8, max. 25.8, min. 22.5. The ratio of head length to head width
averages 1.52. The ratio of the distance across the supraoculars to the space
between averages 3.5 (range 2.9 to 4.7) in 18 specimens. The 4.7 specimen is
exceptional, the next highest being 4.0. The supraoculars are elevated at the
outer edges to a greater extent than in any other rattler except *cerastes*. The
minimum bridge between is, naturally, deep set and further back than in most
species.

The ratio of the length of tail to total length, exclusive of rattle, varies from
about .084 to .098 in the males (average .090) and from .061 to .072 in the
females (average .065).

The largest specimen examined measured 854 mm. (33½ in.), the smallest
207 mm. (8½ in.).

*Pattern and Color.*—The first impression of enyo is of the clearly and
definitely outlined dorsal blotches, and the beautiful harmony of the colors. It is,
I think, the most strikingly marked of the rattlesnakes.

The head is fawn color. A pair of parallel, irregular dark brown marks begin
at the supraoculars and extend to the middle of the head, at which point they are
interrupted by outwardly divergent light marks. Following this break, the dark
marks re-appear and continue to the neck, where they engage the first dorsal
blotch.

A dark brown stripe two or three scales wide arises behind and below each
eye and passes backward above the commissure. The usual light postocular line
of the rattlesnakes is not emphasized in this species; it is merely a light area three
to five scales wide between the two sets of dark marks. No definite preocular light
line is present.

A light supraocular cross-mark is always present; it is clearly and cleanly
outlined and curves forward and inward from the outer edge. Often the posterior
ends of the supraoculars are touched with a light spot.

The labials are punctated with gray. The lower head surface may be spotted
or clear.

The body patterns consists essentially of a set (30 to 42, average 33.5) of
dorsal brown blotches on a fawn background. A secondary series of black spots
appears on each side. The dorsal blotches are edged with black. In shape they
are longitudinal sub-rectangles anteriorly; about 8 or 10 spots behind the head
these change to hexagons, first with side points and then with extensions reaching
toward the secondary series. Finally the two series coalesce about 10 blotches
from the tail and thereafter the pattern becomes a series of rings, wider dorsally
and with reduced sharpness of outline. Low down on the sides there is a tertiary
series of spots, of smaller size than the secondary, and alternating therewith.
The interblotch spaces are punctated with gray, except on the scale rows bordering
the blotches, which thus appear lighter. The punctations increase posteriorly. The
blotch outlines do not adhere to scale rows.

The tail rings, numbering 4 to 8, are neither complete nor definite. There is
little contrast with the ground color which, on the tail, is heavily punctated with gray.

Specimens from the northern part of the range are lighter colored and bear a considerable superficial resemblance to *cerastes*, but the head proportions are quite different, being especially narrow in *enyo* and wide in the sidewinder.

The ventral surface is cream, heavily dotted with gray or brown. The edges of the ventral scales are marked by the termini of the secondary body blotches.

The anterior rattle is black.

*Material.*—The description contained herein is based on an examination of the following specimens, all of which are from the Peninsula of Lower California, except LMK 3002-3 which are from islands in the Gulf of California:

- CAS 45879, Miraflores
- CAS 45880, San Antonio
- CAS 45881, Todos Santos
- CAS 45882, San Bartolo
- CAS 45883-4, San Pedro
- CAS 45885, San José del Cabo
- CAS 45886, Sierra Laguna Mts.
- LMK 2223-30, La Rivera
- LMK 3002, San Francisco Island
- LMK 3003, Carmen Island
- MVZ 11919-20, Todos Santos
- MVZ 11921, Miraflores
- MVZ 11922, Eureka
- SDSNH 15509, Jaraguay
- SDSNH 15510, 10 mi. N. of Cataviña
- Stanford 4328, San José del Cabo
- USNM 5291, Cape San Lucas (Cotypes, 2 specs.)
- USNM 12623, La Paz
- USNM 23724, San Pedro Mts.
- USNM 37570, Santa Anita

Total preserved specimens 30, of which 8 were seen alive.

*Localities, Range.*—The localities in which this species has been collected are the following:

- Cape Region, Lower California, Mexico
  - Cape San Lucas (Type locality)
  - La Paz
  - San José del Cabo
  - San Bartolo
  - Miraflores
  - Santa Anita
  - San Antonio
San Pedro
Todos Santos
Sierra de la Laguna
La Rivera
Eureka
San Pedro Mts.

Central Lower California:
Mulegé

Northern Lower California:
Jaraguay
10 mi. N. of Catavíña

Gulf of California Islands:
San Francisco Island
Carmen Island

Specimens have been seen from all of these localities except Mulegé.

Thus, it will be observed that the species ranges northward throughout Lower California from the Cape almost to the southern end of the San Pedro Martir Mountains. (See Map). The two San Diego Society of Natural History specimens are of particular interest, for these (collected late in 1930 by L. M. Huey at Jaraguay and near Catavíña) carried the species 270 miles to the north of the previous record (Mulegé). And these northern specimens, taken within 50 miles of the known range of C. c. oreganus, instead of indicating a tendency toward intergradation with the latter, are even more distinctive in coloration than the Cape specimens, and are quite as different in lepidosis and form.

The only species of rattlesnakes now known to have ranges coincident with enyo are mitchelli throughout the entire range, lucasensis in the Cape region, and ruber in central and northern Lower California.

Habits.—Not much is known concerning the habits of this species. From observations of captive specimens and the character of the eye one would judge it to be largely nocturnal. It does not seem to be vicious.

A specimen 608 mm. in length collected March 22, contained eggs.

It is known to feed on mammals. Both island specimens contained mammal remains.

These snakes in their movements progress as do ordinary rattlers and not like sidewinders, this statement being based on field observations by L. M. Huey and captive specimens seen by the writer. Nevertheless it is believed that the superficial color resemblance (particularly of the northern specimens) to C. cerastes has led to some confusion, and it is my opinion that enyo is the basis of the widespread supposition that the sidewinder occurs in north-central Lower California. While the presence of cerastes here is by no means impossible, definitely identified specimens are lacking, the most southerly of which I have knowledge being from the San Felipe Desert somewhat south of Lat. 31 deg.

The venom yield is moderate for a snake of this size, 0.2666 g. of dried

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purified venom being secured from five large and three medium specimens. From this an adult yield of about 0.04 g. might be expected. Githens and George report the M. L. D. for 350 g. pigeons as 0.1 mg., equal to oreganus and somewhat more powerful than atrox venom. Enyo venom being 40 per cent as toxic as tigris, and in four times the quantity, it is probably a more dangerous snake than tigris.

**Diagnostic Characters.**—Enyo is characterized, especially as to form, by its slender head, and, as to color and pattern, by the brightness of the hues and the distinctness of the marks. Pattern alone will distinguish this form from all other species except confluentus and its subspecies; especially is the pattern different from polystictus, which appears to be the only other member of the genus having so long and slender a head.

Superficially enyo most nearly resembles cerastes and stephensi. From the former it may be readily segregated by the lack of horns; although the supraoculars are distinctly raised, they are not the true horn-like appendages of cerastes. Some specimens of stephensi, particularly from the northern part of its range, are not unlike enyo in color and pattern. Here we must depend for identification on the supraocular sutures, which are almost invariable in stephensi, but absent in enyo, and the head shape, the former having a relatively larger, and especially broader, head.

**Differential Characteristics**

The table herewith has been prepared for the purpose of indicating the essential differences of tigris and enyo from each other and from those species and subspecies to which they appear to be most nearly allied, or with which they have been confused. Thus there are presented schedules of the two species under consideration and, in addition, Crotalus confluentus stephensi with which tigris was formerly grouped; Crotalus confluentus mitchellii which has been considered by some to be closely allied to tigris; Crotalus confluentus oreganus which has been referred to by certain authors as in possible subspecific relationship with enyo; and Crotalus cerastes which has some superficial resemblances to both, but especially enyo.

The mitchellii material has been divided into two parts, namely, that from Arizona and from Lower California, the many available California specimens being excluded from the tabulation. It was thought that if there were any tendency in mitchellii toward tigris or enyo, this would best be shown by treating separately the adjacent geographical groups of specimens.

Similarly, in the case of oreganus, the comparative material is restricted to the nearest available specimens to the enyo territory, that is, specimens from Lower California and San Diego County, California;
oreganus as a whole covers a very large area and some minor variations are found throughout the range.

In the following notes on the differential characteristics the discussion is limited to those which show tendencies of interest, not all of those listed in Table No. 1 being mentioned.

**Scale Rows**

The scale rows of tigris are normally 23 and of enyo 25. The confluentus subspecies usually have 25, although there is a tendency in mitchellii-stephensi toward 23 in the northern and eastern areas of their ranges. Thus eight out of seventeen Arizona mitchellii have 23 rows, while the same is true of only one out of nineteen from Lower California. Cerastes is definitely lower than the other species.

**Ventral and Caudals**

Both tigris and enyo have lower average ventral scale counts than the confluentus subspecies, all of which are approximately the same. In this characteristic neither stephensi nor Arizona mitchellii is conspicuously lower than Lower California mitchellii or oreganus. Thus in ventral scales there is a fairly definite differentiation between stephensi and tigris, there being some overlapping in extremes, but none in what might be considered the normal range. Cerastes is below all others to such an extent that there is no overlapping.

There is no noteworthy difference in the caudal counts amongst these several species, except in the case of cerastes which is below all others.

**Labials**

In number of labials enyo and tigris are again intermediate between cerastes and the confluentus subspecies, stephensi being the lowest of the latter.

None of these species or geographical groups has more than an occasional divided first infralabial or intergenial with the exception of the Arizona mitchellii, which has no less than half the first infralabials divided, and a fourth further cut to form intergenials. Thus, in this species, we find a tendency toward those characteristics which distinguish ruber and exsul in the atrox group.

**Miscellaneous Head Scales**

The rostral-prenasal contact, as usual, brings mitchellii, from whatever area, into sharp contrast with the remaining species under discussion,
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<th>Species</th>
<th>Tigriopus</th>
<th>Enyalius</th>
<th>Stephanopus</th>
<th>Michelleius</th>
<th>Ozeanus</th>
<th>Conatus</th>
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<td>Number of specimens tabulated</td>
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<td>30</td>
<td>39</td>
<td>19</td>
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<td>109</td>
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<td>9.0</td>
<td>10.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Total scales, average</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* 1 There is one specimen out of 25 with possible supracaudal sutures, although these are more probably crescent resulting from improper preservation.
* 2 This maximum is from a single unusual specimen; except for this the maximum is 2.8.
* 3 Usually practically obsolete.
* 4 There is a peculiar scale usually present below the first caudal, between the supracaudal and the upper lochia, which might be interpreted as a third lochia.
* 5 Many parts of the prenasal cut off, the beginning of the characteristic micheliella separation.
* 6 Includes no island specimens.
* 7 This is never a definite range in micheliella.
* 8 Lochia in micheliella are not definite.
* 9 A single unusual specimen 12 below any other.
* 10 This figure is without great accuracy in micheliella because of the breakup and the scales.
* 11 Eleven specimens from Lower California; the remainder from San Diego, Calif.
* 12 Not particularly accurate owing to the tendency of the final yellow ring in the young to split into several black rings (2 or more) with increased age.
* 13 The L.M.D. is taken from the results of Gehrels and George and is in terms of mg. for 350 g. pagers.
for *mitchellii* rarely has these scales in contact, while the others have contact invariably. However, this is not the case with *oreganus* from all areas; Arizona *oreganus*, particularly those from the northern part of the range, have the prenasals sutured in many cases, and in about 15 per cent of the specimens contact is entirely prevented.

Internasals are normally two in all of these forms except in *mitchellii*, which is indeterminate, and in *oreganus* which has normally 3 or more. This is a character which will seldom fail to separate *enyo* from *oreganus*. *Enyo* and *tigris*, with their simplified scale arrangements, usually have fewer scales on the crown anterior to the supraoculars than any of the other forms. However in this character they do not approach *scutulatus* or *molossus*. In minimum scale rows between supraoculars there is no important difference between the species under consideration.

Sutured supraoculars, almost always present in *stephensi* and absent in *tigris*, constitute an excellent key character for segregating these two forms. This will also separate *stephensi* from *enyo*.

The prenasal-supralabial contact is not of importance in distinguishing the forms here under consideration, since contact is normal in all except *mitchellii*.

The loreals are quite variable in the *confluentus* subspecies and are not a definite quantity in *mitchellii*. It is worthy of note, however, that *tigris* rarely has more than one or *enyo* other than two. *Enyo* usually has an extra scale, not found in the other species (except some *mitchellii*), between the upper loreal and the point of the supraocular.

Neither the postnasal-preocular contact, nor the ocular arrangements show useful differences between these species.

The rostral shape is of interest, particularly in distinguishing *enyo* from *oreganus*, for in the former it is always wider than high and in the latter the opposite. *Tigris* and *cerastes* are like *enyo*; *mitchellii* and *stephensi* usually, but not invariably so.

**Form**

The relative head size is of distinct importance in the differentiation of the two species under consideration. *Tigris* has proportionately the smallest head of any of the western rattlesnakes, this being one of the most evident differences from *stephensi*, and in fact from all of the *confluentus* subspecies. Only *mitchellii* from Lower California has a distinctly smaller head than the others, being shorter even than *enyo*, which in turn is shorter than the rest. It must be remembered, in checking this character-
istic, that only adults can be considered, as the young have proportionately larger heads. In addition, some variations are to be expected owing to distortion in preservation; as many as possible should be measured prior to setting.

