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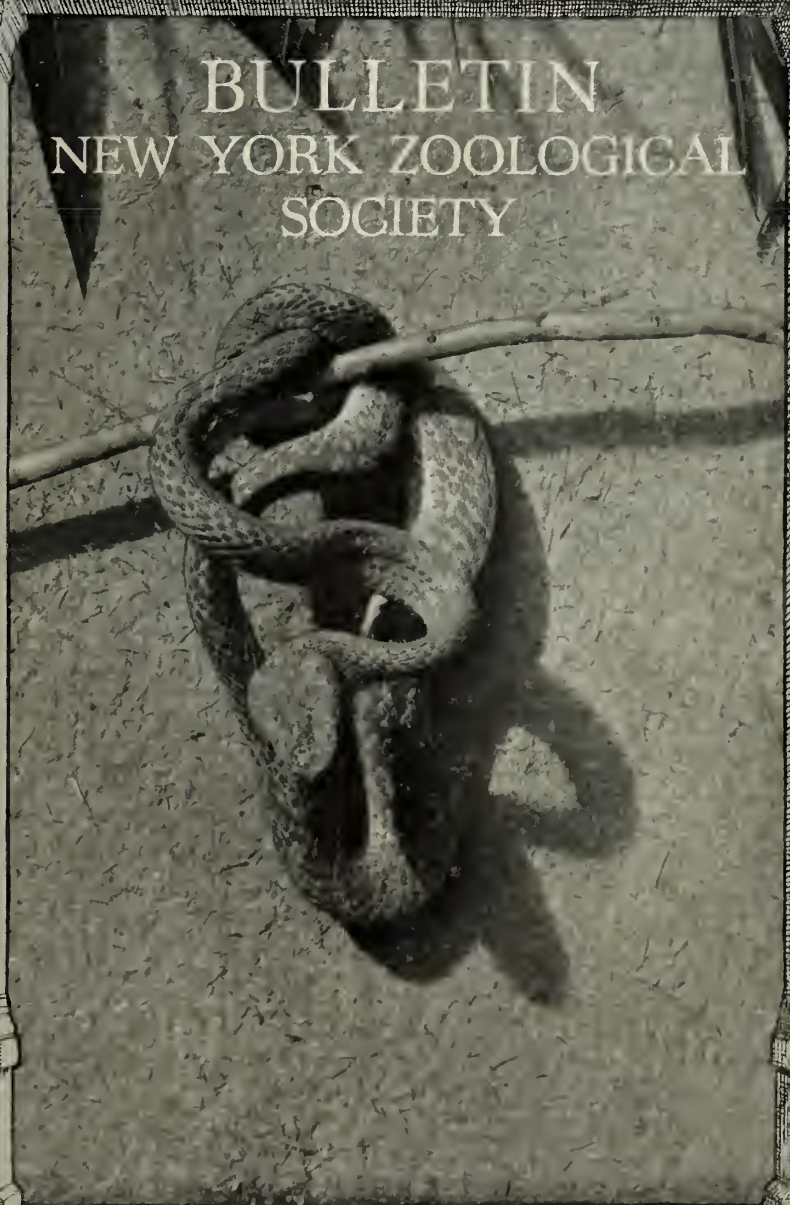

The Poisonous Serpents of the New World

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NEW YORK ZOOLOGICAL SOCIETY

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Editorial and Subscription Offices, Zoological Park, New York City, Elwin R. Sanborn, Editor.

Fig. 1. The Bushmaster; Surucucu, *Lachesis muta*. Attaining a length of twelve feet, this dramatic species of the American tropics may justly be rated as the king of the world's viperine serpents. Drop for drop its venom is not so deadly as that of some other New World species, but excessive fang length and the amount of venom injected at a bite, render it the most formidable of the New World poisonous reptiles. It ranges from southern Central America throughout equatorial South America.

BULLETIN
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The Poisonous Serpents of the New World

A Comparative Review

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Illustrated from photographs made in the Zoological Park by the Author and Elwin R. Sanborn. Also from photographs made in the field as indicated under the plates.

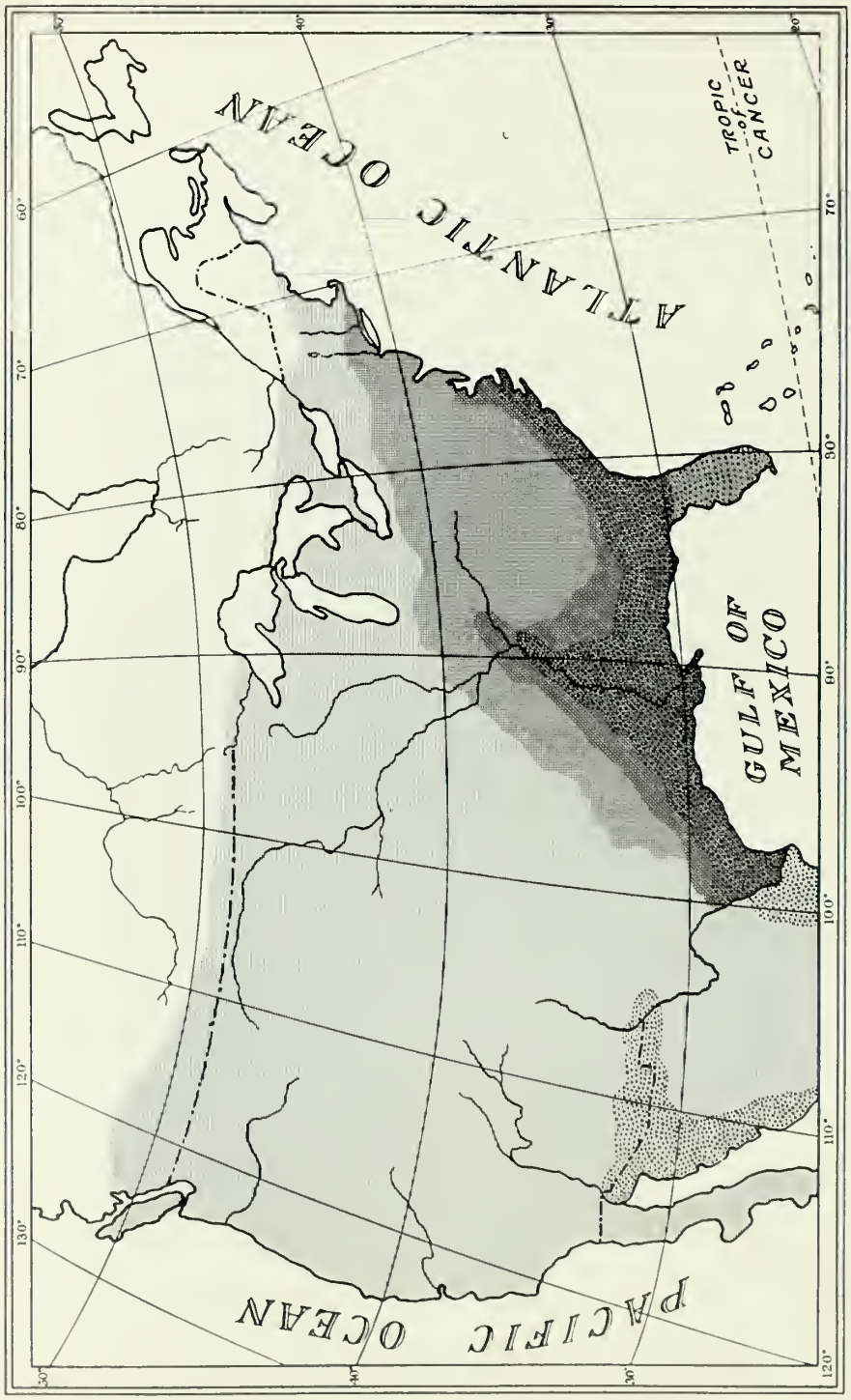
THIS work has been prepared after requests for a readable account of the poisonous serpents of North and South America and the adjacent areas. The plan has been to bring them together with generally complete illustrative detail for comparison and identification. Queries from various latitudes have guided the author in presenting the text as a zoogeographical account. This produces a practicable summary for persons going into unfamiliar country, to planters or others engaged in permanent work in broadly scattered areas, and to students generally. The illustrations are arranged in the continuity of zoological classification.

The author has made personal investigations over a wide area. These have been recorded from coast to coast in North America, including the southwestern deserts; in Mexico, Guatemala, Honduras, Costa Rica and Panama; and in Brazil.

The poisonous snakes of the New World, comprising some of the most deadly known species, and some of great abundance, have not been considered collectively in terms that may be broadly understood. Three important conditions are to be noted at the beginning:

The North American poisonous species are quite different in their make-up from the tropical types. Their venoms are different and require treatment by specific grades of serum to produce the most efficacious results. With the exception of the eastern copperhead, the southeastern water moccasin and two small coral snakes in the southerly latitudes, the greater area of North America contains but one other type of poisonous serpent—the rattlesnake. There is, however, a considerable number of species of rattlesnakes. Approximately a dozen distinct kinds of these characteristic serpents occur in various parts of the United States. There is great variety in size, pattern and coloration. They inhabit a variety of country, some being characteristic in frequenting deserts, others plains, swampy areas or mountains.

