

BULLETINS

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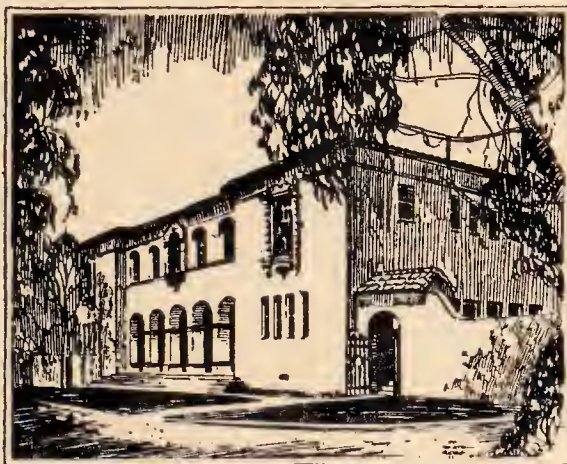
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No. 26

**Taxonomic Studies of the Rattlesnakes
of Mainland Mexico**

By LAURENCE M. KLAUBER

Consulting Curator of Reptiles, Zoological Society of San Diego



SAN DIEGO, CALIFORNIA

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LAURENCE M. KLAUBER

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TAXONOMIC STUDIES OF THE RATTLESNAKES OF MAINLAND MEXICO

INTRODUCTION

Somewhat over six years ago I began the preparation of a work on the habits and life histories of the rattlesnakes. While this study is to be non-taxonomic in scope, it appeared desirable to include a checklist and key, for which reason it seemed necessary to investigate the validity of several species and subspecies lately described. It was also hoped that some of the collections recently made, particularly in Mexico, might permit a more definite determination of the zones of intergradation between subspecies. In the course of this work, there were accumulated certain taxonomic data worthy of record; and since these are inappropriate for inclusion in the prospective work on life histories, it seems best to publish them separately.

This discussion will deal largely with species found in mainland Mexico, since studies of rattlesnakes from that area have been handicapped by inadequate material, a condition now in part remedied by some recent important acquisitions. Where an understanding of a Mexican form will be facilitated by data on the characteristics of the same form as it occurs in the southern United States or in Central America, the results of these extra-territorial surveys are given, for the studies have not been limited by international boundaries. These new researches have been reinforced by scale counts and other data accumulated in the past in connection with former taxonomic studies of the rattlesnakes. The papers resulting from these prior researches are cited in the bibliography. They contain data on methods of measurement, scale nomenclature, and other criteria not re-explained in the present paper.

The data set forth primarily involve new conclusions respecting ranges, relationships, and subspecific differentiations. Where no new data are at hand, the forms are treated briefly, and, in some instances, are mentioned only in the supplementary key and tables.

One new species and three new subspecies are described. These are *Crotalus pusillus*, *Crotalus durissus culminatus*, *Crotalus durissus*

tzabcan, and *Crotalus triseriatus aquilus*.^{*} The last is only a new name for a previously known form—the northern subspecies of *Crotalus triseriatus*. Other changes in current nomenclatorial practices are made for reasons that are fully detailed.

Although this paper is designed to cover only the rattlesnakes of the Mexican mainland, I have completed the national survey by appending a key and distributional list of the rattlesnakes of Baja California and the adjacent islands. The division of the key into two separate sections will be found to simplify the exposition and aid in rapid determinations. After all, a key is presumed to be a useful tool, and it will be seldom that anyone will wish to identify a rattlesnake unless at least it be known whether it came from mainland Mexico or the Baja California peninsula.

In several instances I have started with a group discussion, before embarking on the treatment of individual species or subspecies. Such groups, where they have been used, are employed only to facilitate the discussion of specific and racial differences and trends; there is no intention to suggest that the groups are co-ordinate in value or that they involve uniform degrees of relationships. Likewise the serial order in which the forms are treated is not based on any schedule of phylogenetic arrangement.

^{*}*Crotalus lepidus morulus*, another new subspecies, was added while this paper was in press.

THE INTERMEDIUS GROUP

Dr. Hobart M. Smith (1946, p. 79)* made a notable contribution to the taxonomy of the montane rattlesnakes of Mexico when he pointed out the differences that segregate the snakes of the *omiltemanus* (= *intermedius*) group from such forms as *triseriatus*, *pricei*, and *lepidus*, and their subspecies — differences of head size, scale keeling in the parietal region, and the simplifications and suppressions in the scales of the side of the head in *intermedius*, particularly in the ocular-loreal-nasal region. Once this group of rattlesnakes is separated from the others, the understanding of all is greatly facilitated and clarified. My reason for adopting the name *intermedius* for the group instead of *omiltemanus* will appear hereafter.

Of the *intermedius* complex, I have had available for study 22 specimens, and some additional data are at hand on three more. Since at least three forms are involved, the material is meagre and the conclusions are, at best, tentative. I shall first discuss the differences that distinguish the *intermedius* group from *triseriatus* and others, using all the available *intermedius* specimens as a unit, without segregating them into subspecies.

Outstanding Intermedius Characters.—The small head of the *intermedius* rattlers, as pointed out by Smith, is a real difference, although the application in diagnosis of an ontogenetically variable character of this type is rather unsatisfactory. I find that all the *intermedius* specimens, with the exception of two *transversus*, fall close to the regression line $H = .031L + 6.5$.† This is well below the corresponding lines of *triseriatus*, *aquilus*, *pusillus*, and *pricei*, especially in the adult ranges. The head lengths of adults 550 mm. long over-all have averages (to the nearest ½ millimeter) as follows: *triseriatus* 29, *pusillus* 28, *aquilus* and *pricei* 27, *intermedius* group 23½. Thus the linear adult difference between *intermedius* and the others is at least 15 per cent. Remembering that this means a difference of not less than 50 per cent in bulk, it will be seen that *intermedius* has a notably small head. In adults the difference can be easily seen without the necessity of measurements; it is not so marked in juveniles.

The tail-length regression lines for the *intermedius* group are approximately $T = .083L + 1.2$ in the males, and $T = .061L + 2.9$ in the females. The snakes of the *intermedius* group are shorter-tailed than *triseriatus*, *aquilus*, and *pusillus*, although the differences are hardly sufficient to be of diagnostic value. The *intermedius* tail proportionality is about the same as that of *pricei*. The fangs

* Full citations to references of this type will be found in the bibliography.

† I fully realize the anomaly of straight-line equations with constant terms for body proportionalities of this type; however, their practicality and reasonable accuracy, within the usual range from juveniles to adults, fully justifies their use, in preference to slightly more accurate but also more complicated higher-degree curves passing through the origin. It is to be understood that, where equations of this type are given in the present studies, all dimensions are expressed in millimeters.

in *intermedius* are short, not only in proportion to the body, as might be expected in a short-headed snake, but in proportion to the head as well.

The rattle widths are found to be different in two subspecies of *intermedius* and therefore will be discussed separately under the subspecies.

All available specimens of the *intermedius* group have 21 scale rows at mid-body, thus showing a similarity to *pricei* rather than to *triseriatus*, *aquilus*, and *pusillus*. The same is true of the labials, which are lower (on the average) in the *intermedius* group and *pricei* than in the others. Also, in the intersection of the anterior subocular with the supralabials, similar relationships are evident; for, in the *intermedius* group, the labials contacted are the third and fourth as in *pricei*, rather than the fourth and fifth as is normal in *triseriatus*, *aquilus*, and *pusillus*.

Smith (1946, p. 98) has pointed out the absence of keeling on the posterior head scales of the members of the *intermedius* group. This difference is quite apparent, particularly as to the parietal, rather than the occipital region, for the parietal region scales are smoother in *intermedius* than in *triseriatus*. Farther back, both groups have keeled scales, although the ridges are more accentuated in *triseriatus*.

In squamation, the outstanding divergences of the *intermedius* group involve the contacts of various scales on the side of the head. None of these characters is invariable in the members of the *intermedius* group, with a corresponding difference in other rattlers, and hence unfailing key characters are not at hand. Nevertheless, in summation, they do testify to the unity of this group and its definite separation from *triseriatus*, *aquilus*, and *pusillus*. Among all rattlesnakes the one most nearly related to *intermedius* is undoubtedly *pricei*, as confirmed by several characters already mentioned.

The head-scale items above referred to are these: (1) A frequent contact of the prenasal* and the loreal over the top of a much reduced postnasal. This does not occur in a majority of specimens of the *intermedius* group, but certainly it is more frequent in these than in any other form. In fact, I have seen only one specimen, a *pricei*, belonging to any other species, in which this contact was made. Borderline cases are frequent in the *intermedius* forms; in these the internasals, prenasals, postnasals, and loreals meet at a point. But whether the prenasal-loreal contact is, or is not, effected, the jutting of the prenasal over the postnasal, with a reduction of the latter in size, is characteristic of the *intermedius* forms.

(2) The loreal contacts one or more supralabials. This contact is almost always made in *intermedius* and *omiltemanus* (but not in *transversus*), and is found in no other rattlesnake. In the material I have examined, it fails only on one side of a single *i. intermedius*, and on one side of an *i. omiltemanus*. It is probably the best single character for recognizing the *intermedius* complex.

* I prefer the continued use of the older terms prenasal and postnasal to Smith's preseminal and postseminal.

(3) Lack of prefoveals.* These are nearly always absent in the *intermedius* group but are present to the extent of one or more in all other species. Occasionally a pit-border scale or lacunal extends so far forward out of the pit in *intermedius* that it is difficult to tell how it should be classified—whether as a lacunal or prefoveal.

(4) In most rattlesnakes the crescentic lower preocular passes forward along the upper edge of the pit until it ends in contact with the loreal. In *intermedius* and its allies, the lower preocular generally passes into the pit, thus failing to contact the loreal. In some specimens this is quite clear, but in others it is difficult to tell whether a contact with the loreal is made just on the edge of, or within, the pit. I have not found this a particularly satisfactory character in classifying specimens, although, as an additional peculiarity of *intermedius*, it is important.

Smith (1946, p. 81) has called attention to differences between the jaw bones of *intermedius* and *triseriatus* subspecies. Were more material to be skeletonized, these differences might prove to be of the highest importance.

Having discussed the *intermedius* group as a group, I shall now proceed to a consideration of the several species and subspecies that are included in it.

***Crotalus intermedius intermedius* Troschel**

TOTALCAN SMALL-HEADED RATTLESNAKE

- 1865. *Crotalus intermedius* Troschel, in von Müller, Reisen in Vereinigten Staaten, Canada und Mexico, vol. 3, p. 613
- 1882. *Crotalus intermedius* Fischer, [not of Troschel, 1865], Abh. Nat. Ver. Bremen, vol. 7, p. 230
- 1896. *Crotalus triseriatus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 581

* Smith advocates the term subloreal for the small scales that, in most rattlesnakes, occupy the area (usually triangular) between the postnasal, lower loreal, pit-border, and supralabials. I prefer the term prefoveals, as, in many species (e.g. *molossus*), these scales extend forward, between the prenasal and the first supralabial, to the rostral, and hence occupy an area far removed from the loreal. It is true that in some species they extend backward between the pit-borders (or lacunals) and the labials and would, in such an instance, deserve the name of subfoveals, the prefoveals and subfoveals being distinguished from each other as postoculars are segregated from suboculars. In any case, these small scales are more nearly related to the pit than to the loreal. The new scale designations foveal, lacunal, pre- and postsupraloreal, preciliary (as applied to rattlesnakes), postrostral, and interoculabial were arrived at in discussions with Charles H. Lowe, Jr., and Kenneth S. Norris, and comprise our joint recommendations. The lacunals are the scales forming the inner border of the pit. Pre- and postsupraloreals are self-explanatory; they are particularly prevalent in *molossus*, *basiliscus*, and *durissus*. A preciliary is a small scale sometimes detached from the upper posterior corner of an upper preocular. Postrostrals are scales in contact with the rostral, and lying between the prenasal and the first supralabial. Where an unbroken chain of prefoveals reaches the rostral (as is usual in *molossus*) all, including the one touching the rostral, are counted in totaling the prefoveals. Interoculabials are the scales between the eye and the lip, including a subocular and a supralabial at the upper and lower ends of the series. They are usually counted below the center of the eye.

1936. *Crotalus triseriatus triseriatus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 247
1940. *Crotalus triseriatus anahuacus* (part) Gloyd, Chi. Acad. Sci. Spec. Pub. no. 4, p. 91.
1941. *Crotalus triseriatus gloydi* Taylor, Univ. Kans. Sci. Bull., vol. 27, pt. 1, no. 7, p. 130.
1946. *Crotalus gloydi lautus* Smith, Univ. Kans. Sci. Bull., vol. 31, pt. 1, no. 3, p. 75
1946. *Crotalus gloydi gloydi* Smith, Univ. Kans. Sci. Bull., vol. 31, pt. 1, no. 3, p. 78

Unfortunately, the type specimen of Troschel's *Crotalus intermedius*, once contained in the Bonn Museum, is no longer available, having been destroyed in World War II, as I have lately been advised by Dr. Robert Mertens.

Nomenclatorial Problems.—It has usually been assumed that *Crotalus intermedius* Troschel, 1865, was either a synonym of *triseriatus* Wagler, 1830, or was unrecognizable. As a matter of fact, it may definitely be shown to belong to the form described as *Crotalus gloydi lautus* by Smith in 1946; for both the original description, which is quite complete, and the itinerary of the collector, Baron von Müller, sharply narrow the possibilities to the short-headed rattlesnakes, and especially to the subspecies that, for the purposes of this discussion, I shall designate by the vernacular name of Totalcan small-headed rattlesnake.

The type of *intermedius* Troschel was described as having 21 scale rows, 160 ventrals, 20 subcaudals (therefore a female), 10 supralabials of which the fourth and fifth were separated from the orbit by a single scale, a pair of internasals, a pair of canthals, 3 intercanthals (thus making a total of seven scales in the internasal-prefrontal area), 3 intersupraoculars, and more than 40 dorsal body blotches. The type was only 16½ inches long, yet had 4 rattles.

Baron von Müller's expedition took him only to the states of southern Mexico; altogether, he visited Veracruz, Puebla, Distrito Federal, Morelos, México*, Guerrero, and Oaxaca. The combination of 21 scale rows and 7 scales on the crown at once limits the possibilities in this area† to *triseriatus* and

* I have made it a quite illogical practice to use an accent in designating the state but not the country.

† As a matter of fact, it is not necessary to lean heavily on von Müller's itinerary in order to eliminate contenders for the name *intermedius*. Only one other rattlesnake, *pricei*, comes near to conforming to Troschel's type, and this does not fit unless we assume the type to have been one of the rarely found specimens of *pricei* with nearly all dorsal blotches cross-confluent. Even conceding this assumption, by applying R. A. Fisher's method of compounding probabilities to the squamation of Troschel's type in comparison with the known population statistics of *pricei* and the Totalcan rattlesnake, we find that the relative probability of Troschel's type being *pricei* is .22, compared with .93 in the case of the Totalcan small-headed rattler. As von Müller, at his closest point, was separated from the *pricei* range by about 400 miles, I think we are justified in dropping *pricei* from consideration.

the small-headed rattlesnakes. Of these, *omiltemanus* and *transversus* are eliminated since the ventrals in the type are too low for the former and too high for the latter. Of the southern subspecies of *triseriatus*, the one inhabiting the area traversed by von Müller, I have had available for study about 110 specimens. Of these only 4 have 21 scale rows, and none has as few as 10 supralabials. No female has more than 152 ventrals (although the type of *triseriatus*, a male, has 159), and only 2 females out of 43 have as few as 20 subcaudals. The type description fits the northern subspecies no better, besides which von Müller did not traverse the habitat of the northern subspecies. Thus we find that Troschel's type, to have been a *triseriatus*, would of necessity have been anomalous in several characters. On the other hand, every one of these characters is close to the mode of the Totalcan small-headed rattlesnake. Indeed, one specimen, out of the eight of that form available to me, exactly matches Troschel's type in all but one scale character; it duplicates the type in scale rows, subcaudals, supralabials, intercanthals, and intersupraoculars. Only in the ventrals is there a slight deviation, for this specimen has 162 compared with 160 in the type. This single variation is of no importance, as the Totalcan female range is from 157 to 165, thus bracketing the type. From these data we see how remote is the possibility that the type of *intermedius* Troschel could have represented the species designated *triseriatus* by Wagler, and how perfectly it fits the Totalcan small-headed rattler, and no other.

By a most peculiar coincidence Fischer, in 1882, also described a Mexican rattlesnake under the name *Crotalus intermedius*, being unaware of Troschel's prior use of the name. Fischer's name, of course, has no standing, but the coincidence is the more impressive, in that his type is also a Totalcan small-headed rattler, as can be determined from his figure, which shows the loreal in contact with the second supralabial. The ventrals and the nature of the dorsal blotches in Fischer's type eliminate *omiltemanus* and *transversus*. Any argument disputing the allocation of *intermedius* Troschel that I have made, on the score of the relative rarity of the Totalcan small-headed rattler, compared with *triseriatus*, is at once refuted by the fact that the same allocation can be verified in the case of the type of *intermedius* Fischer.

Subspecific Relationships.—Although intergradation between *intermedius* and *omiltemanus* has not yet been demonstrated, I prefer to consider *omiltemanus* a subspecies, since they are similar in virtually all characters except the number of ventrals and body blotches.

Smith (1946, p. 75) segregated his new subspecies *lautus* (= *intermedius*) from *gloydi* Taylor, 1941, by reason of its having the postnasal in contact with 2, rather than 1, supralabials, and in having the lower preocular in contact with the loreal. With a larger series of *intermedius* at hand than was available to Smith—although the *gloydi* material is still limited to the type, a specimen in very poor condition—these differences disappear in the greater variability of the *intermedius* series. At least two specimens of *intermedius* have their lower preoculars in contact with the loreals. Another specimen of *intermedius* has its postnasals in contact with the first supralabials only, although

it is true that this specimen is from an area (Michoacán) distant from the type locality of *lautus*, and may eventually be shown to belong to a different subspecies, when additional material shall have become available. But I do not believe recognition of *gloydi* and its separation from *intermedius* to be warranted, based on a single specimen with only this slight divergence in the postnasal-supralabial contact. In the subspecies *i. omiltemanus*, with 10 specimens available, the postnasal-first-supralabial contacts are found to be quite variable; although in most specimens the postnasal touches both the first and second supralabials (as is the case in *intermedius*), there are some in which only the first supralabial is reached, and in one specimen on one side only, the second. With this variability in the critical differential character, I deem it best not to segregate *gloydi* from *intermedius*, at least until such time as additional specimens from Oaxaca shall disclose other differences between the Totalcan and Oaxacan snakes.

Description of Subspecies.—Seven specimens of *i. intermedius* have been at hand, with some data on 3 others. There are 4 males and 6 females. The data on these are as follows: Scale rows 21; ventrals, males 152 to 161, mean 157.5, females 157 to 165, mean 160.5; subcaudals, males 24 to 29, mean 25.8, females 20 to 22, mean 20.5; supralabials 8 to 11, mean 9.6; infralabials 8 to 11, mean 9.1; scales in the internasal-prefrontal area 4 to 8, mean 6.0; minimum intersupraoculars 1 to 4, mean 2.4; rattle-fringe scales 10; body blotches 38 to 45, mean 42.3; tail bands, males 7 to 9, mean 8.0, females 5 to 7, mean 6.0.

In *intermedius intermedius* the prenasal may or may not—with about equal frequencies—reach the canthal over the top of the reduced postnasal. The postnasal usually touches both the first and second supralabials, but in some specimens it contacts only the first; it may touch either the internasal or both internasal and canthal. In all but one specimen on one side, the loreal contacts a supralabial; usually it touches the second, but it may contact the first as well, or rarely only the first. Usually there are no prefoveals, although one may be present. The lower preocular may or may not contact the loreal.

The longest specimen available is a male measuring 482 mm.; the shortest is 216 mm. The approximate regression lines of the head-body and tail-body proportionalities have already been given in the general discussion of the *intermedius* group, as *intermedius* and *omiltemanus* do not differ in these characters. But *intermedius* does diverge from *omiltemanus* in the width of the proximal rattle, the former having a slightly larger rattle, the equation for which is $W = .012L + .05$. The fang length (upper lumen to point) is contained in the adult body length about 207 times, and in the head length 9.3 times. *C. i. intermedius* has, relatively, the shortest fang of any rattlesnake, not only short compared with the body length, as would be expected from the small head, but in proportion to the head length as well.

The specimens of *intermedius* that I have seen are very dark dorsally and almost without visible pattern. Placed under water, a pattern becomes evident; I presume in live specimens it would be visible to about the same extent. It

comprises a dorsal series of rectangular to elliptical blotches about 7 scale rows wide and $1\frac{1}{2}$ to 2 scales long, end-to-end; the interspaces cover 1 to $1\frac{1}{2}$ scales. The blotches are dark gray-brown edged with black, the interspaces gray-black. The blotches are punctate, the interspaces almost solid color. Additional series of smaller blotches are made evident laterally by groups of punctate scales. The ventrum is cream, buff, or pink, much more punctated with dark-brown or dark-gray in some specimens than in others. The single Michoacán individual is mottled with black below.

Head marks are virtually absent, except that the darkness of the postocular streak is somewhat accentuated, and the posterior labials are lightened, thus setting it off. Below, the infralabials and the adjacent gulars are much punctated, especially anteriorly.

The tail is crossed by a series of bars that are increasingly in contrast with the ground color toward the rattle. It is pink or buff below, with considerable stippling in dark-brown. The anterior lobe of the rattle matrix is buff to brown.

Subspecific Comparisons.—The principal differences between *intermedius* and *omiltemanus* lie in the number of ventrals and body blotches, as shown in the following tabulation:

	<i>C. i. intermedius</i>	<i>C. i. omiltemanus</i>
Ventrals, males, range	152–161	165–175
mean	157.5	170.2
females, range	157–165	173–185
mean	160.5	179.4
Body blotches, range	38–45	45–61
mean	42.3	51.6

It is doubtful whether larger series from the central areas would show overlapping in the ventrals, although specimens from intermediate territory may be expected to do so.

All but 2 of the available specimens of *intermedius* are from the vicinity of the type locality of Smith's *lautus*, from near El Limón Totalco on both sides of the Puebla-Veracruz border, from Las Vigas, Veracruz, and Zacopoaxtla, Puebla. All of these localities are within a radius of about 25 miles. The elevations range from about 7800 to 8500 feet. The two remaining specimens are from distant points. First, there is the type specimen of *gloydi*, from Cerro San Felipe in central Oaxaca at 10,000 feet. This locality is about 200 miles to the south of the center of the Totalcan population. The distinctive characters of this specimen, as far as they may be determined, for it is in very poor condition, have already been mentioned. The second distant specimen is from Tancítaro, Michoacán, a point across the Mexican central plateau, some 300 miles to the west of El Limón Totalco. This specimen also is far from perfect, as the rattles and a part of the tail have been cut off. This snake has all the characteristics of the *intermedius* group, including the important loreal-supralabial contacts.

It is like the type of *gloydi* in that the postnasal touches only the first supralabial, and in addition it is unique among specimens of the *intermedius* group in having 3 internasals. Only the availability of additional specimens from Oaxaca and Michoacán will make it possible to judge whether *intermedius* is divisible into 2 or more additional subspecies, one of which would be *gloydi*. Also, it remains to be seen whether I am correct in judging *omiltemanus* a subspecies of *intermedius*, or whether it should be considered a separate species.

***Crotalus intermedius omiltemanus* Günther**

OMILTEMAN SMALL-HEADED RATTLESNAKE

1895. *Crotalus omiltemanus* Günther, Biol. Cent. Amer., Rept. Batr., p. 192
 1896. *Crotalus triseriatus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 581
 1936. *Crotalus triseriatus triseriatus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 247
 1938. *Crotalus triseriatus omiltemanus* Klauber, Copeia, no. 4, p. 196

I have had 12 specimens of *C. intermedius omiltemanus* available for examination, 5 males and 7 females. Seven specimens were from Omilteme, Guerrero, the type locality, the others being from the vicinity of Chilpancingo in the same state.

Description of Subspecies.—*C. i. omiltemanus* is a small rattlesnake; the longest specimen is a female 560 mm. long, the shortest 218 mm. The head- and tail-length regression lines have already been given for the group as a whole; with so few specimens available, I have not been able to demonstrate any difference between *omiltemanus* and *intermedius* in these proportionalities. In the width of the proximal rattle there is a difference; the *omiltemanus* line, as determined from the few specimens available, is $W = .01L + .13$. *C. i. omiltemanus* has a larger rattle than *pusillus* or *triseriatus*, but smaller than *intermedius*, *aquilus*, or *pricei*. In *omiltemanus* the fang length is contained about 185 times in the body length over-all, and 8.2 times in the head length. These proportions are somewhat less extreme than those of *intermedius*.

The scale-count data are as follows: Scale rows 21; ventrals, males, 165 to 175, mean 170.2, females 173 to 185, mean 179.4; subcaudals, males 24 to 29, mean 26.6, females 20 to 24, mean 22.3. The supralabials vary from 8 to 10, mean 9.2; and the infralabials from 8 to 11, mean 8.9. The scales in the internasal-prefrontal region vary from 5 to 8, mean 6.6; the minimum scales between the supraoculars range from 2 to 4, mean 2.9. The rattle-border scales number either 8 or 10.

The dorsal blotches on the body vary from 45 to 61, mean 51.6; the tail rings from 7 to 11, mean 7.4, in the males, and from 5 to 9, mean 7.0, in the females.

It is well known that among the rattlesnakes (and in many other groups as well) there is a fair degree of correlation between the size of the body, the number of ventral scales, scale rows, and labials. *C. i. omiltemanus* is a subspecies in which the ventral scales are much more numerous than would be expected in a small snake with so few scale rows and labials. For example, rattlesnake species roughly follow the regression line $V = 11.4S - 120$, where V is the average number of ventrals in the males and S the number of scale rows at mid-body. Thus rattlers with 21 scale rows might be expected to have about 120 ventrals, yet *omiltemanus* has about 170.

With regard to the scale arrangements characteristic of the *intermedius* group, the following are the trends shown by the 12 available specimens of *omiltemanus*. The prenasal contacts the loreal in 55 per cent and fails to do so in 45. The postnasal touches both the first and second supralabials in 70 per cent, contacts only the first supralabial in 25 per cent, and touches only the second supralabial on one side of one specimen. Where the prenasal meets the loreal, the postnasal is, of course, prevented from touching the internasal or canthal. In most of the remaining 45 per cent, the postnasal touches the internasal only, but in one instance it reaches both internasal and canthal. Usually the loreal contacts the second supralabial, but in about one-fourth of the specimens it reaches both the first and second. On one side of one specimen it does not touch any supralabial, thus failing in this unique *intermedius* character. Fifteen per cent of the specimens have prefoveals; and the same proportion have lower preoculars that contact the loreals.

The scales bordering the orbit number 7 or 8, usually the former; and the supralabial opposite the posterior edge of the eye is most often the fifth, but may be the fourth or sixth. Usually the anterior subocular contacts the third and fourth supralabials. Sometimes the fourth supralabial touches the eye; this is the only rattlesnake known to me in which this occurs, all others having at least one scale interposed. The posterior suboculars normally touch the fourth and fifth supralabials.

Most specimens of *omiltemanus* are quite dark, with patterns so obscure that they are only evident under water. I cannot say how much of this obscurity may be the result of preservation. One or two specimens have fairly evident markings; and I judge from experience with other kinds of rattlesnakes that live specimens may have readily evident patterns.

The dorsal ground color in *omiltemanus* varies from medium-brown to almost black. The head marks are limited to parallel longitudinal dark-brown bars in the occipital region, and dark-brown postocular streaks passing above the angle of the mouth. Below these the supralabials are buff; they are lighter than any other part of the snake. The underside of the head is heavily mottled with black or gray, particularly laterally toward and including the infralabials.

The body pattern comprises a series of dorsal dark-brown blotches about 5 scale rows wide and 2 scales long, end-to-end, on a lighter brown background. The interspaces measure 1 to $1\frac{1}{2}$ scales. The dorsal blotches are quite irregular

in shape; some are heart-shaped with a posterior indentation. There are 2 lateral rows of spots of smaller size; the upper alternates with, and the lower matches, the dorsal series. Sometimes a third series of spots is in evidence. Ventrally the color varies from gray to almost black, becoming darker posteriorly. The color is applied in the form of dense punctations. Where the ground color is evident, it runs from pink or buff to gray.

The tail is crossed by obscure bars of dark-gray on a light-gray background. The anterior lobe of the rattle matrix is buff to brown. Conspicuous dark spots of the *lepidus* type are not evident.

This subspecies, like other small rattlesnakes, feeds largely on lizards.

Crotalus i. omiltemanus is at present known only from the mountains of central Guerrero, where it has been collected at or near Omilteme and Chilpancingo. The latter point is at an elevation of about 4500 feet, but to the east and west the mountains rise to 6000 feet or above. Smith and Taylor (1950, p. 9) place Omilteme 3 miles northwest of Chilpancingo. Various maps show it about 12 miles slightly south of west of Chilpancingo. Gadow (1908, pp. 377, 381) gives the altitude of Omilteme as about 7000 feet, and its distance from Chilpancingo as about 19 miles.

Crotalus transversus Taylor

CROSS-BANDED MOUNTAIN RATTLESNAKE

1940. *Crotalus triseriatus anahuacus* Martín del Campo, Anales Inst. Biol. Mex., vol. 11, no. 2, p. 742
1944. *Crotalus transversus* Taylor, Univ. Kans. Sci. Bull., vol. 30, pt. 1, no. 4, p. 47

Only three specimens of this species are known: the type, EHT 30001, an adult female from 55 km. southwest of Mexico City, near Tres Marías (=Tres Cumbres), Morelos, at about 10,000 feet; the paratype, EHT 15879, a juvenile probably from the Ajusco Mountains, between Tres Marías and Cuernavaca, which specimen I have not seen; and, finally a specimen in the collection of the Mexican National Museum, from Lagunas de Cempoala (=Zempoala), Morelos.

Description of Subspecies.—The distinctive pattern of *transversus*, as exemplified in the type, comprises a series of narrow crossbands of black on a gray background, except middorsally where the background is buff. The black never engages the anterior end of any scale; therefore, because the scales are arranged in diagonal rows, no black band is uninterrupted. However, middorsally, in lieu of the black, the band scales are darkened with gray, so that the bands are made more even and definite. The bands are about 1 scale wide, and the interspaces 2 to 3 scales, end-to-end. The gray of the ground color and bands is applied in the form of dense punctations. Laterally the gray areas of

the bands and ground color are completely merged, so that only the interrupted black is evident. On the sides, many scales have 2 small black dots at their apices where the scale pits are usually located. The ventrum is heavily mottled with black on buff.

On the head, a light mark across the supraoculars is faintly visible; also a pair of occipital blotches may be discerned, otherwise the top of the head is uniform gray. On each side there is the usual postocular dark streak, but it is only slightly set off from the background above. Below the streak, there is a sharp contrast with the supralabials, which are buff, except for some dark mottling on their lower edges. The infralabials are heavily mottled. The tail is marked with crossbars above. The anterior rattle matrix is buff.

The pattern of the juvenile paratype, as illustrated by Taylor (1944, plate 6, fig. A), exhibits more conspicuous crossbands than the type. I have not seen this specimen. But in the third specimen, the contrast between bands and ground color is much reduced, so that the bands cannot be counted with accuracy, even with the specimen immersed in water.

The two specimens of *transversus* at hand are both females. The scale rows at mid-body are 21, the ventrals 145 and 155, subcaudals, 19 and 20, supralabials 8 to 10, infralabials 8 or 9, internasals 2, canthals 1-1, intercanthals 2, minimum intersupraoculars 2, total scales in the orbit 8; the anterior subocular contacts the third and fourth supralabials; the posterior usually contacts the fourth and fifth, but may contact only the fourth; the fifth supralabial is opposite the posterior edge of the orbit. The upper preocular is undivided.

Relationships.—The pattern of *transversus* is sufficiently different from that of any other rattlesnake found in central Mexico to distinguish the snake immediately. But we may ignore the pattern for the moment, and see what other species the scale data may suggest. There are several important likenesses to the *intermedius* group and *pricei*, including, especially, the dorsal scale-row formula (21-21-17), and the low number of labials (8 to 10). The anterior subocular contacts the third and fourth supralabials and the next subocular contacts the fourth and fifth. The lower preocular fails to reach the loreal. The scales of the parietal area are smooth, and, in the occipital area, they are but weakly keeled. All these are *intermedius* affinities; they show at once that we are not merely dealing with aberrant-patterned specimens of *C. triseriatus triseriatus*, the other small mountain rattler of this area. But there are also differences in squamation between *transversus* and *intermedius* or *omiltemanus*, in that *transversus* lacks some of the most conspicuous characters of these other members of the *intermedius* group. In *transversus* the postnasal is not suppressed, and the prenasal does not approach the loreal over its top. Most important of all, the loreal contacts no labial, since a large prefoveal intervenes. *C. transversus* has 8 rattle-fringe scales, whereas the others usually have 9 or 10.

Thus we find *transversus* to be different from both *intermedius* and *omiltemanus*, on the one hand, and *triseriatus*, *aquilus*, and *pusillus*, on the other. Like *pricei* it has some likeness to both groups, but also differences from both.

Too few specimens of *transversus* are available to permit conclusions as to its body proportions. The head of the type specimen is larger than the head of an *intermedius* or *omiltemanus* of the same length, but the Zempoala specimen falls exactly on the *intermedius* regression line. The tail is slightly longer than that of *intermedius* or *omiltemanus*; it is about the same as in *t. triseriatus*. The rattle width is greater than in *pusillus* or *triseriatus*, and slightly greater than in *omiltemanus*. It closely approaches the proportionality of *intermedius*.

In summary it may be stated that *transversus* fails to agree with any other species in form and scalation; and if we add the peculiar pattern, we must conclude that this is a valid species, possibly intermediate between the *intermedius* and *triseriatus* groups, but somewhat favoring the former. More material will be necessary to make a final determination of its status.

The vagaries of rattlesnake collecting are illustrated by the discovery, as recently as 1940, of this strikingly patterned species so near Mexico City.

THE TRISERIATUS GROUP

Just as the discussion of *intermedius*, *omiltemanus* and *transversus* was facilitated by considering them as a group, because of relationships suggested by certain head-scale contacts, so also it will be advisable to consider *triseriatus* and a related species as a group.

As a result of following H. M. Smith (1946) in divorcing *intermedius* and *pricei* (*pricei* will be treated subsequently) from *triseriatus*, there is a marked simplification in the problem of dividing *triseriatus* into subspecies. In considering its remaining, more limited scope, it should be noted that Gloyd (1940, p. 84) was the first to divide *triseriatus* into northern and southern subspecies. In this division I concur, although I find it desirable to adopt new segregative characters, which, in turn, lead to different boundaries between the subspecies than those Gloyd proposed.

Nomenclatorial Problems.—In order to facilitate the discussion, it is necessary, first, to resurvey some of the nomenclatorial problems involved, and particularly to decide whether the name *triseriatus*, when applied subspecifically, belongs to the northern form (as allocated by Gloyd) or to the southern.

Wagler's* original description (Nat. Syst. Amph., 1830, p. 176) is so brief and generalized that it might apply to any of a dozen rattlesnakes. Cope (1866, p. 309) was apparently the first to give a description of *triseriatus* that made the snake fairly recognizable; this was improved upon by Garman (1883, p. 117), who presented a description sufficiently detailed so as almost to restrict the name to the species to which it has since been usually applied.

* Wagler attributed the name *triseriatus* to Wiegmann, for what reason is not known. Duméril and Bibron (Erp. Gen., vol. 7, part 2, p. 1768, 1854), and Lichtenstein (1856, p. 34) did likewise. It is probable that Wiegmann selected the name and attached it to the type specimen in the Berlin Museum, but failed to publish a description. I have looked in vain among Wiegmann's papers published in *Isis* in 1828 and 1829 for such a description. This in no way affects the validity of the name.

During the present year, I learned that the type specimen of Wagler's *triseriatus* was still available in the Zoological Museum of the University at Berlin. Through the courtesy of Dr. H. Wermuth, to whom I am greatly indebted, I have received scale counts, photographs, and other data which enable me to determine that Wagler's original description was, indeed, based on a specimen of the species long since known as *Crotalus triseriatus*,* thus requiring no changes in our ideas regarding the application of the specific name. However, we learn from the characters of the type that it is an example of the southern, rather than the northern, subspecies, as had hitherto been supposed. This will subsequently become apparent from a redescription of the type and a discussion of the differences between the subspecies, but the weight of the evidence may be summarized thus: In tail length, rattle size, number of subcaudals, and tail rings, the type specimen is beyond the known range of variation of the northern race, but within that of the southern. In head proportions, rattle-border scales, lack of a contact between the postnasal with the first supralabial, and the number of body blotches, the probabilities also lie with its belonging to the southern race, although there is no certainty in these. Only in one character, the number of ventrals, is allocation to the northern subspecies favored, for the number of ventrals is higher in Wagler's type than in any other of the available specimens of the southern subspecies, although within the range of the northern. Of the characters that I have listed, I consider the proportionately long tail, with concomitant high number of subcaudals and tail rings, low number of rattle-fringe scales, and small rattle to be conclusive, so that the name *triseriatus* must be used to designate the southern race. It may be mentioned, in passing, that the southern form is quite prevalent around the City of Mexico and on the road toward Veracruz, from which specimens would have been more readily obtainable in those days before 1830 than from the less accessible districts to the north.

THE SOUTHERN SUBSPECIES OF *CROTALUS TRISERATUS*

I shall now proceed with a discussion of the two forms, beginning with the type subspecies.

***Crotalus triseriatus triseriatus* (Wagler)**

CENTRAL-PLATEAU DUSKY RATTLESNAKE

Figure 1.

1830. *Uropsophus*† *triseriatus* Wagler, Nat. Syst. Amph., p. 176

* It may sound paradoxical to say that it is a satisfaction to learn that the type of *triseriatus* should prove to be *triseriatus*, for how could it be otherwise? But it is a fact that successive writers, elaborating an original inadequate description, and having before them specimens assumed to be the same as that originally described, sometimes cause a name to become firmly affixed to a species or subspecies different from that of the type. Some of Linné's descriptions have suffered this fate. It is only in the rare instances when old types can be resurrected that such errors can be detected and corrected.

† Wagler thought the species worthy of generic separation from *Crotalus*; few early herpetologists and none of those of the present day have accepted this view.

1831. *Crotalus triseriatus* Gray, Synopsis Spec. Class. Rept. in Griffith's Animal Kingdom by Cuvier, vol. 9, p. 78
1859. *Crotalus lugubris* Jan, Rev. Mag. Zoöl., ser. 2, vol. 10, pp. 153, 156 (Prod. Icon. Desc. Ophid., pp 28, 31)
1895. *Crotalus pallidus* Günther, Biol. Cent.-Amer., Rept. Batr., p. 193
1931. *Crotalus triseriatus triseriatus* (part) Klauber, in Githens and George, Bull. Antivenin Inst. Amer., vol. 5, p. 33
1940. *Crotalus triseriatus triseriatus* (part) Gloyd, Chi. Acad. Sci., spec. pub. no. 4, p. 84
1940. *Crotalus triseriatus anahuacus* Gloyd, Chi. Acad. Sci. spec. pub. no. 4, p. 91

Redescription of the Type.—(This is from data supplied by Dr. H. Wer-muth, including a photograph of the right side of the head, a dorsal view of the head, and another dorsal view of the entire body; also Wagler's original color description.) An adult male, length over-all 570 mm., tail length 60 mm., head 32 mm. The scale rows at mid-body are 25, the ventrals 159, the sub-caudals 34, and the upper and lower labials all 12. There are 8 scales bordering the proximal rattle, which has a dorso-ventral width of 3.5 mm. There are two internasals, wider than high, a canthal on either side, with 3 intercanthals between, thus making a total of 7 scales on the crown. The anterior inter-supraoculars are 3+4. Referring to the right side of the head only, the pre-nasal exceeds the postnasal in size; it contacts only the first supralabial. There are 2 prefoveals, the anterior of which prevents a contact between the postnasal and the first or second supralabials. The postnasal contacts both an internasal and canthal. There is a single loreal, somewhat pointed above; it touches the lower preocular, but does not reach any labial. The upper preocular is undivided. The anterior subocular contacts the fourth and fifth supralabials; the second subocular does not reach the supralabials. The posterior edge of the eye is opposite the seventh supralabial. The scales of the occipital area are strongly keeled.

The head marks are no longer conspicuous, with the exception of a dark postocular stripe which darkens the upper halves of the posterior supralabials and stops just behind the last supralabial. Faint crossbars are to be seen on the supraoculars.

There are 41 middorsal blotches on the body and 10 tail rings. The blotches, which Wagler called olive, shading into dark-red, are highly irregular in shape. They are subrectangular anteriorly and somewhat rounded toward the tail. The inner borders are dark. Anteriorly these blotches are 5 to 7 scale rows wide, and about 3 scales, end-to-end, long. The middorsal interspaces measure 1 to 2 scales.

The blotch pattern is quite characteristic of *triseriatus* and will immediately serve to distinguish this form from all but a few of the other species of *Crotalus* having anterior suboculars in contact with any supralabials, such as

pricei, *lepidus*, and *tigris*. The exceptions, not readily segregated by pattern, are the *intermedius* group, *pusillus*, and the northern subspecies of *triseriatus*. The loreal contacts readily distinguish this type from the *intermedius* forms; for the loreal does not touch a labial or the prenasal, but does contact the lower preocular, all of which conditions are reversed in *intermedius*. *C. t. triseriatus* differs from *pusillus* in not having conjoined prefrontals. Its segregation from the northern subspecies, to which the name *C. t. aquilus* will be assigned, will be discussed in due course.

Summary of the Subspecies.—The description of the subspecies *C. t. triseriatus*, based on all the available material—approximately 110 specimens, with a slight preponderance of males—may be summarized as follows:

The largest specimen is a male 683 mm. long; this is not exceptional as another male measures 679 mm. The smallest specimen, also a male, is 151 mm. A female 560 mm. long gave birth to 4 young in captivity. They varied in length from 180 to 188 mm. some weeks after birth. Since the largest available specimen of the northern race is 678 mm., it is apparent that the subspecies do not differ in size.

The tail-length regression lines are approximately $T = .105L - .6$ for the males, and $T = .078L + 1.2$ for the females. The head-length line is $H = .042L + 5.8$, and the regression line for the width of the proximal rattle is $W = .007L + 0.6$. All values are expressed in millimeters in these equations. The fang length (upper lumen to point) is contained in the head length about 5.7 times, and in the length over-all 112 times.

The scale rows at mid-body are distributed thus: 21(4), 22(2), 23(82), 24(4), 25(16), 26(3). The ventrals are, males 136 to 151 (except the type with 159), mean 144.0, females 138 to 152, mean 145.8; subcaudals, males 26 to 34, mean 29.2, females 20 to 28, mean 24.3; supralabials 11 to 15, mean 12.1; infralabials 10 to 14, mean 11.6; body blotches 30 to 57, mean 44.0; tail spots (too indefinite to be accurate), males 5 to 10, mean 7.0, females 3 to 7, mean 5.7.