*Enyo* has a conspicuously narrow head, followed by *tigris*. The *confliuentus* subspecies do not differ much from each other except that *mitchellii* is somewhat the broadest. All are proportionately wider than *tigris* and *enyo*. *Cerastes* in turn is broadest of all.

The ratio of the distance across to the space between the supraoculars is definitely high in *enyo* owing, of course, to the narrow head. The others do not differ in important degree.

The tail-length ratios seem to show no important differences; *enyo* seems to have a slightly longer tail, followed by *cerastes*.

**Pattern**

*Tigris* has a definitely higher number of crossbands than the other species under consideration, which do not differ greatly from each other. In the importance of punctations in the character of markings, *tigris* most nearly resembles *mitchellii*, particularly the Lower California specimens of the latter, rather than *stephensi*. *Enyo*, in its sharp and definite color contrasts, most nearly resembles the northern specimens of *stephensi* and, in color, *cerastes*.

**Venom**

The recent results of Githens and George tend to validate the segregation of *tigris* from *stephensi*, in that the venom of the former is found to be five times as toxic as the latter. No difference is found between *enyo* and *oreganus* venom. It is of interest to note a wide separation between *tigris* and *mitchellii*.

**Conclusions**

*Crotalus enyo* of Lower California, and *Crotalus tigris* of the mountains of southern Arizona and Sonora are valid and distinct species. Superficially, particularly in color and pattern, *tigris* resembles *Crotalus confliuentus mitchellii* and *C. c. stephensi*, but from these it differs in important structural features, especially relative head dimensions, and in venom. In bodily proportions it more nearly resembles *enyo* than it does the *confliuentus* subspecies.

*Enyo*, in color and pattern, most nearly resembles *stephensi*, particularly specimens from the northern areas of the latter, and in color, *cerastes*. 
Structurally *enyo* more nearly resembles *tigris* and, probably also, *polystictus*.

We conclude that *enyo* and *tigris* are more closely related to each other than either is to any of the other species or subspecies considered, but the relationship between the two is not particularly close.

**Acknowledgments**

I am indebted to the following individuals and institutions for the loan of valuable material: Dr. Leonhard Stejneger and Miss Doris M. Cochran of the United States National Museum; Dr. B. W. Evermann and Mr. J. R. Slevin of the California Academy of Sciences; Drs. Joseph Grinnell and Jean Linsdale of the Museum of Vertebrate Zoology, University of California; Drs. C. D. Bunker and E. H. Taylor of the University of Kansas; Dr. G. K. Noble of the American Museum of Natural History; Mr. Roger Conant of the Toledo Zoological Society; and Mr. Geo. S. Myers of Stanford University.

For live material I have to thank Mr. C. C. Lamb of the Museum of Vertebrate Zoology, who kindly forwarded me eight fine specimens of *C. enyo* from the Cape region of Lower California; Mr. Chas. L. Evans, who made an especial and successful effort to secure *C. tigris* from the mountains surrounding Phoenix, Arizona; and Superintendent A. D. Handley of the Southern Pacific Railroad of Mexico at Empalme, Sonora, who sent me the only tiger rattler from that area of which I have had a record.

To my friends Margaret and Griffing Bancroft I am indebted for two specimens of *enyo* from the islands of the Gulf, the first reported from any island habitat.
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Fig. 1. *Crotalus tigris*. Tiger Rattlesnake.
LMK 774. Collected on Squaw Peak near Phoenix, Maricopa Co., Arizona, April, 1928.

Fig. 2. *Crotalus enyo*. Lower California Rattlesnake.
LMK 2223. Collected at La Rivera, Lower California, September, 1929.
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AGE OF THE ORBITOID-BEARING EOCENE LIMESTONE AND TURRITELLA VARIATA ZONE OF THE WESTERN SANTA YNEZ RANGE, CALIFORNIA

BY

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INTRODUCTION

I recently published in these Transactions descriptions of Eocene orbitoids from the western Santa Ynez Range and a discussion of their stratigraphic significance. The conclusions that were reached as to their stratigraphic significance have turned out to be wholly erroneous. The purpose of this note is to call attention to this error and to record some observations on the long-neglected type material of the fossils from the Turritella variata zone that Conrad described in 1856—observations that have a bearing on the age of this zone.

AGE OF THE ORBITOID-BEARING LIMESTONE

Inasmuch as the orbitoids included a stellate "Orthophragmina," representing a genus that in the Gulf States and in tropical America has been recorded only from upper Eocene beds or from deposits referred to the upper Eocene, the orbitoid-bearing limestone was considered of upper Eocene age and it was suggested that it is of the same age as the Turritella variata zone. Eastward from the orbitoid locality the Turritella variata zone, which had been called Oligocene, lies at the top of the Eocene section. This age assignment has not stood the acid test of mapping. Dr. T. L. Bailey and Mr. L. M. Clark discovered that the shale carrying the lenses of orbitoid-bearing limestone, which at the locality on Canada de los Sauces is overlain by the Vaqueros formation (lower Miocene), instead of being at the top of the Eocene section is near the very base.

1 Published with the permission of the Acting Director of the United States Geological Survey.

These results were announced by Mr. Clark in a paper presented at the meeting of the Pacific Section of the American Association of Petroleum Geologists in November, 1930, but unfortunately the paper will not be published. Clark later found, and kindly showed me, the orbitoid-bearing limestone in the section on the north slope of the range near Nojoqui Creek, to which I had referred (pp. 157-160). Here the limestone is found as lenses in a shale that lies far below the *Turritella variata* zone, not only below the beds carrying the Tejon-like fossils but even below those carrying the Domengine^3-like fossils. The Domengine fauna certainly is not of upper Eocene age; it probably is well down in the middle Eocene or in the upper part of the lower Eocene, as these terms are used in the Gulf States.\(^4\) Therefore, my confident correlation of the orbitoid-bearing deposits with the Ocala limestone and other American beds referred to the upper Eocene is worthless, and stellate "Orthophragminas" appeared at an earlier date in California than elsewhere in America, so far as published records and interpretations go. This is an example of what Ulrich calls the stratigraphic perfidy of fossils—an example that I hope I will not soon forget. As it turns out, the discoidal "Orthophragmina" has a more reliable age significance than the stellate one. *Discocyclina psila* is closely allied to *D. perpusilla* Vaughan, a Mexican species from beds referred to the middle Eocene.

**Age of the Turritella variata Zone**

The fossils that were collected by Antisell during the trip across the Santa Ynez Valley and Santa Ynez Range were described by Conrad in volume 7 of the U. S. Pacific R. R. Explorations, pt. 2, pp. 189-196, 10 pls., published in 1856. The illustrations of the fossils in this volume, many of which are represented by miserable specimens, are perhaps the worst that can be found in American Tertiary literature. Not only were the drawings poorly made, but they were oriented in almost any position, even upside down. As early as 1864 Carpenter\(^5\) expressed sympathy for succeeding paleontologists who would have to identify them, though while he was at it he might as well have felt a little sympathy for the zoologists

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3 This name has not been formally adopted by the United States Geological Survey.


who would have to recognize his own tersely described and unfigured species. Antisell collected from beds that can be recognized as the Vaqueros formation, the *Turritella variata* zone, and also older deposits carrying "*Natica*" *inezana*, all of which Conrad called Miocene. Only one of the species from the *Turritella variata* zone—"*Crassatella*" *collina*—has been recognized as an Eocene fossil; the others have been ignored or misinterpreted. The following notes are based on an examination of the type material, which is preserved in the U. S. National Museum.

**Tapes* inezensis** (p. 192, pl. 7, fig. 1)

A left valve, the interior of which is concealed, is the only specimen (No. 13341). Length 49 mm., height 38.5 mm. It is recognized as the figured specimen and is accepted as the holotype. In the figure the specimen is tilted, making it appear too inequilateral. The matrix consists of coarse limy sandstone. Traces of concentric grooves are visible on the exterior.

This species probably is a *Pitar* closely allied to the Tejon *Pitar uvasanus* (Conrad)⁶ and may be identical with it. Smith⁷ listed it as a doubtful Vaqueros species.

**Pachydesma* inezana** (p. 193, pl. 5, figs. 2, 4)

Two specimens are preserved: No. 13349, an almost complete right valve, in which the hinge is almost entirely covered by the matrix of coarse limy sandstone (length 64.5 mm., height 51.5 mm.); and No. 13315, a larger right valve that has matrix and other fossils adhering to the interior (length 68 mm., height 56 mm.). The first specimen agrees rather closely with the figure, which is reduced one-half, and is accepted as the holotype. Both specimens resemble "*Tapes*" *inezensis* in matrix and lithology. Conrad apparently had other specimens, as he described the hinge and cited a length of 3 inches.

So far as this species is concerned my confidence in Antisell’s discrimination of horizons was well founded, but my prediction that it would turn out to be a mactrid or a young *Crassatellites* was a poor guess, for it apparently is precisely what Conrad called it—a *Pachydesma*. Mr. Alex Clark recognized it in material from the *Turritella variata* zone on the

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south side of the range west of the Hollister ranch (field No. A. C. 51-30) and kindly sent me specimens that partly reveal the hinge. The right valve has three cardinals, the anterior one of which is slender and hugs the hinge border. The ligament area is relatively narrow and deeply inset. The left valve also has three cardinals. None of these specimens reveals the anterior lateral or its socket.

Other Eocene species that are referred to *Pachydesma* are as follows: "*Tivela* weaveri" Dickerson⁸ from Oregon, "*Tivela* clifensis" M. A. Hanna⁹ from San Diego, and "*Tivela* kelloggensis" Clark and Woodford¹⁰ from the type Meganos, the last of which closely resembles *inezana*. "*Tivela* packardi" Dickerson,¹¹ a species from the type Domengine, lacks the trigonal outline and probably represents a different genus. Well-preserved specimens of *inezana* and the other three species just cited may show hinge differences that will permit separation from *Pachydesma* s. s.,¹² the monotype of which is the living California species "*Cytherea (Trigonella)* crassatelloides" Conrad. Dall¹³ substituted an earlier name, *Donax stultorum* Mawe,¹⁴ for *Pachydesma crassatelloides*. Mawe cited "Indian Seas" as the locality for *Donax stultorum*, and his figure is not very convincing for the California species. Nothing is to be gained by substituting dubious names for authentic ones, and I am in favor of restoring the name by which this species was known for many years. *Pachydesma* might as well be given generic rank. The elongate outline, the absence of a bifid nymph, and the distinct setting off of the left posterior cardinal from

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¹⁴ Mawe, John, Linnaean system of conchology, pp. 37, 40, pl. 9, fig. 7, 1823.
the nymph distinguish it from *Tivela*.

Clark pointed out that the accessory cardinal attributed to *Pachydesma* by Dall really is the nymph. The so-called accessory cardinals of *Tivela* itself also seem to arise from a splitting of the nymph into two or three parts. This conclusion seems so obvious that it probably has been recorded elsewhere. It could be tested by studying the development of the hinge.

*Pachydesma inezana* has been accepted as a Miocene fossil by many writers. The Vaqueros species from the Santa Cruz quadrangle figured by Arnold as "ineziana" is much like a medium-sized *crassatelloides*. More specimens should be examined to determine whether it can be distinguished from *crassatelloides* on any other basis than size. *Tivela (Pachydesma) inezana* of Wagner and Schilling, from the so-called Monterey of the San Emigdio Mountains, is not the same as Arnold’s Santa Cruz "ineziana." It is more like *inezana* proper but is not so elongate. "*Tivela* gastonensis* Clark, from beds in Oregon referred to the lower Oligocene, has more rounded ends than *inezana*. A San Pablo (upper Miocene) species, *Tivela (Pachydesma) gabby* Clark, is similar to *inezana* in outline, but is more inequilateral.

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Dickerson, Roy E., the Martinez and Tejon Eocene and associated formations of the Santa Ana Mountains: California Univ. Dept. Geology Bull., vol. 8, No. 11, p. 268, 1914.


20 Clark, Bruce L., Fauna of the San Pablo group of middle California: California Univ. Dept. Geology Bull., vol. 8, No. 22, p. 464, pl. 55, fig. 2; pl. 56, figs. 3, 4, 1915.
Crassatella collina (p. 193, pl. 6, figs. 1, 2)

A worn and broken right valve (No. 13339), which has already been noticed by Stewart,\textsuperscript{21} is the only specimen. Length 39 mm., height 31.5 mm. It is accepted as the holotype, as Conrad mentioned only one specimen and this one agrees with the figure, but not with Conrad's dimensions. In matrix and preservation it resembles the type material of "Tapes" inezensis and Pachydesma inezana. Specimens from Nojoqui Creek have a similar matrix and preservation.