South of the northerly and arid area of Mexico, the status of the rattlesnake group changes in the disappearance of species and through the Central American countries and over the entire South American continent, there is but a single distinct species. This has a symmetrical, rhomb-like pattern. The United States, therefore, is the headquarters of the rattlesnakes, with the greater number of the



Distribution of the four "types" of poisonous snakes of North America. The horizontal shading (also underlying all others) shows the area inhabited by rattlesnakes. The vertical lines indicate *habitat* of the copperhead snake (they underlie the dotted area to the base of Florida). The oblique lines represent the distribution of the true water moccasin (and underlie all portions of the southeastern dotted area). The dotted areas approximately show the occurrence of coral snakes.

species forming a radiating group in the southwesterly portion.

The second point relates to the appearance, in Mexico, of the characteristic type of poisonous snake of the New World tropics. This is the so-called lance-head type of pit viper of the genus *Bothrops*. All of the tropical American vipers, with the exception of the bushmaster and a water moccasin, have been assigned to this genus, although the slender-bodied, tree-climbing species with a prehensile tail appear to warrant recognition within a distinct genus. We may take the fer-de-lance as a representative species of *Bothrops*. The name fer-de-lance (relating to the shape of the head—like an iron lance) is a Creole-French term coming from the southerly West Indies. In Central America it is commonly called the barba amarilla (yellow-beard) and in Brazil the jararaca —the latter word relating to an arrow and referring to the shape of the head.

It is the most abundant and widely distributed poisonous serpent of the New World, and represents the characteristic type most broadly developed in the American tropics. All told, approximately twenty-four species of *Bothrops* are scientifically listed. The genus is to a certain extent monotonous in form and pattern of its members. Their venom is largely composed of a powerful haematoxin, which destroys the red cells of the blood and breaks down the walls of the carrying vessels. Rather dominating in its difference is the great bushmaster, extending from Nicaragua and Costa Rica well through Brazil. It is the giant among vipers, attaining a length of twelve feet. Its single species is assigned to a separate genus, *Lachesis*. A number of species of brightly colored coral snakes (*Micrurus*) inhabit the tropical area.

The third point of summary relates to the absence of poisonous serpents in all of the large islands of the West Indies. No dangerous reptiles occur in Cuba, Jamaica, Hayti or Porto Rico, nor anywhere in the West Indies except in the Windward Islands, where the fer-de-lance occurs in St. Lucia, Martinique and Tobago—and Trinidad, lying close to the mainland. The coral snake also occurs on these islands, including St. Vincent. This absence of poisonous reptiles among all the large islands is all the more remarkable owing to the proximity of an infested Central American mainland, the luxuriance of flora of the islands, and climate conducive to reptile development. The islands are fairly well populated with harmless reptiles. This point is graphically illustrated by the map of the Central American and West Indian areas. Particular detail has been applied to the Central American area as queries about the reptile life in these near-by American tropics have indicated the need of descriptive details.

The North American Species

Practically every portion of the United States is inhabited by poisonous serpents—although we might accord to a few states in the northeastern corner of this far-flung area the reputation of being nearly or quite free of them. These are the states of Maine, New Hampshire and Vermont. There are occasional reports of rattlers in the southerly portion of Vermont. The northerly states to the westward are liberally inhabited by rattlesnakes which extend their habitat well into Canada. This condition extends westward to the Pacific Coast. Our southeastern states, warmed by their contact with the Gulf Stream, with thick tangles of river swamps and humid coastal areas, harbour large numbers of poisonous serpents. Texas, Arizona and New Mexico are very liberally supplied with rattlers. The Pacific states also have large numbers of rattlesnakes, while the interior states show "spotty" occurrence, abundant in some areas, moderately so in others. The writer doubts, however, if there are any portions much more abundantly supplied with venomous snakes than some areas of Massachu-

setts, Connecticut, New York, New Jersey and Pennsylvania, where the timber rattlesnake and copperhead infest the mountain ledges.

The species of rattlesnakes vary in size from several that are not larger than the average striped snake to the huge and formidable diamond-back, which attains a length of over eight feet and a circumference of about twelve inches. Throughout the northeastern portion of the United States there is but a single abundant species—the banded or timber rattlesnake, although in western New York a small rattler—the massasauga—is occasionally found and becomes rather common in the eastern central states. The timber rattlesnake gives way on the eastern plains to a species of wide distribution—the prairie rattlesnake, which, in its variation or races, extends westward throughout the Pacific region, and into the Southwest. Going south, in the eastern United States, there is another rattler from about the central portion of North Carolina. This is the diminutive pygmy rattlesnake. Slightly farther south is the range of the big southern diamond-back, which attains the greatest length of any rattlesnake, and is one of the most formidable vipers of the world. The Mississippi Valley forms the western boundary of this deadly species, its place being taken in Texas, thence westward to eastern California, by the big diamond-back of the arid regions—a close second in size, attaining a length of seven feet or more, with the same proportionately heavy body. Going westward into its habitat, we enter the headquarters of the rattlesnakes in the Southwest.

At least four species of rattlesnakes are found in Texas, but the southwestern states have three times that number of distinct kinds. Most of them are confined to the desert areas.

In this distribution of poisonous serpents in North America, two species of moccasins must be considered—the water moccasin and the copperhead snake (highland moccasin, pilot snake or chunkhead). These belong, as do the rattlers, to the family of pit vipers having a deep pit on each side of the head between the eye and the nostril. The water moccasin is common in the swamps and sluggish waterways of South Carolina, Georgia, Florida, Alabama and Louisiana—also portions of adjoining states. The distribution of the copperhead is extensive. It ranges from southern Massachusetts to northern Florida, westward to Oklahoma and Texas in the south, and to Illinois in the northerly portion. It will thus be understood that over the actual West, the only type of poisonous serpent is the rattlesnake (except for a coral snake in the Mexican boundary region).

In the southeastern states, thence along the United States-Mexican boundary, there are two small poisonous serpents of brilliant coloration known as coral snakes. The common coral snake or harlequin snake occurs from southern North Carolina throughout Florida and westward to Texas.

Coral Snakes: The species of *Micrurus* (formerly *Elaps*) are different in form, coloration and habits from all of the other New World poisonous serpents. They are slender, with smooth and glossy scales. The North American species are usually well under three feet in length. The head is not distinct from the neck. Coloration, throughout the genus, is brilliant and in the form of rings of red, yellow and black. These serpents are of burrowing habits, although occasionally found prowling. They are degenerate, New World representatives of the *Elapidae*, the family to which the cobras, krait, mamba and other extremely dangerous Indian, African and Australian types belong.

The bites of coral snakes are very dangerous, the venom being of neurotoxic action, quite different from that of the rattlesnakes and moccasins.

The Coral Snake; Harlequin Snake; Bead Snake, *Micrurus fulvius* (Linné), (Figures 5 and 8), lives much of the time in the ground, though it is sometimes seen in the fields during spring plowing. There are wide rings of crimson and black, the latter narrowly bordered with yellow. Several small harmless serpents "imitate" the coloration to a remarkable degree. Close inspection, however, will show that with the non-venomous species, there are pairs of black rings bordering a yellow one, the reverse of the poisonous type.

The coral snake feeds largely upon the young of other serpents and upon lizards. It does not strike. If stepped on or actually touched, it will turn and deliberately bite, retaining its hold. Accidents are infrequent, but fatal cases

from its bite have been reported. Its range is from South Carolina and Mississippi to Florida, the Gulf States, thence southward into Mexico and Central America.

The Sonoran Coral Snake, *Micrurus euryxanthus* (Kennicott), (Figure 9), is similar to the eastern species, but the black rings are proportionately narrower and the yellow marginal rings much wider. Its range is indicated as southern New Mexico, Arizona and northern Mexico.

The Pit Vipers: The dominating poisonous serpents of North America belong to the *Crotalidae*, a cosmopolitan family. The members are distinguished by a deep pit between the eye and the nostril. The eyes have elliptical pupils, and in North America, at least, these and the head pits serve as distinguishing points for identification, as practically all of the harmless snakes have a round pupil.

The pit vipers are provided with a pair of long, erectile, poison-conducting fangs in the upper jaw (Figures 12 and 13). These fangs are hollow, and in structure like a hypodermic needle. They are attached to movable bones and fold back against the roof of the mouth when the jaws are closed. A membranous sheathing covers the fangs, except when they actually penetrate an object in the act of biting (Figure 14). Pit vipers coil and strike in defense, the blow terminating in a strike aided by an instantaneous bite. At the instant of biting, the muscle over each temporal poison gland is contracted, forcing venom forward and out of the hollow fangs. The dual wounds produced are no more or less than hypodermic injections. The strike and bite are so simultaneous that the reptile appears to instantly return to the former defensive position after the out-thrust of the head from a lateral, S-shaped loop of the neck.

Three genera are represented in North America: *Agkistrodon* (the moccasins); *Sistrurus* (the pygmy rattlesnakes); and *Crotalus* (the typical rattlesnakes).

The Copperhead Snake; Chunkhead; Pilot; Rattlesnake Pilot; Highland Moccasin, *Agkistrodon mokasen* Beauvois, (Figures 15 and 16). The body hue is pale brown, pinkish or light reddish brown, with a series of large blotches on the sides, somewhat like inverted "Y"s. These are usually of a rich, chestnut brown. When looked at from above, a number of the markings will be seen to unite across the back, producing a continuous pattern across the body, the central portion being narrow and broadening on each side, giving the outline of an hour-glass. Numerous specimens from Texas have very wide —consequently fewer—bands, most of them encircling the back and not narrowed at the top, as with eastern specimens.