In *triseriatus* the head is rather pointed but the snout is round. The rostral is wider than high and slightly recurved above. The internasals are wider than high. The total scales in the internasal-prefrontal area range from 6 to 11, the average being 8.3. This compares with a uniform 4 in *pusillus*. A single anomalous specimen of *triseriatus* has 2–2 canthals and a total of 13 scales in the internasal-prefrontal area; but usually the canthals are 1–1, the rest of the scales in this area being disposed between them and behind the internasals. Only rarely is there an even suture between the scales in the intercanthal and the intersupraocular areas, so that there may be doubt to which series some of the border-line scales should be assigned. The same situation occurs in *aquilus*, but not in *pusillus*. The minimum scales between the supraoculars usually number 3 or 4, rarely 2 or 5.

The prenasal is larger than the postnasal; it extends backward at the upper edge only slightly more than at the lower, if at all. Below it may extend some-

what behind the nostril and may curve under the postnasal, in a manner reminiscent of *lepidus*. It contacts only the first supralabial. The postnasal does not reach the lacunals. It usually touches both the internasal and canthal, although rarely contact with the latter scale may be prevented by the interposition of a small presupraloreal. The postnasal rarely touches a supralabial, such contact being prevented by the juxtaposition of the prenasal with the prefoveals. In 8 specimens out of 90 the postnasal contacts the first supralabial on one side only, and in 3 other specimens on both sides; in the other 166 counts no contact is made. In one case the postnasal is fused to a prefoveal and contacts the second supralabial. The prefoveals usually number 2 to 4, but there may be only 1 or as many as 7. The loreal is triangular, and somewhat pointed above, where it meets the canthal. The upper preocular is normally undivided, but in 4 specimens out of 103 it is vertically divided on one side, and in 2 others both upper preoculars are split. The total scales surrounding the eye vary from 7 to 10, 8 or 9 being the usual number. The anterior subocular usually abuts the fourth and fifth supralabials; rarely the third and fourth, or the fifth and sixth may be contacted; and in a few specimens a small scale, an interoculabial, is interposed to prevent any contact. The second subocular seldom touches any supralabial, although in a few specimens the fifth and sixth are reached. The posterior edge of the orbit is usually opposite the sixth or seventh, or, rarely, the eighth supralabial.

The following pattern description is based on 4 live specimens of *triseriatus* from near Tres Cumbres, Morelos, kindly loaned to me by Dr. W. B. Davis of the Texas Co-operative Wildlife Museum: The ground color is grayish-brown, with a faint olive tinge; it is lightest middorsally and darkens laterally. The dorsal blotches are dark-brown, slightly darker at the borders than centrally. There is a very thin light outer edge to each blotch; this light line is neither uniform nor continuous. The blotches are subelliptical in shape and highly irregular. The blotch borders do not follow scale edges. The central blotches are 5 scale rows wide, and 2 to 2½ scales long (end-to-end). The interspaces entail about ¾ of a scale.

There are three auxiliary series of lateral spots on each side. The upper series comprises small round spots and alternates with the main dorsal series. This series is more definite in some specimens than others. The second series is larger, transversely elongate and matches the main series in position. The third and lowest series is less definite than the other two; it alternates with the second series. Posteriorly the dorsal blotches and the middle lateral series merge to form short crossbands. The two upper lateral series are thinly edged with white like the dorsal blotches; and the lowest lateral scale rows are similarly edged, giving the impression of light, wavy, longitudinal lines.

The ventrum, particularly the midventral line, has a distinctly pinkish cast, especially posteriorly. Laterally the ventral scutes are maculated with brown; the extent of this mottling varies considerably in the 4 specimens.

The head marks, which are sometimes quite obscure, comprise 2 parallel rows of dark blotches, such blotches being on the prefrontals and the supraocu-

lars, with the last traversing the entire parietal region in the form of parallel bars. The ground color on top of the head is light-brown. On each side of the head there is a dark postocular stripe which passes above the angle of the mouth and then turns downward. Below this stripe, the labials, particularly posteriorly, are light—lighter than the rest of the head. On the supralabials below each eye there is a dark oval spot; and several smaller spots mark the infralabials at intervals. Except for these, and some lateral punctations, the under side of the head is clear and buff to pink in color.

The tail is lighter than the body, the posterior crossbands becoming lighter, redder, and increasingly indefinite, with wider interspaces. Below, the tail is quite pink and is clearer of punctations than the dorsal interspaces. The anterior rattle matrix is reddish. The rattles are olive-brown. The iris is reddish-brown.

The colors, in a brood soon after birth, exhibited a somewhat greater contrast between the blotches and ground color than did the adults. The tails were yellowish, but not nearly as bright as in some other rattlers—*C. v. helleri* and *C. l. klauberi*, for example.

The hemipenial characters of *triseriatus*, as noted in these Morelos specimens, are as follows: As in all rattlesnakes, the organ is deeply bifurcate. The spines are largest on the shoulders, decreasing in size on both sides. There are about 12 of the largest spines on each shoulder. There are no spines in the crotch. The change from spines to fringes is quite sudden. The fringes become more reticulated distally; there are about 20 fringes to the point where they become reticulate or net-like. The outer ends are rounded and entirely reticulate.

The hemipenes of *triseriatus* differ from those of *pricei* in lacking the spines in the crotch which are so conspicuous in the latter. Also, the change from spines to fringes is less abrupt. In this, the resemblance is to *klauberi* in Arizona, although in *klauberi* there is a still more gradual shift from spines to fringes, with more spines of intermediate size.

The range of the subspecies *triseriatus* includes east-central Veracruz, Puebla, Morelos, Distrito Federal, México (state), central Michoacán, central Jalisco, and southern Nayarit. A specimen of somewhat uncertain status from northern Nayarit is discussed under *pricei*.

Even restricted as *triseriatus* is, after the withdrawal of *pusillus* (to be discussed hereafter) and the segregation of *aquilus*, I am still concerned with the variability that remains in both squamation and pattern. Possibly the enlarged collections of the future will suggest additional subspecific segregations; or it may be that two territorially interwoven species are involved. An alternative reason for this variability may be found in the interrupted range of a montane form such as *triseriatus*. But with the material now at hand, with the exception of *aquilus*, I am unable to make any further logical divisions in *triseriatus triseriatus*.

THE NORTHERN SUBSPECIES OF *CROTALUS TRISERIATUS*

I now turn to consideration of the northern subspecies, which must be described before its differences from the southern subspecies can be indicated.

***Crotalus triseriatus aquilus** subsp. nov.**

QUERETARAN DUSKY RATTLESNAKE

Figure 2.

1877. *Crotalus lugubris* Dugès, La Naturaleza, vol. 4, p. 25
 1885. *Crotalus triseriatus* Cope, Proc. Amer. Philos. Soc., vol. 22, p. 386
 1931. *Crotalus triseriatus triseriatus* (part) Klauber, in Githens and George, Bull. Antivenin Inst. Amer., vol. 5, p. 33
 1940. *Crotalus triseriatus triseriatus* (part) Gloyd, Chic. Acad. Sci., spec. pub. no. 4, p. 84

Type Specimen.—No. 27843 in the collection of the Museum of Comparative Zoölogy of Harvard University. Collected near Alvarez, San Luis Potosí, Mexico, by W. W. Brown in 1923.

Differential Diagnosis.—A rattlesnake of small size and dull coloration. It differs from most other rattlesnakes in having the anterior subocular in contact with one or more supralabials; and in pattern and color from *tigris*, *polystictus*, *lepidus*, and *pricei*, all of which occasionally or universally have this contact. From *pusillus* and *intermedius* it differs in the contacts of the prefrontals and loreals respectively; and from its conspecific relative *triseriatus triseriatus* in tail proportionality and rattle size.

Description of the Type.—An adult female† containing almost full-term embryos. The length over-all is 543 mm., length of tail 35 mm., head length 26½ mm., fang length 3.8 mm., dorso-ventral width of proximal rattle 6.6 mm.

The scale rows are 23–23–17, with 11 at the center of the tail. The ventrals number 160, the subcaudals 19 (the last 2 divided), and the scales fringing the rattle 10. The supra- and infralabials are alike 12 on either side. There are 2 internasals, 1 canthal on each side, and from 3 to 6 intercanthals, depending on how one places the boundary between the intercanthals and intersupraoculars, there being no even suture between these groups of scales. The intersupraoculars are highly irregular; they number about 4+3+3. The scales in the occipital region are heavily keeled.

The rostral is wider than high. The prenasal is larger than the posterior, but does not extend beyond it either above or below the nostril. The prenasal

* *Aquilus*, Latin: dark-colored, dun, or swarthy. The pattern in this subspecies, compared with most other rattlesnakes, is dull and dark. The common name represents the approximate center of the range.

† This female, rather than a male, was selected from the topotypic series because of the modal character of its squamation.

contacts the first supralabial along its entire lower edge; the postnasal touches the first supralabial on the right but not on the left. The postnasal touches both the internasal and canthal. There are 3 prefoveals on each side and a single loreal, which is wider below. The upper preocular is undivided, and does not contact the postnasal; the lower touches the loreal. The anterior subocular contacts the fourth and fifth supralabials. The posterior edge of the orbit is opposite the sixth supralabial. There are 8 scales bordering the orbit on either side. The first infralabials are undivided, and there are neither intergenials nor a submental.

The head is gray-brown above, with a pair of dark-brown, posteriorly-confluent occipital blotches. There are a few dark spots in the parietal region and the supraoculars show faint light marks anteriorly. On each side there is a dark-brown postocular streak passing backward above the angle of the mouth; above, this streak is in slight contrast with the gray-brown of the head, but below it is sharply set off by a cream-colored area on the lower halves of the posterior supralabials. The anterior supraoculars, nasals, and loreals are punctated with gray. Below, the infralabials and anterior gulars are spotted with brown.

The body pattern comprises a series of 38 subrectangular blotches that are longer than wide. At mid-body they are about 5 scale rows wide, and $3\frac{1}{2}$ scales long, end-to-end. The interspaces comprise a single scale. The blotches were originally brown (the epidermis is partly gone), internally edged with darker-brown. The ground color was originally light-brown, heavily punctated. Both blotches and interspaces are now gray. There are at least 2, and possibly 3 rows of smaller, auxiliary blotches on each side; they are not clearly defined. The ventrum is heavily mottled with dark-gray, the density increasing somewhat posteriorly.

The tail is grayish anteriorly, with dark-gray cross-rings; posteriorly it becomes somewhat lighter, and the rings—of which there are 5 altogether—less definite. The tail below is blotched, but less so posteriorly than is the body. The rattle matrix is brown, with a few dark spots.

Topotypic Series.—There is available a topotypic series of 41 specimens from the vicinity of Alvarez. These are MCZ 19051–9, 22916–30, 27842, 27844–7, PANS 20058, 20062, 20067, and LMK 3496–3501, 6575–7. There are 17 males and 24 females. Their statistics, including those of the type, may be summarized as follows: The scale rows at mid-body are 21(1), 22(4), 23(36), 25(1). The ventrals in the males range from 149 to 161, mean 153.7; and in the females 150 to 160, mean 153.5 (a single aberrant female has 143). The subcaudals in the males are 24 to 28, mean 26.2; and in the females 17 to 21, mean 19.7. The supralabials vary from 9 to 14, mean 11.5 (very few have either 9 or 14); the infralabials are 9 to 13, mean 11.2 (nearly half have 11).

The scales in the internasal-prefrontal area range from 6 to 11 with a mean of 7.8; 8 predominate. There are always 2 internasals and 2 canthals, the rest are intercanthals. The minimum scales between supraoculars vary from 1 to 3 with a mean of 2.5; the majority of specimens have 3. The contact between

the postnasal and the first supralabial is not an objective criterion in this series as the contact is often so narrow that one cannot judge with assurance whether or not it is made. In about 25 per cent of the cases there is a wide contact, in 27 per cent, no contact, and in the others the contact is doubtful, being made at a point, if at all. In this series, the postnasal invariably touches both the internasal and canthal, a condition different from that found in *pricei*. Split upper preoculars are occasional in this series; out of 42, 2 have split scales on both sides, and 3 on one side only. With respect to the subocular-supralabial contacts, 67 per cent of the specimens have the anterior subocular in contact with the fourth and fifth supralabials on both sides. Contacts with the third and fourth are occasional, and with the fifth and sixth less frequent. Some touch only a single supralabial. In only one specimen out of 42 does the anterior subocular fail on both sides to contact any supralabial; in 3 other specimens the contact is made only on one side of the head. The second subocular only contacts a supralabial in $3\frac{1}{2}$ per cent of the counts.

The scales bordering the rattle are distributed thus: 8(5), 9(2), 10(34). (In *triseriatus triseriatus* they are most often 8.)

The body blotches vary from 28 to 40 with a mean of 34.5. A single aberrant specimen (MCZ 22921), with a peculiarly broken pattern somewhat resembling *pricei*, has 50 or more; they cannot be counted with accuracy. Although the topotypic series much resemble the type in color and pattern, some are lighter, others darker. There are also variations in the shapes of the dorsal blotches. While they are usually longer than wide, many are indented on the sides, and some on all four edges. Although some blotches are split by cross divisions, longitudinal divisions, such as characterize *pricei*, are quite rare.

The first lateral row of blotches matches the main series, the next below is less definite and falls opposite the interspaces. Compared with the type, most of the topotypic series are lighter and more speckled below. The posterior parts of the tails are lighter both above and below, and some are quite pink.

The tail-ring statistics (4 to 7 in the males and 2 to 6 in the females) mean little since the rings are often too faint and indefinite posteriorly to be counted with accuracy.

Summary of Subspecies.—Altogether, including the topotypic series of 42, I have had available for study 86 specimens of *C. t. aquilus*. There were 40 males and 46 females. A descriptive summary of the subspecies as a whole is as follows: The tail-length regression lines are approximately $T = .093L - 0.3$ for the males and $T = .082L - 3.2$ for the females. The head-length line is $H = .0360L + 7.2$, and the regression line for the width of the proximal rattle is $W = .0108L + .74$. In these equations all values are expressed in millimeters. The fang length is contained in the head length about 6.8 times, and in the length over-all 136 times.

The largest specimen is a male measuring 678 mm. over-all; the smallest is 172 mm.

The statistics of the complete subspecific series are briefly as follows: Scale rows at mid-body 21(7), 22(4), 23(67), 24(2), 25(6); ventrals, males 146 to 161, mean 151.9, females 143 to 160, mean 151.7; subcaudals, males 22 to 28, mean 25.9, females 17 to 23, mean 20.4; rattle-fringe scales 8 to 10, usually 10; supralabials 9 to 14, mode 12, mean 11.6; infralabials 9 to 13, mode 11, mean 11.2; body blotches (except the anomalous specimen already mentioned) 24 to 43, mean 33.2; tail rings (of little importance numerically for reasons already stated) males 3 to 8, mean 5.4, females 1 to 6, mean 3.9.

The patterns and colors throughout the subspecies exhibit considerably more variations than in the topotypic series, as might be expected. Colors vary from light-gray to very dark-gray or brown, with the blotches hardly perceptible. Specimens have been seen from Querétaro with dark-brown blotches on a light blue-gray background, the colors, if not the pattern, being strongly reminiscent of Arizona *klauberi*. A live specimen from Jacala, Hidalgo, had the following Ridgway colors: Blotches Light Seal Brown on a Mummy Brown ground color; below, Ochraceous Salmon, somewhat clouded with brown on the ends of the ventrals.

The dorsal blotches, although quadrangular, often deviate from rectangles, some with indentations, sharp angles, and serrations, others toward circles or ellipses, although round blotches are not as frequent as in *triseriatus*. The auxiliary lateral blotches are usually obscure, but in some specimens they are as clear as the primaries, although always shorter (in a manner resembling *ravus*) along the body of the snake. They often merge with the primaries posteriorly, as is the case in most rattlesnakes. Some specimens are almost solid brown below, although lightening toward the head.

The head marks are usually obscured by the general dark coloration. When evident they tend toward the following: The supraoculars and intersupraoculars are barred by dark bands fore and aft, bordering a central light crossband. A pair of dark blotches occupies the parietal area, and a much larger pair the occipital; the latter may, or may not, be joined middorsally. There is the usual dark postocular stripe characteristic of most rattlesnakes. It passes above the commissure, sometimes stopping there and sometimes reaching the posterior gulars.

The tails are usually clearly barred with gray or brown on a buff background, but the contrast decreases so sharply toward the rattles that the final rings are nebulous. Below, the tail is pink or buff, this being true even in the dark specimens.

The rattle matrix is light-brown to buff, often dotted with dark-brown. The rattle itself is darker than in most Nearctic species.

Certain intrasubspecific clines are in evidence. The ventrals decrease in number toward the south and west, but the contrary is true of the subcaudals. There is a slight, but not conspicuous, reduction in the number of body blotches from San Luis Potosí toward Michoacán.

The subspecies *aquilus* occurs only in southern San Luis Potosí, Guanajuato, Querétaro, Hidalgo, and northern Michoacán. In all probability it will eventually be found in northern Veracruz to the eastward of Zacualtipán (Hidalgo), and in Jalisco to the northeast of Lagos de Moreno.

Subspecific Comparisons.—Having described both *triseriatus triseriatus* and *t. aquilus*, I shall now discuss their differences. Gloyd (1940, p. 92) originally segregated the northern from the southern race of *triseriatus* based on the following characters of the southern form: Small size; fewer ventrals; more dorsal blotches; blotches circular or elliptical rather than square; 3 series of lateral spots, compared with 1 or 2 in the northern form; and more distinct markings on the head. He assigned the southern form to Distrito Federal, México, Morelos, Puebla, and Veracruz; and the northern to Guanajuato, Hidalgo, Jalisco, Michoacán, Nayarit, and San Luis Potosí.

All of the differences pointed out by Gloyd are found to be valid, with the exception of size, head marks, and lateral spots. But the clines are so gradual and the overlaps so great that it is quite impossible to allocate specimens accurately upon these criteria, without leaning heavily on geographical location as well. For example, using Gloyd's territorial divisions, the northern snakes vary in body blotches from 24 to 43, and the southern from 30 to 57. More than half of each group falls in the overlapping range of 30 to 43, inclusive. Similarly, it is found that southern specimens often have rectangular or square, rather than round or elliptical blotches.

As one examines a large series of the species *triseriatus*, the differentiating character most readily apparent between the two subspecies is the rattle size. Comparing snakes of similar over-all lengths, the difference is immediately evident, for it affects not only the width, but the thickness and length of the segments, thus accentuating the difference in any one dimension. Unfortunately, an ontogenetically variable character like rattle width is difficult to apply when classifying specimens, yet this does not make it any the less real.

As far as adults over 400 mm. are concerned, a simple criterion can be formulated to separate the two *triseriatus* subspecies: If the dorso-ventral width of the proximal rattle segment is more than one one-hundredth of the length of the snake over-all, the specimen belongs to the northern race; if less it should be assigned to the southern. Of about 50 adult specimens of each subspecies, not a single specimen failed to fall into a logical geographic pattern when thus segregated. A few northerners came close to, although above, the straight-line discriminant $W = .01L$, but all southerners were well below it.

Below 400 mm. the zone of separation in rattle size between the subspecies is narrower, and there is some over-lapping, possibly due to the character of preservation, for shrunken rattles (buttons especially) make an accurate segregation quite hopeless. In the range from 400 mm. down to the smallest snakes (about 160 mm.) the dividing line between the subspecies is about $W = .0075L + 1$. Specimens below this line are *t. triseriatus*, above they are *t. aquilus*. Stated in another way, the rule for juveniles and adolescents is as

follows: Take $\frac{3}{4}$ of 1 per cent of the snake's length and add 1 mm. If the proximal rattle as measured is smaller than the figure thus obtained, the snake is *triseriatus*, otherwise it is *aquilus*. Example: A snake 240 mm. long has a proximal rattle 3.2 mm. wide; what is it? One per cent of 240 mm. is 2.4 mm.; $\frac{3}{4}$ of this is 1.8 mm. Adding 1 mm. we have 2.8 mm. As this is less than the actual rattle, as measured on the snake, the specimen is *aquilus*.

Of the other characters separating *aquilus* from *triseriatus*, the rattle-fringe scales will probably afford as high a percentage of accurate determinations as any other, by assigning those with 8 or less to *triseriatus* and those with 9 or more to *aquilus*. However, in this character, as in the others, there is considerable overlapping, as can be seen in the following tabulations covering the specimens available to me:

Rattle-fringe scales	<i>C. t. triseriatus</i>	<i>C. t. aquilus</i>
6	1	
7	2	
8	84	16
9	7	6
10	4	57
	—	—
Total	98	79

There is not only overlapping in this character, but indications of intergradation as well, for the specimens of *aquilus* territorially nearest *triseriatus* have the highest proportion of 8 rattle-fringe scales. These scales are, of course, correlated with rattle size.

There are other evident differences between the subspecies, few of which, unfortunately, are of much use in attempting to segregate a single specimen, although cumulatively they may be of value, particularly if some items tend to be in the upper or lower limit of one subspecies, and beyond the range of the other. *C. t. triseriatus* has a longer tail than *C. t. aquilus* and a slightly larger head. *C. t. triseriatus* averages fewer ventrals and more subcaudals; the subcaudals are often of diagnostic value. In *triseriatus* there is less often a contact between the postnasal and the first supralabial than in *aquilus*, and split upper preoculars are less frequent. The rostral tends to be relatively higher in *triseriatus* and the canthus sharper. Light supraocular cross dashes are more frequently evident in *aquilus*.

Summing up, in segregating *triseriatus* from *aquilus*, I should pay first attention to rattle width, followed by the rattle-fringe scales, tail proportionality, and subcaudals.

With this segregation, the range of *C. t. aquilus* may be given as southern San Luis Potosí, Guanajuato, northern Michoacán, Querétaro, and Hidalgo.

It may occur in that part of Veracruz that juts into Hidalgo; also in extreme northeastern Jalisco. *C. t. triseriatus* is found in east-central Veracruz, Puebla, Morelos, Distrito Federal, México (state), central Michoacán, central Jalisco, and Nayarit. The only state in which both subspecies have been taken thus far is Michoacán, where *aquilus* occurs in the vicinity of Morelia and Tacúaro, and *triseriatus* somewhat to the south and west at Tancítaro and near Patzcuaro.

The presence of *triseriatus* in Nayarit has been verified by 3 newly acquired specimens in the University of Kansas collection (29500-2) collected 6 miles south of Ixtlán del Río at 6800 feet. USNM 46333, from Santa Teresa, Nayarit, sometimes referred to *triseriatus*, is actually *C. l. klauberi*, although far from being typical of that subspecies. Paris 98-254 from the western slope of Sierra de Nayarit, in northern Nayarit, while possibly belonging to the subspecies *t. triseriatus*, is more probably *pricei pricei*, and will be discussed under that form.

Despite the proximity of the *triseriatus* and *aquilus* populations in Michoacán, there is no evidence of intergradation or overlapping in the rattle-dimension character. In fact, my whole assumption of the subspecific relationship between these two forms is based on their general similarity, rather than on the availability of any specimens that can be called intergrades. They are more alike as juveniles than as adults. The Michoacán specimens of *triseriatus* have smaller rattles than have those from the central Mexican plateau; hence the cline in this character is not indicative of intergradation. It is by no means impossible that *triseriatus* and *aquilus* might some day be shown to belong to separate species. In any case, *aquilus* is more likely to be conspecific with *triseriatus* than with *pusillus*, for no *aquilus* has paired prefrontals as has *pusillus*.

Nomenclatorial Problems.—Now that the differences between the subspecies *triseriatus* and *aquilus* have been reviewed, certain questions of nomenclature require discussion. I have already pointed out why the name *triseriatus* Wagler, 1830, has been applied to the southern subspecies. First, as to the synonyms of *triseriatus*: *C. lugubris* Jan, 1859; *C. pallidus* Günther, 1895; and *C. t. anahuacus* Gloyd, 1940. In 1940 (Copeia, no. 1, p. 17), in order to safeguard the name *Crotalus polystictus* (Cope), 1865, from anticipation by *lugubris* Jan, 1859, a composite, I established the Milan specimen No. 1414 as the lectotype of *lugubris*. Unfortunately, this lectotype was destroyed in World War II (letter from Dr. Guiseppe Scortecci, July 28, 1950), but the ventral (137) and subcaudal (30) scale counts, and tail proportionality (10.7 per cent), as published by Jan, show it to have belonged to the southern subspecies, *t. triseriatus*. In addition, I have dorsal photographs, kindly sent me by Dr. Scortecci before the war, from which it can be determined that there were at least 48 body blotches, and more probably 52. As either figure is beyond the range (24 to 43) of the northern race, but well within that of the southern (30 to 57), the scale-count indication is confirmed.

The proper allocation of the name *Crotalus pallidus* Günther, 1895, has been subject to a certain doubt because of the condition of the type specimen, of which the pattern is almost obliterated, and because the type locality (which

falls within the southern range) may be inaccurate. The scalation shows that the type does belong to the species *triseriatus*; and the size of the proximal rattle (dorso-ventral width 3.6 mm.; length of the snake over-all 382 mm.) shows it to belong to the southerly subspecies, as is further verified by the number of subcaudals and tail proportionality.

C. t. anahuacus Gloyd is also applicable to the southern race, this having been the describer's intention. It has already been shown that the name *Crotalus intermedius* Troschel in Müller, 1865, is applicable to the Totalcan small-headed rattlesnake, and the same is true of *Crotalus intermedius* Fischer, 1882. The application of the latter name is academic in any case, as it is a homonym.

I have seen specimens of *aquilus* having the uniform grayness, almost without pattern, that characterizes the type of *pallidus*; however, their rattle sizes indicated an affinity with *t. aquilus* rather than *t. triseriatus*, as in the case of the *pallidus* type. I have been unable to determine the extent to which the pattern peculiarities in these gray *aquilus* may have resulted from the conditions of preservation.

Relationship with Other Species.—A part of the investigation of the species *triseriatus* must be concerned with its relationship with *pricei* and *lepidus*. This logically belongs with the discussion of *aquilus*, since any affiliation between *pricei*, or *lepidus*, and *triseriatus* must be through the northern race of the latter.

Amaral (1927, p. 52) was the first to suggest a conspecific relationship between *triseriatus* and *pricei*, reducing the latter to synonymy. Subsequently (1931, p. 33) I considered *pricei* a subspecies of *triseriatus*, because of obvious and consistent differences in pattern. More recently Smith (1946, p. 85) has questioned this relationship, citing reasons for considering *pricei* and *triseriatus* separate species. I now find myself in agreement with Smith. To the differences that he has pointed out, I am able to supplement additional distinguishing features.

Originally a considerable territorial overlap between *pricei* and *triseriatus* was thought to exist, by reason of certain inaccurate locality data assigned to one series of *t. aquilus*. Since the correction of the records, no overlap is evident from the material at present at hand. The most northerly *aquilus* available comprise the topotypic series from Alvarez, San Luis Potosí. The nearest specimens of *pricei* are from 27 miles south of Ciudad Durango, Durango, a location about 250 miles west-northwest of Alvarez; and (in the subspecies *pricei miquihuanus*) some 120 miles to the northeast, at Miquihuana, Tamaulipas. With these gaps, it is only necessary to point out the differences between the species, with a further consideration of character clines, to see whether, assuming the intervening territory to be occupied by one or both species, intergradation is indicated.

The most conspicuous difference between *pricei* and *t. aquilus* is in pattern, especially in the main series of dorsal blotches. The modal *pricei* pattern comprises two series of small spots, one on each side of the middorsal line, while *aquilus* has a single central dorsal series of large subquadrangular blotches.

Were each blotch divided into 4 smaller spots, the *pricei* pattern would be closely approached; or conversely the merging of 4 *pricei* spots would produce an *aquilus* blotch. It is a fact that the *pricei* spots are frequently conjoined across the dorsum, the number confluent varying from none to almost the entire series. But when the spots do join, since they are only transversely merged and are not joined with an adjacent pair in the series, the result is a narrow transverse band, rather than a square. This entails a higher number of blotches in *pricei* than is found in *aquilus*. The southerly specimens of *pricei* exhibit no greater tendency toward cross-confluence than those from farther north. In the Alvarez topotypic series of *aquilus*, many specimens have the blotches indented on the sides, and some on the middorsal line as well. In some instances the side indentations meet to split the blotches, but longitudinal splits are rare. MCZ 19054 is unique in this regard, for it has a single light vertebral line, with an uninterrupted brown line on either side. These lines extend behind the head for about $1/3$ of the body length. This anomalous conversion of blotches into longitudinal lines has been noted occasionally in a number of species of *Crotalus*; in the present instance this does not involve a trend toward *pricei*.

The nearest *aquilus* approach to a *pricei* intergrade, as far as pattern is concerned, is found in MCZ 22921, also one of the Alvarez series. In this specimen the blotches are much broken up, many being quite small; and some are on opposite sides of the middorsal line, although with more irregularity than is found in *pricei*. But as this specimen lacks completely certain other characters that distinguish *pricei* from *aquilus*, it is to be deemed an anomalous *aquilus* rather than an intergrade. In color, it has the lack of contrast between blotches and ground color that characterizes *aquilus* as compared to *pricei*; and the venter is mottled as in *aquilus*, instead of being dark with light-edged ventrals as in most southerly *pricei*.

So much for pattern differences between *pricei* and *t. aquilus*; differences in squamation may be summarized as follows:

<i>C. t. aquilus</i>	<i>C. p. pricei</i>
1. Scale rows usually 23	Scale rows usually 21
2. Rattle-fringing scales usually 10	Rattle-fringing scales usually 8
3. Upper edge of prenasal does not extend rearward farther than the bottom edge	Upper edge of prenasal extends rearward farther than the bottom edge
4. First supralabial does not touch, or makes only a narrow contact with the postnasal	First supralabial makes a broad contact with the postnasal, passing upward behind it
5. Postnasal usually contacts both the internasal and canthal	Postnasal rarely contacts both the internasal and canthal; it often contacts neither because of the presence of a small extra scale, a presupraloreal

- | | |
|---|--|
| 6. Prefoveals usually number 2 or more | Prefoveals usually number 1 or 2 |
| 7. Anterior subocular usually contacts the 4th and 5th supralabials | Anterior subocular usually contacts the 3rd and 4th supralabials |
| 8. Second subocular rarely contacts a supralabial | Second subocular often contacts 1 or 2 supralabials |
| 9. Posterior edge of the orbit is usually opposite the 6th or 7th supralabial | Posterior edge of the orbit is usually opposite the 4th or 5th supralabial |
| 10. Supralabials seldom less than 10 | Supralabials seldom more than 9 |

A survey of these 10 differences, as applied to the available specimens of *aquilus* and *pricei*, shows that none is invariable; there is some overlapping in all. But with the exception of one or two characters, territorial trends indicating intergradation are not in evidence; that is, the deviations of the northerly *aquilus* from the mode are not toward *pricei*, nor, correspondingly, do the more southerly *pricei* deviate from their mode toward *aquilus*. The items in the above list, which, to the extent that they are subject to intrasubspecific clines, oppose any theory of intergradation between *aquilus* and *pricei* are, by numbers in the above list, items 1, 2, 5, 6, 7, 8, 9, and 10. In the jutting of the prenasal over the nostril, and in the postnasal-labial contact (items 3 and 4) the northern *aquilus* and the southerly *pricei* do deviate from their modes toward each other.

In both *pricei* and *aquilus*, there is a reduction in rattle size from north to south, but southerly *pricei* have slightly smaller rattles than northerly *aquilus*, so there is here no suggestion of intergradation. As to pattern, with the exception of the one anomalous *aquilus* that has been mentioned, there is no indication of intergradation; southerly *pricei* do not average fewer spots than those from the north, nor are they more consistently cross-confluent.

To repeat, for these reasons, most of which were originally pointed out by Smith, I am in agreement that *aquilus* and *pricei* are specifically distinct. Probably *pricei* should be viewed as a transition between the *intermedius* and *triseriatus* groups.

Smith (1946, p. 87) finds the closest relative of *triseriatus* in *lepidus*. This, I think, needs further verification, although they are undoubtedly much alike in several important characters. Well-prepared hemipenes of *t. aquilus* are especially needed, as *lepidus* (particularly *klauberi*) is peculiar in this character, in having a gradual transition from spines to fringes, whereas in other forms of *Crotalus* (but not in *Sistrurus*) the transition is abrupt. Such is the case in *triseriatus triseriatus*, and also in *t. aquilus*, to the extent that a determination can be made in non-extruded material.

The outstanding characteristics of *lepidus* are, in squamation, the prevalence of split upper preoculars, and, in pattern, especially in *lepidus klauberi*, a tend-

ency toward widely separated crossbands, sharply contrasting with a gray or light-brown background.

It is true that proportionately more southerly specimens of *lepidus* lack the characteristic split upper preoculars than is evident in those from the north; in fact, most of the deviants in this character are to be found among the few specimens available from the southerly fringe of the range. But this territorial indication of relationship is not evident in the southerly specimens of *aquilus*, the ones most distant from *lepidus*, for these have a higher incidence of split upper preoculars than those in the north. Of the *aquilus* population as a whole, 25.4 per cent of the upper preoculars are split. Specimens with a split scale on one side and an entire scale on the other are about equal in number to those split on both sides.

As to the pattern, it is true that an occasional specimen of *t. aquilus* is reminiscent of *l. klauberi* in the character of the blotches and the nature of the color contrasts between blotches and ground color. I have seen such specimens among those from Querétaro and Hidalgo. But most of the specimens from the areas where *lepidus* and *aquilus* most nearly approach each other—in western San Luis Potosí and southwestern Zacatecas—retain their quite distinctive patterns. To resemble the pattern of *l. lepidus*, *t. aquilus* would have to show a tendency toward the accentuation of every second or third dorsal blotch at the expense of those intervening. I have not noted a single specimen in which such a trend is evident. The pattern differences between *t. aquilus* and *l. klauberi* are even more extensive.

To conclude: *triseriatus* is specifically separated from both *lepidus* and *pricei*, although showing some resemblances to both.

***Crotalus pusillus** sp. nov.**

TANCITARAN DUSKY RATTLESNAKE

- 1908. *Crotalus triseriatus* Gadow, Through Southern Mexico, p. 513
- 1936. *Crotalus triseriatus triseriatus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 247
- 1947. *Crotalus triseriatus triseriatus* (part) Schmidt and Shannon, Fieldiana-Zoölogy, vol. 31, no. 9, p. 84

Introduction—The largest series of rattlers now available from any single locality in central Mexico is a group of 53 specimens from Tancítaro, Michoacán, collected for the Chicago Natural History Museum by Dr. F. A. Shannon and his associates. These had been tentatively classified as *Crotalus t. triseriatus*. Upon calculating the statistics of this presumably homogeneous series, I found the coefficient of variation of the ventrals to be 4.6 per cent in the males, and 2.7 in females.† As these coefficients seldom exceed 2 per cent in really homo-

* Latin: small, insignificant.

† There were too few females of one of the elements of the composite group to develop the full effect of heterogeneity.

geneous series, it was obvious that the group might be composite. (One specimen, showing, by its loreal-supralabial contact, that it was allied to *intermedius* rather than *triseriatus*, had already been set out.) A survey of the specimens immediately indicated that those having high ventral counts all had paired prefrontals, while the others had several irregular scales in this part of the crown. Among the males there was no overlap in the ventral counts of the two components as segregated by the prefrontal criterion; among the females there was some overlapping. Other differences were also noted, but these were neither as evident nor as consistent as the ventral-crown differences. Unless, as seems very unlikely, the ventral count and prefrontal configuration are to be attributed to a single genetic element, and this with almost perfect correlation in two component groups comprising 18 and 34 specimens respectively, two forms specifically distinct—for they occupy the same area without intergradation—are indicated. The component having paired prefrontals is obviously the new one, since before the advent of the Tancítaro series only one specimen with paired prefrontals had been available among all the *triseriatus* material at hand, this being B. M. 1906-6-1-227 from Cerro Nevado, Jalisco. There follows a description of the new species, for which the name *Crotalus pusillus* is proposed.

Type Specimen.—Chicago Natural History Museum no. 39112, collected in June or July, 1941, at Tancítaro, Michoacán, Mexico, altitude 5000 feet, by Dr. Frederick A. Shannon.

Diagnosis.—A small brown or gray rattlesnake with particularly small rattles. Like many of the smaller highland rattlers of central Mexico, the anterior suboculars contact the supralabials. However, *pusillus* differs from the other rattlesnakes having this characteristic, and particularly from *C. triseriatus triseriatus*, the form with which it might be most readily confused, in having paired prefrontals, while the others have 3 or more irregular scales in the prefrontal area. It differs from the rattlers of the *intermedius* group in its lack of contact between the loreals and the supralabials, nor does the prenasal contact the loreal, as is frequent in the *intermedius* group.

Description of the Type.—An adult male, length over-all 652 mm., tail length 67 mm., head length 33 mm., width of proximal rattle 3.8 mm., fang length (to upper lumen) 6.9 mm.

The scale rows are 27-23-17, all keeled except the two lowest lateral rows, which are also the largest of the series. Eight scales fringe the rattle. The ventrals number 154, the anal is entire; there are 32 subcaudals of which only the first is divided. There are 12 supralabials on each side, and 10 infralabials. The rostral is wider than high. There is one loreal on each side and 3 pre-foveals. There are 2 preoculars, neither divided; the upper curves over the canthus to a slight degree. On each side, the anterior subocular contacts the fourth and fifth supralabials. The second subocular does not meet the supralabials. The posterior edge of the orbit is even with the posterior edge of the sixth supralabial. Nine scales border each eye. The prenasals are larger than the

postnasals. The prenasal contacts only the first supralabial; it curves slightly under the postnasal. Neither the postnasal nor the loreal touches any labial.

The scales on the crown comprise a pair of internasals wider than high, and a pair of prefrontals, thus making a total of only 4 scales anterior to the supraocular-frontal area. The supraoculars are much the largest of the head scales. The anterior intersupraoculars are 2+3. The posterior head scales are keeled. The first infralabials meet on the median line; they are undivided, and there are neither submentals nor intergenials.

The head is brown above, with some black stippling, especially posteriorly. The most conspicuous head marks are wide postocular dark-brown bands, which pass above the angle of the mouth and then turn downward behind it. The anterior supralabials are gray; the posterior, below the dark stripe, are buff. There is a dark spot on the labials immediately below the eye. The infralabials are punctated and irregularly spotted with brown. The gulars are buff, punctated outwardly toward the infralabials.

The body pattern comprises a series of 40 irregular subhexagonal blotches about 8 scale rows wide, and $2\frac{1}{2}$ scales long, end-to-end. The interspaces cover about 1 scale. The blotches are deep brown, lighter middorsally. A series of smaller auxiliary blotches is somewhat evident on either side. The entire dorsum is much stippled and punctated, especially within the blotches. The belly is buff anteriorly, with increased dark-gray stippling and mottling rearward, until, at the tail, it becomes almost uniformly black. The anterior lobe of the rattle matrix is black.

Description of the Topotypic Series.—The topotypic series (including the type) is made up of the following specimens, all in the collection of the Chicago Natural History Museum: numbers 37039, 37042, 37046, 37048, 39095, 39097, 39103, 39109, 39112-3, 39117, 39120-1, 39127, 40818-9, 40824-5. This comes to 18 specimens, of which, unfortunately, only 3 are females. This series of paratypes I shall describe as a group; I prefer to deal separately with the few other specimens of *pusillus* that are available.

The longest specimen is a male measuring 674 mm.; the longest female is 522 mm. The shortest specimen is 247 mm., but one of the non-topotypes is 200 mm. The tail-length equation for the males is approximately $T = .111L - 4$, where T is the length of the tail and L the body length over-all, including the tail. Thus an adult 550 mm. long would have a tail length of 57 mm., or 10.4 per cent of the length over-all, which puts *pusillus* in the category of the longer-tailed rattlesnakes (Klauber, 1943, table 19). There are not enough females available to determine a trend line for that sex. The head-length equation is $H = .0442L + 3.84$. Thus a 550 mm. adult, on the average, would have a head length of 28.1 mm. The head length is contained in the body length 19.6 times, showing *pusillus* to be a relatively large-headed rattler (Klauber, 1938a, table 19). The rattle width (proximal rattle) is closely represented by $W = .00583L + 0.3$. This indicates a very small rattle, about 3.5 mm. in

width in a 550 mm. adult snake; *pusillus* has, proportionately, a smaller rattle than almost any other species of the two rattlesnake genera. The fang length is contained in the head length 5.1 times, and in the body length over-all 100 times.

The scale rows at mid-body number 23 in every specimen. The ventrals in the males range from 152 to 161, mean 155.8, and in the females (only 3 specimens) from 150 to 154, mean 153.0. The subcaudals in the males vary from 28 to 33, mean 30.9; the corresponding female figures are 25 to 27, mean 25.7. The supralabials range from 11 to 13, mean 12.0; and the infralabials from 10 to 13, mean 11.3. There are 8 scales fringing the rattles in all but one specimen, which has 7.

The rostral is wider than high. It curves over the snout slightly at the top, and is indented on each side by the prenasals. The fore part of the crown is occupied by a pair of internasals, wider than high, followed by a pair of much larger prefrontals, each of which has a convex, rather than straight, posterior edge. Each prefrontal has a lateral depression, bordered outwardly by a ridge that comprises a part of the canthus rostralis. The supraoculars are rather long and narrow, and are somewhat pointed at both ends. They are much the largest of the head scales. The anterior intersupraoculars are usually 2+3, 3+3, or 3+4; the first row is enlarged.

The prenasal is larger than the postnasal. Above, it extends only slightly behind the nostril; it extends somewhat farther below, cutting off the postnasal from contact with the labials. The prenasal contacts only one supralabial, the first. The postnasal contacts both the internasal and prefrontal. The prefoveals vary from 1 to 5; the average is 3. There is a single loreal on each side; it is slightly higher than wide, and is narrower above. It is always well separated from the supralabials. The upper preocular is undivided; it slants upward anteriorly and may curve over the canthus slightly, where it contacts the prefrontal. The lower preocular is, as usual, slim and crescentic; it forms a part of the upper border of the pit and always reaches the loreal. The total scales in the orbit are usually 8 or 9. The anterior subocular always contacts the fourth and fifth supralabials; an interocular is interposed so that the next posterior subocular does not contact any supralabial. The posterior edge of the orbit is even with the sixth or seventh supralabial. The first infralabials are undivided and meet on the median line. There are no submentals or intergenials.

The body pattern comprises from 33 to 46 subrectangular dorsal blotches (mean 39.8). The tail spots in the males number from 8 to 12, mean 9.9; and 5 to 8 in the females. The body blotches are considerably longer than the interspaces, being about $2\frac{1}{2}$ to 3 scales long (end-to-end), while the interspaces measure 1 to 2 scales. The blotches are 7 to 9 scale rows wide. The blotches are highly irregular, varying from rectangles, through squares, to ovals and circles. They are frequently diagonal, as if the two sides failed to match. There is an auxiliary row of smaller spots on each side, these spots usually being even with the main series.