Much better specimens were figured by Arnold,\textsuperscript{22} who considered this species an Eocene fossil. Arnold's specimen with both valves in attached position has the following dimensions: length 88 mm., height 75 mm., diameter 39 mm. Arnold also figured the hinge of a left valve, in which the right anterior cardinal is clasped in its socket between the left anterior and middle cardinals, the latter of which is broken. Both these specimens are from a locality on the San Julian ranch a few miles west of the type region (U. S. Geol. Survey Loc. No. 4507). Another specimen from the same lot shows the left hinge more satisfactorily. The middle cardinal is long and slender. The anterior end of the chondrophore extends down almost to the edge of the hinge plate, the lower edge of which is broken back a short distance on both specimens. A long narrow ridge lies along the anterior edge of the chondrophore. Apparently a long slender right posterior cardinal fitted into the narrow space between this ridge and the middle cardinal, but the only accessible right hinge is on an immature specimen, collected by Alex Clark on the south side of the range, that does not clearly show this cardinal. No free ventral inner margins are available, but an interior mold from Arnold's locality that has a perfect ventral border for a short distance shows no crenulations. The large specimen figured by Arnold reveals faint hidden radial sculpture on worn patches on the ventral half of the shell, and another corroded specimen in the same lot has distinct hidden radial sculpture toward the ventral edge.

C. collina probably represents a new group of crassatellids. It has

\textsuperscript{21} Stewart, Ralph B., op. cit., p. 146, 1930.

\textsuperscript{22} Arnold, Ralph, New and characteristic species of fossil mollusks from the oil-bearing Tertiary formations of Santa Barbara County, Calif.: Smithsonian Misc. Coll., vol. 50, No. 1781, p. 420, pl. 50, figs. 2, 3, 1907.

Arnold, Ralph, and Anderson, Robert, Geology and oil resources of the Santa Maria oil district, Santa Barbara County, Calif.: U. S. Geol. Survey Bull. 322, p. 32, pl. 12, figs. 2, 3, 1907.
the outline of *Crassatellites*, but its hinge is more like that of *Bathytormus* Stewart and the later Tertiary and living American species, which seem to fall in *Eucrassatella* Iredale. C. *collina* is larger and less elongate than *Bathytormus*; to judge from the left hinge the right posterior cardinal is slender as in *Bathytormus* but is longer; and the left middle cardinal is more slender. The inner crenulations of *Bathytormus* are entirely or virtually suppressed. *Eucrassatella* is more elongate and has a heavier left middle cardinal, apparently a shorter and heavier right posterior cardinal, and the hidden radial sculpture is confined to the hinge border of lunule and escutcheon. *Crassatellites yabei* Nagao, a Japanese species from beds referred to the lower Oligocene, may be similar to *collina*, though the figure of the left hinge fails to show the ridge along the anterior edge of the chondrophore and the right posterior cardinal is described as obsolete. The inner edge of the shell is described as smooth. It seems remarkable that "*Crassatella* collina should simulate in outline the large Eocene species of *Crassatellites*. As Stewart has pointed out, it resembles *Crassatellites dalli* Weaver, an Eocene species from Washington that is a *Crassatellites* s. s. C. *collina* combines characters of the early and late Tertiary crassatellids, but it hardly bridges any gaps. It seems to be more closely allied to *Eucrassatella* than to *Bathytormus* or *Crassatellites*.

It is not generally known that there is one living American species of crassatellids that has crenulated inner margins—"*Crassatellites* brasiliensis" Dall, apparently a synonym of "*Crassatella* uruguayensis" Smith. Forty-six valves are in the type lot of *brasiliensis*, dredged east of Rio de Janeiro in 59 fathoms. Young valves, especially left ones, are not crenu-

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23 The name *Crassatella* has recently been reintroduced into American literature by Stewart (Acad. Nat. Sci. Philadelphia Special Pub. 3, pp. 134-136, 1930), but as he points out it needs special protection. As in many disputed issues in nomenclature there probably will be sharp national cleavages in the use of *Crassatella* and *Crassatellites*.

24 Stewart, Ralph B., op. cit., p. 137, 1930.


26 Nagao, T., Palaeogene fossils of the island of Kyūshū, Japan, pt. 2: Tōhoku Imp. Univ. Sci. Rept. 2d ser., vol. 12, No. 1, p. 48, pl. 2, figs. 17-20, 23-28; pl. 3, figs. 5, 6, 10-12, 19, 23, 24, 1928.

27 Stewart, Ralph B., op. cit., p. 146, 1930.


lated. Hidden radial sculpture is visible in the lower half of adult shells. This species probably is an American representative of the genus *Crassitina* Kobelt,\(^1\) at least it is if “*Crassatella* paeteli Maltzan,\(^2\) from the west coast of Africa, is similar to the type of *Crassitina*.

“*Crassatella* collina is the only one of Conrad’s *Turritella variata* zone fossils that has been recognized as of Eocene age. Gabb’s figure of a specimen from the “Santa Inez” Mountains\(^3\) looks reasonably like *collina*. He also listed it from Ojai Ranch\(^4\) and at an earlier date from the “Santa Inez” Mountains and valley and from “Najohui” ranch.\(^5\) The record for Sargent, Santa Clara County, probably is an error.\(^6\) J. G. Cooper’s record for the south end of the San Joaquin Valley\(^7\) may refer to an Etchegoin (Pliocene) fossil. A. S. Cooper’s later record for San Emidio\(^8\) may refer to the same material.

**Mytilus inezensis** (p. 194, pl. 8, figs. 2, 3)

A number of specimens in a matrix of coarse brown limy sandstone are under No. 13319. The figured specimens are not definitely recognizable. Approximate dimensions: length 40 mm., height 29 mm. This species, which has strong radiating sculpture, has not yet been recognized in the *Turritella variata* zone. *Septifer dichotomus* Gabb,\(^9\) from Tejon, may represent a small race of *inezensis*. Smith\(^10\) recorded *inezensis* as a doubtful Vaqueros species.

**Mactra? gabiotensis** (p. 194, pl. 7, fig. 3)

The only specimen, accepted as the holotype, is the one on the figured slab of brown limy sandstone that also carries the type material of *Trochita*

\(^1\) See Stewart, Ralph B., op. cit., p. 141, 1930.


\(^3\) Gabb, W. M., California Geol. Survey, Paleontology, vol. 2, p. 29, pl. 8, fig. 50, 1886.

\(^4\) Idem, p. 100, 1869.


\(^6\) Hanks, Henry G., Catalogue of the State Museum of California, vol. 2; California State Min. Bur., p. 190, 1885.


\(^8\) Cooper, A. S., Catalogue of the State Museum of California, vol. 5; California State Min. Bur., p. 85, 1899.


\(^10\) Smith, James Perrin, op. cit., p. 172, 1912.
costellata (No. 13310). Length 27 millimeters, height 19.5 millimeters. It is a somewhat warped internal mold of a left valve. "Spisula" bisculpturata Anderson and Hanna,\textsuperscript{41} a Tejon species, needs comparison with it. So far "Mactra" gabiotensis has not been recognized in the Turritella variata zone. Packard\textsuperscript{42} considered it an invalid species. Unfortunately Conrad’s poorly figured and described species can not be so lightly disposed of.

**Trochita costellata** (p. 195, pl. 7, fig. 3)

Two interior molds retaining traces of external sculpture are preserved on the piece of rock carrying the type of "Mactra?" gabiotensis (No. 13310). Both specimens are distorted by crushing. The more perfect one has a long diameter of 21 mm. and a short diameter of 18 mm. *Infundibulum gabiotensis* (p. 194 under *Mactra?* gabiotensis) is a nude name probably intended for the same species.\textsuperscript{43} *Trochita costellata* is not mentioned by Antisell, and it has not yet been recognized in the *Turritella variata* zone.

This name has been employed for a Miocene fossil by many writers, including myself.\textsuperscript{44} *Trochita costellata* proper has less rapidly enlarging volutions and finer sculpture than the Miocene fossil figured under that

\textsuperscript{41}Anderson, Frank M., and Hanna, G. Dallas, Fauna and stratigraphic relations of the Tejon Eocene at the type locality in Kern County, Calif.: California Acad. Sci. Occ. Paper 11, p. 149, pl. 3, fig. 7, 1925.


Kew, William S. W., Geology and oil resources of a part of Los Angeles and Ventura counties, Calif.: U. S. Geol. Survey Bull. 753, p. 50, 1924.

Woodring, W. P. in Hoots, H. W., Geology of the eastern part of the Santa Monica Mountains, Los Angeles County, Calif.: U. S. Geol. Survey Prof. Paper 165, p. 100, 1931.
name by Arnold. This Miocene fossil is very similar to the living \textit{Trochita radians} (Lamarck). Even a Pliocene fossil has been listed as \textit{Trochita costellata},\footnote{Arnold, Ralph, The Tertiary and Quaternary pectens of California: U. S. Geol. Survey Prof. Paper 47, p. 117, 1906.} but in all probability the same Pliocene species has been figured as \textit{Trochita radians},\footnote{Arnold, Ralph, New and characteristic species of fossil mollusks from the oil-bearing Tertiary formations of Santa Barbara County, Calif.: Smithsonian Misc. Coll., vol. 50, No. 1781, p. 424, 1907. Arnold, Ralph, and Anderson, Robert, Geology and oil resources of the Santa Maria oil district, Santa Barbara County, Calif.: U. S. Geol. Survey Bull. 322, p. 60, pl. 21, fig. 1, 1907.} which seems to be the name for it.

\textbf{Turritella variata} (p. 195, pl. 8, fig. 5)

The only specimen (No. 13346) has a length of 45.5 mm. and a diameter of 14.5 mm. The length and preservation of the base agree with the figure, but if this is the figured specimen the drawing is grotesque. It also agrees with Conrad's description of the specimen "which shows 2 revolving lines on the upper part of each whorl distant from 3 equidistant ribs beneath, all nearly or quite equal in size." It is marked in blue ink in the manner in which Arnold marked his figured specimens, but he never published a figure of it. Conrad mentioned other specimens that have disappeared.

Arnold figured this species as \textit{Turritella uvasana} Conrad\footnote{Arnold, Ralph, idem, p. 420, pl. 50, fig. 6; pl. 51, fig. 7, 1907. Arnold, Ralph, and Anderson, Robert, idem, p. 32, pl. 12, fig. 6; pl. 13, fig. 7, 1907.} and as \textit{Turritella (martinizensis} Gabb var., \textit{lompocensis} Arnold.\footnote{Arnold, Ralph, idem, pp. 420, 426, pl. 51, figs. 5, 8, 1907. Arnold, Ralph, and Anderson, Robert, idem, p. 32, pl. 13, figs. 5, 8, 1907.} The type of \textit{variata} has heavier and more closely spaced spiral cords than the type of \textit{lompocensis}. The growth lines are well shown on the type of \textit{lompocensis}. They are much like those of \textit{T. uvasana} Conrad, and the two species probably are closely allied.

species from southern California that has been named *tembloreensis* by Wiedey. *Arnold* and *Wiedey* have used the name *variata* for a form of the Vaqueros *T. inezana* Conrad.

**Natica inezana** (p. 195, pl. 10, figs. 5, 6)

Dall claimed that two species belonging to different genera were included under this name—one a *Neverita* and the other an *Ampullinopsis*—and he separated the type material accordingly, though both lots are under the same number (12359). One lot, labelled *Natica inezana* by Dall, consists of two specimens, one of which is the figured one and was recognized by Dall as the type (holotype), but the other one is marked with the green diamond-shaped sticker used to mark specimens that someone, probably one of C. A. White’s assistants, considered as representing figured material. All the shell is gone on the holotype except a small patch. As a result of this preservation the suture appears channeled and the umbilicus is open. Both the spire and aperture are broken. Height 40.5 mm., diameter 46 mm. The matrix consists of sandy limestone. The other lot, consisting of three specimens, was labelled *Ampullinopsis* by Dall. They have the same preservation and matrix as the first lot, but enough of the shell is preserved to show the sutural shelf mentioned by Conrad. One specimen (height 53 mm., diameter 48 mm.) that shows the sutural shelf also shows a sutural channel and open umbilicus where the shell is broken away. The differences between the “*Neverita*” and the “*Ampullinopsis*” are regarded as a matter of preservation.

Another poor specimen (No. 13347) having the same matrix and preservation is labelled “*Natica inezana* (Con.) Miocene, Santa Inez.” The number is in black ink, whereas on the others it is in red ink. This specimen also probably was in the lot handled by Conrad, according to whom this species was represented by many specimens.

Still another specimen (No. 3575) has the same matrix and preserva-

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53 *Wiedey, Lionel William*, op. cit., p. 120, pl. 12, fig. 8, 1928.

tion, and the number is in the same sprawling figures in red ink. The old label reads "Miocene, Astoria, Oregon," to which Dall added "Ampullinopsis, Geo. Gibbs." A modern label in Dall’s writing reads "Ampullinopsis crassatina Lam. var. mississippiensis Con., Astoria, Geo. Gibbs." This is the sole Astoria material described by Dall. It is larger than any other specimen (height 64 mm., diameter 41 mm.) but falls a little short of Conrad’s 2 3/4 inches. It has a strong slightly concave sutural shelf. The umbilical region is covered with matrix. This specimen certainly is not an Ampullinopsis. It represents the same species as the so-called Ampullinopsis in the type lot of "Natica" inezana and is regarded as conspecific with the holotype of inezana. There is little doubt that it is part of the original lot from the Santa Ynez Range. In matrix and preservation it is unlike fossils from Astoria, and a coral from Astoria bears the same number.56

"Natica" inezana is the large form of "Amaurellina (Euspirocrommum)" clarki Stewart57 found below the Turritella variata zone in the beds carrying Tejon-like fossils and in beds carrying Domengine-like fossils.58 If this conclusion is correct Antisell collected from other horizons than the Turritella variata zone and Vaqueros formation. As "Natica" inezana appears in the lists of fossils that can be recognized as embracing Vaqueros species he was not so astute in discriminating fossil zones as I had imagined, or he collected a naticid from the Vaqueros formation that Conrad identified as inezana. He did not, however, list "Natica" inezana from the beds that are recognized as the Turritella variata zone.