The range is from central Massachusetts to northern Florida (not including the peninsula), westward to Illinois, thence southwest through Missouri and into Oklahoma and Texas.

The Water Moccasin; Cotton-mouth Snake, *Agkistrodon piscivorus* (Lacépède), (Figure 17). The term "cotton-mouth" comes from the habit of opening the mouth in threatening fashion, the mouth parts being whitish.

This is an aquatic serpent, living along streams, lakes, or in swamps. It is particularly abundant along the old abandoned rice ditches of the southern states, and is a much larger and more dangerous reptile than the copperhead, also considerably more pugnacious. It attains a length of six feet, but the average is three to four feet. The colors are dull brown or olive, crossed with darker, usually obscure bands. Young specimens are brightly marked with transverse blotches on a reddish ground.

Distribution is from Virginia, throughout the state of Florida and westerly along the Gulf States into eastern Texas. Inland there is a northerly extension up the Mississippi Valley to southern Illinois, Missouri and western Kentucky.

The Massasauga, *Sistrurus catenatus* (Rafinesque), (Figure 41). A small, brownish or grayish rattlesnake, with chesnut-brown blotches on the back, and a similar row on each side. The species of *Sistrurus*, may be distinguished from members of the typical rattlesnake genus *Crotalus*, by the symmetrical plates on the top of the head.

The Massasauga is from two to three feet long. Occurrence is from western New York, through Ohio to Nebraska, northward into Michigan and Ontario, and southward to Kansas. It often frequents swampy places.

Edward's Massasauga, *Sistrurus catenatus edwardsii* (Baird & Girard) is a southerly subspecies, the blotches proportionately much smaller.

The Pygmy Rattlesnake; "Ground" Rattler, *Sistrurus miliarius* (Linné), (Figure 40) is smaller, seldom more than sixteen to twenty inches long, the rattle so minute as to be scarcely heard. It is common from southern North Carolina throughout Florida and westward to Oklahoma and Texas. The body hue is grayish, with a series of rather widely separated, rounded blotches, and a reddish band along the back, this more vivid on the anterior portion.

The Banded Rattlesnake; Timber Rattlesnake; Canebrake Rattlesnake, *Crotalus horridus* Linné, (Figures 57 and 58), has the most extensive distribution of any poisonous serpent in North America with the exception of the prairie rattlesnake and its various races. It occurs from southern Maine to the easterly portion of the Great Plains, southward to northern Florida, and westerly into Arkansas and eastern Texas.

While preferring mountainous areas, particularly ledgy places, this serpent differs from some other rattlesnakes in exhibiting extreme versatility of living conditions. In New Jersey it inhabits not only the mountainous portions, but is found in the flat central portion, where it hibernates under layers of damp sphagnum moss. In the great swamps or canebrakes of the southeast and lower Mississippi, it grows to a larger size and assumes unique coloration —a pinkish body hue, sooty black markings and narrow dorsal stripe of rusty red. This variation appears to indicate a distinct race, and may ultimately warrant a subspecific name. It is commonly known as the "canebrake" rattlesnake.

The typical coloration is yellow or tan, with wavy crossbands of dark brown or black. Many specimens are well suffused with black, and some are almost entirely black.

The species is common in hilly portions of Massachusetts, New York, Connecticut, New Jersey, Pennsylvania, the Virginias, the Carolinas, Kentucky and Tennessee— in fact, showing the greatest abundance in rocky areas on mountains, where it congregates at specific crevices in ledges every year to hibernate. Its numbers are not being reduced. It has actually become more abundant during the past twenty-five years over portions of the east, particularly in New York, New Jersey and Pennsylvania.

The average length is about four feet in the north, though the writer has measured six foot specimens. The canebrake rattlers of the south attain a length of eight feet, with proportionately smaller head and stouter body than northern specimens.

There is less danger from this snake than from others of its genus, as it does not readily strike unless molested. Mountain specimens prefer to lie motionless, half tucked under shelving rocks, in the hope of being passed without detection, or, if noting danger, to be able to glide into a sheltering crevice. Disturbed in the open, the species usually sounds the rattle, while the intruder is still some distance away.

The Diamond-back Rattlesnake, *Crotalus adamanteus,* Beauvois, (Figure 45). This is the largest and most dangerous of the poisonous serpents of North America. Frequent specimens are six feet in length, and it attains a length of over eight feet, with proportionately heavy body. A six foot specimen will weigh about twelve pounds, have a head nearly three inches in width, and fangs three quarters of an inch long. The great amount of venom injected by such a creature may be surmised.

This powerful reptile inhabits the coastal areas of the Southeast, showing a preference for prowling through scrub palmetto or low brush. It is frequently noted along the wilder sea beaches in Florida where it lurks in the extensive stretches of tangled brush but a short distance from the line of the higher tide wash. The writer has also observed it in the sand hammocks, where the gopher tortoise digs its burrows. It is not a swamp species, although it may frequent woods close to water and does not hesitate to swim across small bodies of water. In the coastal strips it crosses fair-sized tide pools and has been noted several miles from shore, where it has been accidentally carried by the currents. It is also found along the Keys.

Pattern is bold and constant, in the form of a chain of symmetrical rhombs. When adult it feeds largely upon rabbits.

The Western Diamond Rattlesnake, *Crotalus atrox* Baird & Girard, (Figure 46), may be rated as the second most formidable serpent of North America, as to bulk and amount of poison expended at a bite, but it holds first rank in the number of fatalities in listing snake-bites, owing to its great abundance over a wide area.

Both this and the southeastern diamond-back are particularly dangerous in their tendency to quickly strike when accidentally approached. They are given to prowling over ground with little shelter. When disturbed their habit is to throw the body into a coil, sound the warning rattle and deliver a blow. If suddenly surprised, the warning and stroke may be almost simultaneous.

Adult examples of the western diamond-back commonly attain a length of six feet, and there are occasional larger specimens, but the average run is smaller than the big southeastern species. The pattern shows a chain of symmetrical rhombs on a grayish ground. Examples from the sterile areas are pallid, with obscure rhombs, and vary from gray to yellow or pinkish.

The range embraces Texas and extends westward through New Mexico, Arizona and into California. Occurrence also covers a wide area in northern Mexico, with Lower California included. As to its extreme westerly occurrence, Klauber states: "The Colorado Desert in California; likewise northeastern Lower California and Tiburan Island."

The western diamond rattlesnake has several close allies, as follows:

The Mojave Diamond Rattlesnake, *Crotalus scutulatus* (Kennicott), (Figure 48), recognized by the enlarged scales on the top of the head. It ranges from the arid Southwest into northern Mexico.

The San Lucan Diamond Rattlesnake, *Crotalus lucasensis* Van Denburgh, which is restricted to southern Lower California.

The Tortuga Island Diamond Rattlesnake, *Crotalus tortugensis* Van Denburgh and Slevin, of Tortuga Island, Lower California.

The Cedros Island Diamond Rattlesnake, *Crotalus exsul* Garman, which is reddish and apparently recorded only from Cedros Island, Lower California.

The Red Diamond Rattlesnake, *Crotalus ruber** (Cope), (Figure 47). This is distinctly reddish (usually of brick-like hue) with rather obscure and narrow rhomblike markings. It is a quite common and rather large species of limited distribution. The average adult is from four to five feet long, but it occasionally attains a length of six feet. Klauber defines its range as follows: "The narrow belt in California and Lower California west of the desert to the coast, from the north line of Riverside County in California to north central Lower California, but excluding the coastal plains of Los Angeles and Orange Counties. It occurs also on Cerros and certain Gulf of California Islands."

This powerful rattlesnake is at times curiously gentle, showing little excitement if disturbed, and no inclination to strike. It is sometimes difficult to induce it to rattle. Again, found wandering in the open, with no sheltering brush or crevices in which to retreat, it will quickly coil and assume a threatening attitude as if realizing this is the only hope of survival. It is a calm and quiet captive, seldom sounding the rattle.

The Black-tailed Rattlesnake, *Crotalus molossus* Baird & Girard, (Figure 44), indicates relationship to the tropical rattlesnake of wide occurrence to the south, by its more than moderately high keeled scales, and its markings. It is a handsome reptile, with dark rhomboidal blotches edged with yellow and enclosing lighter patches. The tail is usually black. The general body hue is rich yellow—sometimes darker.

It is fairly large, although restricted in size in some portions of its range, which in the United States is along the boundary region from Texas to Arizona. Southward in Mexico it appears to overlap the northern range of the tropical rattlesnake, *Crotalus terrificus*.

The western rattlesnakes have recently received detailed studies which have resulted in some radical changes of long-standing names. These studies have been rendered possible from large series of specimens accumulating in the scientific institutions, affording extensive opportunities for comparison. The most detailed investigations have been conducted by Amaral and Klauber. The former presented a

* Formerly *exsul*, which name is now applied to the Cedros Island species.

provisional key to the rattlesnakes in a bulletin of the Antivenin Institute of America, in 1929. More recently, Klauber prepared a lengthy paper in the Transactions of the Zoological Society of San Diego and has given the writer advance details of very recent findings. These studies are listed in the bibliography at the end of this work.