The general color is brown (or gray if the epidermis is abraded). The main blotches are somewhat darker than the ground color and have black edges. The auxiliary blotches are usually darker than the main series. The dorsal interspaces between blotches are lighter, tending toward buff, than the lateral ground color. Dark punctations are evident over the dorsum, particularly within the main blotches. The punctations increase posteriorly.

The ventrum is buff anteriorly, gradually darkening posteriorly by reason of an increasing concentration of dark-gray stippling until, at the tail, the color may be almost solid black. The stippling is applied evenly so that there is no evidence of a ventral pattern.

The head is without pattern above, being brown or dark-gray, heavily punctated with dark spots. On each side there is a dark-brown postocular band about 2 scales wide, that turns downward just behind the angle of the mouth. The edges of the band are accentuated by internal darkening, by a thin light border above, and a wider light border, which engages the posterior supralabials, below. The supralabials are heavily punctated with gray anteriorly. Sometimes there are several brown spots on the supralabials, the largest of which is just below the eye, but often these are masked by punctations. The lower surface of the head varies from clear to heavily punctated buff; the sutures between infralabials are often accentuated by clumps of dark dots.

Other Material.—In addition to the topotypic series, the following specimens of *pusillus* are available:

British Museum 1906-6-1-227 from Cerro Nevado, Jalisco, is a young male with 23 scale rows at mid-body, 156 ventrals, and 30 subcaudals. It differs from the other specimens in that the suboculars do not touch the labials. It is the only specimen known to me that has been available for more than 10 years or so. Cerro Nevado is about 75 miles from the type locality of *pusillus*.

UI 22809, from the Uruapan road (probably near Carapán), Michoacán, is a juvenile female with 23 scale rows, 162 ventrals, and 29 subcaudals. It clearly belongs to the new species. The place of collection is probably about 25 miles (straight line) from the type locality.

These two are the only other specimens known to me that are unquestionably *pusillus*. There is another, MVZ 45254 from near Chilpancingo, Guerrero, which may be *pusillus*. Strange as it may seem, I cannot be sure whether this rattler is *Crotalus* or *Sistrurus*, for the anterior head scales are pressed so flat that creases cannot be distinguished from sutures. It shows certain differences from both *C. pusillus* and *S. ravus*, but as no other specimens of either species are available from Guerrero, these differences might be due to territorial clines that cannot be evaluated. For the present this specimen must be left in a doubtful status.

Species Comparisons.—*C. pusillus* is much more like *C. t. triseriatus* than any other form. In addition to the paired prefrontals, it can be segregated from members of the *intermedius* group by the nature of the loreal contacts, and from *pricei*, *lepidus*, and their subspecies by pattern. It has smaller rattles than

C. t. aquilus. There remains, then, *C. t. triseriatus*, of whose large range, *pusillus*, as far as is now known, occupies only a small part. I have had available for study somewhat over 100 specimens of *t. triseriatus*, and of these, only one, MZUM 75866 from near Tres Mariás, Morelos, has paired prefrontals. In this specimen these scales are not regular, as in *pusillus*; it is questionable whether the next 2 posterior scales are to be considered as being in the prefrontal or intersupraocular area. This lack of a definite line between these areas is characteristic of *triseriatus* as compared to *pusillus*, in which the boundary is clear. MZUM 75866 is a male with 146 ventrals, while the lowest *pusillus* has 150. In fact, in all the *triseriatus* available, the highest ventral count is 152 (except for the type, which has 159); 9 out of 96 have 150 or more, while 2 *pusillus* out of 20 have 152 or fewer. Thus the overlap in ventrals is seen to be about 10 per cent.

Besides the prefrontals and ventrals there are other average differences between *pusillus* and *t. triseriatus*, but I have discovered none that is sufficiently evident or consistent to be of diagnostic value in a key. *C. pusillus* has a slightly longer head, and a slightly smaller rattle. There seems to be no difference in tail length. The *pusillus* fang is slightly longer, proportionate to either head or body, than that of *triseriatus*.

Comparing the series of 34 *triseriatus* from the type locality of *pusillus*, with the topotypes of the latter—thus avoiding the effects of territorial variations in the more widespread form—the following average differences are observed:

<i>C. pusillus</i>	<i>C. t. triseriatus</i>
1. Longitudinal crease near outer edge of each prefrontal	Prefrontals (canthals) dished but not creased
2. Prefoveals fewer and nearly equal in size	More prefoveals, and more uneven in size
3. Less color contrast between dorsal blotches and ground color	More color contrast between dorsal blotches and ground color
4. Crown unicolor, except for many scattered punctations	Crown with light and dark marks; often with lighter internasals and light supraocular crossbars
5. Paired parietal blotches faint, if at all evident	Paired parietal blotches evident
6. Lower (second) series of lateral blotches represented only by increased punctations	Intermediate (second) series of lateral blotches clearly evident
7. Ventrums marked with evenly distributed punctations, although with increased density posteriorly	Ventral punctations grouped into blotches. Posterior edges of ventrals often unmarked
8. Underside of tail often black because of dense punctations	Underside of tail often pink, with fewer scattered punctations
9. Proximal rattle matrix black in adults	Proximal rattle matrix buff or brown in adults

I have never seen a live *pusillus*. Judging from experience with other rattlers, I believe that a comparison of live specimens of *triseriatus* and *pusillus* would accentuate some of the pattern differences I have pointed out, and would bring to light others that I have missed.

Range.—At present *pusillus* is known only from the highlands of southern Jalisco and western Michoacán.

CROTALUS PRICEI

With the discussion of this species and its subspecies, I shall discontinue, except in the case of *durissus*, any attempt to divide the subsequent subjects into groups, as was done with *intermedius*, *triseriatus*, and their relatives. This is mentioned only so that the reader will not assume that the following species are to be considered as a continuation of the *triseriatus* group.

Crotalus pricei pricei Van Denburgh ARIZONA TWIN-SPOTTED RATTLESNAKE

Figure 3.

- 1895. *Crotalus pricei* Van Denburgh, Proc Calif. Acad. Sci., ser. 2, vol. 5, p. 856
- 1927. *Crotalus triseriatus* Amaral, Bull. Antivenin Inst. Amer., vol. 1, no. 2, p. 52
- 1931. *Crotalus triseriatus pricei* Klauber, in Githens and George, Bull. Antivenin Inst. Amer., vol. 5, no. 2, p. 33
- 1946. *Crotalus pricei pricei* Smith, Univ. Kans. Sci. Bull., vol. 31, pt. 1, no. 3, p. 79

Of this subspecies, I have had available for study about 140 specimens, 88 of which are from Arizona, the rest from northwestern Mexico. About 40 per cent are females.

Crotalus pricei pricei is a small, quite distinctive rattlesnake, having, in its most typical form, a highly individualistic pattern comprising paravertebral rows of small brown blotches on a blue-gray, gray, or light-brown background. On the average, the number of these blotches (counting only one of the two rows) exceeds the dorsal count of any other rattlesnake. Although it is true that, in some specimens, many of the spots of the two rows are joined together across the middorsal line, it is seldom difficult to recognize *pricei* by pattern alone, if the specimen be well preserved. No other rattlesnake except its sister subspecies *pricei miquihuanus*, and *polystictus*, has the dorsal spots divided into two separate rows; and the high number of spots, in itself, is often conclusive.

Description of Subspecies.—The essential statistical data on *p. pricei* are as follows: Scale rows 21 (123), 22 (1), 23 (8); ventrals, males 149 to 162, mean 157.9, females 157 to 171, mean 162.6; subcaudals, males 21 to 30,

mean 24.6, females 18 to 26, mean 21.5; supralabials 8 to 10, mean 9.0 (about 80 per cent have 9); infralabials 8 to 12, mean 9.8; scales in the internasal-prefrontal area 5 to 11, mean 7.0 (about 90 per cent have 6, 7, or 8); minimum scales between the supraoculars 1 to 4, mean 2.3 (about 92 per cent of the specimens have 2 or 3). The body blotches range from 41 to 61, mean 52.1 (most specimens fall between 47 and 60); and the tail bars from 5 to 11, mean 7.6 in the males, and 5 to 10, mean 7.0 in the females.

The largest specimen is a male measuring 576 mm. over-all; the smallest is 159 mm. This is a somewhat smaller snake than *triseriatus*, *aquilus*, and *pusillus*, all of which reach a length of about 675 mm.

The body-proportion regression lines, all expressed in millimeters, are substantially as follows: Head length, $H = .040L + 5.0$; tail length, males $T = .088L - .4$, females $T = .073L - .4$; proximal rattle width $W = .0121L + .06$.

Some of the head-scale characteristics of *pricei* are to a moderate extent diagnostic. Most important is the normally broad contact between the first supralabial and the postnasal—for the former curves up behind the postnasal to contact a prefoveal—which is unique among the rattlers. Unfortunately, this contact is not strongly accentuated in some southerly specimens. The prenasal is broader along its upper edge than along the lower; it sometimes approaches the loreal and rarely reaches it (this contact is normal in the *intermedius* group). The prenasal extends little, if any, beyond the nostril below. The postnasal does not reach the lacunals, the prefoveals intervening. The contact between the postnasal and the scales immediately above it is quite variable, but in any case contact is seldom made with both the internasal and canthal, as is characteristic of *triseriatus* and *lepidus*. Sometimes only the internasal is contacted, or rarely only the canthal; in about 1/3 of all specimens, neither scale is reached by reason of the interposition of a small extra scale that might be considered either an upper postnasal or a presupraloreal. The prenasal touches only the first supralabial as might be expected, since the latter scale curves up behind the postnasal.

The prefoveals usually number 1 or 2, slightly more often 1. Rarely there are 3. The loreal is longer than high, and is less triangular than is the case in *triseriatus*. The upper preocular points diagonally upward anteriorly, curving slightly over the canthus. Although this scale is rarely divided vertically, as is so characteristic of *lepidus*, a few specimens have been found with a division on one side, and more rarely on both. The lower preocular is undivided and forms the upper border of the pit; it meets the loreal. The total scales bordering the orbit usually number 7 or 8. In almost all specimens the anterior subocular contacts the third and fourth supralabials, in contradistinction to *lepidus* and *triseriatus* wherein the contact is nearly always with the fourth and fifth. The posterior subocular—that is, the next scale to the anterior—is much less consistent in its contacts; it may touch the fourth, fifth, or sixth supralabial, or the first or second pair of these together; but in many speci-

mens a small scale is interposed so that no labial is reached. The fifth supralabial is usually the one opposite the posterior edge of the orbit, although occasionally it is the fourth.

The rostral is wider than high, as are also the internasals. The canthals are 1-1; the intercanthals are irregularly arranged and may number from 2 to 9, although most often there are 4, 5, or 6. The boundary between the intercanthals and intersupraoculars is usually ill defined, so there is no sharp distinction between posterior intercanthals and anterior intersupraoculars. Keels are moderately evident in the scales of the occipital, but not the parietal area.

The dorsal pattern comprises two series, one on either side of the mid-dorsal line, of dark-brown spots on a gray, blue-gray, or light-brown background. Some of the spots may merge with their opposites across the back. There is a considerable variability in the proportion of cross-confluent dorsal spots, but most specimens have fewer than half conjoined. A very few specimens have almost all spots merged; merging is more likely to occur where the individual spots of the two rows fall exactly opposite each other.

The blotches of the two dorsal series usually have irregularly serrated edges; they are sometimes accentuated by an internal dark border and an external light one. They are usually (when not cross-confluent) about $2\frac{1}{2}$ scale rows wide and 1 to $1\frac{1}{2}$ scales long. The interspaces are 1 to 2 scales; usually a single scale row separates the two rows middorsally. At least one, and sometimes as many as three, auxiliary lateral rows of spots are present. They are not as sharply distinguishable from the ground color as are the main series. The ground color is heavily punctated with fine dark dots. The lowest lateral scale rows are usually edged with white, giving the impression of serrated longitudinal lines. The ventrum is heavily punctated or blotched with dark-gray or black. These markings are accentuated toward the tail; anteriorly the color may be buff with few dark marks. Usually the posterior edges of the ventrals are unmarked, in strong contrast with their centers, which may be jet black. The ventral markings tend to lighten with age.

The head is heavily punctated forward but is without other distinguishing marks above. There is a pair of brown parallel marks in the occipital region. On the sides there is a dark postocular streak that passes backward above the angle of the mouth. The posterior supralabials are lighter than the anterior. Below, the head is usually buff, with concentrations of dots on the infralabials and outer gulars.

The tail is irregularly barred with brown on a gray background. The anterior rattle matrix is buff to pink, usually without the conspicuous dark spots characteristic of *lepidus*. The rattle-fringe scales usually number 8, although occasionally 9 or 10.

The hemipenes are of the usual *Crotalus* shape. The spines on the outer shoulders are of moderate thickness. There is a sharp transition from spines to fringes on the outer shoulders. There are many small spines in the crotch.

These are carried farther out into the fringes than the outer spines; they constitute the most distinctive feature of the *pricei* organ. The fringes are in rows near the sulcus, but are reticulated outwardly.

Some intrasubspecific differences are in evidence. The most southerly specimens have more subcaudal scales and slightly longer tails, proportionate to the body. The ventrums tend to be darker in the south, and there are more maculations on the infralabials and the outer gulars. The genials are somewhat longer and more sharply pointed in the southerly specimens.

Relationship with Other Species.—I have discussed the *pricei-aquilus* relationship under the latter species. With *lepidus*, although there are some superficial likenesses, particularly in color, it is probable that the relationship is not especially close. The patterns are divergent, in that *lepidus* is characterized by the suppression of from 1 to 4 blotches to every one that is accentuated, thus greatly reducing the blotch numbers, while, on the other hand, in *pricei*, the original spots of the ancestral form have probably been split to double their number. Aside from the occasional divided upper preocular in *pricei*, there is little in the head scales to indicate an affinity with *lepidus*. There are also fundamental differences in the hemipenes, *lepidus* having a more gradual transition from spines to fringes, and being without spines in the crotch.

C. p. pricei shows some likenesses to the *intermedius* group in the backward extension of the prenasal above the nostril; the contact between the anterior subocular with the third and fourth, rather than the fourth and fifth supralabials; and in the suppressions of the keels in the scales of the parietal area. But the reduction of scales in the loreal area, characteristic of the rattlers of the *intermedius* group, is not carried nearly so far in *pricei*.

In pattern, particularly in the heavy application of punctations, and the lack of distinctive marks on the head, *pricei* shows some likeness to *pusillus*.

Range.—In the United States, *pricei* is confined to 5 Arizona mountain ranges: the Santa Ritas, Huachucas, Pinalinos (Grahams), Dos Cabezas, and Chiricahuas. There are a few records not in these ranges but they are all of doubtful accuracy. *C. p. pricei* is most numerous in the Chiricahuas; here it greatly outnumbers *C. l. klauberi*, whereas the contrary is true in the Huachucas.

In Mexico, *pricei* seems to be restricted to the mountainous areas of extreme northeastern Sonora, western Chihuahua, and western Durango. Certain British Museum specimens usually designated as being from Iloiquiro, Tarahumar, probably came from Yoquivo, southwestern Chihuahua. This is in the Sierra Tarahumare.

Of the material now available, the most southerly *pricei* is from 27 miles south of Ciudad Durango. The nearest *triseriatus* is from near Ixtlán del Río, Nayarit, about 175 miles farther south; and the nearest *aquilus* from Alvarez, San Luis Potosí, about 250 miles to the southeast. As there are ecologically suitable mountain areas between, future collecting may be expected to reduce or eliminate these gaps. Indeed, the range of *pricei* may extend south 100

miles to the Sierra de Nayarit, based on Paris 98-254, on which complete data have been kindly supplied me by Dr. Jean Guibé. This snake shows more of an affinity for *pricei pricei* than for *triseriatus triseriatus*, although uncertainties remain. The prenasal almost contacts the loreal; there is a single prefoveal; the postnasal does not touch the canthal and is in broad contact with the first supralabial; the anterior subocular contacts the third and fourth supralabials; and there are only 9 supralabials on each side. All of these are *pricei*, rather than *triseriatus* characteristics; three University of Kansas specimens of *triseriatus* from 6 miles south of Ixtlán del Río, Nayarit, have none of these features. The Paris specimen has a rattle somewhat too large for *t. triseriatus*, although not for *pricei*. But Guibé reports the anterior blotches as cross-confluent, which is rare in *pricei*. The posterior blotches cannot be deciphered because of the condition of the specimen. Thus the allocation of this snake must remain questionable, although somewhat favoring *pricei*.

***Crotalus pricei miquihuanus* Gloyd**

MIQUIHUANAN TWIN-SPOTTED RATTLESNAKE

1927. *Crotalus triseriatus* (part) Amaral, Bull. Antivenin Inst. Amer., vol. 1, no. 2, p. 52
1936. *Crotalus triseriatus triseriatus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 248
1940. *Crotalus triseriatus miquihuanus* Gloyd, Chi. Acad. Sci. Spec. Pub. no. 4, p. 102
1946. *Crotalus pricei miquihuanus* Smith, Univ. Kans. Sci. Bull., vol. 31, pt. 1, no. 3, p. 79

To my knowledge, no additional specimens of this subspecies have been collected since it was described by Gloyd in 1940. The three available are from Cerro Potosí and Ojo de Agua, near Galeana, Nuevo León, and Miquihuana, Tamaulipas. While additional collecting will no doubt extend the range, it may be questioned whether an intergrading population will be found to exist across northern San Luis Potosí and central Zacatecas to join with the most southerly *pricei* in southern Durango. However, montane dwellers frequently have interrupted ranges; and the similarity of the patterns of *miquihuanus* and *pricei*, with their striking paravertebral lines of spots, as well as other distinctive characters, fully justify Smith's decision to consider them conspecific.

I do not find the pattern differences pointed out by Gloyd—*miquihuanus* browner and with more confluence of the dorsal spots—to be consistent. But the other differences, in ventrals and prefrontals, remain. *C. p. miquihuanus* probably has about 6 or 8 fewer ventrals than *pricei*; and 2 of the 3 *miquihuanus* have only 2 scales in the prefrontal area, a lower number than that found in any of 125 specimens of *pricei*. The third *miquihuanus* has 4 scales (2 canthals and 2 intercanthals), a common number in *pricei*.

C. p. miquihuanus has several head-scale characters that reinforce the pattern similarity to *pricei*. The prenasal approaches close to the loreal above the nostril; the first supralabial has a broad contact with the postnasal; the postnasal touches only the internasal, instead of both this scale and the canthal; the first subocular contacts the third and fourth supralabials; and the posterior edge of the orbit is opposite the fifth supralabial. All of these characters are at variance with most specimens of *triseriatus* and *aquilus*.

In its high number of subcaudals, *miquihuanus* resembles the San Luis Potosí specimens of *pricei*. The prenasal approaches the loreal more closely in *miquihuanus* than in most specimens of *pricei*, a possible trend toward *intermedius*. The paired prefrontals are, of course, reminiscent of *pusillus*.

***Crotalus lepidus lepidus* (Kennicott)**

MOTTLED ROCK RATTLESNAKE

- 1861. *Caudisona lepida* Kennicott, Proc. Acad. Nat. Sci. Phila., vol. 13, p. 206
- 1866. *Aploaspis lepida* Cope, Proc. Acad. Nat. Sci. Phila., vol. 18, p. 310
- 1883. *Crotalus lepidus* (part) Cope, Proc. Acad. Nat. Sci. Phila., vol. 35, p. 13
- 1887. *Crotalus (tigris) palmeri* Garman, Bull. Essex Inst., vol. 19, p. 124
- 1936. *Crotalus lepidus lepidus* Gloyd, Occ. Papers Mus. Zoöl. Univ. Mich., no. 337, p. 2

Species Considerations.—The species *Crotalus lepidus* is characterized by high variability in pattern and color, but is rather constant in squamation. It is, in general, a montane, rock-inhabiting form, with an interrupted range, which largely accounts for the pattern diversity. Although almost 300 specimens have been available to me for study, all of the range is by no means adequately represented, for over half of the specimens are from southeastern Arizona, and only 40 are from the larger part of the range in Mexico. For this reason some of my conclusions are to be deemed tentative.

Cope (1866, p. 310), noting that the nasals were entire in the 2 type specimens (only heads were available), placed *lepidus* in a new genus which he called *Aploaspis*; however, having later found this peculiarity to be inconsistent in the species, he abandoned the idea of a generic separation.

As a matter of fact, this nasal divergence from the rattlesnake normal is prevalent in *lepidus* to an important degree, although I should not consider it of generic weight. The only other species in which it is usual is *cerastes*. Unfortunately, in *lepidus*, the nasal union does not comprise a useful key character because of its relatively illegible nature. In this species, the pre- and postnasals are usually joined only at the top, above the nostril; a union below is rare indeed.* The point of junction at the top is quite narrow; and even under

* This is also true of *cerastes*.

considerable magnification it is not easy to tell with certainty whether or not there is a suture, particularly as there is often some creasing or a depression between the scales, even in the absence of a true suture. In an examination of about 100 specimens distributed throughout the range, each side of the head being checked at a magnification of about 20 times, I found the upper junction of the nasals to be as follows:

Smooth complete union	45 per cent
Some creasing	43 per cent
True sutures	12 per cent

It is to be regretted that this distinctive character in *lepidus* is not more clearly evident.

An outstanding characteristic of *lepidus* that may readily be determined, is the vertical splitting of the upper preocular, the anterior half being higher than the part next to the eye, and usually carried over the canthus in front of the supraoculars. This peculiarity is remarkably constant in *lepidus*; out of 279 specimens (558 counts), only 10 specimens with 18 counts (or 3.2 per cent) had undivided upper preoculars. Vertically split upper preoculars are common in *mittelli* and its subspecies, because of the tendency toward the division of various head scales in this species, and are occasionally noted in *triseriatus*, *aquilus*, and *pricei*, otherwise they are rare in *Crotalus* and in *Sistrurus* as well. Thus, the prevalence of this character in *lepidus* is diagnostically important.

The modal pattern in *lepidus* comprises a series of dorsal blotches or crossbands of red-brown, brown, or black on a brown, tan, gray, bluish-gray, or greenish-gray background. Between each pair of these dorsal blotches there are from 1 to 3 intermediate blotches, evidently once of equal importance with the primary series, but now exhibiting various degrees of obsolescence. In some districts the intermediates may be completely suppressed or are represented only by a few black-tipped scales; in others they are moderately evident; and in extreme instances may be so accentuated as to be virtually indistinguishable from the major series. Sometimes the intermediates may be as dark as the main series but are weakened by transverse interruptions, particularly on the middorsal line. Because of the suppressed intermediates, *lepidus* tends to have fewer dorsal blotches than most other rattlers.

Subspecific Segregation.—Gloyd (1936, p. 2) was the first to divide *lepidus* into subspecies. He described the new subspecies *klauberi*, differentiating it from *lepidus lepidus* based on the absence of a dark postocular stripe; a dorsal pattern strongly contrasting with the ground color and equally distinct throughout the snake's length; less evident intermediate blotches; and a lighter ventrum. Later (1940, pp. 22, 104) he added a criterion involving the occipital spots, which are usually merged in *klauberi*, but paired in *lepidus lepidus*.

The additional material that has been collected since *klauberi* was described has continued to validate this subspecific segregation, particularly in the northern part of the range. Tentatively taking Hudspeth County, Texas, as the

dividing area between the subspecies in the United States, we have the following distributions of two characters by specimens:

	Postocular dark streak	
	Strong to medium	Faint to absent
<i>C. l. lepidus</i>	55	2
<i>C. l. klauberi</i>	18	130
	Occipital spots	
	Divided	United
<i>C. l. lepidus</i>	40	9
<i>C. l. klauberi</i>	14	131

Of the significance of the differences demonstrated by these 4-fold tables there can be no question. The occipital spots comprise the more objective criterion, for any well-preserved specimen will supply a definite determination.* The postocular dark streak is less certain, for we must choose between all degrees of accentuation, from complete absence to a streak that is as sharply contrasted with the ground color as are the occipital blotches. Further interfering with the usefulness of this character is an ontogenetic variation, since the young of *klauberi* more often have streaks than the adults from the same area. The streaks are quite marked in embryos of *klauberi*.

The other characters are all valid to a considerable degree, but they do not lend themselves to statistical presentation. Typical *klauberi* from the Huachuca Mountains of Arizona differs widely from the most extreme *lepidus* as found in Terrell County, Texas. In the former there is a strong contrast between the dark blotches of the major dorsal series and the light ground color; the intermediate blotches are represented only by scattered dark scale tips, and the ventrum is but lightly mottled. The Texas specimens present a more mottled aspect. Instead of being sharply outlined, the major blotches are not well set off from the ground color; the intermediate blotches are often so strongly evident as not to be readily distinguishable from the primary series; and the ventrum is heavily mottled. But each subspecies shows both territorial and individual deviations from these extremes, so that not every individual can be classified with certainty. However, a summation of characters will, in most instances, serve to segregate the snakes of Arizona, New Mexico, extreme western Texas (El Paso County), Chihuahua, Durango, Nayarit, and Jalisco, from those of southwestern Texas (except El Paso County), Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí. Western San Luis Potosí and southeastern Zacatecas comprise an area of intergradation.

Summary of the Subspecies.—With this preliminary survey, I shall now proceed to discuss, separately, the characters of the two forms, the geographical

* Except specimens with a *palmeri* type of blotch obsolescence, as mentioned later.

variations and clines within each form, and the consistency of the differences between them. As the initial synonymy indicates, I shall begin with *Crotalus lepidus lepidus*.

Of this subspecies 87 specimens have been available to me, only 16 of which, however, are from Mexico, the rest emanating from Texas. The sexes are about equally represented.

The scale rows are 21(2), 23(70), 24(2), and 25(5). The ventrals in the males number 150 to 168, mean 161.7; and 149 to 168 in the females, mean 161.1. The subcaudals range from 22 to 29, mean 24.6, in the males; and 17 to 23, mean 19.6, in the females. The supralabials range from 10 to 14, but usually number 11 to 13, mean 12.1; and the infralabials 10 to 13, although only rarely 13, mean 11.2. The scales in the internasal-prefrontal area, although ranging from 6 to 16, rarely exceed 12; the mean is 9.4. The minimum scales between the supraoculars vary from 1 to 5; 3 is the prevalent number and the mean is 3.2. The rattle-fringe scales usually number 12, but may be 11 or 10.

The rostral is wider than high. The internasals are somewhat wider than long. The canthals are usually 1-1, but there may be 2 on each side; the anterior part of the split upper preocular, which curves over the canthus, often prevents a contact between the canthal and supraocular. The intercanthals are irregularly arranged, and the dividing line between the prefrontal and the frontal (intersupraocular) area is usually uneven and ill defined. The supraoculars are the largest of the head scales and are often conspicuously raised outwardly above the eyes. The anterior section of the nasal is larger than the posterior. The two sections are usually united above the nostril, rarely below. When not united below, the anterior may curve slightly under the postnasal. The postnasal may or may not touch the first supralabial; when it does, the contact is narrow. Above, it normally contacts both the internasal and canthal. The prefoveals generally number from 2 to 4, although there may be only one, or as many as 5 or more. The loreal is longer than high; it is shorter along its upper than lower edge. The lower preocular forms the upper border of the pit and contacts the loreal. The anterior subocular usually does not touch a labial; where it does, it may touch the fourth and fifth, or only the fourth. The posterior subocular does not contact the supralabials.

The largest *lepidus lepidus* that I have measured was 715 mm. long; it came from Jeff Davis County, Texas. However, a specimen from Culberson County, of which a part of the body is missing, must have been at least 770 mm. long, judging by the head and tail lengths. Both of these large specimens were males. The smallest specimen was 170 mm.

The regression lines representing the body proportionalities of this subspecies are approximately as follows:

Head length $H = .035L + 6.3$

Tail length, males $T = .086L + .1$

females $T = .073L - 1.1$

Width of proximal rattle $W = .018L - .44$

The hemipenes are of average rattlesnake shape. They show a sharp transition from spines to fringes, except bordering the sulcus where there are a few small spines intervening. The proximal fringes or reticulations are edged with many fine points. There are no spines in the crotch, except for tiny ones on the fringe edges.

Crotalus l. lepidus is, as I have stated, a mottled snake with two alternating series of dark-brown dorsal blotches or crossbands on a buff to grayish ground color. There is, first, a darker primary series; and secondly, from 1 to 3 intermediates, usually somewhat lighter and less definitely outlined, between each primary pair. Below there is a variable amount of mottling, from light to very heavy, usually more dense posteriorly. The head is heavily punctated, the only conspicuous marks being a postocular dark stripe on each side, passing above the angle of the mouth; and a pair of occipital blotches, often extended longitudinally. The tail is usually tan posteriorly, with blotches or rings becoming indistinct toward the rattle. The proximal lobe of the rattle matrix is generally buff or light-brown, often stippled or spotted with dark-brown. The matrices are lighter in young specimens.

The statistics of the primary body blotches or bands are as follows: range 13 to 24, but usually from 15 to 21, with an average of 18.6. The tail rings range from 3 to 5, average in the males 4.0, and 3.7 in the females. These tail figures are of minor value as the posterior fading of the tail rings renders many counts uncertain.

Relationships and Subspecific Variations.—At the species level, it is probable that *triseriatus* is the nearest living relative of *lepidus*. This is shown by various similarities in scalation, particularly the fact that the more southerly *lepidus* show the highest tendency toward undivided upper preoculars, and the northern *triseriatus*—*aquilus*—the highest tendency toward a *lepidus*-like division of these scales. The nasals in *triseriatus* are sometimes united above the nostril. The subocular-supralabial contacts, postnasal contacts above and below, and certain other resemblances are evident in the scalation of the two species. Occasionally specimens of the one form are distinctly reminiscent of the other in color and pattern. But with all of these likenesses, there is no area in which a real intergradation is indicated.

The relationship between *l. lepidus* and *l. klauberi* will be discussed under the latter subspecies.

As to intrasubspecific trends within *l. lepidus*, the following may be noted: There is a slight decrease in the number of ventrals and an increase in subcaudals from Texas southward into Mexico. Some increase in the number of

labials is also noted. The fact that the southerly specimens have a tendency to lose the characteristic split upper preocular has already been mentioned. Subocular contacts with the labials are more common to the southward.

The pattern variations found in *lepidus* in Texas are as follows, proceeding in a southeasterly direction:

Culberson County (1 specimen). This is completely mottled; the primary blotches are only slightly accentuated compared with the intermediates.

Jeff Davis County (6 specimens). The primary blotches are moderately clear and may be readily distinguished from the intermediates. The interblotch areas are much spotted and punctated; more so than in *klauberi* in El Paso County. But the intermediate blotches are not particularly strong and it is difficult to determine the number between each pair of primaries.

Presidio County (4 specimens). Although the primaries can be readily distinguished from the secondaries, the latter have become more even and accentuated; it may be observed that there are usually 3 intermediates between each pair of primaries. The occipital blotches are small and not very clear, but they are divided. The postocular dark streaks are strongly to moderately evident.

Brewster County (16 specimens). In this county there is much variation in pattern. Although none has clear interspaces like *klauberi*, some have the primaries quite strongly accentuated; but in others there is little difference in depth of color between primaries and intermediates, such difference as there is being accentuated posteriorly.

Terrell County (21 specimens). This population is much like the previous one. There are always plenty of intermediate maculations, but the major bands can be distinguished without difficulty, although none is clear like *klauberi*. Several specimens have only one intermediate band per interspace.

Valverde County (3 specimens). In one specimen the primary contrast is strong, in the others weak, owing to interblotch mottling.

Real County (1 specimen). A small specimen with considerable blotch contrast.

Altogether, in Texas there is so much variability within each county that pattern clines are not notable. Probably the reduced emphasis of the primary blotches, compared to the intermediates, is most evident in Brewster County.

With regard to squamation, the following trends have been noted: The southeasterly specimens have smaller and more rugose scales on the head, the canthals being less often flat and enlarged; the postnasal more often contacts the first supralabial; the rattle-fringe scales are more often 12, rather than 10; and subocular contacts with the supralabials are rarer.

The available Mexican material assignable to the subspecies *lepidus* is relatively meagre and from widely scattered places. Without doubt it represents several isolated populations; and were adequate numbers of specimens available so that one might be sure that the differences observed represent group,

rather than individual, idiosyncrasies, it is probable that at least two additional subspecies could be defined. The differences are such that geographical groups must be dealt with separately. These I shall treat starting in the north and working southward.

First, there are four specimens (Chi. Acad. 10503-5, KU 28089) from the Sierra del Carmen in northern Coahuila. These do not differ essentially from *lepidus* as found across the Rio Grande in Texas. All 4 are relatively dark and considerably mottled, with intermediate blotches quite evident. The differences between primaries and intermediates become more marked posteriorly. The tails are gray, rather than pink. The occipital blotches are divided and the postocular streaks are in evidence.

From Monclova, in east-central Coahuila, we have the type specimen of Garman's *palmeri* (MCZ 4578) and from the nearby Sierra de Gloria, 2 more recent specimens (CNHM 47095-6). Garman's type, which he originally described as a subspecies of *tigris*, is peculiar in that the anterior dark marks are virtually obsolete; thus it is not possible to determine whether the postocular and occipital marks favor *lepidus* or *klauberi*. Of the two new Gloria specimens, the larger is like the type of *palmeri*, in that the first several blotches, including the occipitals, are completely suppressed. Postocular streaks are faintly evident. Intermediates are absent. The ventrum is mottled. The other Gloria specimen is smaller and darker. It is mottled in a typical *lepidus* manner; the blotches are evident anteriorly, including the occipitals, which are divided. The postocular dark streaks are moderately distinct.

One other specimen shows *palmeri* tendencies. This is UI 22812 from 15 miles north of Escalón in the southeast corner of Chihuahua, about 175 miles to the west of the Monclova and Gloria specimens. The dorsal blotches are everywhere faint, but especially toward the head. The occipital spots are divided and postocular streaks are evident. Intermediates are faintly represented as clouds of gray punctations.

From these 4 specimens I should conclude that *palmeri* is nearer *l. lepidus* than *klauberi*, as shown by the divided occipital blotches when they are present at all. The same conclusion would be reached from geographical considerations. Should additional specimens from this area show consistency in the *palmeri* character of obsolete anterior blotches—a condition not noted in either *lepidus* or *klauberi*—then I should recommend recognition of *palmeri* as a subspecies, although I do not do so now, in view of the present inadequate material. If *palmeri* is found to range across central Coahuila to include the Escalón area, it may involve intergradation with *klauberi*, although several of the latter from the vicinity of Santa Barbara in southern Chihuahua do not exhibit any *palmeri* tendencies.

Proceeding southward, the next area from which specimens of *lepidus* are available is Ojo de Agua in south-central Nuevo León. These (CNHM 30851-3) clearly represent a stunted race. One specimen only 405 mm. long has an incomplete string of 9 parallel rattles 7 mm. wide. Another adult is not quite so extreme. Postocular dark stripes and divided occipital blotches are evident in all 3 specimens, thus showing that they should be allocated to *lepidus*,

as would be expected from the geographical pattern. The dorsal interspaces are clear, as in *klauberi*. Lateral spots, matching the main series, but not merging therewith until the tail is reached, are usually conspicuous. The ventrums are quite dark.

From southern Tamaulipas 2 specimens (MZUM 101376 and 101559) taken in the vicinity of Gómez Farías are at hand. One of these is an adult, the other a juvenile. Both are extremely dark, both dorsally and ventrally, being matched in this character by only one other specimen in the entire *lepidus* complex, this being USNM 46333 from the opposite side of Mexico in Nayarit. In these Tamaulipas specimens the postocular stripes are prominent and the occipital blotches divided. In the adult the main blotches are but little darker than the ground color, which is very dark; in the juvenile there is a good contrast, one intermediate per interspace being also evident. These two specimens have the highest primary blotch counts (28 and 29) of any *lepidus*. They are the most southeasterly *lepidus* that have been found to date; and should others from the same vicinity maintain the dark colors and high blotch records, a subspecific segregation would be justified.*

*While this paper was in press I received for examination, through the courtesy of Norman Hartweg, Charles F. Walker, and William E. Duellman, two additional specimens of *lepidus* from the mountains to the northwest of Gómez Farías, Tamaulipas. These bring the specimens from this area to a total of four; and as the new specimens substantiate the differences previously noted, I shall describe these Tamaulipan snakes as a new subspecies, in this condensed footnote.

***Crotalus lepidus morulus* subsp. nov.**

TAMAULIPAN ROCK RATTLESNAKE

Differential Diagnosis.—A subspecies of *C. lepidus* differing from the other subspecies, *lepidus* and *klauberi*, in being of a darker color (particularly accentuated in juveniles) and in having a higher number of primary body blotches. These range from 28 to 34 in *morulus*, while the range in *klauberi* is 13 to 21, and in *lepidus lepidus* 13 to 24. Of the latter there are 3 specimens with 24, and it is no doubt significant that all three are from the *lepidus* areas nearest to the type locality of *morulus*. The next highest *lepidus* has 22 body blotches. *C. l. morulus* also probably has a higher percentage of undivided upper preoculars and unfused nasals than the other two subspecies.

Type Series.—Holotype: MZUM 101376, an adult female, collected 10 miles northwest of Gómez Farías on the trail to La Joya de Salas, Tamaulipas, Mexico, at an altitude of about 5300 ft., in a forested flat, by Frank Harrison. There are 3 paratypes, all from the same vicinity in Tamaulipas: MZUM 101559, a juvenile male, Rancho Viejo, about 5 miles west of Gómez Farías, at 4000 ft.; and MZUM 104306, an adult female, and 104307, a juvenile female, both from near La Joya de Salas.

Description of the Type Series.—Size: max. 535 mm., min. 225 mm. Scale rows 23; ventrals, male 161, females 161, 167, 171; subcaudals, male 30, females 20, 21, 25; supralabials, 12–14; infralabials, 12–13; scales in internasal-prefrontal area 8–12; loreals 1 or 2; prefoveals 2–5; only 2 out of 8 upper preoculars divided; all nasals divided, above and below; no suboculars in contact with the labials; rattle fringe scales 9 or 10. Primary body blotches 28, 29, 34, 34. The blotches are wider than long; there are single intermediates between each pair of primaries; in the juveniles it is difficult to distinguish the posterior primaries from the intermediates, but in the adults the intermediates largely disappear. The juveniles are very dark, both above and below, with black dorsal blotches on gray backgrounds that are heavily mottled by the intermediates. The adults are slate-gray to dark slate-gray with dark-brown blotches. The postocular stripes are very dark; the occipital blotches are paired.

C. l. morulus comprises the most southeasterly population of *lepidus* yet discovered; its segregation is geographically logical.

Turning inland to northwestern San Luis Potosí, we have two specimens, MZUM 77261 from Charcas and LSUMZ 2438 from Cerro Peñon Blanco at 9600 feet altitude. In the Charcas specimen, which is a juvenile, the intermediates are clear but readily distinguishable from the primaries. The postocular stripe is sharp and the occipital blotches divided. I should refer this specimen to *lepidus*. The other, an adult, said to have been bright-green in life, but now blue-gray, exhibits *klauberi* tendencies, and is to be considered an intergrade. The main blotches are unusually long middorsally, covering almost as much space as the interspaces. Intermediates are virtually absent. The occipital blotches are narrowly united at their centers; the postocular streaks are moderately evident, being particularly dark along their upper edges. The upper preoculars are undivided.

The Paris Natural History Museum has 3 specimens (01-314, 01-315, 01-316) collected by Diguët at or near Real de Pinos in the southeasterly corner of Zacatecas. Dr. Jean Guibé has kindly furnished me with considerable information respecting these specimens. The primary blotches are brown on a blue-gray ground color; there are no intermediates. One specimen has indistinct postocular streaks and confluent occipital blotches, thus resembling *klauberi*; the other two have strong postocular streaks and divided occipital blotches like *lepidus*. Thus, assuming that all 3 were collected at Real de Pinos, we would consider this an area of intergradation between *klauberi* and *lepidus*, a conclusion quite consistent with the allocation of other specimens in this part of Mexico.

It should be recorded that these 3 Paris specimens, all of which are females, are low in ventrals (149, 150, 151), a tendency consistent in all *lepidus*, *klauberi*, or intergrades found in Jalisco, southern Zacatecas, or northwestern San Luis Potosí.

***Crotalus lepidus klauberi* Gloyd**

BANDED ROCK RATTLESNAKE

Figure 4.

- 1883. *Crotalus lepidus* (part) Cope, Proc. Acad. Nat. Sci. Phila., vol. 35, p. 13
- 1936. *Crotalus lepidus klauberi* Gloyd, Occ. Papers Mus. Zoöl. Univ. Mich., no. 337, p. 2
- 1944. *Crotalus semicornutus* Taylor, Univ. Kans. Sci. Bull., vol. 30, pt. 1, no. 4, p. 52

This outline of this subspecies is based on a survey of 209 specimens, 14 from New Mexico, 6 from El Paso County, Texas, 24 from Mexico, and the rest from Arizona, mostly from the Huachuca Mountains

Summary of the Subspecies.—The principal statistics of *klauberi* are as follows: Scale rows at mid-body 21(3), 22(4), 23(187), 24(2), 25(2). Ventrals, males 152 to 172, mean 161.7; females 155 to 170, mean 162.1. Sub-

caudals, males 20 to 29, mean 24.6; females 16 to 24, mean 19.9. Supralabials 10 to 14, usually 11, 12, or 13, mean 11.9; infralabials 9 to 13, usually 10, 11, or 12, mean 11.3. The scales in the internasal-prefrontal area range from 5 to 13 but usually number 7, 8, or 9; the mean is 8.2. The minimum intersupraoculars number 1 to 4, most often 3, mean 2.7. Every specimen examined from the United States had split upper preoculars. The rattle fringe scales usually number 12 but there may be 11 or 10. The primary body blotches range from 13 to 21 with a mean of 17.3. The tail rings vary from 1 to 6 in the males, mean 3.1, and 1 to 4 in the females, mean 2.4. However, these last counts are not of importance as the posterior tail marks are often faint and uncertain.

These numerical statistics give the essential data on the squamation of *klauberi*, for the scale arrangements and contacts already described under *lepidus*, are, with few exceptions, equally applicable to the westerly subspecies. In *klauberi* the prenasal curves under the postnasal more often and more distinctly than is the case in *lepidus*, so that the posterior point of the prenasal contacts one of the prefoveals. As a result, there is less often a contact between the postnasal and the first supralabial in *klauberi* than in *lepidus*. Contacts between the anterior subocular and the supralabials (usually the fourth and fifth) are more frequent in *klauberi* than in *lepidus*, although, in the latter, contacts are relatively frequent in specimens from Brewster County, Texas. The discrepancy in size between the smaller, posterior part of the divided upper preocular and the larger, anterior part that curves over the canthus, is greater in Texas *lepidus* than in Arizona *klauberi*. The scales on the crown are slightly more subdivided in *lepidus* than in *klauberi*.

The largest available specimen of *klauberi* is a male 828 mm. in length. This is from El Oro Mesa near Santa Barbara, Chihuahua, altitude 7000 feet. This snake does not grow so large in Arizona, for the maximum in a more numerous series from that state measured only 625 mm. The smallest specimen from any area was 166 mm.