Through the kindness of Mr. W. P. Popenoe, who forwarded material from the collections of the California Institute of Technology, I have been able to compare the type lot of inezana with specimens from the zone carrying Tejon-like fossils (California Inst. Tech. Loc. No. 389). In preservation and matrix the two lots agree, but the matrix of some of the type material consists of darker and denser limestone. The largest specimen from locality 389 has a length of 86 mm. and a diameter of 59 mm., but all the shell is gone and the spire is broken. Smaller specimens

55 Idem, p. 90.
56 Idem, p. 141.
agree well with those in the type lot of *inezana*. A *Neverita* is represented in this zone, but it is much smaller. The one specimen from the zone carrying *Nerita triangulata* Gabb (California Inst. Tech. Loc. No. 401) also represents *inezana*. It has a length of 59 mm. and a diameter of 48 mm. (spire broken; specimen distorted). "Amaurellina (Euspiro-
crommium)" *clarki* need not be suppressed as a synonym of "*Natica*
*inezana*, for *clarki*, the type of which is from the so-called Domengine of
Simi Valley, is smaller, more globose, and has a higher spire. If these
differences are not of specific value, they certainly are of subspecific rank.
"*Natica* *inezana* is found at Tejon, and its presence in the Santa Ynez
Range is strongly suggestive of horizons near the Tejon.

"Amaurellina (Euspirocrummium)" *clarki*, and presumably also
"*Natica* *inezana*, has the umbilical callus and folded-back basal inner
lip (siphonal fasciole ?) of *Pachycromium* but has a stronger sutural
shelf, thinner callus at maturity, and no spiral sculpture. If it is allied to
*Pachycromium* it needs a separate name, but there are a great many
ampullinids to consider before it can be disposed of. I now doubt whether
"*Natica* *acuminata* Lamarck, which lacks the folded-back basal inner lip
and has relatively strong punctate spiral sculpture, should be referred to
*Pachycromium*, though I originally placed it there. I had overlooked
the faint spiral sculpture of the type species of *Pachycromium* and the
obvious spiral sculpture of "*Natica* *acuminata*, to both of which Stewart has
called attention.

Gabb listed *Natica inzana* as a synonym of *Neverita recluziana*, and
Smith included it in a list of Vaqueros species.

Dall’s recognition of *Ampullinopsis* at Astoria undoubtedly influ-
enced him in considering that some of the beds there are of Oligocene age,
for it is an Oligocene genus in both Europe and the Gulf States and
survived until lower Miocene time in Florida. It has not yet been found
on the Pacific Coast of North America.

In addition to the species described by Conrad, the fossil from the
Santa Ynez Valley listed by Antisell (p. 73) as "*Tagelus* (*Cultellus,

59 Woodring, Wendell P., Miocene mollusks from Bowden, Jamaica, pt. 2; Carnegie

60 Stewart, Ralph B., Gabb’s California Cretaceous and Tertiary type lamellibranchs:


62 Smith, James Perrin, Geologic range of Miocene invertebrate fossils of California:
San se\nseems\nThe fossils. The following are included by Antisell (p. 73) in the lists of fossils characteristic of beds recognized as the Turritella variata zone.

Cyclas permacra. Antisell also recorded this species from the beds recognized as representing the Vaqueros formation. "Sierra Monica" is the only locality mentioned by Conrad. The holotype (No. 13340) is a Lucinoma, presumably from the Topanga formation (middle Miocene), similar to L. acutilineata (Conrad) and L. annulata (Reeve). The figure is upside down.

Ostrea panzana. The holotype (No. 13338) is free of matrix and probably represents a small specimen of Ostrea titan Conrad. Conrad cites "Panza and Estrella Valleys" and also "at Gaviote pass specimens of Ostrea panzana occur twice the size of those from the above localities". These large specimens are not preserved, but they probably were the Vaqueros form of titan rather than the Eocene O. tayloriana Gabb.

Tapes montana. Conrad cites "San Buenaventura" for this species. The only specimen, apparently not the figured one (No. 13321), seems to be an Eocene Macrocallista, possibly allied to M. hornii (Gabb).

This brief survey of Conrad's fossils from the Turritella variata zone supports the earlier impression that this zone carries Eocene stocks and also others that are strangers to West Coast Eocene faunas. Nevertheless there is a preponderance of Eocene phyla, and so far as present records go it is accepted as representing the youngest Eocene faunal zone in California—a conclusion that is in harmony with its stratigraphic position. I considered part of the deposits at the south end of the San Joaquin Valley that Wagner and Schilling called the "San Emigdio" and "Pleito" formations as of the same age as this zone and made a veiled suggestion that the San Lorenzo formation of California and Weaver's Lincoln horizon in Washington might embrace beds of Eocene age. These suggestions should be discounted, as they were made on the basis of a hasty acceptance of current correlations and not on any intimate acquaintance with the fossils. Probably all of them are younger than the Turritella variata zone. The Butano sandstone of the Santa Cruz Mountains, which underlies the San Lorenzo formation, is a more promising possibility. Arnold\n
recorded a *Pecten*, a fragment of a large *Venericardia*, a large *Turitella*, and an echinoid from an outcrop of supposed Butano sandstone. Dr. H. G. Schenck informs me that this collection of fossils could not be found at Stanford University.

Oligocene deposits should be represented on the West Coast as in other Tertiary marine provinces. It seems reasonably certain, however, that too much has been included in the West Coast Oligocene. After the Eocene and Miocene parts are deducted there should still be an Oligocene residue. Each of these alleged Oligocene faunas should be considered on its merits. Writers who cite Dall as authority for the recognition of Oligocene beds on the Pacific Coast should remember that he included in the Oligocene not only the Vicksburg group of the Gulf States, which is still considered of Oligocene age, but also the lower Miocene and part of the middle Miocene of Florida (Tampa, Chipola, Oak Grove, and Shoal River formations), all the Miocene of the Caribbean region, and still further some upper Eocene (Ocala limestone).
A NEW SUBSPECIES OF PEROMYSCUS FROM THE GULF COAST OF LOWER CALIFORNIA, MEXICO

BY

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The species Peromyscus crinitus is at present known in Lower California only from suitable and very limited areas on the desert mountains in the northern part of the peninsula. Through the recent purchase of a small collection of mammals from the vicinity of Gonzaga Bay, situated in latitude 29° 50', on the eastern coast of Lower California, a series of six specimens of an apparently new race of this mouse has been acquired by the San Diego Society of Natural History. This may be known as:

Peromyscus crinitus pallidissimus subsp. nov.

LOWER CALIFORNIA CANYON MOUSE

Type.—From a small island in Gonzaga Bay, Lower California, Mexico, lat. 29° 50' north, long. 114° 20' west; no. 8864, collection of the San Diego Society of Natural History; adult male; collected by A. W. Anthony, November 21, 1930; original number 1175.

Characters.—In size, this race resembles Peromyscus crinitus stephensi, but is paler and lacks much of the buffy underparts found in stephensi. The dark overcast of the back is much paler than stephensi. Cranially, this new race has a slightly flattened brain case compared with stephensi, though here also measurements are nearly alike.

Range.—Known from the type locality, as above, and from San Felipe, on the east coast of Lower California, to the northward. Specimens from the latter locality are not typical, but they are nearer to pallidissimus than to specimens of stephensi found in the vicinity of the International Boundary.
Remarks.—The accompanying map shows the position of the small island upon which the type series was taken. The island is unnamed, although designated as "Willard Point" on U. S. Navy Hydrographic Office Chart No. 619. It is worthy of note that this is the first occurrence of crinitus in an insular locality.

Specimens examined.—Peromyscus crinitus stephensi: Lower California, Mexico, 1 (Signal Mountain); San Diego County, California, 4 (1 from Mountain Springs; 3 from Mouth of Palm Canyon, Borego Valley); Inyo County, California, 8 (4 from Pleasant Canyon, Panamint Mountains; 1 from Onyx Mine, 10 miles west of Ballarat, Panamint Valley; 3 from Orondo Mine, Argus Mountains); Yuma County, Arizona, 4 (Tinajas Altas). Peromyscus crinitus pallidissimus: Lower California, Mexico, 37 (31 from San Felipe; 6 from Gonzaga Bay, type locality).
INDEX

Transactions of the San Diego Society of Natural History, Volume VI.
Titles of papers and new systematic names are in **heavy-faced** type.

**A**

A Molluscan Species New to the Recent West Coast Fauna, 319-324

A New Clapper Rail from Sonora, 235-236

A New Least Bittern from Sonora, 227-228

A New Race of Bell Sparrow from Lower California, Mexico, 229-230

A New Race of Gilded Flicker from Sonora, 171-172

A New Subspecies of Peromyscus from the Gulf of Lower California, Mexico, 389-390

A New Subspecies of the California Boa, with Notes on the Genus Lichanura, 305-318

A New Verdin from Central Lower California, Mexico, 211-212

Abbott, Clinton G., 136, 172

Acacia greggii, 22

Accipiter cooperii, 242
  cooperi mexicanus, 242
  mexicanus, 242
  velox, 242

Actinocyclina, 151, 152, 155, 156, 157, 161, 162
  americana, 154
  aster, 152, 155, 164, 168, 170
  calita, 155
  mariannensis, 154
  subtaramellei, 154

Adenostoma fasciculatum, 230

Admiral, 18
  Lorquin’s, 20
  Red, 18

Aegithalus flaviciceps, 199, 200, 271

Age of the Orbitoid-bearing Limestone and Turritella variata Zone of the Western Santa Ynez Range, California, 371-388

Agelaius phoeniceus sonoriensis, 288

Aglais antiopa, 18
  californica, 18

Aimophila, 300
  botterii botterii, 300
  carpalis, 299
  cassini, 300
  quinquestrata, 300
  ruficeps scottii, 299

Aktinocyclina, 151

Alauda rubescens, 279

Alder, 5

Alderman, 18, 19

Alfalfa, 10, 26

Algae, 147, 157


Amaurellina (Euspirocrommis) clarki, 384, 385

Amazilus salvini, 253
  verticalis, 253
  verticalis salvini, 254

Amasona albifrons saltuensis, 247
  finschi, 247

Amblypygus, 162

Ammodramus bimaculatus, 298
  savannarum bimaculatus, 298

Ammonite, 160

Amorpha californica, 9

Amphispiza belli, 229, 230
  belli belli, 229, 230
  belli cinerea, 229, 230
  belli nevadensis, 300
  belli *xerophilus*, 229, 230
  bilineata, 219, 220, 221, 222
  bilineata bangsi, 220, 221, 222, 224
  bilineata bilineata, 221, 222, 224
  bilineata cana, 221, 223, 224, 300
  bilineata deserticola, 219, 220, 221, 222, 223, 224, 300
  bilineata grisca, 219, 222
  bilineata pacifica, 220, 221, 223, 224, 300
  bilineata tortugae, 221, 222, 223, 224

Ampullinid, 385

Ampullinopsis, 383, 384, 385
  crassatina var. mississipiensis, 384
An Annotated List of the Butterflies of San Diego County, California, 1-40

Anderson, Robert, 159, 162
Anemone, Sca, 186
Angle-wing, Marsyas, 18
Angulogerina, 70
carinata, 46, 71, 79, 88
hughesi, 46, 70, 79, 88
Anise, 5
Anomalinidae, 78
Anosia plexippus, 12
Anthocharis cethura, 8
cethura deserti. 8
lanceolata australis. 8
sara, 8
sara reakirtii, 8
sara reakirtii ab. wrighti. 9
sara stella, 8
Anthony, A. W., 239, 389
Antigonus spinola rubescens, 279
Antisell, Thomas, 159, 374, 375, 381, 384, 385, 386
Antrostomus goldmani, 251, 252
ridgwayi, 251, 252
ridgwayi ridgwayi, 251
ridgwayi troglodytes, 252
vociferus, 252
Aphelocoma sieberii arizonae, 240, 269
Apodemia moro, 21, 39
moro deserti, 39
moro mejicanus, 39
moro virgulti, 21, 39
palmeri marginalis, 21
Ara militaris mexicana, 247
Arca, 157
Archilochus alexandri, 253
Argynnis callippe, 14
semiramus, 14
Arnold, Ralph, 159, 162, 186, 189, 190, 377, 378, 382, 383, 386
Aster, 34
Astroceris, 151, 152
Asterodiscocyclina, 152
Asterodiscus pentagonalis, 151
Astragalus psaltria hesperophilus, 296
Astragalus leucopsis, 28
Astur, 242
Asturina plagiata maxima, 243
Asyndesmus lewisi, 256
Atalopedes campestris, 36
Athene whitneyi, 251
Atlides halesus, 22
Atropine semi-baccata, 27
Atrytona vestris, 36
Auriparus flaviceps, 200, 211
flaviceps flaviceps, 200, 201, 202, 211, 212, 271
flaviceps fraterculus, 200, 201, 202, 272
flaviceps ignatius, 211, 212, 223
flaviceps lamprocephalus, 200, 201, 202, 211, 212, 223
flaviceps ornatus, 199, 200, 201, 202, 211, 271
Ayres, 186