The more important findings relate to the relationship of the Pacific rattlesnake, long considered a valid species, to the prairie rattlesnake and the definite races or subspecies of the latter in the Southwest. Also the status of the tiger rattlesnake, showing it to be truly an Arizona and north Mexican species, and the so-called tiger rattlesnake of Nevada and desert California to actually represent southwesterly races of the prairie rattlesnake. Mitchell's rattlesnake (the white or pallid rattlesnake), long listed as a valid species, also becomes a subspecies of the prairie rattlesnake.

The Prairie Rattlesnake, *Crotalus confluentus confluentus* Say, (Figure 49), and its races or subspecies has the widest range of any North American species of its genus. Its extension into Canada indicates that it ranges farther north than any other rattlesnake. The distribution of the typical form covers the Great Plains from the longitude of eastern Nebraska to the Rocky Mountains, extending southward to central Texas along the easterly range, and to the Mexican border to the westward. Extension northward is into Canada, at least to the fiftieth parallel. This snake appears to be abundant in the vicinity of Medicine Hat.

Usual coloration is yellowish to darker brown, with a symmetrical row of rounded and separated blotches on the back, these narrowly bordered with yellow or white, and a distinct V-shaped marking of light color on the large shield above each eye.

Despite its poisonous nature, the prairie rattlesnake is undoubtedly of considerable economic importance over a great area, owing to it being one of the natural enemies of destructive rodents.

The Pacific Rattlesnake, *Crotalus confluentus oreganus* (Holbrook), (Figures 50 and 51). This is the common and only rattlesnake of the Pacific region north of southern California, and represents a westerly race of the prairie rattlesnake, from which it differs in tendency toward darker markings, even to suffusion of black, and the edges of the blotches fusing in a rhomb-like chain. In southern California, its range overlaps most of the other California species except *Crotalus atrox*, in the area of the Colorado desert. It occurs over varied country, embracing the mountains up to altitudes of eight thousand feet, the sea coast levels, inland plains, and desert areas. It is as much at home on the sterile slopes of desert mountains as in regions of heavy timber. The range is from British Columbia southward through Washington, Oregon and California, and into Lower California. It also occurs on Santa Catalina and Los Coronados Islands. Eastward the habitat extends into Idaho, Nevada, Utah and Arizona, overlapping the typical form.

While occasionally attaining a length of five feet, the average size is between three and four feet. There is a variation in pattern and hues, ranging from brown to grayish or greenish, with large dorsal blotches edged with a paler hue, these lighter margins in contact, to blackish specimens with no markings but the paler edges, indicating the dorsal blotches. Such specimens are sometimes called "diamond-backs."

In the northern portion of the range, this snake congregates in the fall at specific crevices in rocky ledges, in preparation to hibernate. Large numbers annually return to these places, which are the so-called snake dens. Such habits are similar to those of the prairie rattlesnake, along eroded river banks, and the timber rattlesnake on mountain ledges in the east.

The following additional subspecies of *confluentus* have been recently named:

The Great Basin Rattlesnake, *Crotalus confluentus lutosus* Klauber, (Figure 52). Found in the Plateau Region from the Rockies to the Sierras, including Utah, Nevada, northern California east of the Sierras, southeastern Oregon and southern Idaho.

The Midget Faded Rattlesnake, *Crotalus confluentus concolor* (Woodbury). Recorded from Utah and Colorado.

The Grand Canyon Rattlesnake, *Crotalus confluentus abyssus* Klauber, (Figure 53). A

form observed only in the Grand Canyon of the Colorado, in Arizona. Klauber states, "In the Grand Canyon occurs a peculiar phase of *Crotalus confluentus,* distinguished by its vermilion or salmon coloration and an almost complete absence of markings in the adult."

The Panamint Rattlesnake, *Crotalus confluentus stephensi* Klauber, (Figure 54), has been thus far recorded from northwestern Esmeralda County, Nevada, and Round Valley, Mono County, California, southeasterly to Clark County, Nevada, and northern San Bernardino County, California. It appears that this snake has formerly been confused with Mitchell's rattlesnake—the white or bleached rattlesnake —(the subspecies following), but the sponsor for its subspecific name describes a difference in the arrangement of the head plates.* It has also been confused with the tiger rattlesnake, which appears to be confined to Arizona and northern Mexico. It is a rather pallid, desert form.†

Mitchell's Rattlesnake; White Rattlesnake; Bleached Rattlesnake, *Crotalus confluentus mitchellii* (Cope), (Figure 55), is a pallid variety, with obscure, transverse markings. Its length is from four to five feet. The keels of the body scales are quite high and rough, and there may be an indicated relationship here with the rattlers of Mexico, which would be diverse to the taxonomic arrangement. Some examples are almost white. The usual hues are yellowish, gray, or even pinkish. Desert mountain slopes, among rocks, scattered cacti and thorny bushes, are the usual lurking places. A coiled specimen resembles a big tuft of faded cotton among the rocks.

Distribution is from central Arizona to the base of the foothills on the western slope of the Coast Range in California, from northern Los Angeles County southward throughout the entire peninsula of Lower California; also on Santa Margarita and other islands in the Gulf of California.

The Tiger Rattlesnake, *Crotalus tigris* Kennicott, (Figure 56), receives its name from the tawny body hue, with darker markings of ring-like pattern. It inhabits the deserts of Arizona and northern Mexico, preferring the higher slopes, among the rocks.

The Lower California Rattlesnake, *Crotalus enyo* (Cope), occurs in Lower California. The anterior markings are transversely rhomb-like, becoming narrower, or band-like on the posterior portion. It appears to be confined to the southerly portion of Lower California.

The Horned Rattlesnake; "Sidewinder," *Crotalus cerastes* Hollowell, (Figures 61 and 62). A strictly desert species of small size and pallid hues, occurring in southern California, Nevada, Arizona and portions of southwestern Utah. The large scale above each eye is developed into an upright horn. Living on dry and yielding sand, this snake progresses by throwing lateral loops of the body forward, causing it to move off at an oblique angle to the direction in which the head is pointing, and with such a degree of agility as to appear grotesque and warrant the name "Sidewinder."

The Spotted Rattlesnake,* *Crotalus triseriatus* (Wagler), (Figure 59). A small grayish species, with rows of spots extending lengthwise, but fusing into cross bands on the tail. It is reported as rare and occurs in the mountains of southern Arizona and northern Mexico.

The Green Rattlesnake, *Crotalus lepidus* (Kennicott), (Figure 60). Another small species, seldom exceeding twenty-four inches and readily distinguished by its greenish or greenish-gray hue, marked by widely separated and narrow rings of black. Always regarded as of rare occurrence, although the range extends along the region of the Mexican boundary, from Eagle Pass on the Rio Grande, westward through New Mexico and Arizona. Its distribution into Mexico is not definitely known.

Willard's Rattlesnake, *Crotalus willardi* Meek. Apparently the smallest rattlesnake, and of rare occurrence. The length appears to be not more than fifteen inches. It is recorded from Arizona and northern Mexico. Two parallel white stripes, one on the lip and the other extending from the snout thence beneath the eye and to the lower and rear portion of the jaw, are characteristic.

* "From *mitchellii* it differs in having the rostral generally in contact with the prenasal." (Klauber).

† Full technical definition of this and other subspecies of *Crotalus confluentus* are presented in the Transactions of the San Diego Society of Natural History, Vol. VI, No. 3, pp. 95-144, plates 9-12, with map.

* Formerly designated as *pricei.*

This map illustrates the absence of poisonous serpents in the West Indies. The shaded portions (the mainland and a few islands on the extreme right) show the occurrence of venomous snakes. The unshaded portions contain no dangerous reptiles. Nestled as they are within the curving shores of infested mainlands, it appears remarkable that Cuba, Jamaica, Hayti and Porto Rico, with their luxuriance of tropical flora, have never furnished records of poisonous reptiles.

The Mexican and Central American Species

A radical change in the species of poisonous serpents take place south of the arid portion of Mexico. The rattlesnakes abruptly give way and serpents of the genus *Bothrops,* typical of the American tropics, appear. The reptilian fauna of the Central American countries and South America is quite similar, although a number of species occurring in the latter are characteristic to the more southerly countries, and the great bushmaster is found only in the southerly portion of the Central American area, whence it ranges southward through the South American tropics. The prevailing and most widely distributed poisonous species are the rattlesnake now restricted to a single species and on high ground, and the fer-de-lance or barba amarilla, *Bothrops atrox,* in the low, coastal areas. Coral snakes are common in the humid forests. A poisonous sea snake occurs in the bays and off the western coasts of Central America.

Marine Serpents: The curious members of the *Hydrophidae* or sea snakes may be recognized by the vertically compressed or paddle-like tail. There are many species which abound in the Indian Ocean and the western tropical Pacific. A single kind, however, occurs in waters of the New World—off the west coast of Mexico, Central America and northern South America. All of the marine serpents are very poisonous and appear to be highly specialized allies of the Elapine group.

The Yellow-bellied Sea Snake, *Pelamydrus platurus* (Linné), may be recognized by its rather eel-like form, with quite long head, the body compressed and covered above and beneath with small, round scales. Coloration is vivid and unusual. The upper half of the body is black or dark brown, the lower half yellow, demarkation being very apparent while the creature is swimming, particularly if seen from the side. Length is seldom over three feet. It is extensively distributed through the tropical Pacific, and into the Indian Ocean, and often observed in the Bay of Panama and off Punta Arena, Costa Rica, where it may be watched for from steamers clearing the Panama Canal for west coast ports, north or south. It also occurs in the lower Gulf of California.