The regression equations of the body proportions of *klauberi* are approximately as follows:

Head length	$H = .034L + 6.6$
Tail length, males	$T = .081L + .8$
females	$T = .065L + .7$
Width of proximal rattle	$W = .015L + .48$

The *klauberi* hemipenes are characterized by the presence on the fringes of the reticulations of many tiny points. These are particularly evident in the crotch and along the sulcus. These points have the effect of reducing the suddenness of the transition between the spines and reticulations. Except for the points on the reticulations, there are no spines or points in the crotch.

There are slight differences in body proportionality between *klauberi* and *lepidus*. The latter has a slightly longer tail and a somewhat larger rattle. It may be mentioned that both subspecies have robust rattles; they are not suppressed as in some other Mexican mountain forms, particularly *triseriatus* and *pusillus*. The average dorso-ventral widths of the first 6 rattles of Arizona *klauberi* are 3.48, 4.25, 5.11, 5.85, 6.46, and 7.05 mm. The corresponding dimensions of the rattles of Texas *lepidus* are 3.93, 4.76, 5.66, 6.51, 7.20, and 7.74.

Subspecific Trends and Comparisons.—I have already mentioned the more noticeable differences in pattern between *klauberi* and *l. lepidus*: the clearer pattern of the former, with a sharper contrast between primary blotches and ground color; the suppression of intermediate blotches so that only dark scale tips remain; the reduction in ventral maculations; the merging of the occipital blotches; and, finally, the absence, or virtual absence, of the postocular dark streaks in *klauberi*.

Within *klauberi* there are pattern differences, just as there are in the Texas *lepidus*. The most extreme *klauberi* pattern—that is, extreme in its differentiation from *lepidus*—is found in the closest rather than the area most distant from the Texas range of *lepidus*. For it is in El Paso County, Texas, and in adjacent southwestern New Mexico, that the most perfectly patterned *klauberi* occur. They have a buff, tan, or light-brown background, instead of gray-blue or gray-green as in Arizona, and the dorsal blotches are darker (quite black in some specimens) than is the case in Arizona, where the blotches are red-brown or dark-brown. Also in the El Paso-New Mexico specimens the intermediate blotches are almost entirely suppressed. From these territorial trends, it appears doubtful that intergradation between *klauberi* and *lepidus* occurs in Hudspeth County, Texas, or adjacent Chihuahua. Rather, it probably occurs only at the southerly ends of their parallel ranges, that is, in western Zacatecas and northwestern San Luis Potosí.

Crotalus l. klauberi is a common snake in the Huachuca Mountains, and as these mountains comprise an interesting faunal area which many naturalists have visited, more than half of all the specimens of the species *lepidus* available for study have come from the Huachucas.

The snakes of this area are usually gray-blue when preserved, but they are often distinctly greenish in life and may be bright-green middorsally, particularly the light scales that alternate with dark to form an anterior border of denticulations of each primary dorsal blotch. The blotches are usually dark-brown with edges almost black. Their centers are punctated.

The anterior blotches are rather narrow, being about 7 scale rows wide. They are usually subcircular or ovoid. Sometimes there are matching series of laterals. At mid-body the blotches usually widen to 9 to 13 rows with pointed lateral ends. Posteriorly they usually merge with the lateral series, becoming crossbands. There is a considerable individual variation in the point

where the blotches become bands; I have noted it in from 3 to 15 blotches behind the head. The blotches are usually about 2 to 3 scales long, end-to-end, at mid-body, and the interspaces about 5 to 8.

The intermediates are usually represented by black scale tips, but in some specimens there is considerable mottling between the primaries. This is particularly true of the younger snakes. The postocular dark streaks are also more likely to be evident in the young, especially where they pass above the angle of the mouth. Ordinarily it is impossible to determine the number of suppressed intermediates between pairs of primaries, but occasionally they can be counted in young specimens.

The color below is buff to pink, with some punctations, particularly along the ventral sutures, and laterally.

The tail is usually pink to terra cotta, somewhat lighter below. The dark tail rings usually cross the ventrum, which is never true of the body blotches; however, they are often faint posteriorly. In the young the tails are bright yellow.

The rattle matrix is clear cream in the young, and reddish or terra cotta in the adults. Dark-brown dots or clusters of punctations sometimes mark the anterior lobe, although not so often as in Texas *lepidus*.

In the Chiricahua Mountains of southeastern Arizona, *klauberi* is not the most plentiful species, as it is in the Huachucas, for in the Chiricahuas *pricei* far outnumbers *klauberi*, while exactly the reverse relationship exists in the Huachucas.

The two mountain populations of *klauberi* do not interbreed, as they are separated by a desert in which these montane snakes cannot live. Thus the two populations have developed some differences. Compared with the Huachuca snakes, those from the Chiricahuas are more mottled with stronger intermediates. There are usually 3 intermediates per pair of primaries. The anterior blotch denticulations are not only evident in the primaries but in the intermediates as well. The ventrums are more mottled. The primaries are usually about 3 scales long end-to-end, and 11 rows wide; the interspaces measure from 8 to 9 scales end-to-end. The postocular dark streaks are more evident than in the Huachuca specimens; the occipitals are usually joined, although in some specimens only narrowly at their centers. Thus the Chiricahua population shows more *lepidus* tendencies than either the snakes of New Mexico to the east or those of the Huachucas to the southwest.

The Mexican specimens of *klauberi* do not exhibit as wide a diversity of color and pattern as is found in *lepidus*, probably because their range, southeasterly along the Sierra Madre Occidental may not be interrupted, as is the case with *lepidus*. However, there are some variations and an occasional aberrant specimen.

In northwestern Chihuahua, from such points as the San Blas Mountains, Lake Santa María, Corralitos, Río Gavilan near Pacheco, and El Valle, the

snakes usually have the blue-gray color of Arizona *klauberi*, although they are more like the New Mexican snakes in the virtual suppression of intermediates, even black scale tips being rare in adults.

A series (AMNH 67732, 68189-91, 68267-8), from the vicinity of Santa Barbara and San Francisco del Oro in extreme southern Chihuahua, while much more like *klauberi* than *lepidus*, do evidence some trends toward the latter, particularly in young specimens. One young specimen has the black scale tips exaggerated into intermediates reminiscent of young Texas snakes; another, about half grown, has much punctated mottling between primaries. The adults, however, have ground colors of punctated blue-gray, with only scattered black scale tips as remnants of the suppressed intermediates. Blotch denticulations are evident. The occipital blotches are sometimes separated and sometimes united medianly; the postocular dark streaks are faintly in evidence. These specimens do not exhibit anterior blotch fading of the *palmeri* type, as is found in the specimen from near Escalón, in extreme southeastern Chihuahua, as already discussed under *lepidus*.

From southwestern Chihuahua (near Mojarachic) comes the type of Taylor's *Crotalus semicornutus*. I do not find in this sufficient differences from other specimens of *klauberi* to warrant even a subspecific segregation. The upper preoculars are divided in the usual *lepidus* manner. The postocular streaks are evident (a *lepidus* character) but the occipital blotches are joined, thus resembling *klauberi*, as would be expected from the location of Mojarachic. The narrowness of the primaries and the middorsal gaps in the intermediates, while somewhat unusual, are by no means unique; I have seen similar variations in both Arizona and Mexican specimens. With regard to the lateral protrusion of the supraoculars, to which Taylor has called attention, this also is subject to variation in *lepidus* from all areas. Several Arizona specimens have notably overhanging supraoculars; indeed, this character is somewhat influenced by the conditions of preservation.

Specimens available from western Durango continue, but do not accentuate, the variability of the Mexican *klauberi* material. The most notable of the Mexican specimens of *klauberi* is USNM 46333 from Santa Teresa, Tepic (Nayarit). This specimen is referred to *klauberi* only by reason of geography, for by every test it keys out as *lepidus*. It is very dark in color, with little contrast between the primaries and ground color; the ventrum is heavily mottled; the postocular streaks are strongly accentuated. Only in the union of the occipital blotches is *klauberi* suggested. In every character* this snake closely resembles the very dark *lepidus* from near Gómez Farías in Tamaulipas, yet populations of unexceptional *klauberi* characteristics, and *klauberi-lepidus* intergrades occupy the territories between these two localities.

Several specimens are available from Southern Zacatecas and northwestern Jalisco. Superficially these are typical *klauberi*, with light blue-gray backgrounds, and with intermediates absent or represented by black scale tips. The occi-

* Except that it has only 21 primary blotches, while the minimum in *morulus* is 28.

pital blotches are entire in all but one specimen; while the postocular streaks also tend toward *klauberi*, they are strongly accented in one specimen. The mottling below is moderate. The tails of these specimens are yellowish, rather than reddish, as in most northerly *klauberi*.

The Paris Museum has a specimen sent in from Guadalajara, the most southernly point from which the species *lepidus* has yet been reported. The postocular streak is present, but the occipital blotches are united.

The snakes from the southern end of the *klauberi* and *lepidus* ranges, that is, those from southern Zacatecas, northern Jalisco, and western San Luis Potosí, not only indicate intergradation between *lepidus* and *klauberi* because of character interweaving, but likewise they have coincident character differences from the northern populations of either subspecies, in that they have low ventral counts, their rattles are somewhat smaller, the rattle-fringe scales are more often 10 than 12, and the proportion of undivided upper preoculars is high. Thus I conclude that the two subspecies intergrade at the southern limits of their respective ranges. Intergradation elsewhere is possible, but not demonstrated by the material now available.

THE NORTH AMERICAN SUBSPECIES OF *CROTALUS DURISSUS*

Outstanding Durissus Characters.—In its most typical form, *Crotalus durissus*, the Neotropical rattlesnake, is a striking creature with salient characters differentiating it from all other rattlers excepting its own subspecies. Most notable is a sharp vertebral ridge, which is accentuated by being sheathed with scales that are extremely rough. The roughness is caused by raised bosses or tuberculations on each side of the scale keels. This rough vertebral ridge is especially evident in live adults, and cannot but be instantly noted by anyone accustomed to such Nearctic species as *adamanteus*, *atrox*, *viridis*, and *horridus*.

Another consistent peculiarity of the Neotropical rattlesnake is the rattle itself, which, in the *durissus* subspecies, has a different growth rate from that of any other rattlers except the related forms *basiliscus* and *enyo*. It is characteristic of *durissus* that the rattle begins with a relatively small button, compared with that of other rattlesnakes of equal size; but as successive segments are added they reach a size commensurate with the size of the snake. If all rattlesnakes had unbroken strings of rattles, it would be quite easy to identify *durissus* and its relatives by rattle measurements alone.

Although our knowledge of the differences between the venoms of the several species of rattlesnakes is, as yet, quite limited, there is considerable evidence that the venom of *durissus* is different from that of the Nearctic species in being definitely more neurotoxic. It is not known whether this difference is carried into *basiliscus* and *enyo*.

Another distinguishing characteristic of the species *durissus*, except in the subspecies *totonacus*, is the almost universal presence of a pair of dark longitudinal stripes on the neck, extending from 1 to 4 head-lengths behind the head. Although an occasional aberrant specimen of other species may have

longitudinal stripes, *durissus* is the only rattlesnake in which stripes comprise a part of the normal pattern. In *totonacus* the neck stripes of *durissus* have been modified into a single dark band, irregularly streaked with light scales.

The hemipenes of the *durissus* complex differ from those of other rattlesnakes in being more tapering. The distal shaft is thinner and more tapering, in comparison with the dimensions of the spinous base, than is the case in other species.

Crotalus durissus is a snake having a very extensive, although discontinuous, range, from central Mexico to central Argentina. Notwithstanding this wide distribution, it is found to be rather constant in squamation, so that sub-specific segregations must, to a considerable extent, be premised on color and pattern. In this connection it may be well to point out certain homologies in the pattern details of the striped and blotched sections of the *durissus* pattern. These are: (1) the central dorsal stripe corresponds to the light center of a blotch; (2) the paravertebral dark lines are equivalent to the inner dark borders of the blotches; (3) the single light scale row bordering the dark paravertebrals laterally corresponds to the exterior light scale row edging each blotch; and, finally, (4) the color lateral to the light scale row in the longitudinal section corresponds to the ground color in the lateral angles between blotches. Occasionally a fifth homology is evident; this is a low lateral dark stripe on the neck corresponding to the dark lateral secondary spots below the dorsal blotches, or the dark spots that are sometimes found in the upper lateral interspaces.

Comparing the most northerly *durissus* from Mexico with the most southerly from Brazil and Argentina, we find that in the former there is little difference between (2) and (4), and therefore between (2) and (3). On the contrary, in the southern specimens there is little difference between (2) and (4), but (3) is markedly differentiated from either.

Material.—Of North American *durissus* material (exclusive of *totonacus*) I had specimens available as shown in the following table of origins:

Michoacán	17
Guerrero	21
Morelos	2
Distrito Federal (?)	1
Veracruz	4
Oaxaca	23
Yucatán	18
Campeche	5
Tabasco	1
Chiapas	9

Guatemala	20
El Salvador	1
Honduras	63
Nicaragua	4
Costa Rica	10
	—
Total	199

The material has been only moderately adequate. The very size of the snake has proved a handicap to proper preservation, many specimens being poorly preserved, or represented by skins, with or without the head attached. Some of the localities cited are of doubtful accuracy; and there are gaps in the range which may be real or the result of lack of collecting. *Crotalus durissus* is rightly feared by the natives everywhere.

In the present paper I shall treat only the North American forms of *durissus*. They are separated from the South American by an extensive gap at Panamá.

Nomenclatorial Problems.—Initially there are some problems of nomenclature to be resolved, in order to determine the names available for the three subspecies that may be recognized.* These center in (1) the northern part of Yucatán Peninsula; (2) Michoacán, Guerrero, and Morelos; and (3) Chiapas, southern Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica. The snakes of southern Oaxaca are to be considered intergrades between (2) and (3), and those of Tabasco and northern Guatemala (Petén) intergrades between (1) and (3). A small series of 4 specimens from central Veracruz are left in an uncertain status; in character they are somewhat nearer (3) than the others.

The nomenclatorial uncertainties involved in the application of the Linnean names *horridus*, *dryinas*, and *durissus* have been discussed elsewhere† by the present writer and will not be here repeated. Unless some of Linné's types, which have been lost, should unexpectedly be found and prove a change necessary, the name *durissus* should, in the interest of disturbing present nomenclatorial usages as little as possible, be assigned to the subspecies (of the three newly segregated) that occupies the greatest area. This is no. 3 of those above listed—the one occupying extreme southeastern Mexico and Central America. I do not consider the Smith-Taylor (1950, p. 348) assignment of Jalapa, Veracruz, as the type locality of *C. d. durissus* to be a good choice since Veracruz is on the extreme border of the range and is not ecologically typical. The Veracruz population shows differences from that of any other area, and acceptance of this type locality might result in the application of the

* Neglecting, for the moment, the valid subspecies *C. d. totonacus*.

† Bull. Zoöl. Soc. San Diego, no. 17, pp. 81–95, 1941; Copeia no. 1 of 1948, pp. 1–3.

long-used name *durissus* to a population of very limited range, for the availability of additional specimens from Veracruz in the future may indicate the desirability of a nomenclatorial segregation of this population from the rest.

Since no prior name is available for either, I propose to assign new names to the other two populations that I am segregating at this time—*C. d. culminatus* to the northwestern subspecies in Michoacán, Guerrero, and Morelos; and *C. d. tzabcan* to the subspecies of the Yucatán Peninsula.

Crotalus simus Latreille, 1802, because of its inaccurate type locality (Ceylon), and the lack of description beyond the citation of a figure in Seba, carries no indication that it applies to either of the two new subspecies. *Crotalus pulvis* Ditmars, 1905, has a Nicaraguan type locality, and must be placed in the synonymy of *C. d. durissus*, or, more appropriately, in that of *C. unicolor* for reasons given by Gloyd (1940, p. 141), in addition to which it may be pointed out that the ventral counts of the type are too low for a North American *durissus*. *Crotalus terrificus copeanus* Amaral, 1937, is a *nomen nudum* for technical reasons (Rules, art. 25,c), although now established as a synonym of *durissus durissus* by Gloyd, 1940, p. 123.

I shall now proceed to a discussion of the North American subspecies, beginning with *durissus durissus*.

***Crotalus durissus durissus* Linné**

CENTRAL AMERICAN RATTLESNAKE

Figure 5.

- 1758. *Crotalus durissus* Linné, Syst. Nat., ed. 10, p. 214
- 1784. *Crotalus horridus** Daubenton, Anim. Quad. Ovip. Serp., Encyl. Méthod., p. 593
- 1802. *Crotalus simus* Latreille, in Soninni and Latreille, Hist. Nat. Rept., vol. 3, p. 202; vol. 4, p. 323
- 1867. *Crotalus terrificus* (part) Cope, Proc. Acad. Nat. Sci. Phila., vol. 18, no. 4, p. 308
- 1905. ? *Crotalus pulvis* Ditmars, Ninth Ann. Rept. N.Y. Zoöl. Soc., p. 199†
- 1929. *Crotalus terrificus durissus* (part) Amaral, Bull. Antivenin Inst. Amer., vol. 3, no. 1, p. 5
- 1936. *Crotalus durissus durissus* Klauber, Occ. Papers San Diego Soc. Nat. Hist., no. 1, p. 4

* During the period 1784 to about 1850 the name *horridus* was frequently used for the rattlesnakes now known as *C. d. durissus* and *C. d. terrificus* (see Klauber, 1941, p. 81).

† Although *Crotalus pulvis* Ditmars, 1905, was given a Nicaraguan type locality, it is probable that the type actually came from Aruba Island, and therefore it should be placed in the synonymy of *Crotalus unicolor* van Lidth de Jeude, 1887.

6.6. The first, and the fourth or fifth supralabials are conspicuously enlarged. The lacunals touch the supralabials in 25 per cent of the specimens; in the rest a row of subfoveals is interposed. The loreals vary from 1 to 6, with an average of 3.2. The extra scales (where there are more than 2 loreals) comprise postsupraloreals interposed between the canthals and upper preoculars. Canthal-preocular contacts are made in only 15 per cent of the counts. The upper preocular is undivided; the lower is crescentic and contacts the lower loreal. The scales on top of the head are strongly keeled in the parietal and occipital regions. There are 4 or 5 scales between the bottom edge of the orbit and the lip, with 5 predominating.

Divided first infralabials are present in 2 per cent of the counts. Inter-genials or submentals are rarely noted.

C. d. durissus is not as brightly patterned as the other North American subspecies, for there is less contrast between the blotches and interspaces. The blotches are lighter and the interspaces darker than in the more northerly and westerly subspecies.

The most conspicuous head marks are the two forward extensions of the brown paravertebral stripes on the neck, which nearly always reach the posterior ends of the supraoculars and intersupraoculars without interruption. These stripes are more irregular on the head than on the neck; they vary from 3 to 5 scales in width and often their centers are lighter than their lateral borders. The middorsal light stripe that separates them is also irregular on the head, ranging from 3 to 7 scale rows in width; it is widest in the parietal region. There is a dark crossbar engaging the front of each supraocular and the back half of each canthal; these bars are often interrupted middorsally. Thus the supraoculars are dark anteriorly and posteriorly, but their centers are light, forming a wide light crossband. Outwardly divergent dark parietal streaks are represented in this subspecies by scattered dark scales. Postocular dark streaks to the angle of the mouth are usually present, but they are lighter than the dark marks on the top of the head. The sides of the head, with the exception of the supralabials, are often punctated with gray. Punctations may also be present on the mental and first infralabials, but the underside of the head is mostly unmarked, cream or buff.

The body pattern of *durissus durissus* comprises a pair of brown paravertebral stripes on the neck, followed by dorsal diamonds. The neck stripes extend from 1 to 4 head-lengths behind the head; in the majority of specimens between 2 and 2½ head-lengths. They are nearly always separated by a light middorsal band 3 scale rows wide. The paravertebral stripes usually comprise 2 contiguous dark scale rows; however, they are often 3 rows wide anteriorly, in which case the middle of the 3 is generally lighter than the others. The vertebral lines are usually bounded below by a single row of buff scales, often in some contrast with the slightly darker color below.

Behind the parallel lines on the neck, the dorsal pattern comprises a series of brown or red-brown diamonds. These number from 20 to 30 with a mean

of 24.5. In some specimens, particularly adults, the contrast between the posterior blotches and the ground color is insufficient to permit accurate counting. The diamonds usually have somewhat lighter centers than edges. They are about 11 to 13 scale rows wide at mid-body, and 4 to 6 scales long end-to-end. The anterior points are sometimes truncated. Middorsally they are separated from each other by 1 or 2 light scales.

Outwardly the dark dorsal diamonds are edged with a single row of buff or cream-colored scales. The lateral areas between these light rows are light-brown or gray-brown, often in noticeable contrast with the darker blotches.

Laterally there is a series of subsidiary blotches just below the points of the main series on either side; this is comprised of groups of about 4 unicolor dark scales, often bordered with a light row. These spots are just above the ventrals. Posteriorly they may merge with the dorsal blotches to form cross-bands. Between and slightly below the pairs of the secondary series there are usually the members of a tertiary lighter and less definite series, engaging the outer edges of the ventrals.

The ventrum is cream or buff, growing somewhat darker toward the tail, and with increasing punctations marking the outer anterior edge of each ventral scute.

The tail is gray, uniformly punctated and somewhat darker above than below. Crossrings are evident in the juveniles. The proximal rattle matrix is buff in the young specimens, becoming gray with age.

As the snakes of this subspecies mature, the pattern becomes less accentuated, for the lateral areas darken and the blotches become lighter.

Intraspecific Variation.—As here defined, *Crotalus durissus durissus* occurs in central Veracruz, Chiapas, central and southern Guatemala, El Salvador, western and southern Honduras, southwestern Nicaragua, and northwestern and central Costa Rica. While most of Mexico is occupied by many sympatric species of rattlesnakes, none but *durissus* derivatives are known from anywhere in Mexico east or south of the Isthmus of Tehuantepec, or in Central or South America.

Crotalus durissus totonacus, and the two new subspecies, *C. d. culminatus* and *C. d. tzabcan*, will be discussed below, at which point their relationships with *durissus durissus* will also be outlined.

From Veracruz but 4 specimens are available, and these are only tentatively assigned to the subspecies *durissus durissus*. At least they resemble the typical subspecies more than either *culminatus* or *tzabcan*, however peculiar the resulting geographical pattern may appear. Like *durissus durissus*, they are low in ventrals. The scales on the head are not subdivided as in *culminatus*, and the undivided first infralabials segregate them from *tzabcan*. The paravertebral stripes are 3 scale rows wide, another difference from *culminatus*. Their blotches are brown, like those of *durissus durissus*, a divergence from

culminatus or *tzabcan*, whose blotches are black or nearly black. The Veracruz specimens are characterized by heavily pigmented interspaces, resembling the snakes of northern South America in this character. They are somewhat shorter-tailed than the other *durissus durissus*. Despite what might be expected from geographical considerations, the Veracruz specimens show no tendency toward *totonacus*; in fact, divergent trends are evident in scale rows, ventrals, and pattern.

We must await more material from Puebla and northern Oaxaca to determine whether the Veracruz population, which is now known only from the Jalapa-Orizaba area, is as isolated as it appears. Some day it may be shown to be subspecifically distinct from the snakes of Chiapas and Central America, but for the present it will be allocated to *durissus durissus*.

A single specimen recorded from Distrito Federal is left unassigned as I do not have full data on it, and the locality is to be considered uncertain.

With the exception of the Veracruz specimens, I find no territorial clines in squamation in the *durissus durissus* population. From Chiapas toward Costa Rica there is a reduction in the degree of contrast between blotches and interspaces, as might be expected from the differences between the extreme populations in Mexico and South America.

There is a land distance of about 500 miles between the most southeasterly known colony of *durissus* in North America (vicinity of Cartago, Costa Rica) and the nearest Colombian populations in South America (near Tenerife or Honda).

It is to be doubted that this gap will be greatly narrowed by more thorough collecting. Dr. E. R. Dunn, who is most familiar with the herpetology of the intervening territory, states that there are persistent rumors of rattlesnakes in the vicinity of Chiriqui Volcano and Cerro Santiago in western Panamá, although no specimens are yet available in collections. But even though the presence of rattlesnakes in western Panamá may eventually be verified, past extensive collecting in many other sections of the Isthmus quite rule out any expectation of an existing contact between the Central and South American populations.

***Crotalus durissus culminatus** subsp. nov.**

NORTHWESTERN NEOTROPICAL RATTLESNAKE

1895. *Crotalus horridus*† (part) Günther, Biol. Cent.-Amer., Reptilia and Batrachia, p. 194
1896. *Crotalus terrificus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 573

* *Culminatus*, Latin: having a ridge; referring to the accentuated vertebral process.

† See footnote p. 61.

1936. *Crotalus durissus durissus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 190

Type Specimen.—No. 5224 in the collection of E. H. Taylor. Collected by E. H. Taylor and H. M. Smith at El Sabino near Uruapan, Michoacán, Mexico in 1936.

Differential Diagnosis.—A rattlesnake belonging to the species *Crotalus durissus*, characterized, as are the other *durissus* subspecies, by a prominent vertebral process and conspicuous scale tuberculations. From the other *durissus* subspecies it differs in usually having the paravertebral stripes on the neck comprised of single rows of dark scales, instead of two or more, and in the greater subdivision of the scales on the crown.

Description of the Type.—The type is a juvenile female* measuring 382 mm. in length over-all, tail length 24 mm., head length 23½ mm., width of proximal rattle (the button) 4.9 mm. The spinal process is accentuated.

The scale rows are 29–29–19, with 11 rows at the center of the tail, and 11 scales bordering the rattle. The ventrals number 185 and the subcaudals 22. There are 16–17 supralabials and 18–18 infralabials. The rostral is about equal in height and width. The scales on the crown comprise a pair of internasals that are wider than long and with lateral points extended posteriorly along the canthus; a canthal on either side, and 5 intercanthals, thus making a total of 9 scales in the internasal-prefrontal area. The anterior intersupraoculars are 3+5. The suture between the intersupraoculars and intercanthals is moderately evident and even. The supraoculars are the largest of the head scales. The pre- and postnasals are substantially equal in size; the nostril is mostly contained in the postnasal. The prenasal touches the first supralabial on the left, but on the right an interfering line of prefoveals is carried forward to the rostral. The prefoveals number 10–7. A row of subfoveals intervenes between the lacunals and the supralabials on each side. The loreals number 6–7, the extra scales being postsupraloreals that prevent a contact on the right, and almost on the left, between the canthal and supraocular. The upper preocular is the larger; the lower contacts the loreal. On each side there is a small extra scale between the preoculars, a scale abnormality often noted in *mittelli*. Below the center of the eye there are six scales between the orbit and the edge of the lip. The mental is triangular, the first infralabials are undivided, the genials are long and pointed posteriorly, and there are neither intergenials nor submentals.

The head is light gray-brown above, with dark-brown spots on the canthals and on both the anterior and posterior-inward edges of the supraoculars. The anterior ends of the nuchal paravertebral dark stripes are carried forward to the occipital region; they are much the most conspicuous marks on the head. On the sides of the head, the diagonal postocular dark streaks characteristic

* It was desired to select a type specimen from Michoacán, in which state the differentiation of *d. culminatus* from *d. durissus* is most extreme. Unfortunately, the other specimens available from Michoacán are either skins or are in a poor state of preservation, hence this rather unusual choice of a juvenile female as the type.

of nearly all rattlesnakes are in evidence, but they are not nearly so dark or conspicuous as are the paravertebrals. The sides of the head are light-brown to cream, with some dark punctations behind and below the pit. The underside of the head is cream, without markings.

The body pattern comprises a pair of dark lines on the neck, extending $2\frac{1}{2}$ head lengths behind the head, followed by about 27 dark dorsal diamonds. The paravertebrals comprise 2 rows of scales on the head and for the first few scales on the neck, posterior to which they become single-scale rows nearly to their ends, where the rows are doubled again. Thus most of each row comprises a single row of dark-brown scales, a characteristic of *durissus culminatus*, as compared with *durissus durissus*, in which the paravertebrals are wider. The light area between the dark paravertebrals is about 6 scale rows wide on the head and 3 on the neck. The first row of scales below each paravertebral is buff, somewhat lighter than the light gray-brown scales lateral thereto.

The dorsal blotches are dark-brown diamonds, sharper posteriorly than anteriorly, where each is somewhat truncated. The diamonds are far from perfect, as they are marred by a light vertebral line. Each blotch includes a dark-brown inner border, surrounding a light-brown center, and a single-row buff outer border. Each dark blotch is about 11 scale rows wide, and 6 scales long, end-to-end. The lateral areas between blotches are punctated with light-brown. On either side there is a conspicuous row of secondary blotches, each of which falls below the lateral angle of a primary. These lateral blotches comprise about 4 or 5 unicolored dark-brown scales, surrounded by a cream border. Falling between these laterals there is an intermediate series of much less definite light-brown spots. Toward the tail, the major blotches, and the laterals as well, become nebulous and undifferentiated from the ground color, so that the total blotches cannot be counted with accuracy. The tail is grayish above and buff below. Some crossbands are faintly evident.

Paratypic Series; Summary of Subspecies.—*C. d. culminatus* is found in Michoacán, Guerrero, and part of Morelos. I should prefer to restrict the subspecific description to the snakes of Michoacán, which are most sharply differentiated from the typical subspecies, *durissus durissus*; but as most of the topotypic specimens are only skins, I shall include, as paratypes, all of the specimens of *culminatus* available to me. Such specimens as are at hand from Oaxaca are deemed to be intergrades between *culminatus* and *durissus* and are not included in the subspecific summary that follows. The list of paratypes (including the holotype) is as follows: MICHOACÁN: EHT 3468-9, 3617, 5224-36, IU 19172 Hacienda El Sabino, near Uruapan. GUERRERO: MCZ 34353, MVZ 45256-9, CNHM 38496-502, MZUM 85717, 19-20 Chilpancingo; BM 1895-4-6-1, 2, 3 Omilteme; MZUM 99548 25.7 mi. w. of Chilpancingo on the Acapulco Highway; CAS 71761 Huamuytitlán. MORELOS: TCWM 5409 Ixtlilco (10 km. s. of Tepalzingo); USNM 110610 Xochicalco. This makes a total of 36 specimens.

This is a large rattlesnake; the longest measured, a male, was 1355 mm., but some of the skins indicate that it reaches a considerably greater size. The

smallest specimen measured 331 mm.; it is probably about 315 mm. at birth. It is a rattlesnake of ordinary shape, except that, like *durissus durissus*, the vertebral process is accentuated and the dorsal scales have marked anterior tuberculations—a sort of swelling on either side of the keel.

The body-proportionality regression lines are approximately as follows:

Tail length, males	$T = .093L - 3.2$
females	$T = .065L + 1.7$
Head length	$H = .037L + 10.4$
Width of proximal rattle	$W = .0154L - 1.0$

The button width is about 4.8 mm. and the average increase in the next 4 rattles is 1.7 mm. This shows the usual *durissus* difference from most Nearctic rattlesnakes, in that the snake starts with a disproportionately small button, but subsequent rattles quickly bring the string to a size appropriate to so large a rattlesnake.

The scale rows at mid-body are 27(4), 28(1), 29(19), 30(3), 31(14), 32(1), 33(1). The ventrals in the males range from 170 to 182, mean 177.4, and in the females from 173 to 188, mean 182.6.* The subcaudals in the males vary from 25 to 30, mean 28.3; the corresponding female figures are 20 to 24, mean 22.0. The supralabials range from 14 to 18, mean 15.4; and the infralabials from 14 to 20, mean 17.2.

The rostral is usually slightly higher than wide; it does not curve over the top of the snout. The paired internasals are triangular, and their lateral edges often extend backwards along the canthus farther than their centers. The canthals are paired in some specimens, but are broken up in others with the interposition of several intercanthals. The total scales in the internasal-prefrontal area range from 4 to 10 with a mean of 5.6. Only about 1/3 of the specimens have 4, this being the characteristic number generally possessed by *durissus* in other areas. The anterior intersupraoculars vary from 2 to 5 with a mean of 3.1. The anterior nasal is square and somewhat larger than the posterior; it fails to contact the first supralabial because of the interposition of a complete row of prefoveals in about 21 per cent of the specimens. Of the remaining 79 per cent, a postrostral is present at the prenasal-rostral-supralabial corner in 1/3 of the counts. The prefoveals vary from 5 to 11 with a mean of 7.7. The first, and the fourth or fifth supralabials are conspicuously enlarged. The lacunals sometimes touch the supralabials, but in an equal number of cases a row of subfoveals is interposed. The loreals vary from 3 to 8, with an average of 4.9. The extra scales comprise postsupraloreals that are interposed between the canthals

* There is an unusual and unexplained variability in the ventral counts, 1 Omilteme and 2 Chilpancingo specimens being lower than the others. This may result from ecological (probably altitudinal) differences; it is known that specimens accredited to these localities may have been collected some distance away in the country round about, which is of an extremely rough character.

and upper preoculars. The upper preocular is undivided; the lower is, as usual, crescentic and contacts the lower loreal. In 64 per cent of the cases there is a small anomalous scale between the preoculars, somewhat posterior to the center of the suture between them. The scales on top of the head are strongly keeled in the parietal and occipital regions. There are 5 or 6 scales between the bottom edge of the orbit and the lip.

Divided first infralabials are present in 32 per cent of the counts. Inter-genials or submentals are rarely present.

C. d. culminatus is a brightly patterned snake with very dark-brown, or black, diamonds, in strong contrast with a light gray-brown background.

The most conspicuous head marks are the two forward extensions of the dark paravertebral stripes on the neck; these reach the parietal region, and, occasionally, the supraoculars. They are more irregular on the head than on the neck. They vary from 1 to 5 scale rows in width. The central light stripe that separates them is also irregular on the head, ranging from 3 to 7 scale rows in width. The supraoculars usually have dark marks at front and back; but their centers are generally light, presenting a wide light crossband. The posterior edges of the canthals are usually darkened by the same spots that mark the anterior ends of the supraoculars. Postocular dark streaks to the angle of the mouth are usually present in *culminatus*, but they are medium-brown in color, much lighter than the dark marks on top of the head previously described. In some cases, *durissus* has diagonal dark marks on the head that start in the parietal region at the forward ends of the paravertebrals and diverge backward and outward from the paravertebrals. Such marks are rarely, and even then imperfectly, present in *culminatus*. Although a few punctations may be present on the mental and first infralabials in *culminatus*, the underside of the head is mostly unmarked, cream or buff.

The body pattern of *culminatus* comprises a pair of dark-brown or black paravertebral stripes on the neck, followed by a series of dorsal diamonds. The neck stripes extend from $1\frac{1}{4}$ to 3 head-lengths behind the head; the average extent is about 2 head-lengths. They are nearly always separated by a light longitudinal band 3 scale rows wide. Although the paravertebral stripes may in part comprise 2 contiguous dark scale rows, throughout more than half their lengths the dark scales are in single rows. In 4 specimens out of 36, or 11 per cent, double rows of scales exceed single rows in the paravertebrals. This is the characteristic that most readily distinguishes *culminatus* from *durissus durissus*, for in the latter the stripes nearly always comprise double or even triple rows. The vertebral lines are usually bounded below by a single row of buff scales, the ground color below this being slightly grayer and darker.

Behind the parallel lines on the neck, the dorsal pattern comprises a series of very conspicuous black or dark-brown diamonds. These vary in number from 22 to 32 with a mean of 26.6. However, there is no great accuracy in these figures, since the dark color is absent from the posterior body blotches, which

thereby become so poorly differentiated from the background that they cannot be counted with assurance.

The anterior diamonds are outwardly edged with black unicolor scales, usually in one, or, less often, two rows. Each diamond is well-formed and sharp posteriorly, but is often truncated and irregular anteriorly. The diamond centers are lighter, usually gray-brown in color. Sometimes the diamonds are incomplete middorsally, being divided into halves by a continuation of the longitudinal middorsal stripe on the neck. However, occasionally the light vertebral line is only the result of rubbing the vertebral ridge on the container in handling the specimen. The dark diamonds are about 11 scale rows wide and 4 to 6 scales long, end-to-end.

Outwardly the dark dorsal diamonds are edged with a single row of buff- or cream-colored scales. The lateral areas between these light rows are light-brown or gray-brown, in considerable contrast with the much darker blotches themselves.

Laterally there is a series of subsidiary blotches just below the main series on either side; this is comprised of groups of from 3 to 7 unicolor dark scales, often bordered with a light row. These spots are just above the ventrals. Between pairs of the secondary series, there are often the members of a tertiary lighter and smaller series engaging the outer edges of the ventrals.

The ventrum is cream or buff, growing somewhat darker toward the tail, and with increasing punctations marking the outer edge of each ventral scute.

The tail is gray, uniformly punctated and somewhat darker above than below. Crossrings may be faintly discernible in juveniles, but even in these they cannot be counted with accuracy. The proximal rattle matrix is gray.

Subspecific Comparisons.—The essential differences between *durissus durissus* and *d. culminatus* may be summarized thus: *C. d. culminatus* averages higher in scale rows, ventrals, labials, scales on the crown, intersupraoculars, prefoveals, and loreals; it has a shorter tail and fewer subcaudals. This subspecies is conspicuous among all other *durissus* subspecies for the tendency toward increased subdivision of the head scales, both on the top and sides. Although the most conspicuous difference from *durissus durissus* is in the single-rowed paravertebral neck stripes—a difference from *tzabcan* as well—it also has a slightly higher number of body blotches, on the average, and the blotches are darker, being dark-brown or black in *culminatus* and brown or red-brown in *durissus durissus*. There is less contrast between blotches and ground color in the latter subspecies. Except for the width of the neck stripes, *culminatus* is rather similar to *tzabcan* in pattern and color, although the latter is somewhat less contrasting, particularly in the adult stages. In *culminatus* the prefrontal dark bars are more frequently interrupted medianly, and the paravertebral stripes are also more often broken before reaching the supraoculars than is the case in either *durissus* or *tzabcan*. The tertiary lateral blotches are less evident in *culminatus* than in the other two subspecies, and may, in fact, be absent.

Even with the limited *culminatus* material at hand, some intrasubspecific differences are evident. The Michoacán specimens average higher than those from Guerrero in ventrals, labials, scales on the crown, intersupraoculars, loreals, and divided first infralabials; they are lower in subcaudals. In all of these characters they show a wider divergence from the main *durissus durissus* population than do the intermediate Guerrero specimens, just as would be expected from territorial considerations. There seems to be little difference between the Michoacán and Guerrero snakes in the relative extent of the single and double paravertebral dark stripes. Of the 4 specimens out of 33 that would fail to key out properly, 2 are from each state.

The Oaxacan specimens continue an expected trend toward *durissus durissus*, to such an extent that they are to be considered intergrades, and I have not included their statistics in either the *durissus* or *culminatus* character summaries. On the whole, in squamation and pattern most of them are slightly nearer *culminatus* than *durissus durissus*. The blotches in the Oaxacan specimens are quite dark, almost black, thus resembling *culminatus*. The Morelos specimens of *culminatus* exhibit no trends toward the Veracruz population tentatively assigned to *durissus durissus*.

***Crotalus durissus tzabcan** subsp. nov.**

YUCATAN NEOTROPICAL RATTLESNAKE

- 1887. *Crotalus durissus* (part) Cope, Bull. U. S. Nat. Mus., no. 32, p. 89
- 1895. *Crotalus horridus*† (part) Günther, Biol. Cent.-Amer., Reptilia and Batrachia, p. 194
- 1896. *Crotalus terrificus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 573
- 1935. *Crotalus terrificus durissus* (part) Martín del Campo, Ann. Inst. Biol., vol. 6, nos. 3 & 4, p. 296
- 1936. *Crotalus durissus durissus* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 190

Type Specimen.—CNHM 36168, a young male, collected at Kantunil, Yucatán, Mexico, by E. Wyllys Andrews, Oct. 28, 1939.

Differential Diagnosis.—A subspecies of *Crotalus durissus*, characterized, as are all the forms of the species, by a marked vertebral process and strongly tuberculate dorsal scales. The following characters serve to distinguish *tzabcan* from the other North American *durissus* subspecies: The clearly defined dark paravertebral stripes of *tzabcan* will segregate it from *totonacus*, which has an irregular dark middorsal band on the neck. The paravertebrals of *tzabcan* are

*This is the Mayan name for the rattlesnake—*tzab*=with a rattle, *can*=snake. (Schmidt and Andrews, 1936, no. 182, confirmed by R. A. Paynter, Jr., in letter, 1951). This seems appropriate for the rattlesnake of this Mayan area.

†During the period 1784 to about 1850 the name *horridus* was frequently used for the rattlesnakes now known as *C. d. durissus* and *C. d. terrificus* (see Klauber, 1941, p. 81).

2 or more scales wide, whereas they are predominantly only 1 scale wide in *culminatus*. From *C. d. durissus*, *C. d. tzabcan* differs in having more ventral scales (there is some overlapping), and in usually having divided first infra-labial scales, that, in *d. durissus*, are almost never divided.

Description of the Type.—The type is a young male measuring 537 mm. in length over-all, tail length 46 mm., head length $28\frac{1}{2}$ mm., width of proximal rattle 6.3 mm.; the other 2 rattles comprising a complete string, are 5.6 and 4.1 mm. in width. The spinal process is accentuated.

The scale rows are 27–29–19, with 12 rows at the center of the tail, and 10 scales bordering the rattle. The ventrals number 184 and the subcaudals 30. There are 16–17 supralabials and 18–18 infralabials. The first and fourth supralabials are enlarged. The rostral is 3.2 mm. wide by 3.6 mm. high. The scales on the crown comprise a pair of triangular internasals that are wider than long, and a pair of canthals (or prefrontals), that are medianly in contact and are convex posteriorly. The anterior intersupraoculars are 2+2. The suture between the intersupraoculars and canthals is well defined. The supraoculars are the largest of the head scales. The prenasals are larger than the postnasals, and touch the first supralabials on both sides. The postnasals do not reach the labials on either side, contact being prevented by the prefoveals, of which there are 5 on the right and 6 on the left. A lacunal contacts the third supralabial on each side. The loreals number 3–3, including a postsupraloreal on each side. The upper preocular is the larger; the crescentic lower preocular contacts the loreal. Below the center of the eye there are 5 interoculabials. The mental is triangular, the first infralabials are divided, the genials are long and pointed posteriorly. There are neither intergenials nor submentals.

The head is light gray-brown above, with a dark-brown spot on each side engaging the canthals and the anterior edges of the supraoculars. The anterior ends of the dark-brown nuchal paravertebral stripes are carried forward to the posterior ends of the supraoculars and the inner edges of the scales between them; however, there is a short interruption of each stripe in the parietal region. There is a short diagonal dark mark lateral to each gap. On the sides of the head, the diagonal postocular dark streaks characteristic of nearly all rattlesnakes are in evidence, but they are lighter and less conspicuous than the paravertebrals. The sides of the head are light-brown to cream, with some dark punctations on the nasals, and behind and below the pit. The underside of the head is cream, without markings, except for faint punctations on the rostral.

The body pattern comprises a pair of dark lines on the neck, extending for a head length behind the head, followed by about 28 dark dorsal diamonds. The paravertebrals comprise 3 rows of scales on the head, and 2 rows on the neck. The light area between the dark paravertebrals is about 4 scale rows wide on the head and 3 on the neck. The first row of scales below each paravertebral is buff, a trifle lighter than the light gray-brown scales lateral thereto.