B
Baeolophus wollweberi annexus, 271
Bagg, Rufus M., 70
Bailey, T. L., 373
Vernon, 116, 135
Baird, S. F., 199, 332, 343
Baker, Fred, 173-182
Balanosphyrta formicivora aculeata, 256
Bancroft, Giffing, 197, 202, 210, 212, 220, 227, 239, 369
Margaret, 369
Bangs, Outram, 241, 259, 261
Barbour, Thomas, 135, 335, 351
Barnard, D., 135
Barnes, William, 4, 14, 24, 30
Basilarchia loriquini, 20
Basleuterus rufffrons caudatus, 287
Bathytormus, 379
Bean, 32
Bebbia juncea, 21
Behr, Herman, 15
Benchley, Belle, 136, 351
Benjamin, P. H., 4, 14, 24, 30
Benson, H. C., 246
Berry, E. Willard, 148, 152
Bidens pilosa, 7
Bittern, Least, 227, 228
Western Least, 227
Blackbird, Red-winged, 288
Blue, 27, 28, 29
Acmon, 29
Arrow-head, 31
Clemence’s, 30
Coolidge’s Aberrant, 27
Cottle’s, 29
Daedalus, 29
Edward’s, 27
Evius, 29
Greenish, 28
Hilda, 28
Kelsey's, 3, 29
Marine, 26
Orange-margined, 28
Pheres, 29
Pigmy, 27
Reakirt's, 27
Rufescent, 28
San Bernardino, 30
Sonora, 30
Southern, 31
Western Tailed, 28
Boa, 307, 312, 314
California, 318
Desert, 307, 318
Bogert, Charles M., 135, 309, 316
Bolivina, 67
advena, 46, 67, 79
advena var. striatella, 68, 79
argentea, 67
imbricata, 46, 68, 79, 94
spissa, 67
subadvena, 45, 67, 79, 88
subadvena var. spissa, 45, 67, 79, 88
Bombycilla cedrorum, 279
Bonaparte, Charles L., 297
Borden. R. L., 136
Boulenger. G. A., 122, 359
Brephidium exilis, 27
exilis ab. coolidgei, 27
Brewster, William. 241, 250, 294
Brown, Arthur E., 122
Bryant, Walter E., 199, 200, 201
Bubo virginianus pallescens, 243
Buckeye, 20
Buckwheat, Wild, 30
Bulimina, 64
elegantissima, 64
inflata, 45, 64, 79, 86
pagoda, 45, 66, 79, 88
pseudotorta, 46, 66, 79
rostrata, 45, 65, 79, 88
scabra, 51
subacuminata, 44, 45, 65, 79, 88
subcalva, 44, 45, 65, 66, 79, 86
Buliminella, 64
elegantissima, 45, 64, 79, 86
subfusiformis, 64, 79, 86
subfusiformis var. tenuata, 64
Buliminidae, 64
Bunker, C. D., 135, 369
Bunting, Lazuli, 294
Burnham, John, 314
Buteo albonotatus, 243
albonotatus albonotatus, 243
borcalis calurus, 242
calurus, 242
harrisi, 242
swainsoni, 243
Butterfly, Alfalfa, 10
Cabbage, 7
Letcher's, 20
Oaktree, 20
Snout, 39
Yreka Cabbage, 7
Cabbage, 7
Cactus, 222, 223, 224, 230
Cholla, 299
Giant, 172, 222, 243, 267, 269
Cahoon, 286
Cain, B. C., 135
Calamospiza melanocorys, 297
Calcarina stellata, 151
Calcite, 153, 168
Calephelis nemesis, 21
nemesis australis, 21
Callipepla elegans bensonii, 246
gambeli fulvipectus, 245
Callocitta collici, 270
Calliphrys dumerorum, 25
dumerorum perplexa, 25
Calyptra costae, 253
Camp, Charles L., 107
Camptostoma imberbe ridgwayi, 266
Campylorhynchus couesi, 273
gularis, 273
Cannon, W. B., 135
Caprimulgus nuttallii, 252
Caracara, 243
Cardinalis cardinalis affinis, 291
cardinalis superbus, 291
sinuatus, 292
Cardium, 159, 161
breweri, 159, 161
hizenense, 161
Carduelis lawrencei, 296
Carpenter, P. P., 185, 186, 187, 188, 189, 190, 191, 192, 196, 374
Carpodacus mexicanus, 223
mexicanus frontalis, 295
mexicanus ruberrimus, 295
mexicanus sonoriensis, 294, 295
Carrot, 5
Cassia, 11
Cassibulina pulchella, 74
Cassidix mexicanus nelsoni, 289
Cassidulina, 74
californica, 46, 75, 79, 90
corbyi, 46, 75, 79, 94
laevigata, 74
limbata, 46, 74, 79, 90
pulchella, 74, 79, 90
subglobosa, 46, 79
subglobosa var. quadrata, 46, 79
Cassidulinidae, 73
Cassin, John, 204
Cathartes aura septentrionalis, 241
septentrionalis, 241
Catherpes mexicanus albifrons, 273
mexicanus conspersus, 274
mexicanus var. conspersus, 274
mexicanus mexicanus, 273, 274
mexicanus polioptilus, 273
mexicanus punctulatus, 274
Catodon dugesii, 336
septemstriatus, 336
Catopsilia eubule sennae, 9
eubule sennae form pallida, 9
Cat’s Claw, 22
Caudisona enyo, 360
scutulata, 97
tigris, 36
Ceanothus, 18
Centurus "sulfuriventer, 256
uropygialis, 255
uropygialis sulfuriventer, 172, 255, 256
uropygialis uropygialis, 255, 256
Cercyonis, 37
silvestris, 13, 37
silvestris paulus, 37
Cereus, 172
Certhia, 162
Certhia familiaris, 329
familiaris albescens, 329
familiaris leucosticta, 329
familiaris montana, 329
familiaris zelotes, 329
Ceryle alcyon caurina, 254
americana subs. Ceryle septentrionalis, 254
Chachalaca, Chestnut-bellied, 244
Chaetura vauxi, 252
Chamaepelia inca, 249
passerina var. pallescens, 248
Chamiso, 230
Checker-spot, 14, 15, 38
Augusta, 38
Behr’s, 14
Chalcedon, 14, 38
Chara, 16
Editha, 15
Field’s Aberrant, 15
Gabb’s, 16
Southern, 15
Wright’s, 16, 38
Chert, 147, 157
Chloroceryle americana septentrionalis, 254
Chlosyne californica, 17
californica ab. chinoi, 39
lacinia, 39
lacinia adjutrix, 39
lacinia crocale, 17, 39
lacinia nigrescens, 39
lacinia rufescens, 39
Chondestes grammacus strigatus, 299
strigatus, 299
Chordeiles acutipennis texensis, 252
henryi, 252
minor henryi, 252
texensis, 252
Chrysodomus asakuraensis, 161
Chrysonitris macroptera, 295
Chrysophaninae, 25
Chrysothris finschi, 247
Church, C. C., 148
Cibicides, 78
cicatricosa, 46, 78, 79, 92
Clover, 10
Sweet, 28
Cnemidophorus labialis, 345
multiscutatus, 345
Coccyczus americanus occidentalis, 249
Cochran, Doris M., 135, 316, 343, 351, 369
Index to Volume VI

Cocothraustes chrysopeplus, 293
Cocronympha california, 12, 13
california galactinus, 12
Coffee Berry, California, 6
Colaptes cafer collaris, 255
chrysoides brunnescens, 171, 172
chrysoides chrysoides, 171
chrysoides mearnsi, 172
chrysoides tenebrosus, 171, 172, 255
collaris, 255
Coleoptera, 344
Colinus ridgwayi, 245
virginianus ridgwayi, 245
Columba fasciata, 247
fasciata fasciata, 247
flavirostris, 197, 198
flavirostris flavirostrus, 197, 198
flavirostris restricta, 197, 198, 248
Columbigallina passerina pallescens, 248
Comment on the Marsh Sparrows of
Southern and Lower California,
With the Description of a New Race, 203-206
Compsothlypis pitiayumi pulchra, 282
pulchra, 282
Comstock, John Adams, 3, 4, 7, 8, 14, 15, 16, 17, 18, 20, 21, 30, 33, 36, 38, 39, 40
Conant, Roger, 369
Concretion, 147, 157
Conglomerate, 155, 157, 160, 161
Conirostrum ornatum, 199, 201, 271
Conrad, T. A., 159, 373, 374, 375, 378, 380, 381, 382, 383, 384, 385, 386
Contopus pertinax pallidiventris, 265
Conway, E., 136
Cook, L. H., 316, 351
Cooper, A. S., 380
J. G., 186, 187, 188, 189, 190, 196, 380
Copaeodes aurantiaca, 34
Cope, E. D., 98, 122, 123, 310
Copper, Arota, 40
Gorgon, 26
Great, 26
Hermes, 25, 26
Mourning-garbed, 40
Nevada, 27
Purplish, 26
Coragyps atratus atratus, 242
Coral, 384
Corbis, 158
Corthylio calendula cineraceus, 279
Corvus corax sinuatus, 223, 271
cryptoleucus, 271
imparatus, 270
sinuatus, 271
Coues, Elliott, 265
Crassatella, 379
collina, 375, 378, 379, 380
pacteli, 380
uruguayensis, 379
Crassatellid, 378, 379
Crassatellites, 158, 159, 375, 379
brasiliensis, 379
collina, 158, 195, 161
dalli, 379
yabei, 161, 379
Crassatina, 380
Crescent, Field, 39
Mylitta, 17
Phaon, 16
Crimmins, M. L., 135
Cristellaria americana var. spinosa, 53
nikobarensis, 53
pulita, 53
Crotalus, 99, 113, 121, 360, 362
adamanteus, 122
atrox, 97, 105, 106, 118, 119, 120, 122, 123, 124, 127, 131, 134, 137, 355, 360, 365, 366
cerastes, 103, 104, 111, 131, 362, 363, 364, 365, 366, 367, 368
color, 111, 359
confluentus abyssus, 114, 122, 124, 127, 133, 134, 137, 142, 359
confluentus cerberus, 120, 130, 132, 134, 137, 142
confluentus decolor, 111, 122, 126, 127, 133, 134, 137
Crotalus tigris and Crotalus enyo, Two of the Eight Known Rattlesnakes of the Southwest, by J. D. Stejneger.

369

T. H. H. 186, 187, 189, 190, 191.


MONUMENTS, 246

MEMORIAL, 246

CYCLE, 254

CYCLOPS, 257

CYCLOPS, 257
Dentalina, 45, 54, 79, 82
    insecta, 45, 54, 79, 82
    insolita, 54, 79, 82

Descriptions of New Birds from the Mountains of Southern Nevada, 325-332

Dickey, Donald R., 212, 235-236, 286

Dione vanillae, 13

Discocyclina, 147, 148, 150, 151, 152.
    154, 155, 156
    californica, 150
    citrensis, 150
    clarki, 150
    cloptoni, 150
    perkinsi, 150
    perpusilla, 151, 374
    psila, 148, 150, 151, 164, 166,
        170, 374
    salensis, 151

Dodder, 23

Dog-face, California, 9
    Clouded, 10
    Margined, 9
    Southern, 10

Dolson, F. O., 135

Donax stultorum, 376

d'Orbigny, Alcide, 50, 52, 64, 71, 72,
    74, 77, 78

Dorrance, J. R., 158, 162

Dove, Ground, 248
    Mourning, 248

Driver, H. L., 147, 148, 150, 153,
    154, 157

Dryobates arizonae arizonae, 257
    scalaris agnus, 172, 257
    scalaris cactophilus, 257
    villosus icastus, 240

Dunn, E. R., 359

Dusky-wing, 33, 34
    Afranius, 33
    Funereal, 34
    Juvenal's, 35
    Mexican, 32
    Mournful, 34
    Propertius, 33
    Wright's, 33

Dwight, Jonathan, 206

E

Echinoid, 147, 157, 162, 387

Ectopistes marginella, 248

Ehrenbergina, 75
    compressa, 46, 75, 79, 90

Elfin, Western, 24
    Western Banded, 24

Ellipsoidinidae, 71

Ellipsolagena, 71
    apiculata, 46, 71, 79, 88

Elphidium, 61
    hannai, 45, 62, 79, 84
    hughesi, 45, 61, 79, 84
    oregonense, 45, 62, 79, 86

Emberiza amoena, 294
    bilineata, 219
    leucophrys, 302
    pallida, 301
    rostrata, 298
    (Zonotrichia) gracilis, 303

Empidonax difficilis, 263, 264, 265
    difficilis difficilis, 263
    difficilis insulicola, 264
    fulvifrons pygmaeus, 265
    griseus, 265
    pygmaeus, 265
    traillii brewsteri, 264
    wrightii, 264

Entosolenia squamosa var. hexagona,
    squamosa var. scalariformis, 58
    williamsoni, 59