The Coral Snakes: The genus *Micrurus* (*Elaps*), despite the brilliant coloration of its members, is at best a monotonous one, and to list the Central American species would produce a repetition not particularly helpful. A typical Central American species has been selected for photographic illustration together with a series of drawings to show the varying widths of the red bands and the ratio of black to yellow rings among these serpents. The coral snakes of the tropics attain a considerably larger size than those occurring in the United States. Some examples attain a length of nearly four feet, and while they seldom strike, will immediately bite if stepped on. An unfortunate victim in bare feet may find the reptile imbedding its short fangs and retaining its hold. Such bites of the larger species are usually fatal.

In Mexico the common name for these reptiles is "coralilla" and in Central America "gargantilla," the latter meaning a necklace and relating to the similarity of the patterns of these serpents to beads strung in color designs. At least eight species appear to occur in Mexican and Central American areas, among these being *Micrurus fulvius,* ranging southward from the United States—but with proportionately wider red rings, *M. mipartitus* and *M. nigrocinctus.* The latter is commonly seen from Guatemala to Panama and is shown in a photograph from life—(Figure 7).

The Viperine Snakes: The Tropical Water Moccasin; "Cantil," *Agkistrodon bilineatus* Gunther, (Figure 18). This water moccasin is far more dangerous than the species of the North. It is savage, extremely quick, and inclined to instantly strike. Its poison has a higher toxicity than its northern ally.

The large, symmetrical shields on the top of the head immediately distinguish it as a typical moccasin, and offer a point of differentiation from the vipers of the genus *Bothrops.* It is boldly marked, in decorative pattern, as if

embellished with touches of white enamel, and seems to be a smaller species than that of the United States. The writer has noted no specimen over four feet in length. This moccasin should be looked for in swamps and in the marginal vegetation of streams.

Records indicate that it is confined to southern Mexico and the northerly part of the Central American tropics. Listings record it from Tres Marias Island, Colima, Guadalajara, Tehuantepec and Yucatan, also the Pacific coast of Guatemala. The writer heard of it near Belize in British Honduras, but in a careful search of swamps and waterways in the Republic of Honduras failed to find it, nor had Douglas March in his field work found it that far south.

The Palm Vipers: This is a group of quite slender, rather small species—seldom over a yard in length. They are arboreal, have a particularly wide head and all are characterized by a prehensile tail, which as a rule is kept promiscuously twisted about some projection. Approximately six species are listed as occurring in the southern Mexican and Central American area.

Schlegel's Palm Viper; the Horned Palm Viper; the Eyelash Viper; "Bocaraca"; "Toboba de pestana," *Bothrops schlegelii* (Berthold), (Figure 21), is distinct by the development of several small scales between the eye and the large plate above it. Two or three of these scales are directed upward to form spiny horns. There are two color phases. One is greenish or olive, speckled with black and red; the other, equally common, is yellow, often of pale lemon hue, speckled with black. The yellow examples are known as "Orapel."

Prospectors should be wary about going through thick, bushy places. These arboreal vipers are not readily detected, as they blend with surroundings. Under such conditions men have been bitten on the hands and face. A trail gang, cutting through the jungle in the Republic of Honduras had such accidents, several of them terminating fatally. While these snakes are small, the proportionately large head and long fangs, together with a highly toxic venom, render them very dangerous. Range of the horned or eyelash viper includes Guatemala, south through Central America and well into South America.

The Mexican Palm Viper, *Bothrops undulatus* (Jan), also has a horn-like development over the eye, but this is produced by a single upturned scale. This snake is olive or brown, with large, rhomb-like spots, sometimes connected to form a zig-zag band. Recorded from Mexico —Omilteme in Guerrero, Orizaba, Vera Cruz, Aetopam and Oaxaca. It probably ranges into Guatemala.

The Green Palm Viper, *Bothrops bicolor* Bocourt, is uniform leaf green above and yellow beneath and recorded from western Guatemala.

The Yellow-lined Palm Viper, *Bothrops lateralis* (Peters), is green above and beneath, with a yellow line along each side. Some specimens have yellow and dark cross bands on the back. It is found in Costa Rica.

The Black Spotted Palm Viper, *Bothrops nigroviridis* (Peters), illustrates how observation extends the knowledge of a species. This snake was for a long time listed as occurring in Panama and Costa Rica. Through the field studies of Douglas March, in charge of the Serpentarium at Tela, Honduras, the species was found to be well represented in that country. This serpent is green, with black spots or speckled markings.

March's Palm Viper, *Bothrops nigroviridis marchi* Barbour, (Figures 19 and 20). The form discovered in fair abundance in Honduras by Mr. March, represents a subspecies based upon scalation. The markings are similar to the typical form.

The Yellow-spotted Palm Viper, *Bothrops nigroviridis aurifera* (Salvin), occurs in Guatemala. It is green above and greenish yellow beneath, with scattered yellow spots.

Amaral notes the following about another palm viper, *Bothrops leptura*, occurring in Panama thence into northern South America: "Seems to be very poisonous, as its fangs occupy half or more the length of the mouth and its venom glands are quite long and thick."

The Hog-nosed Vipers: Three small species fall within this definition. The snout is sharply upturned with one, moderately so with a second, and pointed but not actually upturned with the other. These snakes in Central America are

usually called "Chatilla" or "Tamagá." They occur over varied terrain, covering the greater portion of Central America and southerly Mexico. The genus ranges into South America.

The Nose-horned Viper, *Bothrops nasuta* Bocourt, (Figure 22), occurs in humid woodlands of eastern Central America, thence southward into Colombia and Ecuador. The snout bears an upturned proboscis-like appendage. Coloration is brown, with thirteen to twenty small black markings on each side of the back, these usually in alternation and separated by a pale line. Length is seldom beyond twenty-four inches.

Landsberg's Hog-nosed Viper, *Bothrops lansbergii* (Schlegel). The snout is carried forward to a sharp point slightly upturned. Coloration is brown, with a double row of darker markings on the back, generally separated by a paler line and often united to form a zig-zag chain. The length is usually under twenty-four inches. Occurrence is largely confined to the drier areas from southern Mexico, through Central America and into northwestern South America.

The Western Hog-nosed Viper, *Bothrops ophryomegas* Bocourt. The snout is sharp, but not upturned. The markings are similar to the two preceding species, but there is a greater number of the dorsal blotches—twenty-six to forty. This little viper inhabits the arid districts of western Central America from Guatemala to Costa Rica.

Other Species:

Godman's Viper, *Bothrops godmani* (Günther), (Figure 23). A small and rather stout species of brown or gray, inclined towards obscure markings, although some examples have a dorsal series of large, dark rhomb-like spots, arranged in zig-zag outline. Occasional specimens are quite vivid, somewhat like the North American copperhead. Average length is under twenty-four inches. Distribution appears to be limited to Honduras and Guatemala; possibly southern Mexico.

The Jumping Viper; "Mano de piedro"; or "Timba," *Bothrops nummifera* (Rüpp), (Figures 24 and 25). This snake seldom reaches three feet, and averages closer to two feet, but it stands out among the *Bothrops* species in having the proportionately stoutest body and largest head. The thick-set body is as incongruously heavy as the grotesque vipers of Africa. Its scales are also peculiar, being exceedingly rough, like those of the bushmaster. Mutilated specimens have led a few observers to the supposition that they had found young bushmasters in areas north of the actual range of that imposing species.

This snake receives its native name of "Mano de piedro" from its resemblance in form to a native implement used in the crushing of corn for tortillas. It is particularly savage, and in striking can make a short jump. This habit also exists with the irritable little hog-nosed vipers. The tales relating to the jumping of the "Mano de piedro" have been exaggerated, but specimens observed by the writer made a striking jump and slide that carried the serpent a full two feet forward. In striking from the side of a log or from a bank, where there is good purchase to lurch its coils, it may be able to jump as much as a yard. At any rate, a snake impelling itself bodily forward is startling, to say the least, and conducive to speculation and native exaggeration.

The fangs are proportionately short, and strangely enough, with all the native fear of reptiles and the branding of many harmless species as poisonous, this snake is but little dreaded, being declared harmless in some areas. The venom has a hæmolytic action, and is of lower toxicity than other species of *Bothrops*.

The body is gray or brown, with dark, black-edged, rhomb-like blotches, in a way, rather similar to the bushmaster, hence another reason for this species being sometimes mistaken for young specimens of the former. Distribution is broad, from Mexico as far north as Tuxpan, south through Central America to and including Costa Rica, and probably northern Panama.

Barba Amarilla; Fer-de-lance; "Tommygoff," *Bothrops atrox** (Linné), (Figures 30 and 31). How the name "fer-de-lance" came to such broad use among English speaking observers, when it originated among the Creole-French in a couple of small islands of the West Indies—Martinique and St. Lucia—may be explained by the fact that this dangerous viper became famous—or infamous—on those islands in particular, owing to their proportionately generous human population and the former abundance of this poisonous serpent. There has been much

* *B. lanceolatus* is now a synonym.

dramatic writing about this snake. It has figured in romantic tales of the islands, where there is a legend that it was imported to induce slaves to remain upon the plantations and make no attempts to escape or hide. The fer-de-lance is now rather rare upon these islands—although very common in Central and South America.