The dorsal blotches are dark-brown diamonds, sharper behind than anteriorly, where each is somewhat blunted. Some of the anterior diamonds are

interrupted by a light middorsal line. Each blotch includes a very dark-brown (almost black) inner border, surrounding a light-brown center, and a single-row buff outer border. The latter is not strongly differentiated from the light-brown interspaces. Each dark blotch is about 13 scale rows wide, and 5 or 6 scales long, end-to-end. The lateral areas between blotches are light-brown, often with a central group of dark-tipped scales. Below, on either side, there is a conspicuous row of secondary blotches of double frequency, one (slightly the larger and higher) falling below the lateral point of each dorsal blotch, the other between each pair of primary blotches. Toward the tail the major blotches, and the laterals as well, become less strongly differentiated from the ground color. The ventrum is buff, except that posteriorly there are gray lateral punctations. The tail is grayish-brown above and punctated buff below, with 7 cross-bands faintly evident. The anterior rattle matrix is gray.

Paratypic Series; Summary of Subspecies.—The following paratypes are available: YUCATÁN: MCZ 7125, 28750, 29244, USNM 46570, AMNH 7863–4, CNHM 49367, MZUM 83935 all from Chichén Itzá; AMNH 38835–6 Yocat; AMNH 38837 Calcehtok; CNHM 26973 Catmis; CNHM 36167 and 36169 Kantunil; CNHM 40728 Mayapán; and USNM 6557 (2 specimens) from an unspecified Yucatán locality. CAMPECHE: USNM 46399–400 Apazote near Yokallum; MZUM 99835–6 San José Carpizo; MZUM 73081 1 mi. n. of Champotón. Total specimens, including the holotype, 23. Other localities, not represented in the paratypic series, are near Dzitas, Yucatán; and near Tulum, Solferino, and near Chetmul, Quintana Roo. The latter localities were supplied by R. A. Paynter, Jr. *C. durissus* also occurs in British Honduras but it is not known whether the snakes of this area would represent *durissus durissus* or *tzabcan*.

This is a large rattlesnake; the longest measured, a female, was 1555 mm.; it no doubt attains a length of at least 1750 mm.; it is probably about 315 mm. at birth. Like all *durissus* subspecies, there is a prominent dorsal ridge, and the dorsal scales are strongly tuberculate.

The body-proportionality regression lines are approximately as follows:

Tail length, males	$T = .092L - 4.0$
females	$T = .067L + 1.3$
Head length	$H = .037L + 9.0$
Width of proximal rattle	$W = .0144L - 0.8$

The button width is about 4.5 mm. and the increase per rattle in the next 4 rattles averages 1.4 mm., thus showing the usual *durissus* growth trend. The fang length in adults is contained in the length over-all about 105 times, and in the head length 4.3 times.

The scale rows at mid-body are 27(9) and 29(14). The ventrals in the males range from 177 to 188, mean 183.4, and in the females from 185 to 191,

mean 188.5. The subcaudals in the males vary from 28 to 32, mean 29.3; the corresponding female figures are 23 to 25, mean 23.9. The supralabials vary from 13 to 18, mean 15.6; and the infralabials from 15 to 19, mean 16.7.

The rostral is usually higher than wide; it is not recurved over the snout. There are 2 internasals and 2 canthals, thus making a total of 4 scales on the crown. The anterior intersupraoculars usually number 2 but there may be 3. The anterior nasal is square and somewhat larger than the posterior; it always touches the first supralabial, although partly separated by postrostrals in 1/5 of the specimens. The prefoveals vary from 3 to 9 with a mean of 5.9. The first, and the fourth or fifth supralabials are conspicuously enlarged. The lacunals touch the supralabials in half of the specimens; subfoveals intervene in the rest. The loreals vary from 2 to 6, with an average of 3.1. The loreals in excess of 2 consist of postsupraloreals. The upper preocular is undivided; the lower is smaller, curved, and contacts the lower loreal. The scales on top of the head are keeled in the parietal and occipital regions. There are usually 5 interoculabials, but rarely there are only 4.

Divided first infralabials are present in 86 per cent of the counts, this high proportion being characteristic of the subspecies. Intergenials or submentals are rarely present.

C. d. tzabcan, except for the very large adults, is a snake with conspicuous dark-brown, almost black, blotches, sharply contrasting with a light gray-brown background.

The most conspicuous head marks are the two forward extensions of the dark paravertebral stripes on the neck; these reach the supraoculars, although occasionally with an interruption in the parietal region. They are more irregular on the head than on the neck. They vary from 1 to 5 scale rows in width, and may be somewhat darker on their edges. The central light stripe that separates them is also irregular on the head, ranging from 3 to 7 scale rows in width. The supraoculars usually have dark marks at front and back; but their centers are generally light, comprising a light crossband, which widens laterally. The posterior edges of the canthals are usually darkened by the same spots that mark the anterior ends of the supraoculars, and these also touch the intersupraoculars. Postocular dark streaks to the angle of the mouth are present but are lighter and less definite than the dark marks previously mentioned on top of the head. The anterior ends of the dark diagonal marks in the parietal region that characterize *durissus* in some areas, are present in most specimens of *tzabcan*. The rostral, nasals, and the region of the pit are stippled with gray. Similar punctations are usually present on the mental and first infralabials, otherwise the underside of the head is unmarked, cream or buff.

The body pattern of *tzabcan* comprises a pair of dark-brown or black paravertebral stripes on the neck, followed by a series of dorsal diamonds. The neck stripes extend from 1 to 2½ head-lengths behind the head; the average extent is about 1½ head-lengths. These stripes are nearly always separated by a light longitudinal band 3 scale rows wide, and the stripes themselves comprise

from 1 to 3 rows of dark scales, 2 predominating. The stripes tend to narrow posteriorly. The vertebral lines are usually bordered below by a single row of buff scales, the lateral ground color below this being slightly grayer and darker.

Behind the parallel lines on the neck the dorsal pattern comprises a series of very conspicuous black or dark-brown diamonds. These vary in number from 21 to 31 with a mean of 26.5.

The anterior diamonds are formed of dark-brown or black unicolor scales, usually in two rows. Each diamond is sharp posteriorly, but is often blunt and irregular anteriorly. The diamond centers are lighter, usually gray-brown in color; often the diamonds are incomplete middorsally, divided into two halves by a light middorsal stripe. The dark diamonds are about 11 to 13 scale rows wide, and 4 to 6 scales long, end-to-end. Posteriorly the diamonds are less even and less in contrast with the ground color. Often they are comprised of dark-tipped scales.

Outwardly the dark dorsal diamonds are edged with a single row of buff or cream-colored scales. The lateral areas between these light rows are light-brown or gray-brown, in strong contrast with the much darker blotches themselves; the contrast between the light blotch borders and the ground color of the interspaces is not usually conspicuous.

Laterally there is a double-frequency series of subsidiary blotches; the larger members of this series match with the main series on either side; the smaller members (really a separate series) are slightly lower and often touch the edges of the ventrals. In the upper lateral areas of the interspaces there are sometimes groups of dark-tipped scales, or even of completely dark scales, that comprise another series of secondary spots. They are not as prominent as the darker and more even series previously mentioned.

The ventrum is cream or buff, somewhat darker toward the tail, and with increasing punctations marking the outer anterior edge of each ventral scute.

The tail is gray, punctated and somewhat darker above than below. Cross-bars may be present in juveniles. The proximal rattle matrix is gray.

In the largest specimens there is a decreasing contrast between the blotches and ground color, since the blotches become somewhat lighter and the interspaces more punctate and darker.

Subspecific Comparison.—Although, in the diagnosis, I have segregated *tzabcan* from *durissus durissus* using the higher ventrals and divided first infra-labials, there are other average differences. Compared with the typical subspecies, *tzabcan* has fewer scale rows, slightly more labials, fewer prefoveals, a lower percentage of lacunal-supralabial contacts, shorter paravertebral stripes, and more body blotches. It has a slightly shorter tail and larger head. In pattern *tzabcan* resembles *culminatus* more than *durissus durissus*; the blotches are darker brown, in many specimens almost black, and the ground color lighter,

resulting in sharper contrasts than in *d. durissus*, in which the blotches are brown. The secondary and tertiary lateral blotches are more accentuated in *tzabcan* than in *durissus*. In some characters *tzabcan* is intermediate between *durissus* and *culminatus*; but this is by no means true of all characters, for, in some, either *culminatus* (as in the break-up of the scales on the head), or in others, *tzabcan* (as in ventrals and divided first infralabials), represents the widest divergence from *durissus durissus*. Thus I should conclude that *culminatus* and *tzabcan* represent separate, rather than serial, branches from the main *durissus* stem. In its high ventral scale count, *tzabcan* resembles *totonacus*, but the Veracruz population of *durissus* intervenes between them.

Although I consider USNM 46522, Montecristo, Tabasco, and MZUM 74917-8, La Libertad, Petén, Guatemala, to be *tzabcan-durissus* intergrades, more specimens will be required to determine the exact boundaries of the two subspecies, and whether the clines in the characters are gradual or steep.

***Crotalus durissus totonacus* Gloyd and Kauffeld**

TOTONACAN RATTLESNAKE

Figure 6.

- 1940. *Crotalus totonacus* Gloyd and Kauffeld, Bull. Chicago Acad. Sci., vol. 6, no. 2, p. 12
- 1945. *Crotalus durissus totonacus* Smith and Taylor, U. S. Nat. Mus. Bull. 187, p. 190
- 1950. *Crotalus basiliscus totonacus* Taylor, Univ. Kans. Sci. Bull. vol. 33, part 2, no. 11, p. 453

Although some data are available on 9 specimens of this subspecies, many uncertainties remain, since only 3 are from localities known with certainty, these being LSUMZ 583-4 from Hacienda Limón, 10 miles west of Ebano in eastern San Luis Potosí, and MZUM 100187 from Rancho del Cielo, about 5 miles northwest of Gómez Farías, Tamaulipas. Three other specimens are presumed to be from places that would involve a consistent geographical pattern. These are the type and one paratype, which are thought to have come from Panaco Island, about 75 miles south of Tampico at a point 12 miles inland from Cabo Rojo, Veracruz, and MZUM 100187 from the southern part of Tamaulipas on the eastern slope of the Sierra above 3000 feet. Of the remaining 3 specimens, 2 were received through dealers, who stated that they came from southern Chiapas, while the last is from an unknown locality. Other specimens of the species *durissus*, from definitely known localities in southern Chiapas, are quite typical *durissus durissus*. For the present, because of the uncertainties involved, I propose to ignore the supposition that there is a separate colony of *totonacus* in Chiapas, and shall assume the *totonacus* population to be concentrated in the area consisting of southern Tamaulipas, southeastern San Luis Potosí, and northern Veracruz, thus comprising a northeasterly border subspecies of *durissus*.

Relationships and Comparisons. Summary of Subspecies.—That *totonacus* is subspecifically related to *durissus* is evident from many likenesses in squamation and pattern; in fact, the major question respecting *totonacus* is whether the differences from typical *durissus* are sufficient and consistent enough to warrant subspecific recognition. Gloyd (1940, p. 1949) has pointed out the following characteristics of *totonacus*, as compared to *durissus durissus*: Higher number of ventrals; less subdivision of head scales; shorter tail; less conspicuous spinal ridge; less tuberculate body scales; shorter and less well-defined paravertebral stripes. All of these differences are evident in some degree, but not with perfect consistency, nor without overlapping. Specimens of *durissus* from some areas have scales that are no more tuberculate than those of *totonacus*, and some have less exaggerated spinal ridges than others. The most consistent differences between *totonacus* and the other *durissus* subspecies, at least those that will best serve as key characters, are the nature of the neck stripes, and the number of scale rows and ventrals. In other North American *durissus* the neck pattern comprises a pair of dark, even-edged stripes, dark-brown to black and 1 to 3 scale rows wide, separated by a middorsal light stripe 3 scale rows wide. These paravertebral stripes extend from 1 to 4 head lengths behind the head. In *totonacus*, these regular stripes are absent; the neck pattern comprises a black band about 7 scale rows wide, irregularly spotted and longitudinally streaked with light scales. In *totonacus* the scale rows at mid-body number 25; in the other *durissus* there are 27 or more. As to the ventrals, the *totonacus* counts are: males, 187 and 189; females, 189, 193, 194 (4 specimens), and 195. Of the other *durissus* subspecies, *tzabcan* has the most ventrals, but even in this subspecies, out of 23 specimens only one male has more than 186 (it has 188), and 4 females more than 189 (2 with 190 and 2 with 191). Thus the validity of *totonacus* is fully justified, particularly based on scale rows and neck pattern.

To the extent that they can be determined from the few specimens available, the following are the other scale characters of *totonacus*: Subcaudals, males 27 or 29, females 22 to 26; supralabials 12 to 15, mean 13.4; infralabials 13 to 16, mean 14.3. The scales on the crown comprise a pair of internasals followed by a pair of canthals or prefrontals. The minimum scales between the supraoculars usually number 2. Although there are most often 2 loreals (an upper and lower) on each side, there is occasionally a postsupraloreal. The prefoveals usually number 3 or 4; they are not carried forward to the rostral, although in one specimen there is an extra scale (a postrostral) in the rostral-prenasal-first-supralabial corner. The lacunals normally contact the supralabials, thus separating the pre- from the postfoveals. The canthals sometimes touch the upper preoculars and sometimes do not. Usually 3 rows of scales separate the orbit from the lip edge; this is fewer than in any other *durissus* subspecies.

C. d. totonacus is a large rattlesnake, the paratype measuring 1665 mm. No small specimens are available. The adult head length is about .043 of the body length over-all. The tail proportionality is about .080 in the adult males, and .065 in the females. The fang length is contained in the head length about

4 times, and in the length over-all about 102 times, proportionalities substantially the same as those of other *durissus*. A vertebral ridge is evident in some specimens, as are also scale bosses; at least the scales are more tuberculate than in Nearctic rattlesnakes.

The average dimensions of the first 4 rattles of two complete strings are 4.8, 6.2, 7.9, and 9.8 mm., clearly a *durissus*, rather than a *molossus*, growth rate. The scales bordering the rattles usually number 12.

The body blotches vary from 27 to 33, mean 30.4. The pattern comprises a series of black-bordered diamonds on a grayish background. The centers of the diamonds are gray or brown. Exteriorly, the rows of scales immediately adjacent to the diamonds are cream or buff, somewhat lighter than the grayish ground color, thus accentuating the light-to-dark contrast. At mid-body the diamonds are about 13 scale rows wide, and about 6 scales, end-to-end, long. They are usually pointed posteriorly but truncated anteriorly. Two or 3 scales, end-to-end, separate the blotches middorsally. On the neck, the diamonds are replaced by a broad black stripe or band about 7 scale rows wide, extending from 1 to 3 head lengths behind the head. This band is irregularly spotted or longitudinally streaked with light scales. Posteriorly, the dorsal blotches lose their inner black borders, so that the blotches are not strongly contrasted with the ground color; indeed, in some specimens, they cannot even be counted with accuracy. On each side, marking the lower lateral scale rows, there is a secondary series of blotches matching the dorsal series, but much smaller. Posteriorly, these merge with the dorsal series to produce crossbands. The ventral color is buff or pink, with some mottling posteriorly.

The head, on top, is strikingly but irregularly marked with contrasting black (or dark-brown) and light-gray. There is a black transverse streak engaging the forward tips of the supraoculars, the posterior halves of the canthals, and the anterior edges of the first intersupraoculars. There is a light blotch in the center of each supraocular, which is edged with black. The central intersupraocular area is light. The parietal and occipital regions are irregularly streaked with alternating and divergent light and dark marks. The usual dark postocular streak of the rattlesnakes is only faintly evident in this subspecies. The labials and the underside of the head are clear.

The tail is dark-gray, almost black in fact, above and below. Crossbands are sometimes in evidence but not to an extent that permits accurate counting. The anterior lobe of the rattle matrix is black, with some grayness below.

The strong color contrasts between blotches and ground color persist as these snakes mature.

There is no present evidence of intergradation between *C. d. totonacus* and *C. d. durissus*. The nearest *durissus* population, that from central Veracruz, shows no trend in characters from the *durissus* mode toward *totonacus*. Thus the latter is assigned to subspecific status under *C. durissus* entirely on a basis of character likenesses, rather than on presumed intergradation.

***Crotalus basiliscus basiliscus* (Cope)**

MEXICAN WEST-COAST RATTLESNAKE

Figure 7.

1864. *Caudisona basilisca* Cope, Proc. Acad. Nat. Sci. Phila., vol. 16, no. 3, p. 166
1875. *Crotalus basiliscus* Cope, in Yarrow, Surv. W. of 100th Merid. (Wheeler), vol. 5, chapt. 4, p. 532
1896. *Crotalus terrificus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 573
1929. *Crotalus terrificus basiliscus* Amaral, Bull. Antivenin Inst. Amer., vol. 3, no. 1, p. 5
1948. *Crotalus basiliscus basiliscus* Gloyd, Nat. Hist. Misc., no. 17, p. 1

Although I have had available for the study of this species more than 160 specimens, they do not comprise a fully representative series. First, several large broods are included; this tends both to restrict variation through parental resemblance, yet also to extend it through the inclusion of aberrants and deformed individuals that would not survive. But even more important is an uncertainty as to the place of collection of a majority of the specimens, whether juveniles or adults. Colima seems to have long been a point of shipment of rattlesnakes of this species to commercial dealers in the United States, where they were and are sold under the trade designation of "Mexican Green Rattlesnakes". Many specimens resulting from these shipments were eventually preserved and attributed to Colima, but their derivations are really not known with accuracy.

Neglecting the subspecies *C. b. oaxacus*, which is known from only 2 specimens collected in central Oaxaca, *C. basiliscus*, as the subspecies *C. b. basiliscus*, is confined to the west coast of Mexico from extreme southern Sonora to Michoacán. It seems to be largely a lowland form, for most of the specimens from known points were collected below the 500-foot contour; however, there are a few specimens from inland points, indicating that it may occur in the higher foothills and even in the mountains.

Relationships With Other Species.—The principal taxonomic problems involving *basiliscus* are its relationships with *molossus* and *nigrescens* to the north and east, and with *durissus* to the southeast. The first relationship I shall discuss under *molossus*, concluding on a note of uncertainty which can only be resolved when more material from critical areas may become available, there being, alike, possibilities of overlapping with an obvious specific separation, intergradation, or hybridization.

As to the *durissus* relationship, although *basiliscus* exhibits no present indication of intergradation with *durissus*, it does show considerable evidence of a close affinity with it. It has a spinal ridge and tuberculated scales, although

neither reaches the extremes of some specimens of *durissus*, in which these characters are accentuated to a greater degree than in any other rattlesnakes. The integrity of the paired prefrontals, so different from the irregular intercanthals of most Nearctic rattlers, is outstanding in both forms. There is a likeness in the distally tapering form of the hemipenes. The principal obvious difference from *durissus* is the lack of paravertebral stripes on the neck in *basiliscus*; however, it is characteristic of this form that the blotches of the neck region are much less distinct than are those farther back on the body. The parallel lines on the neck, particularly the clear black lines that are typical of *C. d. culminatus*, the subspecies of *durissus* most nearly approaching, and, indeed, overlapping the range of *C. b. basiliscus*, will quickly segregate all well-preserved specimens. But it must be remembered that the evidence is negative in *basiliscus*, for its neck pattern is often ill defined and may be obsolete in adults. A few specimens of *basiliscus*, particularly a brood to which I shall revert, have short neck stripes extending less than a head length behind the head, but these lack the clear definition and the sharp color contrasts that characterize *culminatus* at all ages. It may be noted that in *culminatus* and the other northern *durissus* subspecies, the neck stripes are carried forward on the head nearly to the supraoculars, whereas in *basiliscus* the parietal and occipital regions are generally unicolor.

Summary of the Subspecies.—*C. b. basiliscus* is a large rattlesnake with a diamond pattern. Compared with *atrox*, *adamanteus*, *viridis*, and the other large rattlers with which we are familiar in the United States, it is notable for its prominent vertebral ridge, and the roughness of its scales, particularly toward the tail.

The largest specimen examined was a female (captive born) measuring 2045 mm.; a male of the same brood was 2019; the size at birth is about 330 mm. The body-proportion regression lines are approximately as follows: Tail length, males $T = .095L - 5.3$; females $T = .063L - 1.0$ (these define a long-tailed snake, more like *durissus* than the Nearctic species); head length $H = .033L + 9.7$; proximal rattle width $W = .013L + .6$. The button averages 4.7 mm. in width and the mean increment in width of the next 6 rattles is 1.7 mm. As is the case with *durissus*, *basiliscus* starts with a relatively small button for the size of the snake, but the subsequent curve of growth is more rapid than in the Nearctic rattlers. Ultimately, *basiliscus* attains very large rattles, up to 25 mm. in dorso-ventral width. The fang length (upper lumen to tip) is contained in the head length about 5 times, and in the length over-all about 125 times, indicating a slightly shorter fang, proportionately, than in *durissus*, and considerably shorter than in *molossus*.

The hemipenes taper more (distally) than those of the larger Nearctic species. In this they resemble *durissus* and *terrificus*, from which they differ in having heavier spines. More important, however, is the presence in *basiliscus* of an extensive patch of mesial spines (reaching almost to the sulcus) which is absent in *durissus* and its subspecies.

The scale rows in *basiliscus* are distributed thus: 25(9), 26(6), 27(76), 28(8), 29(55). The ventrals in the males vary from 179 to 201, mean 191.4, and in the females from 185 to 206, mean 197.6. The subcaudals range from 26 to 36, mean 30.7 in the males, and 21* to 29, mean 24.4, in the females. The supralabials range from 13 to 18, mean 15.1, and the infralabials 13 to 19, mean 16.1. The fifth supralabial is enlarged. Divided first infralabials, intergenials, or submentals rarely occur.

The rostral is higher than wide. The scales on the crown usually (89 per cent) number 4, comprising a pair of triangular internasals, and a pair of large flat quadrangular prefrontals or canthals. Altogether, the variations in the scales in the internasal-prefrontal area are from 4 to 9, with a mean of 4.25. In making these counts a small scale usually back of, and slightly above the upper loreal, is counted as a postsupraloreal, rather than as a postcanthal. The minimum intersupraocular bridge comprises from 2 to 6 scales (usually 2 or 3) with an average of 2.85. Both crown scales and intersupraoculars tend to increase in number in specimens from the northern part of the range. The prenasals are completely separated from the first supralabials by a row of prefoveals in 34 per cent of the specimens, partly separated (with a postrostral present) in 53 per cent, and fully in contact anteriorly in the remaining 13 per cent. The lacunals contact the labials in half the specimens; in the other half such a contact is prevented by a complete row of subfoveals. The prefoveals range from 3 to 15; most specimens have 5 to 9; the mean is 7.2. The total scale rows from eye to lip edge, counting both a subocular and supralabial, usually (84 per cent) number 5; the rest have 4 or 6, the latter figure being largely restricted to the specimens from southeastern Sonora.

The body blotches number from 26 to 41 (most specimens have 28 to 38) with a mean of 33.2. The tail rings, which often cannot be counted with accuracy in adults, number from 6 to 11, mean 8.8 in the males, and 5 to 9, mean 6.6, in the females.

Crotalus basiliscus is a species characterized by a considerable ontogenetic change in color and pattern, to such an extent, in fact, that one might doubt whether the almost patternless olive-green adults could belong to the same species as the brightly marked red-brown juveniles. That they do change to this degree has been proved by raising specimens at the San Diego Zoo, some of the same brood being now available preserved, both in the juvenile and fully adult stages. This ontogenetic change is evident in both Colima and Sinaloa specimens.

In the juveniles the heads are light-brown, irregularly blotched or streaked on top with red-brown or dark-brown. On the sides there is a brown postocular dark streak ending just above the angle of the mouth. The supraoculars are often somewhat lighter. The sides of the head, below the postocular streak, are usually light, except for a short brown streak behind the pit. Below, the

* One specimen from Alamos, Sonora, has 19; and another from near Apatzingán, Jalisco, has 18.

head is clear buff or cream, except for a few gray punctations on the mental and adjacent infralabials.

The body is brightly marked by a series of dorsal diamonds about 13 to 15 scale rows wide and 6 scales long, end-to-end. These diamonds are separated middorsally by one or two light scales. They are usually sharply pointed posteriorly, but may be truncated anteriorly. Their internal dark borders are darker than their centers, and they are edged externally with single rows of cream-colored or buff scales that set them off clearly. The anterior and posterior dorsal blotches are neither so regular nor so clearly outlined as those at mid-body. Anteriorly the light blotch borders are not strongly in evidence. Occasionally there may be a faint suggestion of paravertebral bars reminiscent of *durissus*, but these are seldom more than one blotch long. Posteriorly, also, the blotches lose their light borders, although their contrast with the ground color enables them to be distinguished. The posterior blotches seldom merge with the laterals to become crossbands, in the manner so characteristic of many species of rattlesnakes.

On the sides, the ground color is light-brown, and on this 2 or 3 rows of auxiliary dark blotches are in evidence. One of these series occupies the upper angles of the interspaces; the second and largest is below the lateral angles of the main blotches, and the third marks the lowest lateral scale rows. Below, the body is cream, with light-gray maculations toward the tail.

The tail is light-gray with dark-gray or brownish crossbars. These bars are not sharply set off against the ground color, but they can usually be counted accurately in juveniles. Ventrally, the tails are cream or light-gray. The rattle matrix is buff, sometimes stippled with gray.

In young adults, the top of the head is brown, or red-brown, somewhat darker at the snout. The supraoculars are sometimes slightly lighter than the surrounding scales. The only marks on top of the head are a few light scales, or rows of light scales, irregularly disposed in the parietal and occipital regions. Some darker spots may be faintly in evidence, particularly in the younger specimens. On the sides, a postocular dark streak, about 2 scales wide, passes backward and downward to a point just above the commissure; it is more sharply outlined below than above, by a light line that begins at the upper preocular. The supralabials are buff along their lower edges. Below, the head is cream or buff, except that the mental and anterior infralabials are stippled with gray.

The body pattern comprises a series of red-brown or brown dorsal diamonds, bordered internally with slightly darker scales, and externally by a single row of light scales whose posterior tips are distinctly lighter than their anterior. The blotches are about 13 scale rows wide, and 5 to 7 scales, end-to-end, long. As the diagonal lines of light scales meet middorsally, the blotches are separated by only a single light scale at this point. The blotches are usually diamond-shaped, the posterior vertebral points being sharper than the anterior. The first blotches on the neck are not so brightly outlined nor so evenly formed as those that follow, and are therefore counted with difficulty. The light

blotch borders tend to disappear posteriorly, so that the blotches often become ill defined toward the tail. Sometimes their continuity can be traced by an increasing accentuation of the internal dark borders. Often this darkening of some scales is without particular pattern, producing a spotted appearance posteriorly by reason of single dark-brown scales being scattered about the light-brown ground color. The interspace areas on the sides are light-brown with 2 or 3 series of rather irregular secondary blotches. The upper series occupies the angles of the interspaces, the second is below the lateral angles of the main dorsal series, as well as below the upper series, so that it is of double frequency. The ventrum is clear anteriorly, but becomes maculated with gray toward the tail.

The tail is gray above, with a series of dark-gray rings somewhat in evidence. These rings are not sharply outlined and are often difficult to count with accuracy, particularly toward the rattle. Below, the tail is gray with darker maculations sometimes present. The rattle matrix is gray.

In fully adult *basiliscus*, the head becomes uniform olive-green, slightly darker anteriorly. On the sides the postocular dark stripe may, or may not, be slightly evident. The preoculars are somewhat lighter than the other scales, and the supralabials, particularly their lower edges, are buff. Below, the color is buff or cream, except that the mental and anterior infralabials may be somewhat punctated with gray.

Much of the body pattern is also lost. The general coloration becomes olive-green, darker dorsally than laterally, the main dorsal blotches being darker than the lateral interspaces. The light rows of scales bordering the blotches lose much of their original contrast, although they are still in evidence, since the posterior tips of the scales are lighter than either the blotches or the interspaces. Toward the tail, the light bordering scales disappear, but the blotches themselves can be traced because of the darkening to dark-brown of the posterior tips of the scales that constitute their internal borders, especially the caudad borders. In some of the very largest specimens, the dark interior blotch borders, that sometimes show posteriorly, are also lost, so that the blotches cannot be counted. The color is uniform olive, except that the edges of each scale may be clouded with dark-gray, and the skin between scales is quite dark.

The secondary lateral blotches are evident as irregular groups of darkened scales. They are somewhat accentuated posteriorly. Below, the color is buff, lightly suffused or maculated with gray.

The tail is almost black above, even the anterior crossrings being usually indistinguishable; it is light-gray to dark-gray below. Sometimes the originally light interspaces continue in evidence laterally in the form of light scale edges. The rattle matrix is dark-gray, almost black.

A specimen 1230 mm. long, said to have been caught in the vicinity of Colima, had the following Ridgway colors in life: Blotches Dull Citrine to Olive Lake; red tipped scales Liver Brown to Hay's Russet.

Variations.—I have previously mentioned a brood with anomalous squamation. Unfortunately, it is from an unknown locality; were an adult population to show similar deviations from the *basiliscus* mode, subspecific segregation might well be warranted. There are 14 specimens in the brood. The scales on the crown, both canthals and intersupraoculars, are more broken up than in *basiliscus*. The proportion of lacunal-supralabial contacts is high—82 per cent compared with 50 per cent in normal *basiliscus*. All but 2 specimens out of the 14 have 4 scales from eye to lip edge, instead of the usual 5. The prefoveals average 4.7 compared with 7.2 in normal *basiliscus*. In pattern, the members of this brood exhibit the most perfect paravertebral neck bands to be found in any *basiliscus*. The middorsal light stripe is usually 3 scales wide and the dark side stripes are 2 or 3 scales wide. These stripes are from 1/3 to 1 head length long.

All of these deviations from the normal are toward *durissus*, and as the mother shows none of them, I am led to presume that this may be a *basiliscus-durissus* hybrid brood, possibly the result of mating in captivity, for the dealer from whom the snakes were obtained made extensive importations from various areas and maintained an exhibit of live snakes.

As no additional specimens of *C. b. oaxacus* have been collected, I am not able to add anything to Gloyd's original description of 1948. Compared with *b. basiliscus*, *oaxacus* has fewer scale rows and subcaudals on the average, although this will be proved only when additional specimens of the southerly form become available.

It is of interest to observe that the two specimens of *b. basiliscus* from farthest inland, CNHM 39094 from 5 miles south of Apatzingán, Michoacán, and EHT 5466 from near Chapala, Jalisco, have lower than average ventrals and subcaudals. Indeed, the latter, a female, has the lowest subcaudal count (18) of any *basiliscus*. It is peculiar in other ways, showing some resemblances to *nigrescens*. Unfortunately, it is in very poor condition and no final conclusions can be drawn respecting *basiliscus* in this area.

***Crotalus molossus molossus* Baird and Girard**

NORTHERN BLACK-TAILED RATTLESNAKE

Figure 9.

- 1853. *Crotalus molossus* Baird and Girard, Cat. North Amer. Rept., part 1, p. 10
- 1854. *Crotalus ornatus* Hallowell, Proc. Acad. Nat. Sci. Phila., vol. 7, p. 192
- 1936. *Crotalus molossus molossus* Gloyd, Occ. Papers Mus. Zool. Univ. Mich., no. 325, p. 2

The principal problems affecting *Crotalus molossus* involve the separation and characterization of its subspecies; whether there is justification for the recognition of more than the three subspecies now considered valid (*molossus molossus*, *m. nigrescens*, and *m. estebanensis*); and the nature of the relationship of *Crotalus molossus* with *Crotalus basiliscus*, the Mexican west-coast

rattlesnake, with which it has a contiguous, or, possibly, an overlapping range, in southern Sonora.

The species *molossus* has an extensive range, from the Grand Canyon in Arizona southward along the Sierra Madre Occidental to somewhat below Mexico City, and from west-central Texas to the Kofa Mountains of western Arizona. But its distribution within this large area is by no means continuous or uniform. It is largely a mountain, or, at least, a rock-inhabiting form; and, as is usually the case with animals having a discontinuous range, it is subject to considerable local variations. These variations manifest a somewhat heterogeneous geographic pattern of characters that have not favored logical segregations into subspecies.

Material.—For this study I have had available a moderately adequate series from the United States, but additional material from Mexico would have been most useful. This is especially true of a species such as *molossus*, which is relatively constant in squamation but variable in color and pattern. Conclusions respecting the latter characters are dependent on snakes in a good state of preservation; unfortunately, some of the specimens from the most critical areas had lost the epidermis or were otherwise defective. As to the derivation of the material used in this study, I have had scale counts and other data on specimens from the following states:

Texas	58	
New Mexico	31	
Arizona	133	
U. S. Subtotal		222
Sonora	19	
Chihuahua	17	
Coahuila	8	
Durango	18	
Nuevo León	2	
Zacatecas	92	
San Luis Potosí	18	
Guanajuato	1	
Querétaro	2	
Hidalgo	1	
Michoacán	16	
Distrito Federal	2	
México	3	
Puebla	1	
Veracruz	4	
Gulf of California islands	3	
Mexican Subtotal		207
Uncertain		2
Grand total		431

Partial data have been available from 46 other specimens that have been examined, of which 42 were from the United States. As a comment on what would seem to be a thoroughly adequate series from Zacatecas, it should be explained that 82 of the 92 specimens compose several broods of young contained in the paratypic series of the subspecies *nigrescens*.

Relationships With Other Species.—*Crotalus molossus* is a handsome rattlesnake of moderately large size. Although showing a relationship with *Crotalus durissus* through *C. basiliscus*, it lacks the conspicuous vertebral ridge and tuberculated scales of the Neotropical rattler. *C. molossus* still retains, unbroken in most specimens, the large flat scales on the crown that characterize *durissus* as compared with the Nearctic species of *Crotalus*. But, at the same time, *molossus* shows a marked tendency toward a subdivision of the scales on the side of the head, resulting in relatively high numbers of labials, loreals, and prefoveals. These subdivisions are more orderly than in *mittelli* and its subspecies, since in *molossus* the preoculars and nasals are not broken up in the heterogeneous manner typical of *mittelli*. The scale differences that characterize *molossus* reach their most complete exemplification in the snakes of the northern part of the range, and it is here also that the most outstanding patterns occur. Aside from the striking color contrasts exhibited by *molossus*, particularly in the Huachuca and Santa Rita Mountains of southeastern Arizona, the most notable features of the *molossus* pattern, are (1) the unicolored scales comprising the elements of the dorsal pattern, (2) the union of the primary blotches with the lateral secondaries to form crossbands, (3) the presence of groups of light unicolored scales within the dark dorsal blotches, usually paired on the two sides of the middorsal line, and (4) the black tail, often in strong contrast with the rest of the body, and with the usual rattlesnake crossbands almost or entirely suppressed. It is characteristic of most rattlesnakes that pattern boundaries cut across scales indiscriminately. In *molossus*, however, as in *scutulatus*, the scales are largely unicolor, and the pattern is thereby accentuated, as the geometric pattern of a floor is accentuated by the use of unicolored tiles. The merging of dorsal and lateral blotches posteriorly to form crossbands is usual among the rattlesnakes; but in *molossus* this often takes place at mid-body or before, and the color contrasts and unicolored scales produce a more conspicuous result than in other rattlers.

Crotalus molossus and *C. basiliscus*, as represented by their typical populations, differ in several important characters, some of so extensive a nature that it is surprising to find in one area a rather close relationship indicated between them.

In general, *basiliscus* is a larger snake with a more prominent dorsal ridge and a rougher, more tuberculated squamation. It has a proportionately longer tail and a steeper rattle growth-curve.* The hemipenes of *basiliscus*

* That is to say, the increments of the rattle widths in successive segments, beginning with the button, are greater in *basiliscus* than in *molossus*. The latter actually begins life with a larger button, but is soon passed in rattle width by *basiliscus*, as the successive segments are added

have larger and heavier spines; the lobes are relatively longer and more tapering distally; and there are numerous spines in the crotch, where there are none in *molossus*. In squamation, there are average differences in several characters, but these involve considerable overlapping; only in the subcaudals are the differences sufficient to be at least partly diagnostic, a condition to be expected from the tail-length divergence. Small scales (subfoveals) more often separate the lacunals from the supralabials in *basiliscus*.

In pattern, although *basiliscus* is quite different from the most extreme *m. molossus*, it does not differ so widely from some *m. nigrescens*. However, the scales of *basiliscus* are less unicolor, the pattern less prominent, and the usual color reddish-brown, rather than olive-brown as in *nigrescens*. Subadult specimens of *basiliscus* often have a light spot in the center of the supraocular, but the supraoculars in both subspecies of *molossus* are unicolor. The greatest difference is in the tail; *basiliscus* has dark-gray rings, quite evident, especially in the young, although not sharply edged, on a light-gray background; whereas in both *m. molossus* and *nigrescens* the tail is black, with rings seldom evident, although one or two may show anteriorly.

With all of these differences, it might be presumed that the segregation of individual specimens between *basiliscus* and *molossus* would be quite easy, yet this is not the case, for in southern Sonora the snakes show intergrading tendencies in several characters. It is necessary to canvass all of the characters and to have at hand the basic data of both species, including tail-length and rattle-trend curves, before one may be assured of the correct assignment of these snakes.

Thus far no actual overlap in the ranges of *molossus* and *basiliscus* has been demonstrated. As known today, they approach each other most closely in southern Sonora, from which area a fairly adequate series of each species is at hand. The most southerly available Sonoran *molossus* specimens are from the immediate vicinity of Guaymas; they are LMK 3252 Caballo, 3444-5 Guaymas, SUNHM 12781-4 Cerro Bocochoibampo, and EHT 206, 236, and 308 10 mi. nw. of Guaymas. The most northerly *basiliscus* are AMNH 63746 Guirocoba, 64250-4 Alamos, SDSNH 18180 Mirasol (16 mi. ene. of Guirocoba), and SDSNH 18181 Guirocoba, all from the southeasterly tip of Sonora.

In practically all characters these *basiliscus* specimens show trends away from the mode of that species and toward *molossus*; and, similarly, the Guaymas *molossus* exhibit trends toward *basiliscus*. This is true of tail length, although each series remains somewhat nearer the regression line of its own species than that of the other. It is true also of head length, *basiliscus* having a slightly smaller head, proportionately, than *molossus* or *nigrescens*. With regard to the important hemipenial characters, it may be observed that one of the two available sets from the Sonoran *molossus* series has a single spine in each crotch. Two organs available from the *basiliscus* series from Alamos have a few spines in the crotch, but not nearly so many as are characteristic of *basiliscus* in the central part of its range. Here again we have an intergradation trend, since *molossus* is typically without, and *basiliscus* typically with mesial spines.

As to the subcaudals, although each group adheres moderately well to the usual range of its own species, we have a Guaymas male with 31, which is 2 higher than any other *molossus* from any area; and, in the Alamos *basiliscus* series a female with only 19, 3 lower than in any other *basiliscus*, except another aberrant specimen from Jalisco, which has only 18. Although the tail colors and patterns retain moderate differences—black with scarcely evident rings in the Guaymas series, and gray with rings readily apparent in the Alamos group—it must be admitted that the differences are not as sharply drawn as between the more typical specimens of the two species.

The Alamos series of *basiliscus* shows other deviations from the mode of that subspecies. Nearly all have 6 scale rows between the lower edge of the orbit and the lip, whereas most *basiliscus* have 5. One *basiliscus* has 9 scales in the internasal-prefrontal area, which is high; and in 3 counts out of 16 there are 7 loreals, also high. One specimen has a single loreal on each side, whereas as few as 2 are rare elsewhere. The number of tail rings is low. Not all of these aberrancies are toward *molossus*, although this is true of several; however, they do emphasize the frequent deviations in this Alamos series.

Having reviewed the character trends in these two groups, it would seem that a good case for intergradation between *molossus* and *basiliscus* has been made, and that the two subspecies of the latter should be known as *C. molossus basiliscus* and *C. molossus oaxacus*. Yet I do not choose this course as yet, preferring to await the availability of more specimens, especially from between Guaymas and Alamos, and also between Alamos and central Sinaloa. As another interpretation of these character trends, it might be suggested that the considerable variability manifest in both the Guaymas and Alamos populations indicates the possibility of a relatively recent hybridization here between *molossus* and *basiliscus*, rather than subspecific intergradation of the usual type. It is to be hoped that future collecting in the critical areas may aid in the final solution of this problem of the relationship between *molossus* and *basiliscus*.

Subspecific Comparisons.—The subspecies *molossus nigrescens* is undoubtedly valid, for there are many differences between the terminal representatives of this southerly race and its northern counterpart, *molossus molossus*. But the location of the territorial line of demarcation between the two, and the selection of efficient key characters for their segregation, is a matter of some difficulty, especially with only rather inadequate and poorly preserved material available from some of the critical localities in Mexico. In many characters the change, speaking territorially, is gradual; there is overlapping because of intrasubspecific variability; and, finally, the differential characters do not change coincidentally, so that the boundary line would be in one place if premised on one character, but farther north or south if based upon another. This non-coincident change in characters is a situation often encountered in problems of subspecific boundaries.

In tabular form the differences between the subspecies are as follows:

<i>C. m. molossus</i>	<i>C. m. nigrescens</i>
1. Majority with 27 or more scale rows (over 90 percent)	Majority with 25 or fewer scale rows (over 70 per cent)
2. Ventrals more (males average 188.7; females 193.1)	Ventrals fewer (males average 174.4; females 177.8)
3. Head scales more subdivided as indicated by the following averages:	Head scales less subdivided as indicated by the following averages:
a. Supralabials 17.4	Supralabials 16.1
b. Infralabials 17.6	Infralabials 16.5
c. Scales in the internasal-prefrontal area 5.3	Scales in the internasal-prefrontal area 4.2
d. Minimum intersupraoculars 2.7	Minimum intersupraoculars 2.1
e. Prefoveals 9.9	Prefoveals 6.6
f. Loreals 4.0	Loreals 3.6
g. Scale rows eye to lip 5.6	Scale rows eye to lip 4.6
4. Tail shorter and with less sexual dimorphism	Tail longer and with more sexual dimorphism
5. Proximal rattle smaller, proportionate to body length	Proximal rattle larger, proportionate to body length
6. Strong color contrast between snout and occipital area, the former dark, the latter light	Weak color contrast between snout and occipital area, both dark
7. Dark longitudinal lines or dots on a light background in the occipital area	Light longitudinal lines or dots on a dark background in the occipital area
8. Light streak, above the dark postocular streak, 3 or more scales wide	Light streak, above the dark postocular streak, 1 or 2 scales wide
9. More anterior body blotches open and extended laterally	Fewer anterior body blotches open and extended laterally
10. Body blotches average 31	Body blotches average 28
11. Wider separation of blotches mid-dorsally	Narrower separation of blotches mid-dorsally
12. Greater contrast between the dark color of the main blotch series and the lateral interspaces	Less contrast between the dark color of the main blotch series and the lateral interspaces
13. Less contrast between the light borders of the blotches and the lateral interspaces	More contrast between the light borders of the blotches and the lateral interspaces
14. General coloration tending toward olive-green	General coloration tending toward olive-brown or red-brown
15. Ventrums tinged with gray posteriorly	Ventrums clouded with gray, often quite dark posteriorly

The schedule presented above is based on a comparison of pure *molossus* with pure *nigrescens*; to secure this result no statistics of specimens from the area of intergradation, involving, tentatively, the states of Sonora, Chihuahua, Coahuila, and Nuevo León, have been included.