Epargyreus titurus, 31

Epitonium, 185, 186
    californicum, 192, 195
    catalinae, 191
    catalinense, 191, 195
    crebricostatum, 188
    fallaciosum, 190, 193, 194, 196
    hindsii, 190, 193, 194, 196
    indianorum, 187, 192, 194
    indianorum tinctum, 189, 196
    (Nitidiscala) californicum,
        195, 196
    (Nitidiscala) cooperi, 189,
        194, 196
    (Nitidiscala) indianorum, 192,
        196
    (Nitidiscala) sawinae, 194, 196
    (Nitidiscala) sawinae catalinense,
        196
    (Nitidiscala) tiara, 190
    (Nitidiscala) tinctum, 193,
        196
    (Nitidiscala) fallaciosum, 193
    sawinae, 191, 194
    sawinae var. catalinense, 191,
        194
    subcoronatum, 187, 190, 192,
        193, 196
    tinctum, 187, 188, 189, 190,
        193, 195
Eponides, 72
ornata, 46, 72, 79, 90
peruviana, 46, 73, 79, 94
tenera, 46, 72, 79, 90
Eriogonum, 30
Erwin, P. R., 135
Erynnis funeralis, 34
juvenalis, 33
lacustra, 33
persius afranius, 33
propertius, 33
tristis, 34
Eriogonum, 30
Erwin, P. R., 135
Erynnis funeralis, 34
juvenalis, 33
lacustra, 33
persius afranius, 33
propertius, 33
tristis, 34
Etter, W. K., 136
Eucalyptus, 11
Euchloe creusa lotta, 37
Euressatella, 379
Euphagus cyanoccephalus cyanocepha-
lus, 290
Euphydryas, 14
chaledona, 14, 38
chaledona ab. fusimacula, 38
chaledona ab. fusisecunda, 38
chaledona ab. hemiluteofus-
cus, 38
chaledona ab. hemimelanica, 38
chaledona ab. mariana, 38
chaledona ab. omnifuscus, 38
chaledona quino, 14, 15
chaledona ab. suprafusa, 38
chaledona ab. supranigrella, 38
editha, 15, 16, 38
editha fieldi, 15
editha wrighti, 15
quino augusta, 38
Euptoieta claudia, 13
hegesia, 37
Eurema mexicana, 11
nicippe, 11
Eurymus eurytheme, 10, 11
eurytheme ab. alba, 10
eurytheme amphidusa, 10
harfordii, 11
Euspirocrommium clarki, 158
Euthlypis lachrymosa lachrymosa, 286, 287
lachrymosa schistacea, 286, 287
lachrymosa tephra, 250, 286, 287
Evans, Charles L., 135, 369
Everes amyntula, 28
Everlasting, 19
Evermann, B. W., 135, 316, 351, 369
F
Falco anatum. 244
carolinensis, 243
hudsonius, 243
peregrinus anatum, 223, 244
sparverius, 244
sparverius phalaena, 244
sparverius sparverius, 244
velox, 242
Ficopsis hornii. 158
Ficus gesteri. 159
mamillatus, 159
Field. George H., 4, 5, 8, 15, 18, 25, 27, 29, 34, 35, 36
Flicker. 172
Gilded, 172
Fluhr, C. G., 136
Flycatcher. 262, 264
Arizona Crested. 260
Ash-throated, 260
Western, 264
Foraminifera, 43, 44, 147, 148, 156, 157, 162
Fortiner, John C., 31, 33
Four New Birds from Northwestern
Mexico, 213-226
Frazar, Marston A., 286
Fringilla chlorura, 296
domestica, 287
frontalis, 295
gambelii. 302
lincolni, 303
maculata, 292, 293
Frisbie, W. B., 136
Fritillary, 13, 14
Callippe, 14
Gulf, 13
Mexican, 37
Semiramis', 14
Variegated, 13
Frizzell, Don L., 319-324
Frondicularia, 56
advena, 57, 79, 84
foliosa. 45, 56, 79, 84
inaequalis, 57
Frutilla, 230
Fusus occidentalis, 159
G
Gabb, W. M., 380, 382, 385
Gaige, Mrs. H. T., 135
Galloway, J. J., 151
Garman, S., 347
Gastropod, 158
Gaudryina, 51
triangularis, 45, 51, 79, 80
Gauldin, B. F., 136
Geococcyx californianus, 249
George, I. D., 360, 365, 368
Geothlypis trichas chryseola, 240, 285, 303
trichas modesta, 285
trichas occidentalis, 285
Gibbs, George, 384
Gibbula, 178
harrisi, 177, 182
Girard, C., 343
Githens, T. S., 360, 365, 368
Glandulina, 56
laevigata, 45, 56, 79, 84
Glaucidium brasiHanum ridgwayi, 251
ridgwayi, 251
Glauconia borrichiana, 3
humilis, 336
septemstriata, 336
Glaucopsyche lygdamus australis, 31
Globigerina, 76
conglomerata, 46, 76, 79
dubia, 77
dutertrei, 77
inflata, 46, 76, 79
Globigerinidae, 76
Globobulimina, 66
pacifica, 66, 79, 88
Globorotalia, 77
crassula, 44, 46, 77, 79, 92
Globorotaliidae, 77
Globularia, 157
hannibali, 158, 162
Gloyd, H. K., 135
Glycymeris, 159, 161
cishuensis, 161
cf. veatchii var. major, 159, 161
Gnaphalium, 19
Gnatcatcher, Plumbeous, 278
Goldman, E. A., 295
Goniurus proteus, 32
Gooseberry, 25
Graham, Norman, 47
Granite, 313, 348
Grant, U. S., IV, 192, 321
Grass, Australian Salt, 27
Gray, John Edward, 190
Grayson, Andrew J., 236
Greene, J. E., 227
Grinnell, Fordyce, 15
Griscom, Ludlow, 244, 268
Grosbeak, Black-headed, 292
Blue, 293
Rocky Mountain Black-headed, 292
Guiraca caerulea interfusa, 293
caeulea salicaria, 293
caeulea salicarius, 293
melanocephala, 292
Gunder, J. D., 4, 15, 16, 27, 34, 36
Gypsina, 148
Gyroidina, 72
soldanii, 46, 72, 79, 90
H
Habrodais grunus, 22
Hair-streak, 22
Boisduval’s, 22
Bramble, 25
California, 23
Columella, 22
Common, 22
Cuyamaca, 24
Gray, 23
Great Purple, 22
Hedge-row, 39
Ines, 22
Juniper, 40
Leda, 22
Nelson’s, 24
Nut Brown, 23
Perplexing, 25
Purplish-brown, 23
Skinner’s, 24
Sylvan, 23
Handley, A. D., 369
Harporhynchus bendirei, 276
curvoirostris maculatus, 274
curvoirostris var. palmeri, 275
Harris, Wray, 178
Hawk, Duck, 223, 224
Marsh, 223, 224
Red-tailed, 242
Heleodytes brunneicapillus, 224, 225
brunneicapillus affinis, 225, 226
brunneicapillus brunneicapillus, 273
brunneicapillus bryanti, 224, 225, 226
brunneicapillus couesi, 273
Heleodytes brunneicapillus purus, 223, 226
        gularis, 225, 226
Heliconiinae, 13
Helmintophaga celata var. lutescens, 282
        luciae, 281
        virginae, 281
Hemiargus gyas, 27
        isola, 27
Hemiusus colosseus, 175, 180
Hemphill, Henry, 190
Henderson, Junius, 135
Henne, Chris, 26
Heodes gorgon, 26
        helioides, 26
        xanthoides, 26
        xanthoides luctuosa, 40
Herrera, A. L., 135
Herrick, Frank E., 46, 47
Hertlein, Leo. G., 159
Hesperia columbia, 35
        juba, 35
        viridis, 35
Hesperiidae, 31
Hesperiinae, 34
Hesperioidea, 31
Heterochroa bredowii californica, 20
Heterohelicidae, 63
Hileman, H. H., 135
Hill, Howard R., 135, 316, 351
Hirano, M., 175
Hirundo albibrons, 269
        bicolor, 268
        erythrogaster, 268
        serripennis, 268
        thalassinus, 266
Holbrook, J. E., 98
Holland, J. G., 19
Hookway, L. C., 158
Hop, 19
        203-206, 211-212, 215, 217, 229-
        230, 231-234, 312, 364, 389-390
Humphrey, R. R., 359
Hungate, J. W., 135
Hurter, Julius, 345
Hutchison, R. H., 135
Hylephila phylaeus, 35
Hyllocharis xantusi, 241
Hylocichla aonalaschkae slevini, 277
        guttata guttata, 277
        slevini slevini, 277
        ustulata ustulata, 277
Klauber, Laurence M., 95-144, 305-318, 333-352, 353-370
Kobler, L. C., 136
Koch, Richard E., 54, 55

L
Lady, Hunter’s Painted, 19
Painted, 19
Virginia, 19
West Coast, 19

Lagena, 57
acuticosta, 45, 57, 79, 84
apiculata, 71
foveolata, 45, 58, 79, 84
hexagona, 45, 57, 79, 84
hexagona var. scalariformis, 45, 58, 79, 84
scalariformis, 58
substriata, 45, 57, 79, 84
sulcata, 45, 58, 79, 84
vulgaris var. substriata, 57
williamsoni, 45, 59, 79, 94

Lagenidae, 53
Lamb, C. C., 130, 135, 369

Lanius ludovicianus gambeli, 280
ludovicianus nevadensis, 280
ludovicianus sonoriensis, 279, 280

Lantana, 12, 20, 31
Lawrence, George N., 199, 236
Lawson, A. C., 43
Le Conte, John L., 343, 344
Leffingwell, D. J., 135
Lenticulina rotulata, 53
Lepidocyclina, 156
Leptotila fulviventris angelica, 249
leptotila fulviventris angelica, 249

Leptotyphlops, 335
borrichiana, 336
dulcis, 337, 342, 347, 348, 350
humilis, 334, 335, 336, 337, 338, 339, 343, 347, 348, 351
humilis cahuilae, 334, 339, 341, 342, 343, 344, 345, 346, 347, 348, 350, 351
septemstriata, 335, 336
septemstriatus, 336

Lerodea eufala, 36
Libythea bachmanii, 39
Lichanura, 306, 310, 311, 313, 314, 316
myriolepis, 310, 311
orcutti, 310
roseofusca, 307, 310, 311, 312, 313, 316, 318
roseofusca gracia, 306, 307, 309, 310, 311, 312, 313, 314, 316, 318
simplex, 311
trivirgata, 306, 307, 309, 310, 311, 312, 313, 314, 316, 318

Liebus, A., 55
Limestone, 147, 148, 150, 153, 154, 155, 156, 157, 161, 162, 164, 166, 168, 170, 373, 374, 383, 384, 387

Linnet, 223, 295
Linsdale, Jean, 135, 316, 351, 369
Linthia, 162
Lituola, 50
Lituolidae, 50
Lituolinae, 50
Loel, Wayne, 192

Lohman, K. E., 147, 148 S. W., 147

Lophortyx, 275
douglasii, 246
douglasii bensoni, 246
douglasii douglasii, 245, 246
gambeli, 245, 246
gambeli fulvipeectus, 245, 246
gambeli gambeli, 245, 246

Lotus scoparius, 26
Loveridge, A., 135, 335, 347, 351
Loxotrema, 158
Loxotrema turritum, 158

Loyd, Ed. 135
Lucinoma, 386
Lucinoma acutilineata, 386
annulata, 386

Lycaenidae, 22
Lycaeninae, 26
Lycaeninae, 26
Lycium, 230

Macaw, 247
Macrocallista, 386
conradiana, 158
hornii, 386
Mactra gabiotensis, 380, 381
Mactrid, 375
Mactroid, 159
Mallow, 19
Malva, 19
Mangrove, 218, 227, 228, 235, 284
Marble, Grinnell's, 8
Southern, 37
March, D. D. H., 135
Margarites parcipictus, 178
Marigold, Downy Bur, 7
Marl, 155, 156
Martin, 269
Western, 267
Mawe, John, 376
McCarty, E. E., 136
McKee, E. D., 115, 116, 135
Megaceryle alcyon caurina, 254
Megascops asio cineraceus, 250
vinaceus, 250
Megathymidae, 36
Megathymus stephani, 37
yuccae, 36
yuccae navajo, 36, 37
Meinhertzhagen, R., 270
Melanerpes formicivorus aculeatus, 256
Melanotis caerulescens effuticius, 274
Melitaea chara, 16
gabbii, 16, 38
gabbii ab. gunderi, 38
gabbii ab. newcombii, 38
gabbii ab. pasadenae, 38
leanira wrightii, 16, 28
leanira wrightii ab. carolynae, 38
leanira wrightii ab. cerrita, 38
Melopelia asiatica mearnsi, 248
Melospiza lincolni gracilis, 303
lincolni lincolni, 303
melodia, 332
melodia saltonis, 302, 303
Menke, H. W., 111
Mercier, A. T., 135
Mesquite, 299
Metal-mark, Behr's, 24
Dusky, 21
Margined, 21
Mormon, 21, 39
Southern, 21
Micropallas whitneyi whitneyi, 251
Miliolidae, 52
Milkweed, 11, 12, 23
Miller, A. H., 280
W. DeWitt, 197
Mimus polyglottos leucopterus, 223, 274
Mite, Red, 360
Mitoura loki, 24
nelsoni, 24
nelsoni ab. exoleta, 24
siva, 24
siva juniperaria, 40
spinetorum, 24
spinetorum cuymaca, 24
Mockingbird, 223
Molothrus ater artemisiae, 290
ater obscurus, 290
Momotus mexicanus, 254
Monarch, 11, 12
Smoky, 12
Moore, Margaret S., 48
Motacilla pileolata, 286
rubiginosa, 282
ruticilla, 286
s. Sylvia currucoides, 278
Mourning Cloak, 18
Mouse, 223, 289
Lower California Canyon, 232
Mid-peninsula Spiny Pocket, 233
San Agustin Silky Pocket, 233
Silky Pocket, 233
Western Spiny Pocket, 231
Mud, 162, 192
Musci-capa guttata, 277
saya, 262
semiatra, 262
Mustard, 6, 7
Myadestes townsendi, 278
Myers, G. S., 135, 351, 369
Myiarchus cinerascens cinerascens, 260, 261
cinerascens inquietus, 260, 261
cinerascens nuttingi, 261
cinerascens pertinax, 261
inquietus, 260
lawrencei olivascens, 261
mexicanus magister, 260
tuberculifer olivascens, 261
tyranthis magister, 260
Myioborus miniatus miniatus, 286
Myiochanes pertinax pallidiiventris, 265
richardsonii richardsonii, 265
richardsonii veliei, 265
Myiodynastes luteiventris luteiventris, 259
luteiventris swarthi, 259
Myiozetetes similis columbianus, 198
similis primulus, 198, 259
similis superciliosus, 198