Among the native residents in the New World tropics, the term fer-de-lance is confined to those small islands. The Spanish-speaking residents of Central America appear to have never heard the term. In Spanish-America the name commonly used for this reptile is "Barba Amarilla," meaning the yellow-beard, and coming from the chin and throat being yellowish.

During the construction of the Panama Canal, these snakes were frequently encountered and the workers, hearing the Spanish term of "tommygoff," meaning nothing more or less than "snake," but not realizing its simple definition, felt it indicated something terse in the way of reptiles and applied the term to this viper—so that the appellation has become common in the region of the Canal.

The length is up to slightly over eight feet, though in some areas it runs much smaller—three to four feet. Coloration is variable, from gray to olive, brown, or even reddish, with dark, light-edged cross-bands or triangles, the apex of these extending to the center of the back. The form is moderately slender, with very distinct, lance-shaped head. Distribution is very extensive, beginning in southern Mexico, including the low-lying coastal areas of Central America, and the greater portion of South America, east of the Andes, except in elevated regions.

This is the most commonly observed poisonous snake of the Central American tropics, and one reason for its abundance is its large litters of young. The litters of three Honduran specimens were sixty-four, sixty-five and seventy-one —(Figure 38). The young produced by a six-foot mother were twelve inches in length. They are born fully provided with fangs.

The effects of the poison are dramatically sinister and rapid, the action being largely hæmolytic, destroying the red blood cells and breaking down the walls of the carrying vessels, which produces great extravasation. This is evident from the reddening of the eyes, discharge of blood from the stomach and mucous walls of the throat and mouth, the same conditions developing through the kidneys and bladder. The tissue about the wound is practically dissolved by rapid necrosis and gangrene. These effects are, however, efficaciously neutralized by serum produced by the several research laboratories in the tropics.

Serpents of this type are liable to be more abundant near slovenly human settlements than in the wilder areas, as they are attracted to such places by the rats and mice which accumulate in areas of ramshackle buildings and trash heaps.

The Bushmaster; "La Cascabela Muda" (the mute rattler), *Lachesis muta* (Linné), (Figures 1 and 39). This is the world's largest viper, but nowhere over its habitat, from southern Central America through tropical South America, does it appear to be abundant. It is more frequently found in Costa Rica and Panama than in the continental area to the south. Distribution extends into Nicaragua, but further observation must define just how far north it occurs. The writer was unable to locate records from Honduras, which thus appears to be too far north to be included in the distribution.

The bushmaster grows to be twelve feet long. These very large specimens are, however, particularly rare. Two adults in the writer's possession were eight and nine feet, respectively. They both deposited perfectly formed eggs, indicating full maturity. It is the only American viper which lays eggs, all the others producing living young. Reports of the largest specimens come from southern Costa Rica, Panama, or extreme northerly South America. This great crotaline serpent is of moderately slender build. A nine foot specimen shows no more bulk, when coiled, than a Texas or Florida rattlesnake slightly over five feet long.

Coloration is vivid. The body hue is pale brown, often pinkish. A series of large and bold, dark brown or black blotches extend along the body. These are wide on the back and abruptly narrow on the sides. The pattern is the reverse of the fer-de-lance, on which the blotches are narrow on the back, widening on the sides.

The bushmaster is a bold and in habits a

particularly dangerous snake, inclined to deliberately edge towards the intruder, bringing the lateral, S-shaped, striking loop to nearer and better advantage. Its excessive length of fangs and great amount of poison render a well delivered stroke of the utmost gravity. It often warns of its presence by rapidly vibrating the tail, as do a number of the other tropical vipers, but the vibration of the bushmaster's tail is as rapid as the specifically provided warning tail of the rattlesnake. The tail of the bushmaster, among leaves, produces quite a loud, buzzing sound.

Deducting observations and records of captured examples, it seems that this snake prefers higher and drier ground than the fer-de-lance. Dr. Herbert C. Clark, Director of the Gorgas Memorial Laboratory, showed the writer two fair-sized specimens which had been killed on the Alajuela Cut, not far from the Canal Zone, by the construction gangs working on the new damming project to provide more water for Gatun Lake.

The Tropical Rattlesnake; "Caseabel," *Crotalus terrificus* Linné, (Figure 42), is the most poisonous of the rattlers, as well as the most savage. The venom differs from northern rattlesnakes and other New World vipers, in having a largely neurotoxic action, and is nearly colorless. It may be regarded as the most strongly toxic among the New World vipers, except that of the unique and isolated island viper, *Bothrops insularis,* found off the coast of Brazil. It is only by the considerably greater amount of venom discharged at a bite that the bushmaster may be rated as more dangerous than the rattlesnake.

This rattlesnake of the tropics has the widest range of any species of *Crotalus.* It occurs from central Mexico to northern Argentina. Moreover, it appears to be the only distinct species of *Crotalus* occurring over this wide area, with the exception of several essentially Mexican species—the Mexican Blotched Rattlesnake, *Crotalus polystictus* Cope, and Stejneger's Rattlesnake, *Crotalus stejnegeri* Dunn, the range of both in western and central Mexico. *Stejnegeri* is remarkable in having a tail proportionately much longer than other rattlesnakes.

The pattern of the tropical rattlesnakes is of the "diamond-back" design. In the arid areas of central and western Mexico, the rhombs are continued to the head. This is the subspecies *basiliscus.* From southeastern Mexico into northern South America, there are elongate bands on the neck, this form defined as the subspecies *durissus* (Figure 42).

Like the bushmaster, the "Caseabel" will slowly work its way towards an intruder, even deliberately glide forward to attack, carrying the neck in a lateral, S-shaped loop, in readiness to strike. The action is not a hostile rush, but an insolent and actual advance. While the rattle is heavily developed, the species is particularly dangerous in infrequently using it. It sometimes assumes a dramatic coil, with rattle buzzing steadily, but more often gives no more warning than a few quick side flings of the rattle, producing single harsh clicks. This is a sound well worthy of recognition in the higher ground of the tropics, as it may be immediately followed by the serpent's stroke—with no further warning.

The effects of the largely neurotoxic venom is described by Mareh: "There is little or no bleeding from Caseabel bites; but death is preceded by blindness, paralysis and suffocation. . . . I believe that the idea holds over much of the range of the Caseabel that a bite will break a man's neck, regardless of the part of the body bitten. This is probably due to some selective action of the venom which causes complete paralysis of the neck. The man's head may, if he be held in a sitting position, slump forward on his chest, roll from side to side, or backward, in such a loosely connected way that the native cannot explain the condition as other than a broken neck."

Rattlesnakes in the Central American tropics frequent the higher, drier areas and thus their distribution but slightly overlaps that of the barba amarilla (fer-de-lance). They are abundant on the unwooded slopes of mountains back from the coast of Guatemala, Honduras, Nicaragua, and Costa Rica, or where the interior country may run into grassland or actually sterile areas. They are reported as particularly common in the mining areas, and a specific serum for their venom has been produced.

Length is up to six and seven feet. The body is heavy and inclined to ridge at the back. The head is proportionately small for such a powerful serpent.

The South American Species

The great continental area extending from approximately north latitude ten, past the equator to south latitude equivalent to the north of Newfoundland in the northern hemisphere, shows as distinct development in its reptile fauna as North America. The tropical portion is an area of great abundance of species of *Bothrops,* the genus of the lancehead vipers, and also of the coral snakes. Approximately fifteen species of the former occur, a dozen of which are essentially South American. At least one species of prehensile-tailed and arboreal *Bothrops,* or palm viper, is altogether South American and about twenty species of the coral snakes are indigenous.

It is important to mention that a number of the rear-fanged Colubrine snakes attain fair size in the American tropics. The fangs of some are quite long, and the bites of such reptiles might be distinctly poisonous. The New World rear-fanged serpents, however, have never been included among the dangerous reptiles. They seldom or never strike at an intruder with intent to use the fangs, which could be engaged only if the snake was to deliberately advance its jaws in the "chewing" motion of serpents utilized in holding or swallowing the prey. The toxicity of their venoms, moreover, is considerably lower than that of vipers and coral snakes. It is utilized in benumbing the prey, which consists largely of frogs and lizards. Fatalities from such serpent bites are practically unknown in the New World, but the larger members of the group should be regarded with caution. Some of them are known as "tree snakes" or "bush snakes," and have a lumpy, angular head, the eye with elliptical pupil. Owing to the lack of actual danger from this group, the absence of noted accidents, and the possibility of confusion by introducing representatives of its generous numbers among reptiles which deliberately employ highly perfected fangs, the rear-fanged, or opisthoglyph serpents are passed without further detail.

The Coral Snakes: Twenty-eight species of *Micrurus* have been scientifically listed. About twenty are indicated as being indigenous to South America. At least twelve species occur in Brazil, but few being actually indigenous to that country. Several are confined to the area north of the equator. Thus the coral snakes may be said to have their headquarters in equatorial America.