While all of the items listed in this schedule indicate real differences between the subspecies, few of them are of utility in allocating questionable specimens. Most of the scale differences involve considerable overlapping, and some of the others lack definiteness. From a survey of all the material available, I should choose for use in a key three characters: (A) the scale rows, item 1; (B) the head coloration, a combination of items 6, 7, and 8; and (C) the lateral body coloration, a combination of items 12 and 13. Unfortunately, B and C will be of little use in the case of faded specimens, or those from which the epidermis has been abraded.

The head pattern and color differences between *nigrescens* and *molossus* are produced by a progressive lightening of the ground color as one proceeds from south to north. In *nigrescens* the top of the head is mostly dark; the light areas comprise only a few longitudinal streaks or small groups of scales diverging outward and backward from the supraoculars and intersupraoculars. These light areas include a narrow light line on either side above the postocular dark streaks. Proceeding northward it will be observed that while the internasals, canthals, and supraoculars remain dark, the parietal-occipital area becomes progressively lighter, for the light longitudinal lines gradually widen at the expense of the dark areas between them, until finally, in typical *molossus*, the light areas greatly predominate, the dark areas having narrowed into dark longitudinal lines or groups of scales.

A somewhat similar change occurs on the sides of the body, where three colors are involved: The dark areas of the dorsal blotches or their lateral extensions; the light rows of unicolored scales that border them; and the lateral interspaces, especially as exemplified toward the upper corners of the angles between blotches. In both *nigrescens* and *molossus* the first color is dark, and the second, comprising the light bordering scales, is always light; but as we survey successive specimens from south to north we find a conspicuous change in the color of the interspaces as compared with the other two. In *nigrescens* these interspaces are virtually as dark as the dorsal blotches themselves—both are in strong contrast with the lighter border rows. Northward the interspaces gradually lighten, increasing in contrast with the dark blotches and decreasing in contrast with the light borders. *C. molossus*, at its northern limit in Arizona, New Mexico, and Texas, exhibits considerable pattern variation. Sometimes a fairly good contrast is retained between the light borders and the lateral interspaces; but even when this contrast remains in evidence, it can always be said that the interspaces are nearer in color to the light borders than they are to the dark blotches. By the color of the dark blotches is meant the darkest areas of these blotches, not the lighter groups of scales that they often carry internally, either centrally, or, as is more often the case anteriorly, paired on either side.

Having devised these criteria (scale rows, head pattern, and body pattern) for the separation of *molossus* from *nigrescens*, we can now survey the snakes of the Mexican states contiguous to the U. S. border to see what may be learned concerning their allocation.

The snakes from the vicinity of Guaymas have already been discussed in connection with a possible relationship with *basiliscus*. As between *molossus* and *nigrescens* they show some affinities with both in scale rows (an equal division between 25 and 27) and in pattern. They are to be considered *molossus-nigrescens* intergrades. Farther north in Sonora there are increasing *molossus* tendencies, and from Hermosillo north, the state may be considered to be inhabited by pure *molossus*. Whether the Guaymas population merges with a pure *nigrescens* population across southeastern Sonora into southern Chihuahua is not known, since no specimens are available from Sonora east or southeast of Guaymas.

In Chihuahua, the snakes from along the crest of the Sierra Madre are nearer *nigrescens* than *molossus* in pattern, at least as far north as Pacheco and San José de Babicora. But as specimens with 27 or 29 scale rows slightly outnumber those with 25, the snakes of this section may be considered intergrades. In the southern part of the state, from such places as Samachique, Boquillas de Conchos, Las Trincheras, and Santa Barbara, the snakes are nearly typical *nigrescens* in pattern, although continuing high in scale rows and ventrals. Thus the classification depends on the relative importance assigned to the different characters. I prefer to consider them *nigrescens*.

In Coahuila, where the altitudes at which these snakes occur are lower than in Chihuahua, several specimens from near Las Delicias in the southern part of the state are *molossus* in all characters. A single juvenile from Sierra Encarnación, in the southeastern corner of the state, is an intergrade, leaning toward *molossus*.

The only two specimens from Nuevo León, are, unfortunately, in a poor state of preservation. Both have 27 scale rows and the patterns seem to be intermediate. I should classify them as intergrades with a tendency toward *molossus*.

Such specimens as I have seen from the next tier of states to the southward—Durango, Zacatecas, and San Luis Potosí—indicate that only pure *nigrescens* occurs there. However, I have had no material from northern Durango.

The question may be asked why, in this study, no weight has been given to the proportion of side-opened blotches—how far anteriorly the openings become evident—formerly considered important in distinguishing *molossus* from *nigrescens*. In this resurvey of the species I have found this an unsatisfactory and unreliable character. It is unsatisfactory because of indefiniteness; the blotches may be open on one side of the body 3 or 4 blotches in advance of the other. In some instances they may be open for 2 or 3 blotches, and then close again for a brief series before reopening. I have tried to overcome these uncertainties by ascertaining the position of the first blotch that is open on

both sides, or by determining the condition at mid-body, but without much improvement in objectivity. But even more important is the variability found within territorially restricted populations. For example, in a southern Arizona series of *molossus* the proportion of the total blotches that were open varied from 27 to 79 per cent, with a mean of 61 per cent. Somewhat the same variation was found in 7 topotypes of *nigrescens*, wherein the variation was from 27 to 82 per cent open, with a mean of 54 per cent. Thus, although it is undoubtedly true that northerly specimens have a higher proportion of laterally open blotches than the southern, the character is of little utility in segregating individual specimens.

Summary of the Subspecies.—Having discussed the differences between the subspecies *molossus* and *nigrescens*, I shall now describe the former, based only on specimens from the United States, in order that the characters will not be compromised by intergrades.

This is a snake of moderate size. The longest specimen measured was a male 1257 mm. and the shortest 291 mm. The tail-length regression lines are about $T = .069L + 1.8$ for the males, and $T = .055L + 1.6$ for the females. The head length is represented approximately by the equation $H = .040L + 6.8$, and the width of the proximal rattle by $W = .0142L + 1.25$. All of these equations involve dimensions in millimeters. The button averages 6.6 mm. in width. The average increment in width of each of the first 5 rattles over its predecessor is 1 mm. The fang length in an adult snake is contained about 4.1 times in the head length, and about 86 times in the length over-all. The fang is proportionately longer in *molossus* than in other large or medium-sized rattlesnakes.

The hemipenes are proportionately shorter and stouter than in other rattlers. The spines vary from very short and quite thin, to short and moderately thick. There are usually no spines in the crotch, although rarely one or two small spines may be found there. The fringes are reticulate rather than parallel.

The following are the statistics of squamation: Scale row distribution 25(14), 26(4), 27(165), 28(1), 29(25). The ventrals in the males vary from 178 to 199, are rarely below 180 or above 196, and average 188.7. In the females the range is from 185 to 199, with a mean of 193.1. Few specimens are below 188. The subcaudals in the males range from 22 to 29 (only 1 with 29), with a mean of 25.4; and 18 to 25 (only 1 with 25), with a mean of 21.2 in the females. The supralabials vary from 14 to 20, are most often 17 or 18, and the mean is 17.4. The infralabials range from 15 to 21, are most often 17 or 18, with a mean of 17.6.

The scales occupying the internasal-prefrontal area, although most often numbering 4, range from 4 to 12 with a mean of 5.3. In compiling these data, it may be noted that any scale above the postnasal, provided it did not contact a supraloreal, was considered a canthal. The minimum intersupraoculars, usually comprising an enlarged anterior pair, range from 1 to 7, with a mean of 2.7.

Following the minimum bridge, the subsequent intersupraoculars are much broken up. The total scales bordering the supraoculars vary from 8 to 15, are most often 10 to 12, and average 11.3.

C. m. molossus is characterized by a high number of loreals, of which there are normally only 1 or 2 in the rattlesnakes. In this subspecies the variation is from 2 to 9 with a mean of 4.0. It should be observed that any small scale (except a prefoveal) contacting either the upper or lower loreal was counted as a loreal; this includes various groupings of pre- and postsupraloreals. A frequent arrangement is a third loreal posterior to the usual upper loreal, thus preventing the intersection of the canthal with the upper preocular. Preciliaries (a preciliary is a small scale cut off the upper inner corner of the upper preocular) are not usual; they were found present in 40 counts out of 247. They are more prevalent in Texas and New Mexico snakes than in Arizona snakes.

The prefoveals are particularly numerous in *molossus*; they range from 5 to 20, with a mean of 9.9. In 83 per cent of the cases they are carried forward to the rostral; in an additional 5 per cent there is a postrostral, but the intersection of the prenasal with the first supralabial is not completely interrupted. In the remaining 12 per cent the prefoveals only partly separate (usually about half) the prenasal and the first supralabial, and there is no postrostral. In most specimens one of the lacunals contacts a labial, thus preventing the merging of pre- and postfoveals. The number of scales in a direct line from a point below the center of the eye to the lip edge (including both a subocular and supralabial) varies from 4 to 7; the mode is 6, and the mean 5.6.

Divided first infralabials are rare in *molossus*. Intergenials and submentals are somewhat more common. Transversely split genials occur occasionally, especially in Arizona specimens.

The body blotches range from 22 to 39, with a mean of 31.1.

Intrasubspecific Trends and Variations.—The following trends in scalation were noted in comparing the snakes of the three states of Arizona, New Mexico, and Texas: 29 scale rows are more prevalent in New Mexico than to the east or west. The labials are slightly more numerous in the Texas specimens. The prefoveals are almost always carried forward to the rostral in the Texas and New Mexico specimens, thus completely separating the prenasal from the first supralabial. Sometimes there is even a double row; and often the prefoveal contacting the rostral (the postrostral) is considerably enlarged. It is in Arizona, and particularly in specimens from the Huachuca and Santa Rita mountains, that the line of prefoveals is most often incomplete, with only a partial separation of the prenasals from the first supralabials. Also, in Arizona there is a greater tendency toward sutures in the normal 4 scales of the crown (2 internasals and 2 canthals) than is evident in the other states. This is carried to an extreme in Yavapai County and specimens from farther west.

I have already outlined the differences in squamation between *molossus* and *nigrescens*. As might be expected, the *m. molossus* of the next tier of states to

the southward, Sonora, Chihuahua, Coahuila, and Nuevo León, show trends toward *nigrescens*.

The body blotches are slightly reduced in number from west to east, being relatively high in both Arizona and Sonora.

The snakes of the subspecies *molossus* are subject to considerably more variation in pattern and color than in squamation. This variation is both individual and regional. Probably the snakes of Yavapai County, Arizona, are as near the mode as any. These will be briefly described, after which a few of the outstanding regional phases will be mentioned.

The general coloration is olive-green to olive-brown. The crown (the inter-nasal-canthal area) is dark red-brown. The supraoculars are somewhat lighter, but are without any well-defined marks. The posterior part of the head is olive-green, considerably lighter than the plates already mentioned, although the contrast is not especially marked in some specimens. The lighter part of the head is irregularly streaked or mottled with longitudinal lines or small groups of dark-brown scales. These occupy much less space than the lighter ground color. On the side of the head, there is a dark-olive postocular streak from 2 to 3 scales wide; it ends above the angle of the mouth. Above this dark streak, the light ground color is evident in a space from 3 to 5 scales wide. The anterior supralabials are flecked with gray; the posterior are usually clear buff. Below, the head is cream-colored, although the mental, anterior infra-labials, and genials are stippled with gray.

The body pattern comprises a dorsal series of rhomboids, brown or red-brown in color and bounded by unicolor light scales that vary from cream to buff, and are lightest middorsally. The blotches are clearest at mid-body; they are often indefinite and irregular on the neck, and are not sharply outlined toward the tail. The blotches are separated by 1 or 2 light scales middorsally. There is a secondary series of blotches on each side, and the major series merges with these through side gaps in the bordering light scales, usually well in advance of mid-body, but sometimes only posteriorly. Laterally, the interspaces between blotches are brown or olive-brown; and as the bordering row of light scales becomes somewhat darker laterally, there is less contrast between this row and the lateral interspaces than there is between the color of the interspaces and the darker color of the blotches themselves. Many of the blotches contain groups of somewhat lighter scales, which, however, are not as light as the borders. These light scales sometimes cross the dorsum, but are often divided middorsally, especially toward the head. Below, the color is yellowish, increasingly flecked with gray posteriorly.

The tails are black, in sharp contrast with the color anywhere on the body. However, one or more grayish rings are usually apparent anteriorly, thus graduating what would otherwise be a sharp color change. Sometimes a complete set of alternating gray and black rings is in evidence, but not with a frequency warranting statistical records. The rattle matrix is black.

Texas specimens differ from those of central Arizona in being somewhat grayer on the sides. The posterior body bands may be so indistinct that they cannot be counted with accuracy. The transition to the black of the tail is usually quite sharp. The intra-blotch light scales are grayish and therefore not strongly contrasted against the brown of the blotches. The light bordering scale-rows are sharply in evidence middorsally but not laterally, where they become grayish and not conspicuously set off from the interspaces.

However, the outstanding pattern characteristic of the Texas specimens is a longitudinal dark dorsal band on the neck, strongly reminiscent of that in *Pituophis catenifer deserticola*. In its most typical form, this band is dark-brown with even lateral edges, and with groups of light scales spaced down its center. These light-scale groups are homologous with the light dorsal interspaces that normally separate the blotches.

Bands of this character are not only prevalent in some sections of Texas, but also in New Mexico, and in the Las Delicias series from Coahuila. I have given some thought to the resurrection of Hallowell's *ornatus* as a subspecific name for the snakes with this neck band, but finally decided that the lack of population uniformity, as well as some territorial inconsistencies, would not warrant this step. Even in Arizona, some specimens have neck ribbons, although they are not as perfect as in some Texas specimens. The difference lies primarily in the irregularities along the lateral edges of the band in these non-Texas specimens, a condition occurring in some of the Texas snakes as well. In most specimens having neck bands, the blotches open laterally immediately posterior to the band.

The New Mexican snakes are not greatly different from those of central Arizona. The lateral colors are olive to gray. The paired light intra-blotch scale groups are usually clear, there being normally 4 or 5 scales in the spot on each side of the dorsum. The contrast between the blotches and the lateral interspaces always exceeds that between the interspaces and the light bordering scales, for the latter tend toward gray laterally. The light and dark areas of the head are moderately in contrast. The change from the gray of the posterior of the body to the black of the tail is quite abrupt.

From such Arizona mountains as the Chiricahuas, Whetstones, Santa Catalinas, Rincons, and Tucsons, and their rocky foothills, the black-tails seem to have no outstanding pattern differences from the Yavapai series. Farther westward from such mountain ranges as the Ajo, Gila Bend, Agua Dulce, and the most westerly of all, the Kofa Mountains of Yuma County, the colors of the snakes are less contrasting, both on the head and body, so that a rigid application of the color criteria of the key might fail in these otherwise quite typical *molossus*. They are the least strikingly marked of all *molossus*, equaled only by the snakes of the mountains or rocky areas of adjacent northwestern Sonora.

I have postponed until the last, comments on the most strikingly marked and distinctive of all *molossus*, those from the Huachuca and Santa Rita moun-

tains of southeastern Arizona. These brightly patterned snakes are probably the most beautiful of all rattlesnakes, both by reason of the clarity of the patterns and the harmony of their contrasting colors. Their divergence from the black-tailed rattlers of other areas almost warrants subspecific recognition.

The Huachuca specimens have strongly accentuated head marks, for the crown and supraoculars, as well as the postocular streaks and the longitudinal lines in the occipital region, are all dark-brown against a light olive-green background. On the body, the major blotches are deep-brown. They are bordered by lines of sulfur-yellow or golden scales that lose but little of their brightness laterally. Intra-blotch groups of light scales are rarely evident in the Huachuca specimens and, when present, are without color emphasis. Laterally the interspaces are dark-yellow or grayish; they are in stronger contrast with the blotches than with the light borders. The blotches usually open laterally at between $1/3$ of the length anteriorly and mid-body. The tails are black, with an anterior light ring or two often in evidence. The dorsal blotches in the Huachuca specimens are so dark and the color so well maintained posteriorly that the body-tail contrast is not particularly striking.

Comparing the snakes of the Santa Rita Mountains with those from the Huachucas, it is noted that the former have equally good color contrasts on the head. The intra-blotch light spots are more evident in the Santa Rita snakes. The light border scales are lighter and more yellowish in the Santa Ritas than in the Huachucas, which, by comparison, are more golden. The tail bands are somewhat more evident in the Santa Rita specimens.

As I pointed out in discussing squamation, the Huachuca and Santa Rita specimens differ from other *molossus* in the United States in the high percentage of specimens in which the prenasals are only partly or not at all separated from the first supralabials. Thus, it seems indicated that the isolation which has produced the marked color differences in these mountain populations, has been of relatively long standing.

A single specimen (MVZ 36490) is available from Ensenada del Perro at the south end of Tiburón Island in the Gulf of California. As far as I know, this is the only *molossus* thus far collected on that island. It is lighter than most *molossus*, the blotches being obsolescent. The head is almost devoid of markings. The tail is black but distinctly barred. This snake is 930 mm. long, and has a broken string of 13 rattles that have reached parallelism at a width of 12.5 mm. Thus there is evidence of stunting. There are 37 body blotches. In some characters, this specimen is intermediate between *C. m. estabensis* of San Esteban Island and *C. m. molossus* of the mainland. This suggests somewhat the same relationship as that of the Santa Catalina Island (California) *C. v. helleri* between *C. v. caliginis* of South Coronado Island and *C. v. helleri* of the mainland.

Two specimens are available from the Havasupai area of the Grand Canyon in Coconino County, Arizona; these also show evidence of belonging to a stunted race.

***Crotalus molossus nigrescens* Gloyd**

MEXICAN BLACK-TAILED RATTLESNAKE

Figure 10.

1887. *Crotalus molossus* Garman, Bull. Essex Inst., vol. 19, p. 123 (p. 5 of separate)
1936. *Crotalus molossus nigrescens* Gloyd, Occ. Papers Mus. Zoöl. Univ. Mich., no. 325, p. 2

I have already discussed the differences between *m. nigrescens* and *m. molossus*; it remains only to record the statistics of the former and some of its intrasubspecific trends. Sonora, Chihuahua, Coahuila, and Nuevo León specimens, whether intergrades or leaning strongly toward *nigrescens*, are not included in the data that follow.

Summary of the Subspecies.—The longest specimen I have seen was a male measuring 1092 mm. The shortest was 250 mm. The tail-length regression lines are, for the males $T = .075L + 2.2$, and for the females $T = .054L + 1.3$; the head-length equation is about $H = .041L + 8.8$; and the width of the proximal rattle $W = .016L + 1.5$. All dimensions are expressed in millimeters. The fang length is contained about 4.4 times in the head length, and 88 times in the length over-all. Proportionately, the fang is slightly shorter than in *molossus*, but still is longer than in most rattlesnakes.

The hemipenes are somewhat longer and are distally more tapering than in *molossus*. The spines are long and thin; there are a few small points in the crotch. The fringes are reticulate.

The scale rows are distributed thus: 23(8), 24(1), 25(103), 26(0), 27(45). The ventrals vary from 166 to 186, mean 174.4, in the males; and 168 to 187, mean 177.8, in the females. The subcaudals range from 21 to 28, mean 24.3, in the males; the corresponding female statistics are 16 to 24, mean 19.6. The supralabials are 13 to 19, mean 16.1; and the infralabials 14 to 19, mean 16.5. The scales in the internasal-prefrontal area are usually 4, although a few specimens with 5, 6, and 8 have been seen; the mean is 4.2. The minimum intersupraoculars most often number 2, but may number up to 5; the mean is 2.15. The total scales contacting the supraoculars vary from 7 to 12, with a mean of 9.7. The loreals range from 2 to 9; they most often number 3 or 4, and the mean is 3.6. I have observed no specimen with preciliaries. The prefoveals range from 2 to 13, the mean being 6.6. They are less often carried forward to the rostral than is the case in *molossus*; in *nigrescens* 41 per cent completely block a prenasal-first-supralabial contact, 21 per cent partly block the contact because of the presence of a postrostral, and the remaining 38 per cent have no extra scale in the rostral-prenasal-first-supralabial corner. The scales from orbit to lip, counting both a subocular and supralabial, range from 3 to 6, mean 4.6.

The body blotches vary from 20 to 34, with a mean of 27.8, slightly less than in *molossus*.

C. m. nigrescens is not so strikingly patterned as *molossus*; it is darker and more uniformly colored. The head is dark above, either dark olive-brown or red-brown, marked with a few light longitudinal lines or groups of scales posteriorly. Sometimes the head, aside from the light lines, is almost black. The dorsum is marked with diamonds of a color similar to that of the head, edged with a line of unicolor buff or tan scales. The lateral interspaces are of the same dark color as the dorsal blotches, or they may be slightly lighter; in any case, there is more contrast between the light border scales and the interspaces, than between the interspaces and the dorsal blotches. The dorsal blotches open laterally, sometimes anteriorly, but usually in the caudal half of the body. The tail is black or very dark gray-brown; lighter crossbands are sometimes visible. The posterior part of the body is so dark that there is little of the *molossus* type of contrast at the root of the tail. The ventrum is mottled with gray, darkening posteriorly. The rattle matrix is black.

With the limited material at hand, conclusions respecting intrasubspecific trends must necessarily be tentative. Snakes with the fewest scale rows are found in San Luis Potosí, Querétaro, and Michoacán, and it is probable that the ventrals are also lowest here. A slight reduction is noted in the labials from north to south. In general, it can be said that the subdivisions of the head scales, which are characteristic of *molossus*, and which differentiate this species from most other rattlesnakes, are not only less evident in *nigrescens*, but are least prevalent in specimens from the Querétaro-Michoacán area. In the sense of being nearer the rattlesnake mode, *nigrescens* is more primitive than *m. molossus*.

***Crotalus scutulatus salvini* Günther**

HUAMANTLAN RATTLESNAKE

1895. *Crotalus salvini* Günther, Biol. Cent.-Amer., Rept. Batr., p. 193
1896. *Crotalus scutulatus* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 575
1940. *Crotalus scutulatus salvini* Gloyd, Chi. Acad. Sci., Spec. Pub. 4, p. 201

At the time that Gloyd segregated *salvini* from *scutulatus scutulatus* as a valid subspecies, 4 specimens were available. These have now been increased to 9, including 2 (MZUM 99842-3) from Caderayta, Querétaro, thus in part bridging the gap between the southernmost *s. scutulatus* in Zacatecas and San Luis Potosí, and the small area hitherto known to be inhabited by *salvini* in Tlaxcala, east-central Puebla, and west-central Veracruz.

In the United States and extreme northwestern Sonora, *scutulatus* is a desert dweller; although it reaches altitudes of over 5000 feet in the Transition Zone of west-central Arizona, it is much more prevalent in the Upper and Lower Sonoran zones of the southwest. It is quite common in the Mojave Desert of California at altitudes of 2000 to 2500 feet, and is found down to sea level, or just above, in the Gila Basin and the adjacent Yuma Desert at the

head of the Gulf of California. But in Mexico (except in Sonora) *scutulatus* is a highland form, probably occurring infrequently below 4000 feet, and more often between 6000 and 8000 feet. Its range appears to be somewhat intermittent, as is usual in montane species; it does not seem to be as common anywhere south of Durango as are several other rattlers, some of which are smaller and therefore even more likely to be overlooked by collectors.

Subspecies Segregation.—Gloyd originally separated *salvini* from *s. scutulatus* on the following characters:

<i>C. s. salvini</i>	<i>C. s. scutulatus</i>
1. Fewer ventrals	More ventrals
2. Less subdivision of the scales of the crown	More subdivision of the scales of the crown
3. Blotches of dorsal patterns without light borders	Blotches bordered by a row of light unicolored scales
4. Dark postorbital stripe not extending more than halfway to the angle of the mouth	Dark postorbital stripe extending to the angle of the mouth
5. Tail rings all of the same color as the posterior body blotches, distal ones not black	Distal tail rings black, in contrast with the posterior body blotches
6. Basal segment of the rattle matrix without black on the upper half	Upper half of the basal segment of the rattle matrix black

These various characters undoubtedly are valid in distinguishing the terminal populations of *salvini* and *s. scutulatus*, but unfortunately there is considerable variability in the intervening area, and it becomes difficult to select accurate key characters, or to determine a boundary between the subspecies, since the characters do not change simultaneously.

Tentatively assigning the Querétaro specimens to *salvini* for purposes of discussion, we have the following data on the differences that have been suggested:

The ventrals in *salvini* average 168.0 (range 165–172) in the males; and 172.0 (range 165–175) in the females. For *s. scutulatus*, in the area between Querétaro and central Chihuahua, the corresponding figures are: males 168.8 (166–172); females 172.5 (168–177). It will be seen that there is no significant difference here. On the other hand, in the northwesternmost *s. scutulatus* population, in the Mojave Desert of California, where the higher temperatures would lead to an expectation of higher ventral counts, the males average 181.4 and the females 184.6. Arizona specimens have somewhat fewer, the males averaging 177.9, and the females 180.6 ventrals. These are real and significant differences, but to segregate *salvini* from *s. scutulatus* on a basis of ventrals would allocate to *salvini* all of the Mexican specimens except those from Sonora and northern Chihuahua; and in any case, the dispersion of the ventrals is too great for them to be useful as a key character.

The scales on the crown, that is, those occupying the internasal-prefrontal area, comprise a slightly more indicative criterion. In 8 specimens of *salvini* (including those from Querétaro) these scales number 8 in 6 specimens, and 9 in 2. In specimens available from Zacatecas to central Chihuahua the corresponding figures are 8 (7 specimens), 9(4), 10(1), 11(1), 12(1), 13(1), 15(1); mean 9.6. This tendency to a greater subdivision of these scales continues into California, where the mode is 11, and the mean increases to 11.8. However, even in California and Arizona, about 7 per cent of the specimens have only 8 scales in the internasal-prefrontal area, and an additional 12 per cent have 9. Occasional Arizona specimens have only 6 or 7 scales. This character therefore is not of much use in a key.

The presence in *s. scutulatus*, or absence in *salvini*, of a light row of scales—a row distinctly lighter than the adjacent ground color—bordering the dark dorsal blotches seems to be a fairly distinctive character, at least in well-preserved and unfaded material. One specimen of *salvini* out of 6 (USNM 110926 from Puebla) fails in this character. In this criterion, the two Querétaro snakes would fall in the northern rather than the southern category, although the rows of light scales are by no means as distinctive as in most specimens from farther north. This character is sometimes only evident laterally, for the dorsal blotches may be only separated by two scales without room for ground color between.

In well-preserved material the dark orbital stripe would probably be of value. Unfortunately, few available specimens of *salvini* have the terminus of this stripe clearly defined. Only the accessibility of more first-class material will prove the importance of this character. It has been noticed that in Mexican specimens the postocular light stripe—it borders the orbital dark stripe already discussed—usually points toward the second or third supralabial anterior to the commissure, whereas in the California and Arizona snakes this light line is carried straight to a point above the angle of the mouth.

The contrast between the distal tail rings and the posterior body blotches probably constitutes the best key character for segregating *salvini* from *s. scutulatus*, allocating the Querétaro specimens to the former; for, although not invariable, there is a strong tendency for the terminal rings in *salvini* to be but little, if any, darker than the body blotches, while in the great majority of *s. scutulatus* the distal rings of the tail are either black or at least conspicuously darker than the body blotches.

The darkening of the top of the anterior lobe of the rattle matrix is not unrelated to the previous character, since its color is really a part of the last tail ring. It is a fairly consistent character, although not invariable. It is useless in the case of juveniles, for the dark color that characterizes the upper part of the proximal matrix lobe in *s. scutulatus* is usually not evident until later in life. In this character, specimens from Zacatecas, Durango, and southern Chihuahua are usually somewhat darkened.

Summary of Subspecies.—In conclusion, I should say that I consider *salvini* a valid subspecies of *Crotalus scutulatus*. Its definition is handicapped by lack of adequate material and the gradualness of the character clines. Tentatively, I should consider Querétaro specimens as being *salvini* and those from Zacatecas and northern San Luis Potosí as belonging with *s. scutulatus*. As thus restricted, the statistics of *salvini* (8 specimens, 4 males, 4 females) are as follows: The tail length in the adult males is about .075 of the length over-all, and about .056 in the females. The head proportionality is about .046, and the dorso-ventral width of the proximal rattle about .016. The fang length (upper lumen to point) is contained in the body length 97 times, and in the head length 4.4 times.

The data on squamation are: Scale rows 24(1), 25(6), 29(1); ventrals, males, 165 to 172, mean 168.0, females, 165 to 175, mean 172.0; subcaudals, males, 23 to 26, mean 24.5, females, 18 to 20, mean 18.8; supralabials 12 to 15, mean 13.3; infralabials, 13 to 15, mean 14.1; body blotches, 30 to 33, mean 32.0; tail rings, males, 4, females, 3 or 4.

The largest specimen available was a male 932 mm. long. No juveniles have been seen.

C. s. salvini has been collected at the following localities: QUERÉTARO, Caderayta; TLAXCALA, Huamantla (type locality); VERACRUZ, 2 and 3 km. w. of Limón; PUEBLA, 28 km. nw. of Tehuacán, San Diego, and 10 mi. w. of Alseseca on the road to Jalapa.

***Crotalus atrox* Baird and Girard**
WESTERN DIAMOND RATTLESNAKE

- 1852. *Crotalus cinereous* Le Conte in Hallowell, Proc. Acad. Nat. Sci. Phila., vol. 6, p. 177
- 1853. *Crotalus atrox* Baird and Girard, Cat. North Amer. Rept., part 1, p. 5
- 1861. *Caudisona atrox* var. *sonoraensis* Kennicott, Proc. Acad. Nat. Sci. Phila., vol. 13, p. 206

There seems little doubt that *Crotalus cinereous* is the proper name for this snake, under a strict interpretation of the rules of zoölogical nomenclature. Those taking a contrary view base their position on the details of the method of presentation of the name in Hallowell's original publication of Le Conte's notes, although these were modified in the direction of formality in a subsequent republication. The point has been made that Le Conte had no intention of describing a new rattlesnake, but the matter of intent has no bearing on the case. Many valid names have resulted from merely listing, under a new binominal title or side heading, a description that had previously appeared elsewhere under a non-binominal name, the author having no thought of newly describing a creature under the Linnean system. This was not what Le Conte

was doing; it is merely cited to show that intent is not important in deciding whether a name is valid under Art. 25 of the rules, as elaborated for manuscript names by Opinion 4.

Since an official method* is now available for the conservation of long-established trivial (specific and subspecific) names, a course hitherto possible only in the case of generic names, I do not now recommend the replacement of *atrox* by *cinereous* as I did in 1936. On the contrary, a suitable application for the retention of *atrox* has been made to the International Commission.

Crotalus atrox is found throughout a wide area in northern and northeastern Mexico in the states of Sonora, Chihuahua, Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí. It is most common in dry, lowland situations. However, as in the case in Arizona and New Mexico, where it occurs up to 5000 feet or somewhat higher, so also *atrox* has occasionally been found in the northern Sierra Madre area, as for example at Rodeo, Durango, at about 4700 feet (AMNH 68343) and even up to 7000 feet near Illescas, in western San Luis Potosí (LSUMZ 2440-3). It has been reported from Hidalgo, but I have not seen specimens from that state. It has been taken in the lowlands of northern Veracruz. There are, as yet, no records from Zacatecas, although it will no doubt be found there, for the Illescas specimens came from not far from the border. If *atrox* occurs in the central plateau about Mexico City, it must be rare or restricted to isolated localities, as no specimens have yet been reported from this area, which has received close attention from collectors in recent years. No valid record of *atrox* is known from the west coast of Mexico from Sinaloa to Guerrero, inclusive.

The most interesting problem connected with the distribution of *atrox* in Mexico has to do with an apparently isolated colony, 7 specimens from which were collected in 1936 by Norman Hartweg and James A. Oliver in mountain areas above Tehuantepec, Oaxaca (Hartweg and Oliver, 1940, p. 29). Subsequently Woodbury and Woodbury (1944, p. 372) reported an additional specimen from this area; the American Museum of Natural History secured one through the activities of another collector, and the University of Illinois three.

It was naturally expected that these specimens, presumably from an isolated colony distant some 400 miles from the southern limit of the main *atrox* population, would show some divergences of scalation or pattern, but none of importance has been found. The only difference in scalation is a high prevalence of vertically split lower preoculars. There are minor pattern differences from the usual run of Texas and Arizona specimens, the most conspicuous being a group of dark spots, or a dark area, on the first ventral or the last central gulars. I have not seen such spots on specimens from elsewhere in Mexico. Thus, while it has been suggested that this colony may have resulted from some human agency, which is indeed possible, these differences, however slight, indicate that these snakes may have had time in which to differentiate, which would have required a long interval.

* Bull. Zoöl. Nomen., vol. 4, pp. 270, 283, 627, 1950.

Another territorially anomalous specimen, this time from central Veracruz, was taken in 1946. This is KU 24129, collected by W. W. Dalquest near Río Blanco, 20 km. wnw. of Piedras Negras at an altitude of 300 feet. This is somewhat more than halfway down the gap between the previously known localities in northern Veracruz and the Tehuantepec colony, and has shown the possibility that other population remnants may remain along the Veracruz coast, and thence south across the Isthmus of Tehuantepec. Altogether, the evidence is increasing that the Tehuantepec colony is the remnant of a more widespread population, and that connecting links, although tenuous and even broken, may be more definite than was first thought possible.

***Crotalus viridis viridis* (Rafinesque)**

PRAIRIE RATTLESNAKE

1818. *Crotalinus viridis* Rafinesque, Amer. Month. Mag. & Crit. Rev., vol. 4, no. 1, p. 41
1823. *Crotalus confluentus* Say, in Long's Exped. from Pittsburgh to Rocky Mts., edited by Edwin James, vol. 2, p. 48, footnote
1936. *Crotalus viridis viridis* Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 191

Although the U. S. National Museum contained a specimen of *Crotalus v. viridis* from Mexico (no. 264 from Espía, Chihuahua) as early as the 1850's, and additional specimens were taken by the Mearns expedition in Sonora in 1893, the subspecies was not included in the Mexican fauna by Cope, Yarrow, Stejneger, A. E. Brown, and others. This omission resulted from an inaccurate catalogue entry that credited no. 264 to Oregon, and certain early confusions between *C. v. viridis* and *C. s. scutulatus*.

Compared with its very extensive range in the United States and Canada, *C. v. viridis* has a relatively small range in Mexico, being found only along the U. S. border in northeastern Sonora, northern Chihuahua, and Coahuila. The southernmost specimen thus far recorded is from Muzquiz, Coahuila. The Mexican localities known to me are as follows: SONORA: San Bernardino; CHIHUAHUA: Espía, 2 mi. e. of Samalayuca, 6 miles west of the Sonora line on the road from Bavispe (Sonora) to Casas Grandes; COAHUILA: Muzquiz. There are several other specimens from indefinite localities; altogether I have seen 9 *C. v. viridis* from Mexico.

Mexican specimens of *viridis* often have their dorsal blotches indented fore-and-aft, as is the case with many southwestern Texas specimens. But this pattern peculiarity is not always consistent, for I have seen other Mexican snakes with patterns that would be considered typical of *viridis viridis* in Wyoming or Nebraska.

Mexican specimens of *viridis viridis* exhibit no tendencies toward *viridis cerberus* or *viridis nuntius* of Arizona. Although some years ago I reported

viridis cerberus from northern Sonora, I am now quite certain that this record is undependable, and therefore this subspecies should not be allocated to Mexico unless verified by additional material. The most southerly authentic records of *C. v. cerberus* in Arizona are from the Santa Catalina and Rincon mountains. This subspecies has not been reported from the Santa Ritas, Huachucas, or Chiricahuas, mountain ranges in southern Arizona that have been the scenes of extensive collecting. An old record from Fort Buchanan, in Santa Cruz County, was based on a specimen (*C. v. helleri*) that probably came from near San Diego, California.

***Crotalus polystictus* (Cope)**

MEXICAN LANCE-HEADED RATTLESNAKE

- 1859. *Crotalus lugubris* (part) Jan, Rev. Mag. Zool., ser. 2, vol. 10, pp. 153, 156 (Prod. Icon. Desc. Oph, pp. 30, 31)
- 1863. *Crotalus lugubris* var. *multimaculata* Jan, Elenco Sist. degli Ofidi, p. 124
- 1865. *Caudisona polysticta* Cope, Proc. Acad. Nat. Sci. Phila., vol. 17, p. 191
- 1875. *Crotalus polystictus* Cope, in Yarrow, Surv. W. of 100th Merid. (Wheeler), vol. 5, chpt. 4, p. 533
- 1877. *Crotalus jimenezii* Dugès, La Natureza, vol. 4, p. 23

Nomenclature.—There seems no doubt that, under a strict interpretation of the rules of nomenclature, the proper name for this snake is *Crotalus multimaculatus* Jan, 1863. Notwithstanding my having designated Milan specimen no. 1414 (a *triseriatus*) as the lectotype of *C. lugubris* Jan, 1859, *multimaculata* Jan, 1863, retains its independent valid status, for in 1863 the Westphal-Castelnau specimen was designated as the type of *multimaculata*, and this particular specimen was adequately described in Jan, 1859, p. 157 (p. 32 of the separate). This is unquestionably an "indication" as provided in the rules (art. 25, a; see also Bull. Zoöl. Nomen., vol. 4, p. 149, 1950). Later a figure of the Westphal-Castelnau specimen (Jan and Sordelli, Icon, Gén., liv. 46, plate 3, fig. 3, 1874) confirmed the fact that this actually was a specimen of the snake now known as *C. polystictus*, but this later confirmation was not a necessary part of the original description. It is sufficient that in 1863 Jan recognized the composite character of his original *C. lugubris* and designated the Westphal-Castelnau specimen (previously and adequately described) as the type of the new subspecies *multimaculata*. The Milan and Paris specimens were retained under the type subspecies *l. lugubris*, as indicated by the letters M and P. (see p. viii, Jan, 1863).

However, I do not choose to recognize the name *C. multimaculatus*, since a method is now available for the conservation of specific and subspecific names of long standing (Bull. Zoöl. Nomen., vol. 4, pp. 270, 283, 627), and *C. polystictus* Cope has been the generally accepted name for this snake for nearly

100 years. The matter has been brought to the attention of the Commission, recommending the conservation of this name.

Summary of Subspecies.—*Crotalus polystictus* is one of the most distinctive of rattlesnakes, differing in shape and pattern from the usual run of its congeners as much as does any other rattler with the exception of *willardi*. It has a narrow head and rounded snout; and in most specimens the long elliptical blotches readily distinguish it from all but a few specimens of *C. t. triseriatus*—at least when the material is well preserved. But, even so, sharply selective key characters are not superficially evident.

I have had 27 specimens of this species available for study, 13 males and 14 females. The principal statistics follow: Scale rows, 25(7), 26(1), 27(18), 28(1); ventrals, males 162 to 177, mean 167.0, females 167 to 187, mean 175.4; subcaudals, males 25 to 29, mean 26.5, females 17 to 25, mean 20.9; supralabials 12 to 15, mean 13.6; infralabials 11 to 16, mean 14.2; body blotches (irregularities often make the counts somewhat uncertain) 35 to 47, mean 40.5; tail rings, males 5 to 7, mean 6.2, females 4 to 7, mean 4.9.

In form, the outstanding peculiarity of *polystictus* is its slender head and rounded snout. In other rattlesnakes the width of the head in adults varies from about 70 to 85 per cent of the head length; in *polystictus* it is less than 60 per cent. The regression lines are approximately as follows: Tail length, males, $T = .073L + 2.1$, females, $T = .0594L - .38$; head length, $H = .0367L + 6.4$; width of proximal rattle $W = .009L + 1.28$. The largest specimen is a female 930 mm. long; the smallest is 258 mm.

In head squamation, *polystictus* differs from the rattlesnake mode in several particulars. The anterior and posterior nasals usually fail to make contact above the nostril, such contact being prevented by an elongated canthal or subcanthal. Unfortunately, this scale, which might be considered a supranasal, is not sufficiently consistent in its relationship with adjacent scales to permit its use in a key. Sometimes it occupies the position of an ordinary canthal; at others it may lie below the true canthal; in still other cases it reaches forward to the rostral, thus comprising (with its opposite) an additional pair of internasals, upsetting the usual key character of *viridis* and its subspecies; and, finally, in some instances, it contacts its fellow on the opposite side, thus preventing the contact of the true internasals with the rostral.

The prenasal is usually considerably higher along the rostral than posteriorly at the nostril; it is deeply indented by whatever scale comprises the supranasal.

One of the most consistent of the *polystictus* head-scale peculiarities is a pair of elongated posterior intercanthals, each of which is about twice as long as wide, much slimmer than the scales occupying this prefrontal area in other rattlesnakes. This configuration was found in 20 specimens out of 24.

In *polystictus* the anterior subocular contacts the supralabials, a contact only evident in a few of the smaller species of rattlers. No specimen of *polystictus*

has yet been seen in which this contact is not made, and always with the fourth and fifth supralabials. The prefoveals number from 1 to 3.

Crotalus polystictus has a distinctive pattern, both on the head and body. The top of the head is marked by several dark-brown, black-edged ellipses behind light supraocular crosslines; a small pair in the postfrontal region, outside of these a much larger divergent pair, and back of the first, a second large parietal pair, also divergent. Of the marks on the crown, probably the most individualistic and consistent, and therefore most suitable for a key, are the light supraocular transverse marks. These are thin, even, and edged with black or dark-brown. Outwardly they are curved slightly backward. I have not yet seen a specimen in which these marks were not conspicuously evident.

On the side of the head are several additional dark marks, edged with black as are the others, and separated by light lines or broader light areas. There is a small blotch engaging the labials immediately below the pit; a second of larger size below the eye with its lower end directed backward; and a dark postocular ellipse, the largest of all, which reaches a point above the commissure. There are several dark spots along the lower labials, and often a white vertical line on the mental, somewhat like that in *willardi*. In the evenness and sharpness of distinction between the dark and light marks on the head, *polystictus* is rivalled only by *willardi* and *meridionalis*.

On the body, the modal pattern of *polystictus* comprises two dorsal lines of ellipses. These are dark-brown with black edges, and have their major axes directed longitudinally. Laterally there are several additional lines of auxiliary blotches which are longitudinally shorter than the main series. The ground color between blotches is gray, tending to buff middorsally.

There are considerable divergences from the modal pattern of the body, in that the two main series tend to merge dorsally when the pairs of ellipses are directly opposite each other; they are perfect only when they alternate in longitudinal position; also, the blotches are sometimes round or oval rather than elliptical.