Mytilus inezensis, 380

N

Nagao, T., 161
Nasturtium, 7
Nathalis iole, 7
Natica acuminata, 385
inezana, 375, 383, 384, 385
Naticid, 384
Nautilus umbilicatulus, 60
Nelson, Edward W., 219, 220
R. N., 148, 162
Nerita triangulata, 158, 385
Netting, M. G., 135
Nettle, 19
Neugeboren, Johann Ludwig, 55
Neverita, 383, 385
recluziana, 385

New and Renamed Subspecies of Crotalus confluentus Say, With Remarks on Related Species, 95-144

New Sonora Races of Toxostoma and Pheugopedius, 207-208

New Species of Mollusks, 173-182
Nitidiscala, 185, 189, 191
Nitidoscala, 190
fallaciosa, 190
Noble, G. K., 135, 351, 369
Nodogenerina, 63
lepidula, 45, 63, 79, 86
Nodosaria, 45, 54, 56, 79, 84
brevicula, 45, 55, 79, 82
deceptoria, 45, 54, 79, 82
exilis, 55
(Glandulina) laevigata, 56
insecta, 45, 54, 79
insolita, 54
koina, 46, 55, 79, 94
lepidula, 63
parexilis, 44, 45, 55, 79, 82
rocundata, 56
tosta, 45, 55, 79, 84

Nonion, 60
costifera, 60, 79, 84
incisa, 46, 60, 79
umbilicatula, 45, 60, 79, 84

Nonionella, 61
auris, 61
miocenica, 45, 61, 79, 94
Nonionidae, 60

Nonionina auris, 61
bulloides, 76
costifera, 60
incisa, 60
umbilicatula, 60

Notes on Some Species of Epitonium, Subgenus Nitidiscala, from the West Coast of North America, 183-196

Notes on the Worm Snakes of the Southwest, With Descriptions of Two New Subspecies, 333-352

Nummulites, 148, 170
papyracea, 148

Nuttall, Thomas, 98

Nymphalidae, 13

Nymphalinae, 13

O

Oak, Live, 20, 22
Oberholser, H. C., 200, 201, 203, 206, 215, 217, 264, 293, 297
Oberholseria chlorura, 296

Ochlodes nemorum, 35
sylvanoides, 35

Olsson, A. A., 160
Oolina apiculata, 71

Oprerculina, 148, 156, 162, 170
ocalana, 156
cf. ocalana, 164

Oporornis tolmiei, 284

Orange-tip, Desert, 8
Felder’s, 8
Reakirt’s, 8
Sara, 8
Stellar, 8
Wright’s Aberrant, 9

Orbitoid, 148, 152, 156, 162, 373

Orbitoides papyracea, 148
stellata, 151

Orbitolites radians, 151

Orbitolites Pratti, 148

Orbulina, 77
universa, 46, 77, 79, 92
universa var. aculeata, 77

Orcutt, C. R., 310

Oriole, Arizona Hooded, 289

Ornismya costae, 253

Ornithium imberbe ridgwayi, 266

Orsoscoptes montanus, 276

Orpheus leucopterus, 274
montanus, 276

Ortalida wagleri, 244
Ortalis wagleri, 244
Ortenburger, A. I., 135
Orthophragmina, 152, 162, 373, 374
americania, 154
mariannensis, 154
mariannensis var. papillata, 154
Ortyx douglasii, 245
montezumae, 246
Osborn, R. P., 48
Osgood, W. H., 232
Osprey, 243
Ostrea erici, 159
hiranoi, 175, 180
idriaensis, 159
panzana, 386
tayloriana, 157, 159, 386
titan, 386
Otocoris alpestris, 332
alpestris adusta, 266
Otus asio cineraceus, 250
cooperi, 250
vinaceus, 250
Owl, Horned, 251
Oyster, 157
P
Pachycereus, 222
Pachycrommiun, 385
Pachydesma, 375, 376, 377
crassatelloides, 376, 377
inezana, 159, 375, 376, 377, 378
ineziana, 377
Packard, E. L., 191, 381
Palmer, T. S., 98
Pandion haliaetus carolinensis, 243
Pansy, Garden, 13
Paphia restorationensis, 321
Papilio eurymedon, 6
indra pergamus, 5
multicaudata, 5
rutulus, 5
zelicaon, 5
Papilionidae, 5
Papilionoidea, 5
Parabuteo unicinctus harrisi, 242
Parsley, 5
Parus annexus, 271
Passer domesticus domesticus, 287
Passerculus, 203
alaudinus, 298
anthinus, 297
beldingi, 217
rostratus, 203, 204, 205, 215, 216, 218, 219
rostratus anulus, 204, 205, 206, 217
rostratus beldingi, 204, 205, 206, 217
rostratus guttatus, 203, 204, 205, 206, 216, 217
rostratus halophilus, 203, 204, 205, 206, 217
rostratus rostratus, 203, 204, 205, 206, 216, 217
rostratus sanctorum, 206
santorum, 206, 217, 219
sandwichensis, 205, 218, 297
sandwichensis alaudinus, 297, 298
sandwichensis anthinus, 297
sandwichensis anulus, 219
sandwichensis atratus, 218, 219, 298
sandwichensis bryanti, 205, 206, 218
sandwichensis halophilus, 219
sandwichensis nevadensis, 297, 298
sandwichensis rostratus, 218, 219, 298
sandwichensis sanctorum, 219
sandwichensis savanna, 297
Passerina amoena, 294
versicolor pulchra, 293, 294
versicolor versicolor, 294
Patch, Bordered, 39
California, 17
Chino, 39
Crocole, 17
Patton, R. E., 136
Pecten, 387
ashiyaensis, 161
magnolia, 157
perrini, 158
yneziana, 158, 159, 161
Peers, Susie, 135
Penthestes sclateri eidos, 240
Perkins, C. B., 100, 135
Perognathus, 233
arenarius, 233
baileyi, 233
fallax, 233
formosus, 233
longimembris, 231, 233
longimembris aestivus, 233
longimembris panamintinus, 233
longimembris venustus, 233
spinatus, 231, 233
Index to Volume VI

spinatus peninsulae, 231, 232, 233
spinatus prietae, 232, 233
spinatus rufescens, 231, 232, 233
spinatus spinatus, 231, 232, 233
Peromyscus, 223
crinitus, 389, 390
crinitus pallidissimus, 389, 390
crinitus stephensi, 389, 390
Peters, J. L., 259, 261, 335
Petrochelidon albifrons albifrons, 269
albilinea, 268
Peucaea, 300
carpalis, 299
ruficeps scottii, 299
Pewee, Wood, 265
Phaedrotes piasus, 31
sagittigera, 31
Phainopepla, 279
nifens lepida, 279
Phalaenoptilus nuttallii nuttallii, 252
Pheugopedius, 208
felix pallidus, 208
felix sonorae, 208, 272
sinola cinereus, 208, 272
sinola sinola, 208
Pheucticus chrysopoeplus, 293
Philotes battoideis bernardino, 30
sonorensis, 30, 40
sonorensis comstocki, 40
sonorensis ab. sonoralba, 40
Phoebe, Black, 263
Say, 262
Pholadomya, 162
Pholisora catullus, 33
libya, 33
Phos blakianus, 158
Phrynosoma cerroense, 345
schmidtii, 345
Phytiodes campestris, 39
marcia, 17
mylitta, 17
phaon, 16, 17
tharos, 17
Piaya cayana extima, 210, 249
cayana mexicana, 209, 210
cayana stiritoni, 209, 210
cayana thermophila, 209, 210
Pica beechii, 270
colliei, 270
Picolaptes brunneicapillus, 273
Picus arizonae, 257
Pieridae, 6
Pieris beckerii, 6
protodice, 6
protodice vernalis, 7
rapae, 6, 7
rapae novangliae, 37
rapae yreka, 7
sisymbrii, 6
Pigeon, Band-tailed, 247
Red-billed, 197
Pine, 25
Yellow, 328
Pipilo fuscus intermedius, 296, 297
fuscus mesoleucus, 297
maculatus montanus, 296
mesoleucus, 297
Piranga flava oreophasma, 290, 291
heptica, 291
heptica oreophasma, 290
ludoviciana, 290
rubra cooperi, 291
rubra rubra, 291
Pitangus sulfuratus derbianus, 259
Pitar, 375
uvasanus, 375
Pituophis catenifer annectens, 312, 341
catenifer deserticola, 341
vertebralis, 312
Planispirina celata, 52
Planulina, 45, 53, 79, 82
Planulina, 78
ornata, 46, 78, 79, 92
Platypasaris aglaiae richmondi, 258
Plebejus acmon, 29, 30
acmon cotelei, 29, 30
acmon ab. kelseyi, 29, 30
acmon labecula, 30
icarioiodes ab. daedalus, 29
icarioiodes evius, 29
melissa, 28
monticola, 30
pheres, 29
saepiolus, 28
saepiolus hilda, 28
saepiolus rufescens, 28
Plectofrondicularia, 63
californica, 45, 63, 79, 86
miocenica, 46, 63, 79, 86
Poanes melane, 40
Polioptila caerulea moenissima, 278
melanura lucida, 278
nigriceps restricta, 278
Polites sabuleti, 36
sabuleti comstocki, 36
Polyborus auduboni, 243
cheriway auduboni, 243
Polygonia satyrus, 17
satyrus marsyas, 18
zephyrus, 18
Polygonus lividus arizonensis, 31
Polymorphina, 59
biserialis, 59
charlottensis, 45, 59, 79, 86
complanata, 59
compressa, 59
elongata, 59
Polymorphinidae, 59
Poocaetes gramineus var. confinis, 298
Poecetes gramineus confinis, 298
Poospiza bellii var. nevadensis, 300
Popenoe, W. P., 154, 384
Potamides, 158
Prenes errans, 36
Progne subis hesperia, 269
subis subis, 269
Psarocolius aeneus, 290
cyanocephalus, 290
pustulatus, 289
Pseudocopacodes eunus, 34
Pseudomiltha, 162
Psittacula cyanopygia pallida, 247
Ptilogony's townsendi, 278
Pullenia, 76
bulloides, 46, 76, 79, 92
Pulvinulina crassa, 77
Pulvinulina, 73
pacific a, 73, 79, 90
subperuviana, 46, 73, 79
Pyrrhuloxia sinuata, 292
Pyrrhuloxia sinuata sinuata, 292
Quail, 246
Gambel, 245
Queen, 12
Striated, 12
Quinqueloculina, 52
akneriana, 45, 52, 79, 82
seminulum, 52

**R**

Rahmgren, F. H., 136
Rail, Clapper, 205, 235, 236
Rallus, 205
elegans, 236
nayaritensis, 236
obsoletus, 235, 236
obsoletus nayaritensis, 235, 236
obsoletus rhizophorae, 235, 236
obsoletus yumanensis, 235
tenuirostris, 236
Rat, Wood, 313
Black, 131, 134, 142
Bleached, 134
Grand Canyon, 114, 134, 142
Great Basin, 98, 99, 100, 124, 129, 134, 140
Lower California, 360
Midget Faded, 111, 134
Mojave, 144
Pacific, 134, 138
Panamint, 108, 134, 140
Prairie, 134, 138
Tiger, 106, 107, 144, 356, 360, 369
Raven, 223, 271
Rector, Lucile, 307
Regulus calendula cineraceus, 279
Reichenbach, Heinrich G. L., 256
Rena humilis, 336


Rhamnus californica, 6
Rhoads, Samuel N., 267
Richmond, Charles W., 206, 246, 293, 295
Richmondena cardinalis affinis, 291
cardinalis superba, 291