The tendency of several harmless snakes to "mimic" the dangerous species of *Micrurus* is more pronounced in South America than in Central America. Several of these non-venomous "imitators" are startling in their similarity to the poisonous species, as the South American coral snakes run to a greater variation in the width of the rings, and black on the outside of the yellow rings. (Note Figure 6.) This makes it particularly difficult to offer any fixed formula of gross differentiation in pattern to distinguish the inoffensive from the dangerous kinds. Some species of the innocuous genera *Pseudoboa* (Figure 10) and *Erythrolamprus* (Figure 11) are remarkable in their similarity of colors and ringed patterns to those of *Micrurus.* As representative examples of South American coral snakes, the following are selected:

Micrurus corallinus (Wied), (Figure 3), of the Lesser Antilles and tropical South America; *Micrurus frontalis* (Dumeril & Bibron), (Figure 4), of southern Brazil, Uruguay, Paraguay and Argentina, and *Micrurus lemniscatus* (Linné), (Figure 2), of the Guianas and Brazil. Here are examples of the differences among the species as to the ratio of yellow, red and black rings, the width and arrangement of the latter being particularly important. With *corallinus* the tendency is toward single black rings, narrowly margined with yellow or dull white; with *frontalis* there is black outside of the yellow rings (which are considerably broader), thus producing actually three black annuli; and with *lemniscatus* this is particularly pronounced, the yellow and black rings being so wide as to encroach upon and reduce the red, so typical of coral snake coloration. A length of four feet is not rare. These reptiles should be regarded as highly dangerous.

The South American Vipers: The resumé of the pit vipers of the South American continent is condensed, with the suggestion that the

reader employ cross-reference to the detailed descriptions already given under Central America, of species occurring in both countries. The palm vipers or prehensile-tailed members of *Bothrops* are more numerously represented as to species in Central America, although at least one is indigenous to South America and two others occur in the northern portion.

The Green Palm Viper, *Bothrops bilineatus* (Wied), is leaf-green above, uniform or speckled with black. A yellow line or series of spots run along the outer row of scales. The range is essentially northern, or approximately north of south latitude fifteen, including Brazil, Bolivia, eastern Peru and Ecuador. The native name is "Surucucu patiabo."

Schlegel's Palm Viper, *Bothrops schlegelii* (Berthold), (Figure 21), has already been described in the Central American fauna. Both the olive and yellow phases occur in South America. There are records from Colombia and Ecuador. It probably ranges into western Venezuela and northwesterly Brazil.

Bothrops leptura, another prehensile-tailed species, is recorded from western Colombia. It also occurs in Panama.

The hog-nosed vipers are represented in the northerly portion of South America by *Bothrops lansbergii* (Schlegel), so commonly found in the Central American tropics. The range is into Colombia, Venezuela and northern Brazil. Regarding its occurrence in Colombia, Amaral writes: "The 'Fer-de-lance' (*B. atrox*) which is the main problem in the plantations in Central America, seems to be comparatively uncommon in Santa Marta, its place being taken by another venomous species seldom found elsewhere but surprisingly common in the Santa Marta district. This is the dry-land Hog-nosed Viper (*Bothrops lansbergii*), which constitutes about 50 per cent of the Rio Frio catch. This species has been found among leaves in dry forests and also under bushes, dead trees, etc., so that it is anticipated that with the progressive clearing of the jungle, it will probably invade the banana plantations and may become dangerous to the laborers in that section."

The Island Tree Viper, *Bothrops insularis* (Amaral), (Figure 27). Unique in its genus in appearing to be confined to a small island composed of steep, rocky slopes, with separated patches of tropical vegetation. This island has barely three-quarters of a square mile of surface. It is known as Queimada Grande and situated on the coast of the State of Sao Paulo, about forty miles southwest of the Bay of Santos.

This curious viper is pale brown, with rather widely separated cross bands. Adult length is between three and four feet.

There are many birds on the island, some of them possibly resting there during incidental migrations from outjutting points of the mainland or the other islands in the vicinity. Hence these snakes, which occur in abundance, have plenty of food, and appear to feed, when adult, upon nothing but birds, for the immediate killing of which they have developed a particularly powerful venom. Experiments have demonstrated that this isolated viper has the most highly toxic venom of any species of its genus.

Bothrops insularis is not immediately related to the palm vipers, although it is arboreal and has a partially prehensile tail. It seems to be more closely allied to the terrestrial species of *Bothrops,* and among them, the following may be listed to indicate the extent of the genus:

Bothrops pulcher (Peters), of the Andes of Ecuador; *Bothrops micropthalmus* Cope, of Peru and Ecuador; *Bothrops pictus* (Tschudi), of Peru; *Bothrops xanthogrammus* (Cope), of the mountains of Colombia and Ecuador; *Bothrops cotiara* (Gomes), of Brazil; and *Bothrops castelnaudi* Dumeril & Bibron, of Brazil, Ecuador and eastern Peru. The distribution of these species will probably be found to include broader areas as further studies develop of South American herpetology. *Bothrops ammodytoides* Leybold, seems to be the most southerly species and confined to the pampas of the Argentine and northeastern Patagonia. It is small, with a wart-like protuberance upturned on the snout.

Continuing the list, is a series illustrated by photographs from life. As they range through country where the language is largely Portuguese or Spanish, the matter of "common" or "popular" names has been guided by designation in the native language where they commonly occur, with occasional digressions with species of particular prominence.

Bothrops itapetiningae (Boulenger) is known in Brazil as "Boipeva" and "Coti-

arinha." It is rather small, of ruddy brown, with a series of dorsal patches which may fuse with similar blotches on the sides. It is of rather scant occurrence and comparatively restricted distribution. (Figure 26).

Maximilian's Viper; "Jararaca"; "Urutu"; "Jararaca do rabo branco," *Bothrops neuwiedii* (Wagler), (Figures 28 and 29), is a fair-sized species, which, in Brazil, is one of the most widespread of the pit vipers, occurring in all of the northeastern, Central, southeastern and southern states. It also extends into Argentina and northern Paraguay. It shows considerable variation in markings and Amaral has named several subspecies. The general coloration is olive or brown, with a double row of dark, triangular markings along the back, these being in alternation, or sometimes fused. At the base of each triangle on the sides are two spots of similar color.

The most handsomely marked member of the genus is a large species commonly known as "Urutu," *Bothrops alternatus* Dumeril & Bibron, (Figure 37), attaining a length of five feet, quite heavy of body, and characteristic in the deep brown chocolate crescents on the sides, these vividly edged with yellow or white. This attractively-patterned species occurs in southerly Brazil, Paraguay, Argentina and Uruguay.

There are two rather similar species called the Jararaca (fer-de-lance), and their distribution may be thus defined:

Bothrops atrox (Linné), (Figures 30 and 31), the "barba amarilla" of Central America, "fer-de-lance" in Martinique and St. Lucia, and the "Barcin" and Mapepiré balsayn in Tobago and Trinidad, occurs abundantly in Venezuela, Colombia, Ecuador, easterly Peru, Bolivia, the Guianas and southward in Brazil, to approximately latitude 23° s.

Bothrops jararaca (Wied), also called the Jararaca, commonly occurs in Brazil, from about south latitude 10° to northern Argentina and northeastern Paraguay.

The Jararacucu, *Bothrops jararacussu* Lacerda, (Figures 33, 34, 35 and 36), is proportionately thicker-bodied, with a bigger head than the former. Its markings are likewise different. The paler outline markings of the blotches dominate the pattern, and there is a greater amount of the lighter colors on the sides. This is a quick and savage snake, and its big head, with excessive length of fangs, renders it extremely dangerous. The range is largely confined to Brazil.

The Bushmaster, "Surucucu," or "Mapepiré Z'Anaima" in Trinidad, *Lachesis muta* (Linné), (Figures 1 and 39), already considered in detail under the Central American section of this article, ranges over a considerable portion of tropical South America, including the northern states of Brazil, but is nowhere common. It may be immediately distinguished by its exceedingly rough body scales and the smooth plates under the tail being replaced at the end by small scales and a stout, sharp spine.

The Tropical Rattlesnake, *Crotalus terrificus terrificus* (Laurenti), (Figure 43), has been treated in detail under Mexico and Central America, where its northerly races indicate two distinct subspecies. Of these, *durissus* ranges into Venezuela and Colombia. In the Portuguese speaking countries it is known as "Cacavel" and "Boicininga" and in Spanish as "Cascabel." Its range is over the greater part of South America in the drier, elevated areas, to southern Brazil and the northern Argentine. In the northern portion of the continent, the bands on the neck are much elongated, as with Central American specimens. Examples from the greater continental area have shorter neck bands, but all exhibit the characteristic rhomb-like marking of the back.

Extracting venom from a fer-de-lance. The first step in the preparation of serum. The venom is injected (in small quantities) into horses to render them immune and thus produce an antivenomous serum.

Antivenines for Snake Bite

The pioneers in production of antivenines for the bites of New World serpents were Doctors Vital Brazil and Afranio do Amaral. Dr. Amaral is now Director of the splendid organization known as the Instituto Soro Therapico, at Sao Paulo, Brazil, which is conducted under the auspices of the government. Dr. Brazil is now Director of an equally modern plant known as the Instituto Vital Brazil, which is situated at Nietheroy, a suburb of Rio de Janeiro. These institutions produce specific grades of sera for the different types of poisonous snakes. A grade is prepared to neutralize the venoms of the *Bothrops* group, which is particularly marked in its haemolytic action, and another for that of the tropical rattlesnake, which indicates powerful neurotoxic and haemotoxic elements. Another is produced to counteract the largely neurotoxic venom of the coral snakes. There is also a polyvalent serum, which is not so efficacious as a specific type, but intended for use when the bite is from an undetermined serpent. These sera are largely available south of the equator.