It is because of these variations in both squamation and pattern that, although *polystictus* is one of the most distinctive and easily recognized of the rattlesnakes, deterministic characters are not easily set forth in a key. I recommend the thin black-edged lines across the supraoculars as the most useful.

Crotalus polystictus is found in the highlands of central Mexico from southern Zacatecas southward to Morelos and east-central Veracruz, including southeastern Jalisco, Guanajuato, and north-central Michoacán. Judging from the specimens available, I should assume it to be most common within a radius of about 100 miles of the point where these last three states meet. The Paris Museum has a specimen from Tehuantepec, Oaxaca. There is no question as to the correct identity of this specimen; at my request it was recently checked by Dr. Jean Guibé, who reports it the one figured by Angel in plate 77, fig. 2 of the reptile volumes of the Mission Scientifique. The pattern of this speci-

men is aberrant only in that the supraocular light lines are not turned backward laterally. It is to be doubted whether this specimen came from a lowland point such as Tehuantepec. It might have come from some high-altitude locality in the Isthmus of Tehuantepec, but it is more likely to have been recorded as being from the shipping point from which Diguët sent it to the Paris Museum, rather than the place where it was collected, a frequent custom of the last century.

***Crotalus stejnegeri* Dunn**

LONG-TAILED RATTLESNAKE

Figure 8.

1919. *Crotalus stejnegeri* Dunn, Proc. Biol. Soc. Wash., vol. 32, p. 214

Through the courtesy of Mr. Langan W. Swent, an American mining engineer, I have finally succeeded in securing two live specimens of this almost-mythical rattlesnake, of which previously only 3 had been known, 2 in the U. S. National Museum and 1 in the British Museum. The newly acquired snakes were collected about 6 mi. north of Yamoriba (about $105^{\circ}47'$ W, $24^{\circ}12\frac{1}{2}'$ N), Durango, Mexico. They comprise an adult male and a young female, the latter being the first of the sex available.

C. stejnegeri, although a small rattlesnake, does not exhibit the tendencies shown by the other small montane rattlers of Mexico, for the latter usually run to reduced scale rows and ventrals, and simplified head scales, tending in some degree toward *Sistrurus*. *C. stejnegeri*, on the contrary, is relatively high in scale rows and ventrals, and exhibits the extreme subdivision of head scales characteristic of such northern forms as *viridis* and *atrox*.

Summary of Species.—With only 5 specimens available, 4 males and 1 female, the descriptive outline of the species must necessarily be tentative. The longest specimen measures 614 mm., the shortest 282. The body is quite slender for a rattlesnake. The head-length regression line, as roughly indicated by these 5 specimens, is $H = .03L + 9$, which, for a 600-mm. adult would give a head length of 27 mm. or $4\frac{1}{2}$ per cent of the body length over-all. The male tail length line is $T = .135L - 4.4$, which at 600 mm. gives a tail length of $76\frac{1}{2}$ mm. or 12.7 per cent of the over-all length. The single juvenile female has a tail proportion slightly below 10 percent; from data on other rattlers I should expect this to drop to 9 per cent or less in the adults. In any case, this rattler has a proportionately longer tail than any other species. The rattle is very small, being either primitive or degenerate; starting with a button with a width of only 2.1 mm., the proximal rattle in the adults only slightly exceeds 3 mm. (max. 3.3). I should judge that the regression line of the width of the proximal rattle may be of the order of $W = .004L + 8.5$. The fang length is contained in the adult body length about 88 times, and in the head length 4.0 times.

The scale rows at mid-body are 25(1), 27(3), 29(1); ventrals, males, 174 to 178, mean 176, female, 171; subcaudals, males, 43, 44, 45, 45, female,

37; supralabials 14 to 16, mean 14.8; infralabials 14 to 17, mean 15.8. The body blotches vary from 35 to 43, mean 40.2; the tail bands number from about 12 to 14, but the last are so obscured by the darkening of the ground color that they cannot be accurately counted.

The rostral is about as high as wide. The internasals are wider than high and are sharply curved upward along the canthus, causing a ridge more accentuated than in any other form except *willardi* and its subspecies. The canthals, which are usually 1-1, but may be 2-2, are also slightly ridged outwardly. Between the canthals there are many small irregular scales. The total scales in the internasal-prefrontal area vary from 10 to 21, mean 15.4. There is no definite division between the intercanthals and intersupraoculars. The minimum scales between the supraoculars vary from 5 to 8. The extreme subdivision of the scales in these parts of the crown is most unusual in a small rattlesnake. The same condition exists on the sides of the head, for there are about 7 or 8 prefoveals, the exact number being indeterminate since the lacunals do not touch the labials, a characteristic of only a few of the largest rattlesnake species. There are usually 4 scale rows from the orbit to the lip edge. The loreals number 4 or 5, there being an upper and lower, with one or more small scales either before or behind the upper loreal. The resemblance here is to *molossus*, a much larger snake having no other likeness to *stejnegeri*. The preoculars are not divided.

The first infralabials, which, as usual, meet on the midventral line, are carried farther back and have blunter ends than is usual in the rattlers. In one specimen this prevents the second infralabials from reaching the anterior genials, but this does not occur in the other specimens, so that this lack of contact cannot be used as a key character. For this purpose dependence must be put on the high number of subcaudals, which, as far as is now known, sufficiently exceeds all other rattlers to avoid overlapping.

The dorsal pattern comprises a series of brown blotches on a light gray-brown ground color. The blotches are 9 to 11 scale rows wide and 2 to 3 scales (end-to-end) long. The interspaces are two scales long, and, as the blotches and interspaces do not normally cut across scales, the blotches have decidedly serrated borders. The blotch inner borders are darker than the centers; they are usually dark-brown or black. There are three lateral series of blotches on each side, the middle row being the largest; this row matches in position with the main series, whereas the other two are opposite the dorsal interspaces. All blotches become somewhat lighter posteriorly. Toward the tail the dorsal and second row of blotches join to form crossbands. The ventrum is heavily mottled with irregular dark-brown or black blotches on a cream ground color.

The head pattern on top comprises pairs of spots in the prefrontal, intersupraocular, and parietal areas, and a pair of elongated occipital bars. The supraoculars are crossed by light central bars, edged with black. On the sides there is a dark postocular streak which passes just above the commissure; other-

wise the side of the head is grayish. The only conspicuous marks below are blotches that engage the infralabials and adjacent gulars, 3 or 4 scales in advance of the angle of the mouth.

Anteriorly the tail is barred with brown or black crossmarks on a gray background. The ground color becomes progressively darker posteriorly, with the result that the marks become indistinct. The underside of the tail, which is gray, also becomes darker toward the rattle. The anterior lobe of the rattle matrix is black.

The hemipenes are different from those of any other rattlesnake. They are not only longer and slimmer, proportionately, as might be expected from the long tails, but they are different in form, although deeply bifurcate as in all rattlers. The spines are small, slim and very numerous. They cover the entire periphery except at the sulcus and are present in the crotch. The transition to fringes is rather gradual as in *Sistrurus*. The fringes are relatively small and disappear completely at the outer end, where the shaft is smooth and slightly expanded. Such a smooth area is present in no other rattler.

To date, *stejnegeri* has been collected only at Plomosas, Sinaloa; and Ventanas and Yamoriba, Durango, Mexico. All three localities are in the mountains along the Sinaloa-Durango border.

***Crotalus willardi meridionalis* Klauber**

SOUTHERN RIDGE-NOSED RATTLESNAKE

1936. *Crotalus willardi* (part) Klauber, Trans. San Diego Soc. Nat. Hist., vol. 8, no. 20, p. 231
1949. *Crotalus willardi meridionalis* Klauber, Trans. San Diego Soc. Nat. Hist., vol. 11, no. 8, p. 131

When this subspecies was originally described only 4 specimens were available. Three new ones, MZUM 101552, 101556-7 from Laguna del Progreso (about 50 mi. wnw. of Ciudad Durango), Durango, altitude about 8000 feet, are now at hand. Seven additional specimens of *willardi willardi* have been collected, bringing the total study series of that subspecies to 31. Of these, 27 are from the Huachuca Mountains, and 4 from the Santa Rita Mountains of southeastern Arizona. The typical subspecies has not been collected in Mexico.

The new material fully validates the subspecies *meridionalis*. In *w. willardi*, 27 out of 31 specimens have 25 scale rows at mid-body, and only 4 have 27.

In *meridionalis* 5 out of 7 specimens have 27 rows; the other 2 have 29. Other differences are indicated by the following tabulation:

		<i>C. w. willardi</i> (15 males, 16 females)	<i>C. w. meridionalis</i> (3 males, 4 females)
Ventrals, males,	range	147-154	147-149
	mean	150.7	148.0
Ventrals, females,	range	152-159	147-152
	mean	154.7	148.8
Subcaudals, males,	range	25-28	31-34
	mean	27.3	32.7
Subcaudals, females,	range	21-25	29-30
	mean	22.6	29.8
Body blotches,	range	18-25	28-33
	mean	23.3	30.4

It will be noted that although *meridionalis* has fewer ventrals, on the average, than *w. willardi*, there is some overlapping, and the ventral counts are therefore not useful as key characters. In the subcaudals and body blotches, however, the differences are sufficiently wide to serve in a key, for there is no overlapping.

The tail rings of *willardi* have no statistical interest since they do not constitute a uniform series; there are usually one to three anterior rings followed by a longitudinal bar.

All of the newly available specimens of both *w. willardi* and *meridionalis* have the bright head marks characteristic of these subspecies, including the central vertical line on the rostral and mental, that serve to distinguish both subspecies from *w. silus*, which, peculiarly enough, occupies the area between them. The blotches on the anterior infralabials are longer in *meridionalis* than in *w. willardi*; they are less sharply outlined, grayer and more punctate in the former. The posterior pair of blotches is longer and narrower in *meridionalis*, for in this subspecies these blotches hardly extend beyond the infralabials, while in *w. willardi* they mark the adjacent gulars.

***Crotalus willardi silus* Klauber**

CHIHUAHUA RIDGE-NOSED RATTLESNAKE

1917. *Crotalus willardi* (part) Stejneger and Barbour, Check List of North American Amphibians and Reptiles, [ed. 1], p. 111
 1949. *Crotalus willardi silus* Klauber, Trans. San Diego Soc. Nat. Hist., vol. 11, no. 8, p. 128

The range of this subspecies is restricted to northeastern Sonora and western Chihuahua. No new material has become available since the publication of the original description in 1949.

***Crotalus tigris* Kennicott**

TIGER RATTLESNAKE

Figure 11.

1859. *Crotalus tigris* Kennicott, in Baird, Reptiles of the Boundary, U.S.-Mex. Boundary Survey, vol. 2, p. 14

Crotalus tigris is a species notable among the rattlesnakes for the small size of its head, and for the punctated application of color in its blotches, which indeed are in the nature of cross-stripes, the source of its name. In both of these characters it most nearly resembles *C. mitchelli mitchelli* of the Cape region of Baja California, although more extreme than the latter in both characters. Although the blotches of many species of rattlesnakes will be found, upon close examination, to be comprised of dark stippling, in *tigris* the spotting is particularly evident, only a few specimens having blotches in which the dark elements are applied as a wash or uniform color.

Description of the Species.—The following statistics of *tigris* are based on 59 specimens, of which 17 were from Sonora and the rest from Arizona. *C. tigris* is a species of medium size. The longest specimen measured was a male 815 mm. long; the shortest was 307 mm. From unborn embryos it is estimated that the average size at birth is 225 mm. The body proportionality regression lines are approximately as follows: Tail length, males, $T = .087L - 2.7$; females, $T = .063L + 1.1$; head length, $H = .025L + 9.0$; dorso-ventral width of proximal rattle, $W = .012L + 4.2$. The average width of the button is 7.2 mm., a very large initial rattle for a relatively small snake, and the average increment in width per rattle from the button to rattle number 4 inclusive is 1.01 mm. The adult fang length (upper lumen to tip) is contained in the length over-all about 165 times, and in the head length 6.1 times.

The hemipenes are rather attenuated, as in *C. viridis* and its subspecies. The transition from spines to fringes is sharp. The spines are short and of moderate thickness; they are concentrated on the shoulders, except that a few are carried into the crotch, where 3 or 4 spines are in evidence. The fringes are somewhat reticulate; there are from 35 to 40 fringes, beginning the count at the outermost point reached by the spines.

The scale rows are distributed thus: 21(2), 22(4), 23(37), 24(2), 25(11), 27(1). The ventrals in the males range from 158 to 172, average 164.4; and in the females from 164 to 177, average 168.7. The subcaudals vary from 23 to 27, mean 24.8 in the males; and 16 to 21 in the females, mean 19.4. The supralabials vary from 11 to 16; they are usually 12 to 15 with an average of 13.7. The infralabials vary from 11 to 16, but are usually 13 to 15, with a mean of 13.7. The minimum scales between the supraoculars vary from 3 to 8, average 4.96; the scales in the internasal-prefrontal area are much broken up; they range from 11 to 37, mean 16.9.

In some specimens of *tigris* the anterior subocular makes contact with a supralabial, usually the fifth. The contacting ocular is of the diagonal type

called the lacrimal by Gloyd, rather than a true subocular; nevertheless the distinction between these scales is not a sharp one, so that attention must be called to the possibility if this contact is employed in a key.

The head markings are obscure and indefinite; there are a few irregular blotches on the top of the head posteriorly. Supraocular cross-dashes are sometimes present. The side marks also are less definite than in most rattlers. An obsolescent dark ocular stripe is usually present. The labials are heavily spotted, but otherwise the underside of the head is clear.

The body pattern comprises from 37 to 52 transverse bands, with a mean of 42.7. They do not cross the ventrum. The bands are formed of dark-gray or brown punctations on a gray, lavender, cream, buff, or pink background. The bands are widest middorsally, where they are wider than the interspaces. Their contrast with the ground color increases posteriorly. A secondary series of small blotches is usually evident on the lowest lateral rows between the major blotches. Often scattered scales in the blotches have black tips. A few specimens have hexagonal blotches anteriorly. The tail rings vary from 6 to 10 in the males, mean 7.8; and 4 to 7 in the females, mean 5.5. The rings are punctate and indefinite; they are not complete below. The anterior rattle matrix is tan or brown.

The Sonoran specimens of *tigris* tend to be somewhat grayer and darker than those from Arizona.

Although a number of specimens of *tigris* have recently been collected in Sonora, the range has not been extended south of Guaymas, nor east of Pílares.

In Arizona, the only state in the United States in which *tigris* is found, a specimen (AMNH 68599) collected by C. M. Bogert at Humbug Mine, 10 miles above Castle Hot Springs, Yavapai County, is the first from that county, extending the range about 20 miles north of the previous record. This brings the overlap in the ranges of *tigris* and *pyrrhus* up to at least 50 miles. Since both forms prefer rocky habitats they are sometimes found together.

Sonoran records of *tigris* include the following: Cobos (4 mi. w. of Sasabe), Pílares, 5 mi. sw. of Las Alesnas (23 mi. wsw. of Caborca), 11.5 mi. n., 12.3 mi. n., 5 mi. se., and 5 mi. sw. of Hermosillo, 1 mi. sw. of El Zapo, 10 mi. nw. and 2 mi. w. of Guaymas, Caballo (near Guaymas), and El Boludo (15 mi. w. of Tricheras).

***Crotalus cerastes laterorepens* Klauber**

COLORADO DESERT SIDEWINDER

1859. *Crotalus cerastes* (part), Hallowell, Pac. RR. Surv. Rept. (Williamson), vol. 10, part 4, p. 17
1944. *Crotalus cerastes laterorepens* Klauber, Trans. San Diego Soc. Nat. Hist., vol. 10, no. 8, p. 94

The sidewinder seems to be quite common in sandy areas along the Gulf of California coast of Sonora. It had been previously reported (from its highly individualistic tracks) as far south as Bahia Kino; now, through the activity of J. M. Savage and his associates from Stanford University, the range has been further extended to Tastiota. The University of Illinois has a specimen from 1 mi. se. of Altar, a new inland record for Sonora.

The southerly specimens from Sonora differ from typical *laterorepens*, as found in extreme southeastern California, in that they usually have 21 instead of 23 scale rows, and the anterior lobe of the rattle matrix is only partly black instead of all black, even in adults. The terminal tail rings are black. A specimen from Punta Peñasco had brilliant orange blotches in life. The middorsal scales of the sidewinder are more prominently tuberculated than in any other rattlesnake occurring in the United States.

Crotalus cerastes laterorepens has been reported from the following Mexican localities, all in Sonora: 4½ and 26 mi. sw. of Sonoyta, 10 mi. ne. of El Papalote, Punta Peñasco (also 9 mi. ne.), 1 mi. se. of Altar, Puerto Libertad (also 6 mi. ne.), Bahia Kino, Punta Kino (also 8 mi. nw.), and Tastiota.

***Sistrurus ravus* (Cope)**

MEXICAN PIGMY RATTLESNAKE

Figure 12.

1865. *Crotalus ravus* Cope, Proc. Acad. Nat. Sci. Phila., vol. 17, no. 4, p. 191

1896. *Sistrurus ravus* Boulenger, Cat. Snakes Brit. Mus., vol. 3, p. 571

This species is so distinct that it involves no difficult taxonomic problems. It is fairly common in a restricted highland area of central Mexico lying to the east, southeast, and southwest of Mexico City. No other species of the genus *Sistrurus* has been found within 400 miles of this area.

Description of the Species.—Scale counts and other data are now available on 49 specimens of *ravus*, although the number of females (18) is rather inadequate for defining the range of female variation. The species data compiled from these specimens are as follows: The largest specimen examined was a male measuring 699 mm. The shortest juvenile was 175 mm. A female 586 mm. in length contained 9 embryos. The approximate regression lines of the body proportions are, for the tail lengths of the males, $T = .10L - 1.0$, and for the females $T = .076L + .8$; the head length equation is $H = .039L + 6.8$, and that of the dorso-ventral width of the proximal rattle $W = .0091L + .42$. All dimensions in these equations are in millimeters and the body lengths are over-all. The fang length (upper lumen to point) is contained in the body length about 108 times, and in the head length 5.7 times. These are adult proportions.

The scale rows are 21 (38 specimens), 23 (10); ventrals, males, 138 to 152, mean 144.8, females, 138 to 149, mean 144.2; subcaudals, males, 26 to

30, mean 28.2, females, 20 to 25, mean 23.0; supralabials 10 to 13, mean 11.1; infralabials 9 to 13, mean 10.8; body blotches 25 to 35, mean 30.4. The tail rings are too obscure to be counted with accuracy; there are about 3 to 6 in the males, and 3 to 5 in the females.

Although usually adhering to the 9-plate crown of *Sistrurus*, sutures, either completely or partly dividing the parietals, are not unusual. These divisions diverge outward and backward from the middorsal line. The anterior suboculars usually touch the fourth and fifth supralabials as in *S. catenatus*, rather than the third and fourth as in *S. miliarius*. The upper preocular rarely contacts the postnasal, being usually prevented by a junction of the prefrontal and the loreal. A small upper loreal is present on one side of one specimen.

Sistrurus ravus is light-brown or gray-brown in color, with a conspicuous series of dark-brown, black-edged blotches down the back. These blotches are square or hexagonal anteriorly but become elongated into rectangles or ellipses posteriorly. They are about 5 scale rows wide at mid-body, and 4 scales long, end-to-end. There is a single conspicuous series of lateral blotches on either side; each lateral blotch is immediately below a corresponding member of the main series, but the laterals are much shorter, being only 1 or 1½ scales long. The ventrum is lightly mottled. The tail is crossed by brown blotches which become less evident posteriorly, where both the blotches and ground color are lighter than on the body. The anterior rattle matrix is buff. The most prominent head marks are a pair of longitudinal parietal blotches. The usual rattlesnake post-ocular streak is only faintly in evidence in the form of dark stippling. There are scattered dots on the underside of the head.

Several specimens lately acquired by the University of Michigan from just south of Mexico City (MZUM 99839-40 Contreras, 99847 Santa Rosa, 101560-1 Cañada de Contreras, all in Distrito Federal) are strongly melanistic. A specimen from Tres Cumbres, Morelos, in the collection of the Mexican National Museum, is of the same character. The melanism is most accentuated in the adults, just as is the case with *Sistrurus catenatus catenatus* from certain areas in Ohio. In the adults the specimens must be held at a favorable angle in order to render the dorsal spots visible. Middorsally the interspaces are lighter than laterally. In one specimen, the dorsal blotches are as wide as long, an unusual shape in this species. The bellies of these melanistic individuals are heavily mottled, although the underside of the neck is lighter. The light line separating the parietal blotches, the only conspicuous head marks in this species, is somewhat evident in the melanos. It was noted in a series of embryos from one of these melanistic specimens, that, although the dorsal blotches were dark-brown, other areas of the body that would no doubt have become equally dark in the adult stage, including the ventrum, were cream-colored and quite without pigment.

The territorial distribution of *ravus* seems quite logical. Although 4 specimens are from Oaxaca, distant 150 miles or more from the main occupied area in México (state), Distrito Federal, Morelos, Tlaxcala, Puebla, and east-cen-

tral Veracruz, they are from the central highland area of that state, and show no important character deviations from the main group.

The newly available specimens of *ravus* maintain the previously noted differences from the other species of *Sistrurus*—the rounded snout; the lack of conspicuous head marks; and the dorsal blotches longer than wide, with a secondary lateral series conspicuously narrow as measured along the snake, although extended transversely.

ABBREVIATIONS

The following abbreviations serve to indicate the museums whose specimens are designated by numbers in the text:

AMNH	American Museum of Natural History
BM	British Museum, Natural History
CAS	California Academy of Sciences
Chi. Acad.	Chicago Academy of Sciences
CNHM	Chicago Natural History Museum
EHT	Private collection of Edward H. Taylor
IU	Museum of Natural History, University of Illinois
KU	Museum of Natural History, University of Kansas
LMK	Private collection of L. M. Klauber
LSUMZ	Museum of Zoölogy, Louisiana State University
MCZ	Museum of Comparative Zoölogy, Harvard University
MVZ	Museum of Vertebrate Zoölogy, University of California, Berkeley
MZUM	Museum of Zoölogy, University of Michigan
PANS	Academy of Natural Sciences of Philadelphia
Paris	Museum National d'Histoire Naturelle
TCWM	Texas Co-operative Wildlife Museum
SDSNH	San Diego Society of Natural History
SUNHM	Natural History Museum, Stanford University
USNM	United States National Museum, Smithsonian Institution

A KEY TO THE RATTLESNAKES OF MEXICO

(exclusive of Baja California, and the Islands of the Gulf of California
and the Pacific Coast)

- 1a Top of the head with large plates anteriorly (usually 9 in number) including a single frontal and a pair of large, symmetrical (but sometimes sutured) parietals in contact Genus *Sistrurus* 2
- 1b Top of the head with scales of varying size; more than one scale in the frontal area; parietals, if enlarged, not in contact or symmetrical Genus *Crotalus* 3
- 2a Upper preocular not in contact with the postnasal; rostral curved over the snout; canthus rostralis rounded; dorsal body blotches longer than wide or color black *Sistrurus ravus*
- 2b Upper preocular in contact with the postnasal; rostral not curved over the snout; canthus rostralis sharply angled; dorsal body blotches square or wider than long *Sistrurus catenatus tergeminus**
- 3a Outer edges of the supraoculars extended into raised and flexible horn-like processes distinctly pointed at the tip *Crotalus cerastes laterorepens*
- 3b Outer edges of the supraoculars not extended into pointed horn-like processes 4
- 4a Subcaudals in males more than 40, and in females more than 35 *Crotalus stejnegeri*
- 4b Subcaudals in males fewer than 40, and in females fewer than 35 5
- 5a Tip of the snout and the anterior canthus rostralis raised into a sharp ridge *Crotalus willardi*
(For subspecies continue on to 6)
- 5b Tip of the snout and the anterior canthus rostralis not raised into a sharp ridge 8
- 6a No white vertical line on the rostral or mental *Crotalus willardi silus*
- 6b A white vertical line on the rostral and mental 7

* No unquestionably accurate records of this snake in Mexico are known, all reports thus far being subject to some doubt. However, occurrence south of the border is not improbable.

- 7a Scale rows usually 25; subcaudals 29 or fewer in the males and 26 or fewer in the females; body blotches 26 or fewer *Crotalus willardi willardi**
- 7b Scale rows usually more than 25; subcaudals 30 or more in the males and 27 or more in the females; body blotches more than 26
Crotalus willardi meridionalis
- 8a Prenasals separated from the rostral by small scales or granules
Crotalus mitchelli pyrrhus†
- 8b Prenasals contacting the rostral 9
- 9a Body pattern comprises a series of 35 or more crossbands composed of conspicuous dark-gray or brown dots on a buff, pink, or light-gray background; dorso-ventral width of proximal rattle contained in the head length less than $2\frac{1}{2}$ times *Crotalus tigris*
- 9b Body pattern comprises diamonds, hexagons, rectangles, ovals, or ellipses, or, if bands, not made up of conspicuous dots; dorso-ventral width of proximal rattle contained in the head length more than $2\frac{1}{2}$ times 10
- 10a Anterior subocular contacts one or more (usually 2) supralabials 11
- 10b Anterior subocular fails to reach any supralabial 21
- 11a Each supraocular transversely crossed by a thin, black-bordered light line that usually bends backward outwardly; a clearly outlined round or oval dark blotch immediately below and touching the eye; usually a pair of slim intercanthals, each about twice as long as wide *Crotalus polystictus*
- 11b No thin, black-bordered transverse lines on the supraoculars; no clearly outlined round or oval blotch immediately below the eye; intercanthals, if paired, not long and slim 12
- 12a Dorsal pattern comprising two rows of small blotches on opposite sides of the middorsal line, some or many of which may be united across this line
Crotalus pricei
(For subspecies continue on to 13)
- 12b Dorsal pattern comprising a single central row of dorsal blotches or crossbands, uninterrupted middorsally; or blotches virtually obsolete 14

* This subspecies has not yet been recorded from Mexico, but may occur in extreme northeastern Sonora. It is to be expected in the Huachuca Mountains, which reach an altitude of at least 6,000 feet on the Mexican side of the border. It is included in the key so that, if found there, a proper identification will follow.

† This subspecies has not yet been collected in mainland Mexico, but it unquestionably occurs in northwestern Sonora, for it has been taken just north of the boundary line in the Tinajas Altas Mountains of Arizona.

- 13a Ventrals 147 or more *Crotalus pricei pricei*
- 13b Ventrals 146 or fewer *Crotalus pricei miquihuanus*
- 14a Anterior subocular in contact with the third and fourth supralabials; lower preocular usually fails to reach the loreal 15
- 14b Anterior subocular in contact with other than the third and fourth supralabials; lower preocular usually crosses above the pit to contact the loreal 17
- 15a Loreal does not contact any supralabial; pattern of narrow crossbands
Crotalus transversus
- 15b Loreal in contact with one or more supralabials; pattern of dorsal blotches
Crotalus intermedius
(For subspecies continue on to 16)
- 16a Ventrals 163 or fewer in the males, and 169 or fewer in the females
Crotalus intermedius intermedius
- 16b Ventrals 164 or more in the males, and 170 or more in the females
Crotalus intermedius omiltemanus
- 17a Prefrontals paired, and with even but convex posterior edges
Crotalus pusillus
- 17b More than 2 scales in the prefrontal area 18
- 18a Upper preocular split vertically, the anterior section being higher than the posterior and curved over the canthus rostralis in front of the supraocular; primary dorsal body blotches or crossbands usually fewer than 25
*Crotalus lepidus**
(For subspecies continue on to 19)
- 18b Upper preocular not split vertically; or, if split, the anterior section not conspicuously higher than the posterior and not curved over the canthus rostralis in front of the supraocular; primary dorsal body blotches usually exceed 24
Crotalus triseriatus
(For subspecies skip to 20)
- 19a A dark stripe passing backward from the eye to the angle of the mouth; a pair of separated occipital blotches; the dorsal pattern of blotches or

* It has been necessary to double-key *lepidus*, as the anterior subocular sometimes contacts one or more labials and sometimes does not. The same is true of *triseriatus*, although this contact fails in the latter form much less often than in *lepidus*. I have not double-keyed *pusillus*, although in a specimen from Nayarit, the anterior subocular fails to reach the supralabials. Very dark specimens of *lepidus* with more than 26 primary blotches, with or without split upper preoculars, belong to the new subspecies *C. l. morulus*, which was described too late to be properly incorporated in this key.

crossbars often not strongly differentiated from the ground color and with intermediate blotches almost as prominent as the major series

Crotalus lepidus lepidus.

- 19b Postocular dark stripe obsolescent or absent (except in juveniles); occipital blotches confluent; the dorsal pattern of dark blotches or crossbars strongly differentiated from the ground color *Crotalus lepidus klauberi*

- 20a Rattle-fringe scales usually 8; rattle smaller; in snakes exceeding 400 mm. in length, the dorsoventral width of the proximal rattle lobe is less than .01 times the body length over-all; in snakes less than 400 mm. in length, the width of the proximal rattle lobe is less than .075 times the body length, plus 1 mm. *Crotalus triseriatus triseriatus*

- 20b Rattle-fringe scales usually 10; rattle larger; in snakes exceeding 400 mm. in length, the dorsoventral width of the proximal rattle lobe exceeds .01 times the body length over-all; in snakes less than 400 mm. in length, the width of the proximal rattle lobe exceeds .075 times the body length, plus 1 mm. *Crotalus triseriatus aquilus*

- 21a More than two internasals, that is, scales between the nasals and in contact with the rostral, regardless of size or position *Crotalus viridis*
(For subspecies continue on to 22)

- 21b Two internasals 23

- 22a Pattern of brown blotches on a tan or buff background; lightly mottled with brown below *Crotalus viridis viridis*

- 22b Pattern of dark-brown or black blotches on a dark-gray, dark-brown, or almost-black background; heavily mottled with dark-brown or black below *Crotalus viridis cerberus**

- 23a Upper preocular split vertically, the anterior section being higher than the posterior and curved over the canthus rostralis in front of the supraocular; pattern usually of blotches or crossbars seldom exceeding 24 in number *Crotalus lepidus*†
(For subspecies continue on to 24)

- 23b Upper preocular not split vertically; or, if split, the anterior section not conspicuously higher than the posterior and not curved over the canthus rostralis in front of the supraocular; pattern of diamonds, hexagons, rectangles, or ellipses usually exceeding 24 in number 25

- 24a A dark stripe passing backward from the eye to the angle of the mouth;

* It is doubtful whether this subspecies occurs in Mexico, there being only one highly questionable record to date. If it is found in Mexico, it will be in the mountains of Sonora near the U. S. border.

†See also the footnote under 18a.

a pair of separated occipital blotches; the dorsal pattern of blotches or crossbars often not strongly differentiated from the ground color and with intermediate blotches almost as prominent as the major series

Crotalus lepidus lepidus

- 24b Postocular dark stripe obsolescent or absent (except in juveniles); occipital blotches confluent; the dorsal pattern of dark blotches or crossbars strongly differentiated from the ground color *Crotalus lepidus klauberi*

- 25a Ventral scales 163 or fewer

Crotalus triseriatus

(For subspecies continue on to 26)

- 25b Ventral scales 164 or more

27

- 26a Rattle-fringe scales usually 8; rattle smaller; in snakes exceeding 400 mm. in length, the dorsoventral width of the proximal rattle lobe is less than .01 times the body length over-all; in snakes less than 400 mm. in length, the width of the proximal rattle lobe is less than .075 times the body length, plus 1 mm.

Crotalus triseriatus triseriatus

- 26b Rattle-fringe scales usually 10; rattle larger; in snakes exceeding 400 mm. in length, the dorsoventral width of the proximal rattle lobe exceeds .01 times the body length over-all; in snakes less than 400 mm. in length, the width of the proximal rattle lobe exceeds .075 times the body length, plus 1 mm.

Crotalus triseriatus aquilus

- 27a Tail rings contrasting, alternating white or light-gray with brown or black; at least 8, and usually more, scales occupying the internasal-prefrontal area

28

- 27b Tail black or dark-gray, with rings, if present, only slightly evident, because of lack of contrast between the light and dark areas; usually 4 (less often 6 or more) large flat scales or plates occupying the internasal-prefrontal area (not including subcanthals or supralorals)

30

- 28a Light and dark tail rings of approximately equal widths; the postocular light stripe, if present, reaches the supralabials 1 to 3 scales in advance of the angle of the mouth; minimum scales between the supraoculars rarely less than 4; no flat crescentic scale bordering each supraocular posteriorly

Crotalus atrox

- 28b Dark tail rings narrower than the light; the postocular light stripe, if present, passes backward above the angle of the mouth; minimum scales between the supraoculars usually 2, rarely more than 3; usually a flat crescentic scale bordering each supraocular on the posterior-inward side

Crotalus scutulatus

(For subspecies continue on to 29)

- 29a Dorsal blotches usually bordered by a row of light unicolored scales; dark postocular stripe extended to the angle of the mouth; distal tail rings dis-

tingtly darker than the body blotches, usually black; upper part of proximal lobe of the rattle matrix black (except in juveniles)

Crotalus scutulatus scutulatus

- 29b Dorsal blotches usually not bordered by a row of light unicolored scales; dark postocular stripe not extending to the angle of the mouth; distal tail rings not in sharp contrast with the body blotches, not black; upper part of the proximal lobe of the rattle matrix only slightly, if at all, darkened

Crotalus scutulatus salvini

- 30a No paired dark vertebral stripes on the neck; or if present, not extending posteriorly as much as 1 head length before meeting the first dorsal blotches 31

- 30b On the neck a pair of quite regular dark stripes 1 to 3 scale rows wide, separated by a single light middorsal stripe 2 or 3 scale rows wide, these stripes extending from 1 to 4 head lengths behind the head before meeting the first dorsal blotches 35

- 31a A black or dark-brown bar, bordered before and behind with cream or buff, crossing the head between the anterior points of the supraoculars

Crotalus durissus totonacus

- 31b No bright contrasting pattern in the prefrontal area as above described 32

- 32a Tail usually black or very dark-brown with light crossbars seldom in evidence posteriorly; rattle matrix usually black; subcaudals usually fewer than 28 in the males and 23 in the females

Crotalus molossus

(For subspecies continue on to 33)

- 32b Tail usually gray, with light-gray crossbars in evidence posteriorly; rattle matrix usually gray; subcaudals usually 28 or more in the males and 23 or more in the females

Crotalus basiliscus

(For subspecies skip to 34)

- 33a Scale rows at mid-body usually 27 or more; color of the internasal-pre-frontal area darker than the posterior part of the head, which, however, is longitudinally streaked with lines of dark scales; light areas above the postocular dark stripes more than 2 scales wide; lateral interspaces nearer in color to the light rows of scales that bound the blotches, than to the dark colors of the blotch interiors

Crotalus molossus molossus

- 33b Scale rows at mid-body usually 25 or fewer; color of the internasal-pre-frontal area not conspicuously darker than the posterior part of the head, which, however, is longitudinally streaked with lines of light scales; light streaks 1 or 2 scales wide above the postocular dark stripes; lateral interspaces nearer in color to the dark areas of the dorsal blotches, than to the light rows of scales that border those blotches

Crotalus molossus nigrescens

- 34a Ventrals 180 or more *Crotalus basiliscus basiliscus*
- 34b Ventrals 179 or fewer *Crotalus basiliscus oaxacus*
- 35a The dark lines on the neck comprised more of single than of double or triple rows of dark scales; usually more than 4 scales in the internasal-prefrontal area *Crotalus durissus culminatus*
- 35b The dark lines on the neck comprised more of double or triple rows of dark scales than of single; usually only 4 scales in the internasal-prefrontal area, comprising a pair of internasals and a pair of prefrontals or canthals 36
- 36a Ventrals usually 179 or fewer in the males, and 185 or fewer in the females; first infralabials usually undivided *Crotalus durissus durissus*
- 36b Ventrals usually 180 or more in the males, and 186 or more in the females; first infralabials usually divided transversely *Crotalus durissus tzabcan*

A KEY TO THE RATTLESNAKES OF BAJA (LOWER) CALIFORNIA, MEXICO

(Including the Islands of the Pacific Coast of the Peninsula,
and of the Gulf of California)

- 1a Outer edges of the supraoculars extended into pointed (but flexible)
horn-like processes *Crotalus cerastes laterorepens*
- 1b Outer edges of the supraoculars not extended into pointed horn-like
processes 2
- 2a Prenasals usually separated from the rostral by small scales or granules,
or at least the front edges of the prenasals chipped and sutured; upper
preoculars often divided horizontally, vertically, or both
Crotalus mitchelli
(For subspecies continue on to 3)
- 2b Prenasals usually in contact with the rostral and without chipped or
sutured front edges; upper preoculars rarely divided 5
- 3a Last supralabial about twice as long as those before it; head smaller, the
length of the head contained in the adult body length (over-all) more than
24 times; original rattle-button, if present, more than 7½ mm. wide,
dorsoventrally *Crotalus mitchelli mitchelli*
- 3b Last supralabial not conspicuously longer than those before it; head
larger, the length of the head contained in the adult body length (over-
all) less than 24 times; original rattle-button, if present, less than 7½
mm. wide, dorsoventrally
- 4a Size smaller, adults seldom exceed 650 mm.; scale rows usually 23
*Crotalus mitchelli muertensis**
- 4b Size larger, adults exceed 650 mm.; scale rows usually number 25 or more
Crotalus mitchelli pyrrhus
- 5a Usually 3 or more internasals (scales between the nasals and in contact
with the rostral regardless of size or position) 6
- 5b Two internasals 7
- 6a Adults smaller, rarely exceeding 650 mm. *Crotalus viridis caliginis**
- 6b Adults larger, exceeding 650 mm. *Crotalus viridis helleri*
- 7a Tail with alternating black and light ash-gray rings, both colors being in
marked contrast with the posterior body color 8
- 7b Tail not having alternating black and light ash-gray rings 12

- 8a First infralabials usually divided; basic body color pink, red, or red-brown; dark punctations not conspicuous in dorsal blotches 9
- 8b First infralabials usually undivided; basic body color cream, tan, buff, or gray; dorsal blotches conspicuously punctated with dark dots 11
- 9a A pair of intergenials usually present; generally no contact between the prenasal and the first supralabial; dark tail rings often interrupted laterally
*Crotalus exsul**
- 9b Intergenials usually absent; prenasal usually contacts the first supralabial; dark tail rings rarely interrupted laterally *Crotalus ruber*
(For subspecies continue on to 10)
- 10a Usually a single loreal; scale rows usually 28 or more; light preocular stripe 2 scales wide or less (at the second row of scales above the supralabials); body color red or red-brown *Crotalus ruber ruber*
- 10b Usually 2 or more loreals; scale rows usually 27 or fewer; light preocular stripe 3 or more scales wide (at the second row of scales above the supralabials); body color yellow-brown or olive-brown
Crotalus ruber lucasensis
- 11a Upper preocular usually not in contact with the postnasal and no upper loreal present *Crotalus tortugensis**
- 11b Upper preocular usually in contact with the postnasal or such contact prevented by an upper loreal *Crotalus atrox*
- 12a Scales in the internasal and prefrontal areas total 12 or more; scales on the crown and in the frontal area rough, ridged and knobby
Crotalus enyo
- 12b Scales in the internasal and prefrontal areas total less than 12; scales on the crown and in the frontal area flat and smooth, although the edges may curl up *Crotalus molossus*
(For subspecies continue on to 13)
- 13a No darkening of the crown of the head; body blotches usually more than 37 *Crotalus molossus estebanensis**
- 13b Crown of the head dark-brown in contrast with olive-green farther back; body blotches usually less than 38 *Crotalus molossus molossus**

* These are all island species or subspecies, not occurring on the peninsula of Baja California. *C. m. molossus* is a mainland form in the United States and mainland Mexico, but not in Baja California. Most of the subspecies not designated with the asterisk (*) occur on islands as well as on the peninsula of Baja California (see the appropriate table).

TABLES OF CHARACTERS AND GEOGRAPHICAL DISTRIBUTION

The numbers in parentheses in Table 1 represent the means of the items listed, except in the case of the scale rows at mid-body, in which the mode is indicated. The scales in the internasal-prefrontal area should be understood to exclude encroaching pre- and postsupralorals. In counting intersupraoculars the minimum over any course is cited. The body blotches are counted only to the base of the tail, any tail marks being omitted from the count. I have not listed the tail rings as in many species they cannot be counted with accuracy; they are seldom of use in discriminating between forms, except in the subspecies of *C. viridis*.

With regard to the statistics of squamation set forth in Table 1, it should be stated that there were insufficient specimens of the following species and subspecies to determine the ranges of variation and averages with any degree of finality: *C. basiliscus oaxacus*, *C. durissus totonacus*, *C. intermedius intermedius*, *C. intermedius omiltemanus*, *C. pricei miquihuanus*, *C. pusillus* (females), *C. scutulatus salvini*, *C. stejnegeri*, *C. transversus*, and *C. willardi meridionalis*. These limitations likewise throw doubt on the accuracy of some of the morphological data set forth in Table 2.

In most of the forms, all of the available material was used in calculating the scale statistics, whether or not the specimens came from Mexico. However, in the case of a few wide-ranging species, because of known extensive intra-subspecific variations, it was decided to use the statistics of territorially restricted populations, including some adjacent to Mexico, when the Mexican material by itself was insufficient. These limitations were as follows:

<i>C. atrox</i>	Mexico only
<i>C. cerastes laterorepens</i>	Arizona and Sonora
<i>C. scutulatus scutulatus</i>	Mexico only
<i>C. viridis viridis</i>	Mexico, Texas, and New Mexico

The specimens from which the morphological data in Table 2 were derived were not correspondingly restricted, all available material being used.

The range in the ventrals in *C. triseriatus triseriatus* does not include the type specimen with 159. In several instances I have not hesitated to omit scale counts so different from the normal as to be clearly from freaks, or possibly miscounts that could not be verified because the specimens were no longer available.

With regard to the body proportionalities listed in Table 2, it should be emphasized that these are only applicable to adults. Rattlesnake body proportions are subject to considerable change during growth, this being particularly true of the head proportionality. To determine juvenile ratios the regression equations set forth in most of the species descriptions should be used.

The largest measured specimen is not necessarily from Mexico in the case of those subspecies that range beyond the limits of that country. The largest measured specimens are males (except in the case of *C. c. laterorepens*) in those forms in which adequate material is available. The column headed "large adult male" is presumed to indicate the size reached by say 2 to 4 per cent of the largest males in a population. With respect to the rattlesnake species that attain a very large size, my record maximum specimens are by no means exceptional, since very large specimens are seldom available in collections because of the difficulty of preserving them.

It will be observed from Table 2 that *C. stejnegeri* has proportionally the longest tail, followed by *C. willardi* and its subspecies, *S. c. tergeminus*, *S. rarus*, *C. durissus* and its subspecies, *C. t. triseriatus*, *C. t. aquilus*, and *C. pusillus*. Long-tailed forms are more prevalent in Mexico than in the United States.

It is less easy to gauge relative head lengths since it is characteristic of these genera that the smaller species tend to have proportionately larger heads than the larger species. Among the small species, *C. i. intermedius* and *C. i. omiltemanus* are outstanding for their small heads; and among the medium-sized snakes *C. tigris* has the smallest head.