**Q**

Ridgway, J. L., 148
Robert, 200, 211, 217, 219, 220, 242, 246, 265, 270, 273, 275, 287, 294, 300, 328
Riggs, E. S., 111
Ringlet, 12
Boisduval's, 12
California, 12
Riodinidae, 21
Index to Volume VI

407

Ripley, F. C., 47  
Rivers, J. J., 15  
Robin, 277  
Robulus, 53  
ad americanus var. spinosus, 46, 53, 79, 94  
cushmani, 53  
nikobarensis, 45, 53, 79, 82  
Rock, 147, 158, 223, 313, 348, 359, 381  
Rohrer, J. A., 136  
Rosalin?araucana, 71  
onnata, 72  
peruviana, 73  
Rotalia (Gyroidina) soldanii, 72  
nitidula, 72  
Rotaliidae, 71  
Rotalina crassa, 77  
Ruthling, P. D. R., 135  
Ruthven, A. G., 135, 335

S
Sagrina branneri, 70  
californiensis, 70  
elongata, 70  
Salicornia, 218, 235  
Salpinctes obsoletus obsoletus, 223, 274  
Sand, 162, 186  
Sandstone, 147, 148, 155, 157, 375, 380, 386, 387  
Satyr, 17  
Little, 37  
Sylvan, 13  
Satyridae, 12  
Saurophagus derbianus, 259  
Saurothera Californiana, 249  
Sayornis nigricans, 263  
nigricans amnicola, 263  
nigricans aquatica, 263  
nigricans brunnescens, 263  
nigricans salictaria, 263  
nigricans semiatra, 262, 263  
saya quiescens, 262  
saya saya, 262  
sayus quiescens, 262  
Scala, 189  
crebricostata, 189  
hindsii, 188, 189, 190, 193  
indianorum, 189, 192  
tincta, 189, 190, 194  
Scalaria, 185  
crebricostata, 187  
cumingii, 188  
gracilis, 188  
hindsii, 188  
indianorum. 186, 187, 192, 196  
(indianorum) var. tincta, 186, 193, 196  
subcoronata, 187, 188, 189, 193  
Scaphidurus major nelsoni, 289  
Scardafella inca, 249  
Schenck, H. G., 148, 150, 156, 387  
Schilling, K. H., 160, 377, 386  
Schmidt, K. P., 135  
Schubach, Tex., 135  
Schubert, R. J., 54, 77  
Schwager, Conrad, 54, 55, 57, 78  
Searl, C., 135  
Seiurus noveboracensis notabilis, 284  
Selasphorus platycercus platycercus, 253  
rufus, 253  
Septifer dichotomus, 380  
Serpula (Lagenia) sulcata, 58  
Setophaga miniata, 286  
ruticilla, 286  
Shale, 147, 148, 157, 373, 374  
Siagonodon, 335, 336  
dugesii, 336, 347, 350  
humilis, 336  
septemstriatus, 336  
Sialis currucoideis, 278  
mexicana bairdi, 277  
Sidewinder, 363, 364  
Sigmolina, 52  
celata, 45, 52, 79, 82  
schlumbergeri, 52  
Simpson, G. W., 136  
Siphogenerina, 70  
branneri, 46, 70, 79, 88  
hughesi, 46, 70, 79, 88  
Siphonalia merriami, 158, 159, 161  
tularensis, 158  
Sister, California, 20  
Sitta carolinensis nelsoni, 272  
pygmaea, 329  
pygmaea canescens, 328, 329  
pygmaea leuconucha, 328, 329  
pygmaea melanotes, 328  
Siurus naevius notabilis, 284  
Skinner, Henry, 15, 33, 34
Skipper, 32, 34, 35, 36  
Columbia, 35  
Desert Sandhill, 36  
Dun, 36  
Eufala, 36  
Eunus, 34  
Field, 36  
Fiery, 35  
Forest, 35  
Green, 35  
Hewitson’s, 34  
Juba, 35  
Large White, 32  
Long-tailed, 32  
Navajo, 36  
Powdered, 32  
Sandhill, 36  
Silver-spotted, 31  
Skinner’s Arizona, 31  
Stephen’s, 37  
Two-banded, 32  
Umber, 40  
Wandering, 36  
Western Checkered, 32  
Woodland, 35  

Slevin, J. R., 135, 316, 338, 351, 369  
Smith, James Perrin, 375, 380, 385  
Snake, Gopher, 312, 341  
Desert Worm, 338  
San Lucan Worm, 338  
Worm, 335, 337, 338, 342, 348, 351  

Some Geographic Variations in Piaya cayana, 209-210  
Sooty-wing, 33  
Mojave, 33  
Sparrow, 224  
Black-throated, 220, 223  
Coastal Bell, 229  
English, 287  
Gambel, 302  
Large-billed, 215, 216  
Marsh, 203, 204, 205  
Savannah, 218, 297  
Scammon Lagoon Marsh, 204  
Song, 303  
Speotyto cunicularia hypugaea, 251  
Sphaeroidina, 76  
bulloides, 46, 76, 79, 92  
Sphyrapicus varius nuchalis, 257  
varius var. nuchalis, 257  
Spicer, V. D. P., 173-182  
Spinus lawrencei, 296  
pinus pinus, 295  
psaltria hesperophilus, 296  
psaltria mexicanus, 296  
psaltria psaltria, 296  
Spiroloculina celata, 52  
Spisula bispiculata, 381  
Spizella breweri, 301  
pallida, 301  
passerina arizonae, 301  
socialis var. arizonae, 301  
Squirrel-cuckoo, 209, 210  
Red, 209  
Stejneger, Leonhard, 98, 107, 122, 123, 135, 310, 311, 316, 351, 369  
Stelgidopteryx ruficollis psammoschrous, 268  
ruficollis serripennis, 250, 268  
Stenostoma humile, 336  
septemstriatum, 336  
tenuiculum, 336, 337, 347, 350  
Stephens, Frank, 32, 108, 239, 344  
Stewart, Katherine C., 41-94  
Ralph B., 378, 379, 385  
Roscoe E., 41-94  
Stirton, R. A., 210  
Stone, L. J., 47  
Witmer, 98  
Strepsidura ficus, 158  
lorezana, 159  
Strigatella (Atrimitra) coronadoensis, 176, 182  
catalinae, 176  
diegenis, 176  
Strix hypugaeae, 251  
pratincola, 250  
Strong, A. M., 183-196  
Struthus caniceps, 301  
Strymon adenostomatis, 23  
auretorm spadix, 23  
californica, 23  
columella, 22  
dryope, 23  
leda, 22  
leda ines, 22  
melinus, 22  
saeipium, 39  
saeipium chlorophora, 23, 40  
saeipium fulvescens, 40  
sylvanus, 23  
Sturnella neglecta, 287, 288  
Sturnus obscurus, 290
Sulphur, 11
  Boisduval's, 10
  Boisduval's Pale, 10
Cloudless, 9
Flavid, 10
Harford's, 11
Pallid, 9
Senna, 9

Sundevall, Carolus J., 199
Swallow, 267
  Barn, 268
  Northern Violet-green, 267
Swallowtail, 5
  Anise, 5
  Daunus, 5
  Edwards', 5
  Pale, 6
  Western Tiger, 5
Swan, J. G., 186
Swann, H. Kirke, 242
Swarth, Harry S., 201, 240, 263, 297, 299, 302
Sylvia auduboni, 283
  celatus, 282
  nigrescens, 284
  occidentalis, 284
  tolmiei, 284
  Townsendi, 284

T
Tachycineta lepida, 267
  thalassina brachyptera, 267
  thalassina lepida, 266, 267
  thalassina thalassina, 266, 267
Tagelus (Cultellus), 385
Tanager, Cooper, 291
Tanagra ludoviciana, 290
Tangavius aeneus aeneus, 290
Tanner, V. M., 135
Tapes, inezensis, 375, 378
  montana, 386
Taylor, E. H., 135, 369
Tellina tivel, 377
Telmatodytes palustris aestuarinus, 273
Termite, 348

Tertiary Foraminifera from Humboldt County, California. A Preliminary Survey of the Fauna, 41-94

Textularia, 50
  cf. abbreviata, 44, 50, 79, 80
  agglutinans, 50
  flintii, 45, 50, 79, 80
  rugosa, 51
Textulariidae, 50
Textularinaceae, 50
Thamnophis, 132
  ordinoides couchii, 132
  ordinoides elegans, 132
  ordinoides hammondii, 132
Tharsalea arota, 40
  hermes, 25, 26
  nubila, 40
  virginiensis, 25
Thayer, John L., 241
The Races of Auriparus flaviceps (Sundevall), 199-202
Theclinae, 22
Thistle, 19
Thorn, Fred, 14
Thorybes mexicana, 32
Thrasher, 207
Thrush, Water, 284
Thryomanes bewickii eremophilus, 272
Thryophilus, 208
  modestus pullus, 208
  sinaloa cinereus, 272
Thryothorus, 208
  mexicanus, 273
Tick, 360
Tinnunculus phalaena, 244
Tivela, 159, 377
  cliffensis, 376
  gastonensis, 377
  kelloggensis, 376
  (Pachydesma) gabbii, 377
  (Pachydesma) inezana, 377
  packardi, 376
  weaveri, 376
Todd, W. E. Clyde, 206
Tortoise-shell, California, 18
Townshend, J. K., 98
Toxostoma bendirei, 276
  crissale crissale, 276
  crissalis, 276
  curvirostre curvirostre, 275
  curvirostre insularum, 207, 208, 276
  curvirostre maculatum, 207, 208, 274, 275
  curvirostre occidentale, 275
  curvirostre palmeri, 207, 208, 275
  lecontei, 276
  lecontei lecontei, 276
Trigonella, 376
Urbaninae, 31
Urbanus ericetorum, 32
ruralis, 32
tessellata occidentalis, 32
Uta concinna, 345
Uvigerina, 68
hughesi, 70
peregrina, 46, 69, 79, 88
peregrina var. bradyana, 46, 69, 79, 88
pigmea, 69
probosidea, 46, 69, 79, 88
pygmaea, 69
senticosa, 46, 68, 79, 88
(Uvigerinella) californica var. ornata, 68
Uvigerinella, 68
californica var. ornata, 46, 68, 79, 88

V
Valvulineria, 71
araucana, 46, 71, 79, 90
Van Cleveland, F., 135
Van Denburgh, J., 99, 122, 132, 307
Vanessa atalanta, 18
cardui, 19
carye, 19, 20
carye ab. letcheri, 20
huntera, 19
virginiensis, 19
Vaughan, T. W., 151
Velates, 162
Venericard, 160, 161
Venericardia, 387
hornii, 158
Venerupis (Protothaca) restorationensis, 321, 324
restorationensis, 322
staminea, 321, 322
tenerrima, 321, 322
Venus tripla, 377
Verdin, 199, 202, 211, 212, 223
San Ignacio, 211
Vermivora celata celata, 282
celata lutescens, 282
celata oreastera, 282
luciae, 281
ruficapilla ridgwayi, 281
virginiae, 281
Verneuilina, 51
scabra, 45, 51, 79, 80
Verneuilinidae, 51
Vetch, 28
Vine, Passion, 13
Violet, 14
Virco bellii arizonae, 280
cassinii, 281
gilvus swainsonii, 281
huttoni stephensi, 280
plumbeus, 281
solitarius cassinii, 281
solitarius plumbeus, 281
swainsonii, 281
vicinior, 281
Vultur atratus, 242
Vulture, Black, 242
Turkey, 241

W
Wagner, C. M., 160, 377, 386
Walker, F. E., 135, 359
Warbler, Yellow, 283
Weaver, Charles, 386
Weed, Loco, 28
Wegeforth, Harry, 136, 351
Weinberg, F., 131, 135
West, O. R., 136
Wetmore, Alexander, 192
Weymouth, A. A., 321
White, C. A., 383
White, 6
Becker’s, 6
California, 6
Common, 6
Tinted Cabbage, 37
Vernal, 7
Wiedey, L. W., 383
Wiley, Mrs. G. O., 135
Willett, George, 187, 193
Williamson, H. H., 135
Willow, 5, 17, 18, 20, 23
Wilsonia pusilla chryseola, 286
pusilla pileolata, 286
Woodbury, A. M., 111, 135, 359
Woodpecker, 172, 267, 269
Gila, 256
Woodring, W. P., 145-170, 371-388
Wren, 207
Cactus, 224, 225
Rock, 223

Wright, A. H., 135
J. T., 171, 197, 198, 201, 208,
210, 239, 241, 242, 243,
244, 247, 248, 249, 254,
269, 270, 271, 292
William Greenwood, 17
William S., 1-40

X
Xanthocephalus xanthocephalus, 288
Xanthornus bullockii, 289
Xiphorhynchus flavigaster mentalis,
257
flavigaster tardus, 257

Y
Yellow, Dwarf, 7
Mexican, 11
Nicippe, 11

Yuca, 37

Z
Zamelodia melanocephala capitalis, 293
melanocephala maculata, 292, 293
melanocephala melanocephala, 292, 293
Zenaidura macroura marginella, 248
Zephyr, 18
Zerene caesonia, 10
eurydice, 9
eurydice amorphae, 10
eurydice bernardino, 9
Zimmer, John, 291
Zonotrichia botterii, 300
cassini, 300
gambeli gambeli, 302
leucophrys, 302
quinquestriata, 300