The snakes with conspicuously tiny rattles are *C. pusillus*, *C. t. triseriatus*, *C. stejnegeri*, *S. rarus*, and *C. willardi*. These snakes have rattles so delicate that complete strings of more than 4 or 5 rattles are rather rare and hence my increment statistics are not very accurate. Adults of these species, when rattling, cannot be heard beyond 4 to 6 feet.

The rattlesnakes having the shortest fangs, proportionate to their heads, are the snakes of the *intermedius* group: *transversus*, *i. intermedius*, and *i. omiltemanus*. The longest fangs (relatively speaking) are those of *polystictus*, *stejnegeri*, *totonacus*, and *molossus*.

It should be understood that, in Tables 3 and 4 showing geographical distribution, the entries are only general in character. Ranges may be quite discontinuous; they often depend on ecology.

TABLE 1
SCALE COUNT AND PATTERN STATISTICS OF MEXICAN MAINLAND RATTLESNAKES

	Scale Rows at Midbody	Ventral Males	Scutes Females	Subcaudal Males	Scutes Females	Supralabials	Infralabials	Scales in Internasal- Prefrontal Area	Intersupra- oculars	Body Blotches
<i>S. catenatus tergeminus</i>	23-27 (25)	138-155 (147.5)	143-160 (152.3)	27-34 (30.4)	21-30 (25.4)	10-14 (11.6)	11-14 (12.5)	4	1	28-50 (39.4)
<i>S. rarus</i>	21-23 (21)	138-152 (144.8)	138-149 (144.2)	26-30 (28.2)	20-25 (23.0)	10-13 (11.1)	9-13 (10.8)	4	1	25-35 (30.4)
<i>C. atrox</i>	23-27 (25)	173-192 (181.1)	173-191 (183.4)	23-32 (25.9)	17-24 (20.2)	13-17 (15.2)	14-19 (16.6)	11-30 (18.1)	3-7 (4.6)	30-43 (35.8)
<i>C. basiliscus basiliscus</i>	25-29 (27)	179-201 (191.4)	185-206 (197.6)	26-36 (30.7)	18-29 (24.4)	13-18 (15.1)	13-19 (16.1)	4-9 (4.3)	2-6 (2.9)	26-41 (33.2)
<i>C. basiliscus oaxacus</i>	25		174-175 (174.5)		20	14-17 (15.8)	16-17 (16.3)	4-6 (5.0)	3-5 (4.0)	29
<i>C. cerastes laterorepens</i>	21-25 (21)	135-148 (141.0)	138-148 (144.7)	17-24 (20.8)	14-19 (16.1)	10-14 (12.1)	10-16 (12.7)	9-27 (17.9)	2-7 (4.3)	30-42 (36.0)
<i>C. durissus durissus</i>	27-31 (29)	170-181 (173.6)	172-187 (180.6)	28-33 (30.3)	20-26 (22.9)	13-17 (14.6)	13-19 (16.1)	4-6 (4.1)	2-4 (2.1)	20-30 (24.5)
<i>C. durissus culminatus</i>	27-33 (29)	170-182 (177.4)	173-188 (182.6)	25-30 (28.3)	20-24 (22.0)	14-18 (15.4)	14-20 (17.2)	4-10 (5.6)	2-5 (3.1)	22-32 (26.6)
<i>C. durissus totonacus</i>	25	187-189 (188.0)	193-195 (194.0)	27-29 (28.0)	22-26 (24.0)	12-15 (13.4)	13-16 (14.3)	4	1-4 (2.2)	27-33 (30.4)
<i>C. durissus tzabcan</i>	27-29 (29)	177-188 (183.4)	185-191 (188.5)	28-32 (29.3)	23-25 (23.9)	13-18 (15.6)	15-19 (16.7)	4	2-3 (2.2)	21-31 (26.5)
<i>C. intermedius intermedius</i>	21	152-161 (157.5)	157-165 (160.5)	24-29 (25.9)	20-22 (20.5)	8-11 (9.6)	8-11 (9.1)	4-8 (6.0)	1-4 (2.4)	38-45 (42.3)
<i>C. intermedius omiltemanus</i>	21	165-175 (170.2)	173-185 (179.4)	24-29 (26.6)	20-24 (22.3)	8-10 (9.2)	8-11 (8.9)	5-8 (6.6)	2-4 (2.9)	45-61 (51.6)
<i>C. lepidus lepidus</i>	21-25 (23)	150-168 (161.7)	149-168 (161.1)	22-29 (24.6)	17-23 (19.6)	10-14 (12.1)	10-13 (11.2)	6-16 (9.4)	1-5 (3.2)	13-24 (18.6)
<i>C. lepidus klauberi</i>	21-25 (23)	152-172 (161.7)	155-170 (162.1)	20-29 (24.6)	16-24 (19.9)	10-14 (11.9)	9-13 (11.3)	5-13 (8.2)	1-4 (2.7)	13-21 (17.3)
<i>C. lepidus morulus</i>	23	161	161-171 (166.3)	30	21-25 (22.0)	12-14 (12.8)	12-13 (12.3)	8-12 (9.5)	2-3 (2.5)	28-34 (31.2)
<i>C. mitchelli pyrrhus</i>	23-27 (25)	168-185 (178.0)	163-187 (178.7)	20-28 (23.7)	16-23 (19.3)	13-19 (16.1)	13-19 (16.1)	21-52 (35.0)	4-8 (5.9)	23-42 (33.3)
<i>C. molossus molossus</i>	25-29 (27)	178-199 (188.7)	185-199 (193.1)	22-29 (25.4)	18-25 (21.2)	14-20 (17.4)	15-21 (17.6)	4-12 (5.3)	1-7 (2.7)	22-39 (31.1)
<i>C. molossus nigrescens</i>	23-27 (25)	166-186 (174.4)	168-187 (177.8)	21-28 (24.3)	16-24 (19.6)	13-19 (16.1)	14-19 (16.5)	4-8 (4.2)	2-5 (2.2)	20-34 (27.8)
<i>C. polystictus</i>	25-28 (25)	162-177 (167.0)	167-187 (175.4)	25-29 (26.5)	17-25 (20.9)	12-15 (13.6)	11-16 (14.2)	6-11 (8.2)	1-5 (3.0)	35-47 (40.5)
<i>C. pricei pricei</i>	21-23 (21)	149-162 (157.9)	157-171 (162.6)	21-30 (24.6)	18-26 (21.5)	8-10 (9.0)	8-12 (9.8)	5-11 (7.0)	1-4 (2.3)	41-61 (52.1)
<i>C. pricei miquihuanus</i>	21	138-141 (139.5)	143	26-31 (28.5)	23	9	8-10 (9.0)	4-7 (5.0)	2-3 (2.3)	43-53 (48.3)
<i>C. pusillus</i>	23	152-161 (155.8)	150-162 (155.3)	28-33 (30.9)	25-29 (26.5)	11-13 (12.0)	10-13 (11.3)	4	2-3 (2.5)	33-46 (39.8)
<i>C. scutulatus scutulatus</i>	25-27 (25)	166-182 (171.5)	168-186 (174.9)	21-27 (23.5)	16-22 (18.7)	12-16 (14.6)	12-18 (15.5)	7-15 (9.8)	1-3 (2.1)	30-40 (35.3)
<i>C. scutulatus salvini</i>	24-29 (25)	165-172 (168.0)	165-175 (172.0)	23-26 (24.5)	18-20 (18.8)	12-15 (13.3)	13-15 (14.1)	8-9 (8.3)	1-2 (1.9)	30-33 (32.0)
<i>C. stejnegeri</i>	25-29 (27)	174-178 (176.0)	171	43-45 (44.3)	37	14-16 (14.8)	14-17 (15.8)	10-21 (15.4)	5-8 (6.2)	35-43 (40.2)
<i>C. tigris</i>	21-27 (23)	158-172 (164.4)	164-177 (168.7)	23-27 (24.8)	16-21 (19.4)	11-16 (13.7)	11-16 (13.7)	11-37 (16.9)	3-8 (5.0)	37-52 (42.7)
<i>C. transversus</i>	21	145	145-155 (150.0)	25	19-20 (19.5)	8-10 (8.7)	8-9 (8.9)	5-6 (5.7)	2-3 (2.3)	37-41 (39.0)
<i>C. triseriatus triseriatus</i>	21-26 (23)	136-151 (144.0)	138-152 (145.8)	26-34 (29.2)	20-28 (24.3)	11-15 (12.1)	10-14 (11.6)	5-13 (8.2)	1-5 (3.1)	30-57 (44.0)
<i>C. triseriatus aquilus</i>	21-25 (23)	146-161 (151.9)	143-160 (151.7)	22-28 (25.9)	17-23 (20.4)	9-14 (11.6)	9-13 (11.2)	5-12 (7.9)	1-4 (2.6)	24-43 (33.2)
<i>C. virdis virdis</i>	23-29 (25)	165-183 (173.4)	172-190 (180.5)	22-29 (25.7)	16-23 (20.0)	13-18 (14.8)	13-19 (15.8)	13-32 (20.6)	2-5 (3.4)	32-51 (40.5)
<i>C. willardi willardi</i>	25-27 (25)	147-154 (150.7)	152-159 (154.7)	25-28 (27.3)	21-25 (22.6)	12-15 (13.6)	12-16 (13.6)	19-41 (30.6)	6-9 (7.8)	19-25 (23.3)
<i>C. willardi meridionalis</i>	27-29 (27)	147-149 (148.0)	147-152 (148.8)	31-34 (32.7)	29-30 (29.8)	14-17 (14.6)	14-15 (14.5)	26-55 (37.7)	6-9 (7.7)	28-33 (30.4)
<i>C. willardi silus</i>	25-27 (27)	149-158 (153.2)	154-159 (156.9)	29-35 (30.9)	25-30 (26.8)	13-16 (14.1)	13-15 (14.1)	26-46 (36.9)	6-10 (7.7)	20-27 (23.4)

TABLE 2

MORPHOLOGICAL STATISTICS OF MEXICAN MAINLAND RATTLESNAKES

	Size in Millimeters			Adult Body Proportionalities as Percentages of Body Length Over-all				Average Rattle Dimensions, mm.		Number of Times Fang Length is Contained in	
	At Birth (estimated)	Large Adult Male	Largest Measured	Tail, Males	Tail, Females	Head	Proximal Rattle	Button	3 or 4 Succeeding Increments	Body Length Over-all	Head Length
S. catenatus tergeminus	215	800	820	11.0	8.4	4.4	1.25	3.3	1.0	120	5.5
S. rarus	175	620	699	9.8	7.7	5.1	.97	2.3		108	5.7
C. atrox	330	1700	1685	7.9	5.8	4.0	1.62	6.9	1.3	106	4.6
C. basiliscus basiliscus	330	1700	2015	9.2	6.3	3.9	1.36	4.7	1.7	125	5.0
C. basiliscus oaxacus											
C. cerastes laterorepens	190	640	767	8.6	6.2	4.7	1.49	3.4	1.0	105	5.1
C. durissus durissus	315	1600	1695	10.0	6.9	3.9	1.33	4.3	1.3	104	4.4
C. durissus culminatus	315	1600	1355	9.1	6.5	4.5	1.46	4.8	1.7		
C. durissus totonacus	315	1600	1632	8.2	6.5	4.1	1.35	4.8	1.7	102	4.0
C. durissus tzabcan	315	1600	1555	8.8	6.8	4.4	1.34	4.6	1.4	105	4.3
C. intermedius intermedius	150	500	482	8.5	6.6	4.2	1.26			207	9.3
C. intermedius omiltemanus	160	550	560	8.5	6.6	4.2	1.02	2.6	.5	185	8.2
C. lepidus lepidus	190	650	715	8.6	7.1	4.5	1.67	3.9	.9	148	6.8
C. lepidus klauberi	195	670	828	8.1	6.6	4.2	1.60	3.5	.8	162	7.3
C. lepidus morulus			535		7.3	5.0	1.17	2.6			
C. mitchelli pyrrhus	265	1100	1295	7.2	6.1	4.3	1.76	6.7	1.1	107	4.9
C. molossus molossus	280	1200	1257	7.1	5.7	4.6	1.53	6.9	1.0	86	4.1
C. molossus nigrescens	270	1150	1092	7.7	5.5	4.8	1.56	6.3	1.2	88	4.4
C. polystictus	230	850	930	7.6	5.9	4.5	1.06	3.6	.6	89	3.9
C. pricei pricei	160	550	576	8.0	6.5	5.0	1.22	2.6	.4	155	7.5
C. pricei miquihuanus							1.06				
C. pusillus	175	620	674	10.5	8.6	5.0	.65	1.6	.2	100	5.1
C. scutulatus scutulatus	265	1100	1231	7.4	5.3	4.0	1.50	5.7	1.0	126	5.1
C. scutulatus salvini	250	1000	932	7.7	5.5	4.6	1.55			97	4.4
C. stejnegeri	170	600	614	12.7	9.8	4.3	.51	2.1	.3	88	4.0
C. tigris	210	770	815	8.4	6.4	3.6	1.73	7.2	1.0	165	6.1
C. transversus	150	500	459		8.0	5.2	1.16			196	10.0
C. triseriatus triseriatus	175	620	683	10.4	8.1	5.4	.82	2.0	.3	112	5.7
C. triseriatus aquilus	175	620	678	9.3	7.7	4.8	1.20	2.9	.5	136	6.8
C. viridis viridis	270	1150	1206	7.5	5.3	4.2	1.40	5.5	1.4	115	5.1
C. willardi willardi	165	560	593	10.2	8.0	5.1	1.24	2.2		110	5.7
C. willardi meridionalis	165	560	562	11.7	9.8	5.3	1.12			92	5.0
C. willardi silus	170	590	636	11.0	9.1	4.9	1.17	2.4		92	4.7

TABLE 3
GEOGRAPHICAL DISTRIBUTION OF RATTLESNAKES IN MEXICO
(Except Baja California and the adjacent islands)

	<i>S. catenatus tergeminus</i>	<i>S. ravus</i>	<i>C. atrox</i>	<i>C. basiliscus basiliscus</i>	<i>C. basiliscus oaxacus</i>	<i>C. cerastes laterorepens</i>	<i>C. durissus durissus</i>	<i>C. durissus culminatus</i>	<i>C. durissus totonacus</i>	<i>C. durissus tzabcan</i>	<i>C. intermedius intermedius</i>	<i>C. intermedius omiltemanus</i>	<i>C. lepidus lepidus</i>	<i>C. lepidus klauberi</i>	<i>C. mitchelli pyrrhus</i>	<i>C. molossus molossus</i>	<i>C. molossus nigrescens</i>	<i>C. polystictus</i>	<i>C. pricei pricei</i>	<i>C. pricei miquihuensis</i>	<i>C. pusillus</i>	<i>C. scutulatus scutulatus</i>	<i>C. scutulatus salvini</i>	<i>C. stejnegeri</i>	<i>C. tigris</i>	<i>C. transversus</i>	<i>C. triseriatus triseriatus</i>	<i>C. triseriatus aquilus</i>	<i>C. viridis viridis</i>	<i>C. willardi willardi</i>	<i>C. willardi meridionalis</i>	<i>C. willardi silus</i>		
Aguascalientes														P			P	6																
Campeche										+																								
Chiapas							+																											
Chihuahua			+											+		ExN	5,S		+			+								N			W	
Coahuila			+										+			N,C	5					S								N				
Colima				+																														
Distrito Federal		+					3										+	+									+	+						
Durango			+											+			+	+	+			+		W									Sw	
Guanajuato																	+	+											+					
Guerrero								+				+																						
Hidalgo			+														+	6					P						+					
Jalisco				+										+			P	E			Se							+						
México		+															+	6									+	+						
Michoacán				+				+			+						+	+			W							+	+	Ne				
Morelos		+						+									P	+								Nw	+							
Nayarit				P										+					11									+						
Nuevo León			+									+				5	5			S		P												
Oaxaca		+	2		+		S9	S9			+							6																
Puebla		+					3				Ne						+	6					+					+						
Querétaro																	+	6					+						+					
Quintana Roo										+																								
San Luis Potosí			+						Se				W				+					+								S				
Sinaloa				+																				Se										
Sonora			+	S		W								P(Ne)	4	N,Wc	5		Ne			N			+					Ne	7	8		Ne
Tabasco							10			10																								
Tamaulipas	1		+						S				12								Sw	Sw												
Tlaxcala		+																6					+					P						
Veracruz		+	+				C	N		Wc							Wc	C					Wc					Wc	P(Nw)					
Yucatán										+																								
Zacatecas			P										Se	S			+	S				+											Sw	

Abbreviations:—The numbers refer to appropriate footnotes.

+ Present in the area
C Central area
E East
Ec East-central
Ex Extreme (example, ExS is extreme south)
N North
Nc North-central
Ne Northeast
Nw Northwest
P Probably present, but no definite record
S South
Sc South-central
Se Southeast
Sw Southwest
W West
Wc West-central

A comma stands for "and", thus C, E means the central and easterly parts of the area.

Notes.—

1. This is based on old reports of somewhat uncertain accuracy. However, the occurrence of *S. c. tergeminus* in Mexico is not impossible.

2. An isolated population of *C. atrox* exists in southern Oaxaca; it is thought by some to have been introduced by man's agency.

3. There are doubtful records from Distrito Federal and Puebla.

4. *C. m. pyrrhus* certainly occurs in northwestern Sonora, although no specimens have yet been collected there. It has been found near the border in Arizona mountain ranges that extend south into Sonora.

5. Specimens from southern Sonora, central Chihuahua, extreme southern Coahuila, and southern Nuevo León are *molossus-nigrescens* intergrades. It is not known whether pure *molossus* occurs in Nuevo León.

6. There are records in the literature from most of these states, not represented by specimens at present available. While many of the older identifications of Mexican rattlesnakes are untrustworthy, *C. polystictus* is so distinctive that most of these records are probably authentic.

7. I once reported *C. v. cerberus* from Sonora (under the name *C. v. oreganus*), but later learned that the collector's records were untrustworthy. While the presence of *cerberus* in north-central Sonora is not impossible, it is improbable and should not be considered authentic unless validated by new material. This footnote applies only to the subspecies *C. v. cerberus*; *C. v. viridis* definitely occurs in northeastern Sonora.

8. The southerly fringes of the Huachuca Mountains across the border in Sonora are high enough to harbor *C. w. willardi*, and it is probable that the subspecies will eventually be collected in Mexico.

9. *C. d. durissus*-*C. d. culminatus* intergrades.

10. *C. d. durissus*-*C. d. tzabcan* intergrades.

11. A Paris Museum specimen is doubtfully assigned to *pricei*.

12. The new subspecies *C. lepidus morulus*, instead of *C. l. lepidus*, is found in southern Tamaulipas.

KLAUBER: MEXICAN RATTLESNAKES

TABLE 4

GEOGRAPHICAL DISTRIBUTION OF RATTLESNAKES OF
BAJA CALIFORNIA, MEXICO, AND THE ADJACENT ISLANDS

	C. atrox	C. cerastes laterorepens	C. enyo	C. exsul	C. mitchelli mitchelli	C. mitchelli muertensis	C. mitchelli pyrrhus	C. molossus molossus	C. molossus estebanensis	C. ruber ruber	C. ruber lucasensis	C. tortugensis	C. viridis caliginis	C. viridis helleri
Peninsula of Baja California	Ne	Ne	C,S		S		N,C			N,C	S			N _w
Islands														
Los Coronados													+	
Cedros				+										
Santa Margarita			+		+						+			
Cerralvo					+									
Espiritu Santo					+									
Isla Partida (south)			+											
San Francisco			+											
San José					+						+			
Monserate										+				
Carmen			+											
San Marcos										+				
Tortuga												+		
Tiburón	+							+						
San Esteban									+					
South San Lorenzo										+				
Pond										+				
Angel de la Guarda							+			+				
El Muerto						+								

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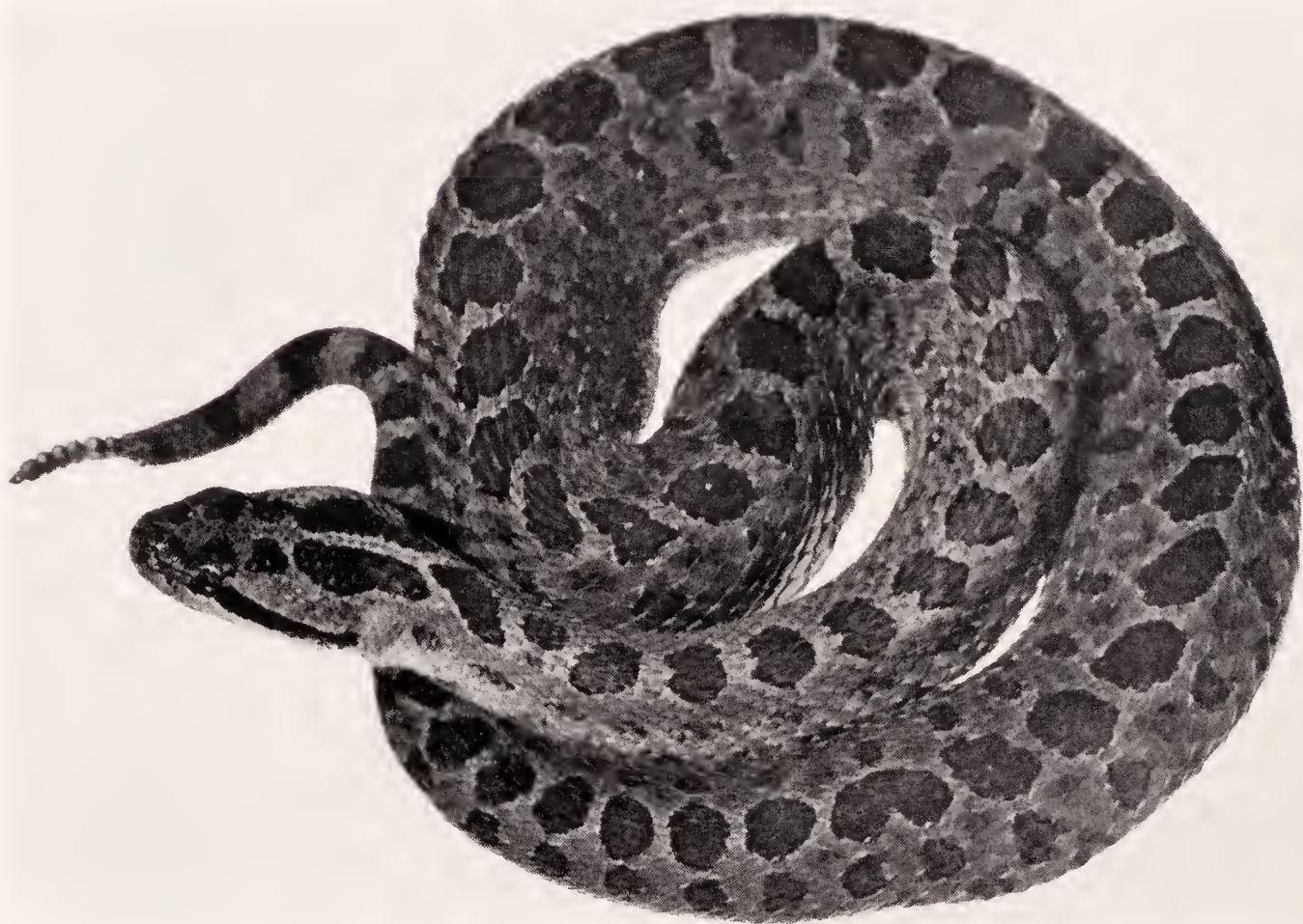


Fig. 1. *Crotalus triseriatus triseriatus* CENTRAL-PLATEAU DUSKY RATTLESNAKE.
Adult male from 5 km. north of Tres Cumbres, Morelos, Mexico, at 10,000 ft.



Fig. 2. *Crotalus triseriatus aquilus* QUERETARAN DUSKY RATTLESNAKE.
Adult male from Jacala, Hidalgo, Mexico, at 6,000 ft.



Fig. 3. *Crotalus pricei pricei* ARIZONA TWIN-SPOTTED RATTLESNAKE.
Adult female from San José de Babicora, Chihuahua, Mexico, at 7000 ft.



Fig. 4. *Crotalus lepidus klauberi* BANDED ROCK RATTLESNAKE.
Adult male from Gold Gulch, Dos Cabezas Mts., Cochise Co., Arizona.



Fig. 5. *Crotalus durissus durissus* CENTRAL AMERICAN RATTLESNAKE.
Adult male from Veracruz, Mexico.

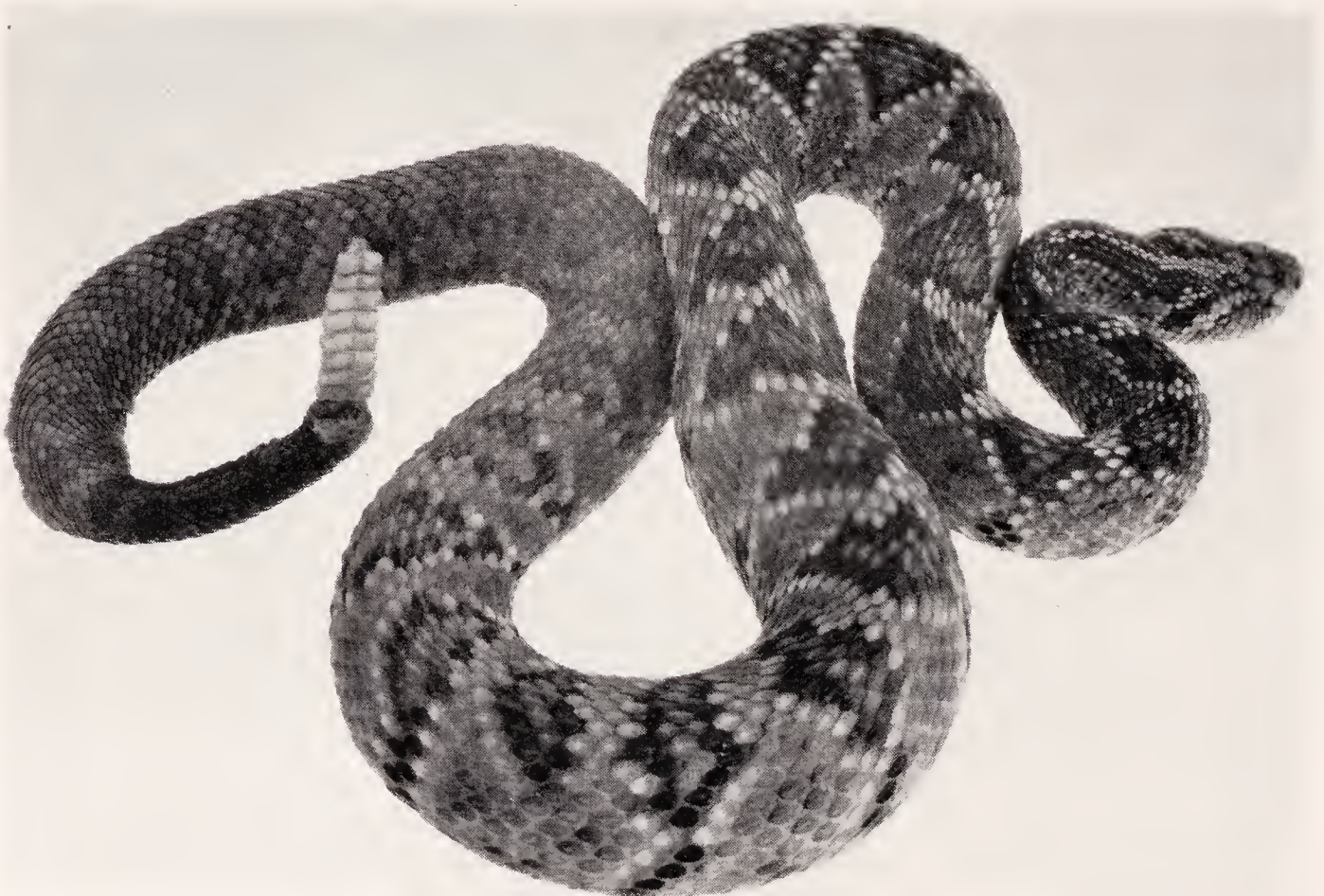


Fig. 6. *Crotalus durissus totonacus* TOTONACAN RATTLESNAKE.
Adult female, locality unknown.

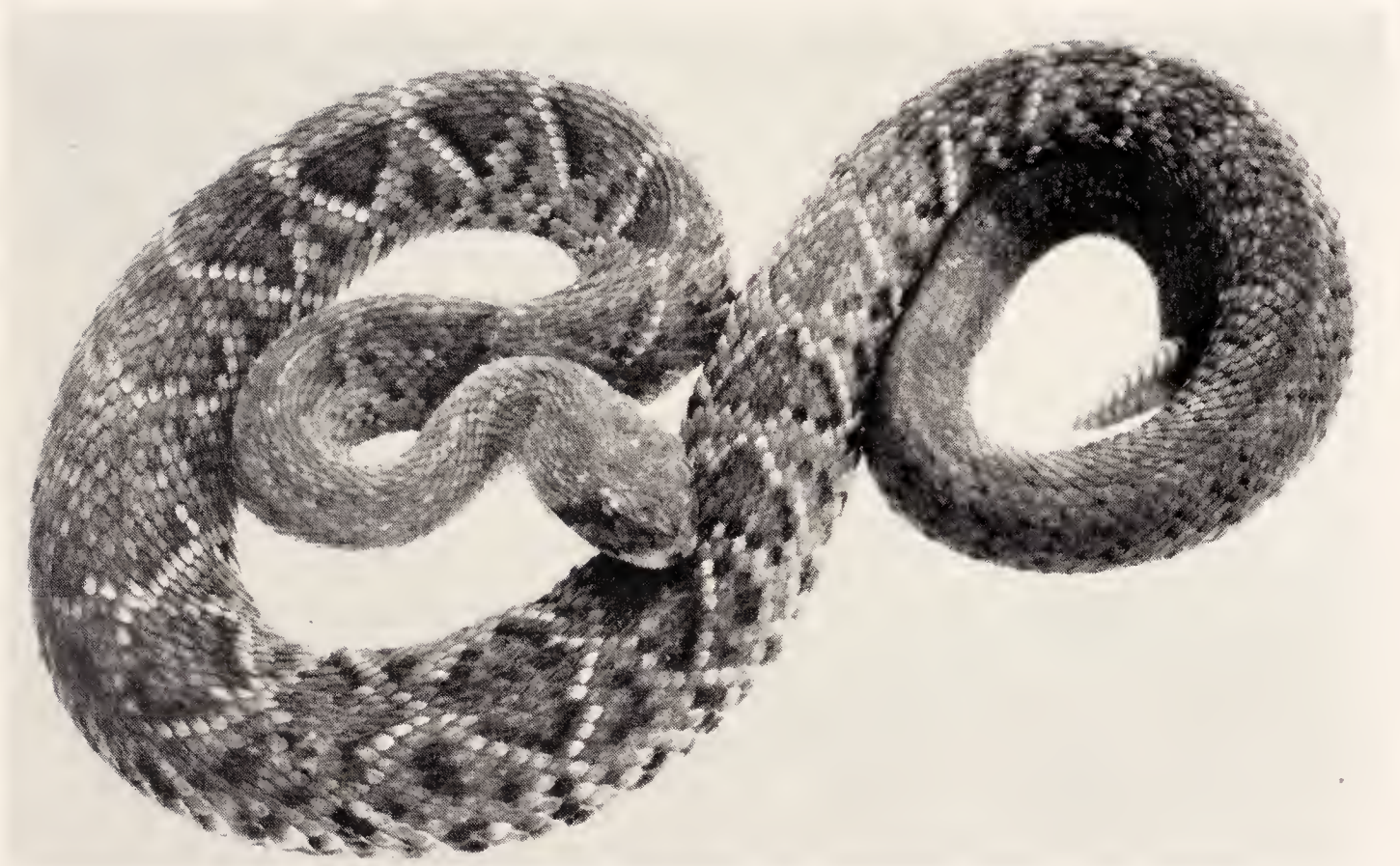


Fig. 7. *Crotalus basiliscus basiliscus* MEXICAN WEST-COAST RATTLESNAKE.
Young adult male from near Colima, Colima, Mexico.

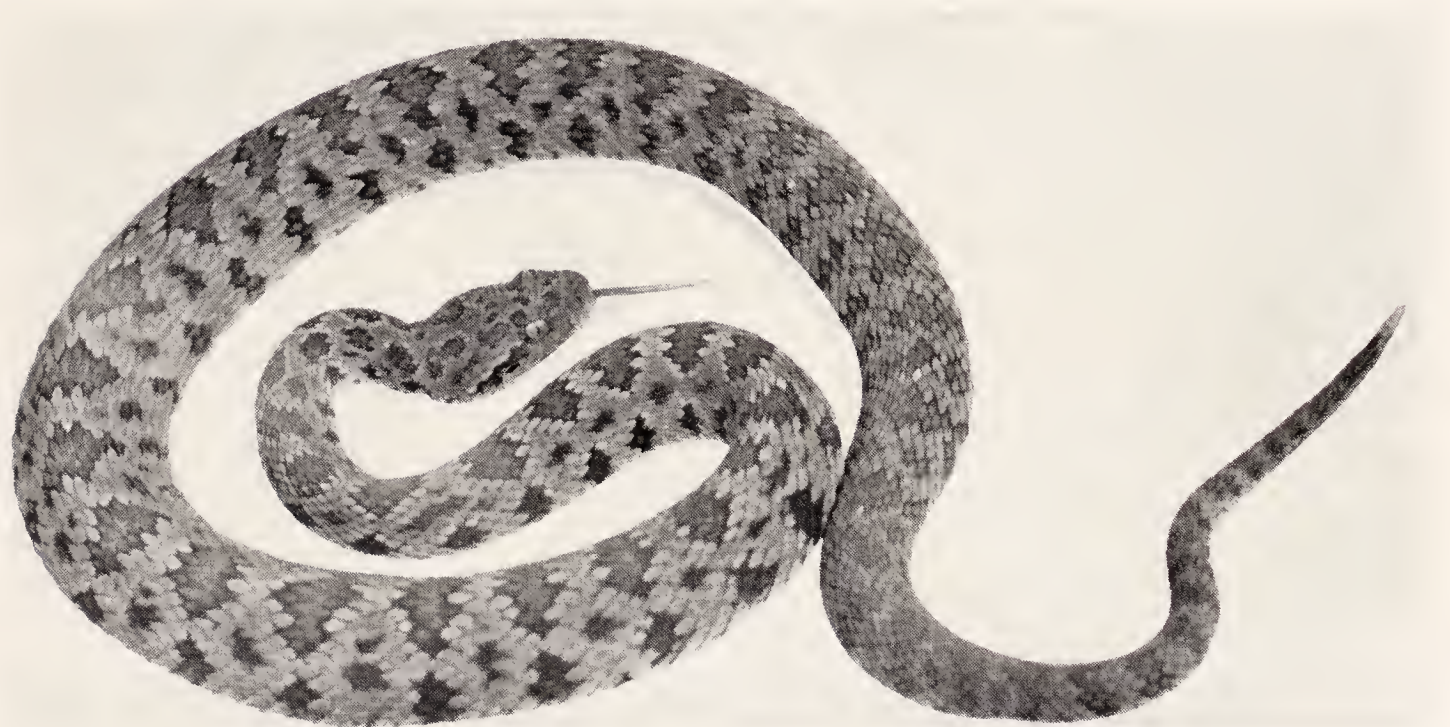


Fig. 8. *Crotalus stejnegeri* LONG-TAILED RATTLESNAKE.
Adult male from 6 miles north of Yamoriba, Durango, Mexico.



Fig. 9. *Crotalus molossus molossus* NORTHERN BLACK-TAILED RATTLESNAKE.
Young adult male from Ramsey Canyon, Huachuca Mts., Cochise Co., Arizona.

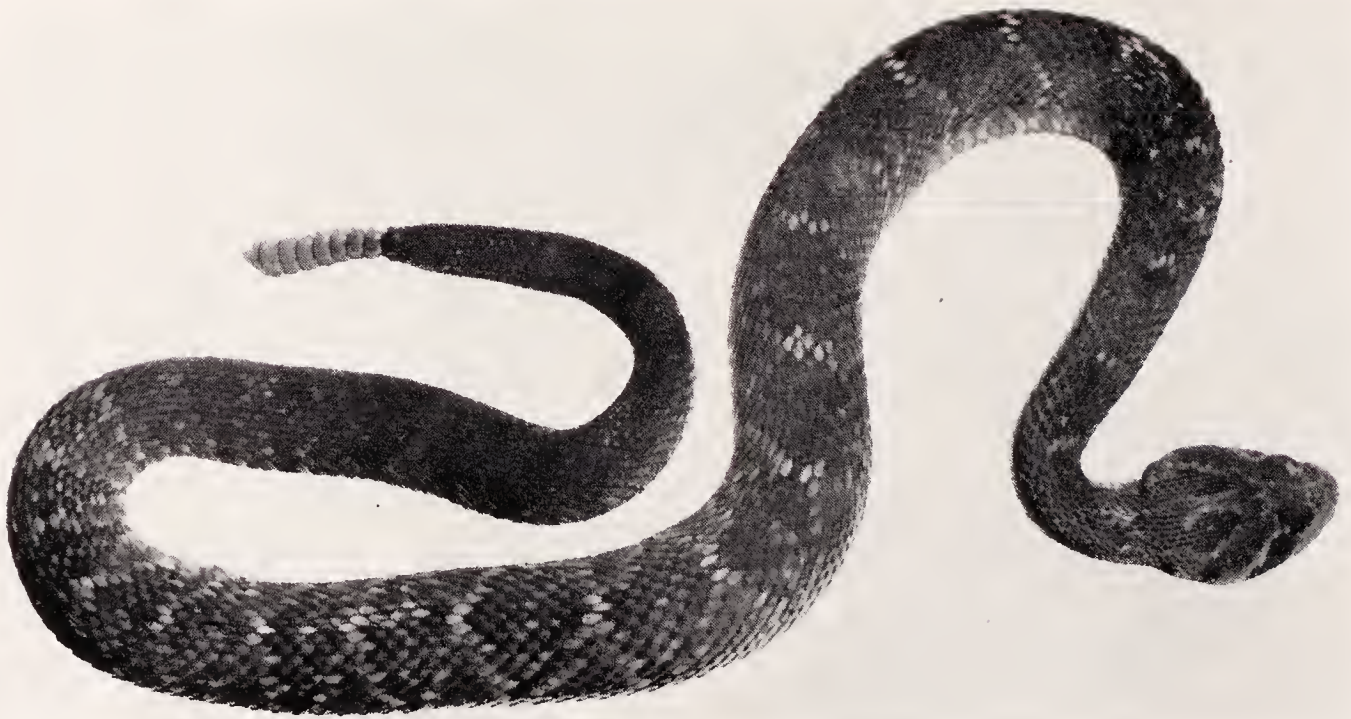


Fig. 10. *Crotalus molossus nigrescens* MEXICAN BLACK-TAILED RATTLESNAKE.
Adult male from 6 miles north of Yamoriba, Durango, Mexico.

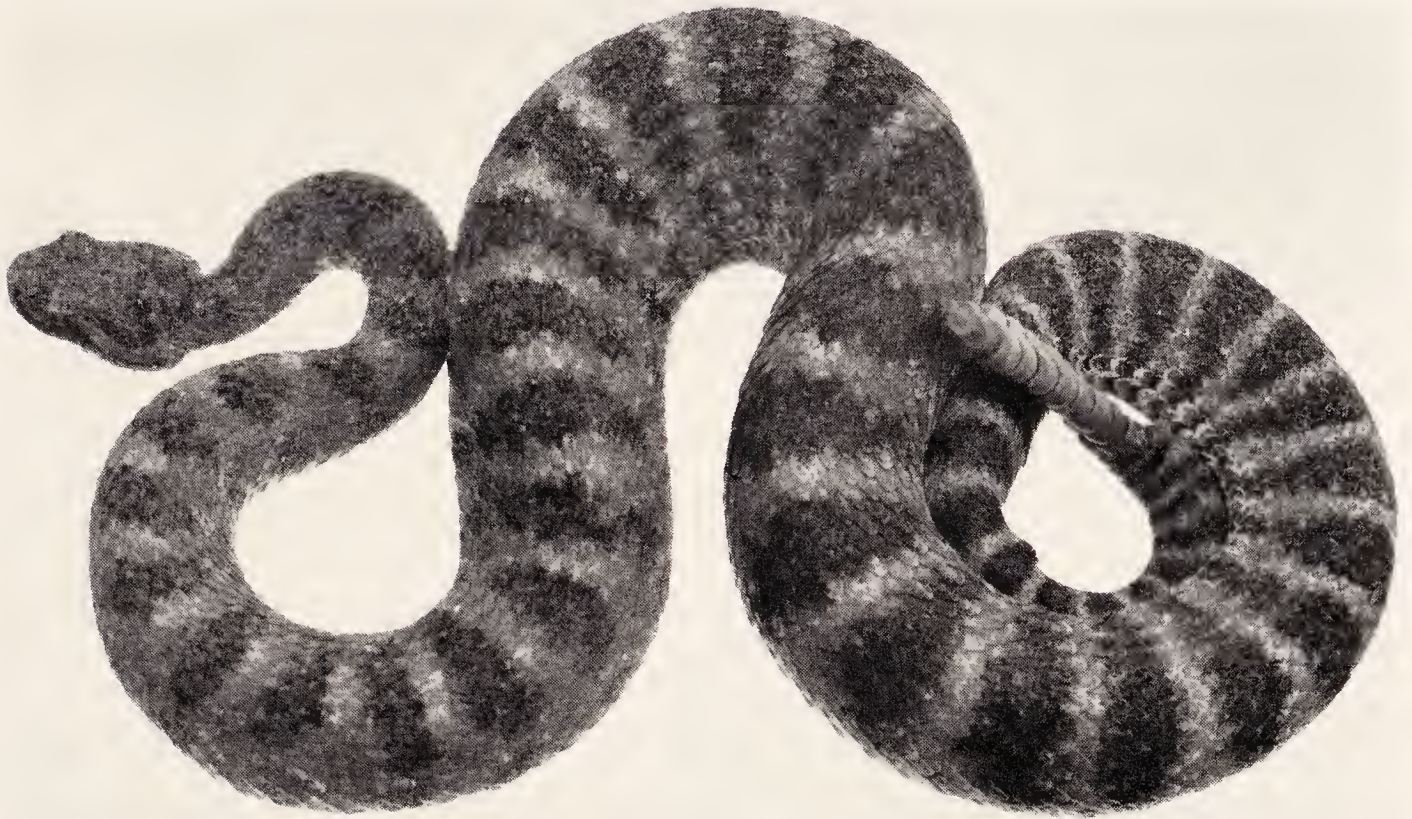


Fig. 11. *Crotalus tigris* TIGER RATTLESNAKE.
Adult male from Estrella Mts., Maricopa Co., Arizona.



Fig. 12. *Sistrurus ravus* MEXICAN PIGMY RATTLESNAKE.
Adult male from near Huitzilac, Morelos, Mexico, at 8,500 ft.
Photograph through the courtesy of John E. Werler.