North of the equator, the Serpentarium at Tela, Honduras, jointly maintained by the Antivenin Institute of America, Harvard University and the United Fruit Company, collects venoms from the *Bothrops* types and the tropical rattlesnake, for preparation of such specific sera. These venoms are sent to the laboratory at Glenolden, Pennsylvania, where the immunization of horses and consequent developments to the perfected antivenin are conducted.

The Antivenin Institute of America also prepares a serum for general use in the United States, where the venoms of the pit vipers—the rattlesnakes, copperhead and moccasin, are so similar that a polyvalent serum is practicable and efficacious. The venoms of these North American vipers is largely haemotoxic. As the danger from the coral snakes in the United States is very slight—as indicated from the extreme infrequency of accidents—no specific serum has been produced for North America.

From this resumé of different types of serum, it will be understood that anyone going into country where poisonous serpents are common, should use care in being provided with the proper kinds. All of these sera are hypodermically administered.

Serpentarium at Tela, Honduras. This institution is maintained jointly by Harvard University, the Antivenin Institute of America and the United Fruit Company for the purpose of extracting venom from native reptiles, and producing serums. The large thatched structure is a shaded snake pit. One of the smaller buildings contains a photographic dark-room, and the other screened cages for study of individual specimens. From a photograph by Anton Vestby.

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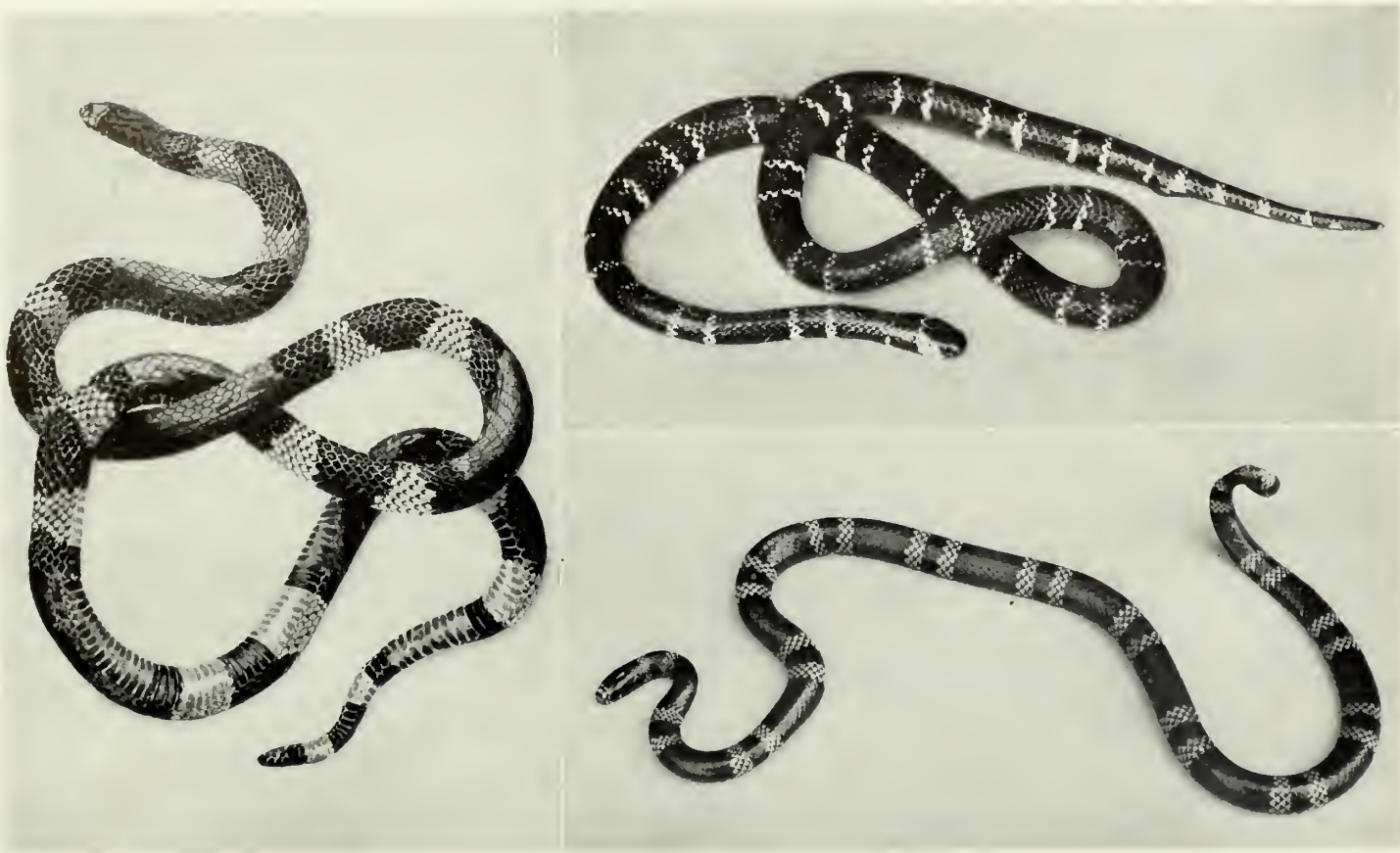
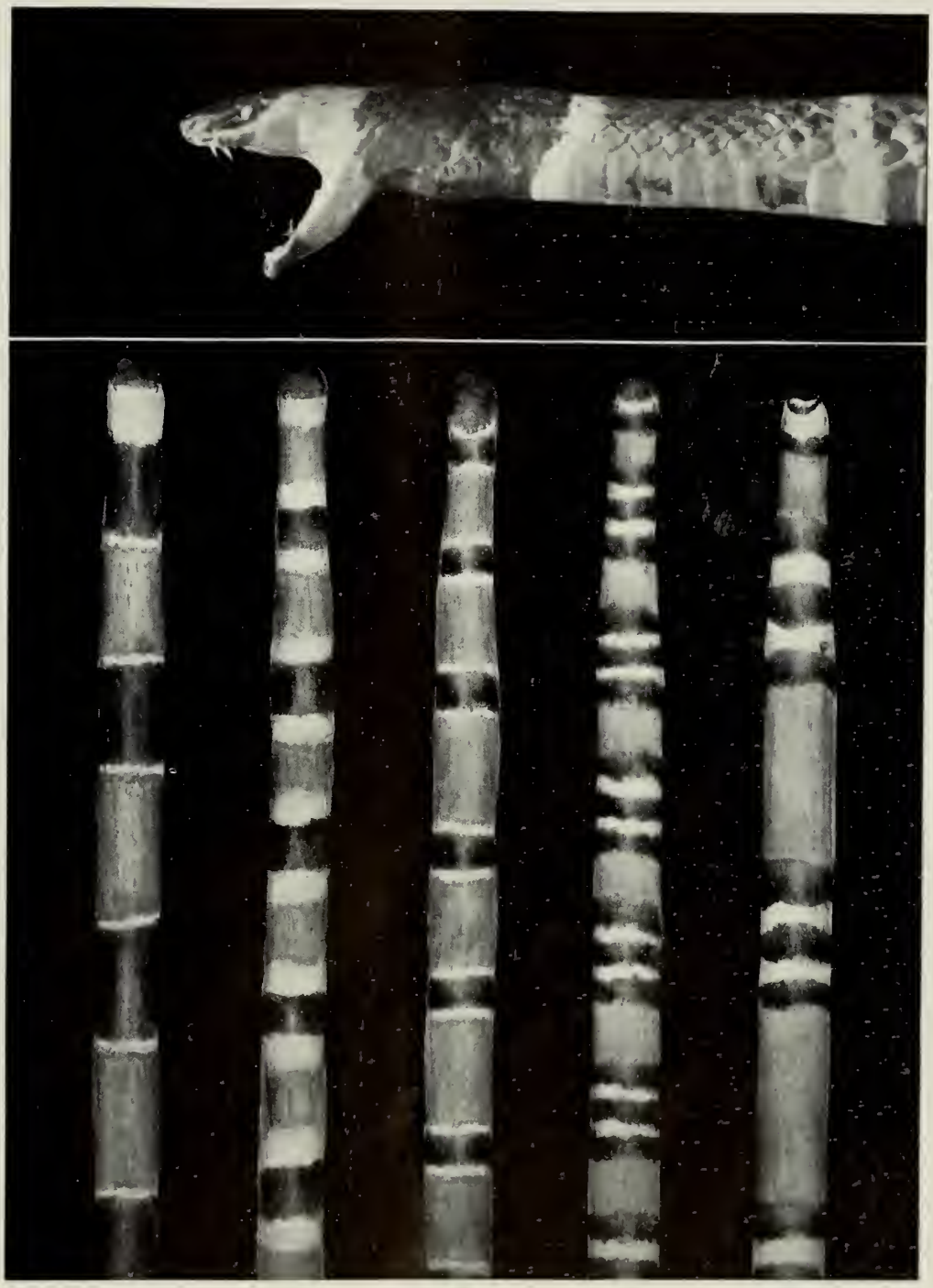


Poisonous Coral Snakes

Left Fig. 2. *Micrurus lemniscatus.* The Guianas and Brazil. The yellow rings are wide and heavily margined on the outside with black.

Upper right Fig. 3. *Micrurus corallinus.* Tropical South America, and the Lesser Antilles. The other extreme in width of the yellow rings, which are in immediate contact with the red areas.

Lower right Fig. 4. *Micrurus frontalis.* Southern Brazil to Argentina. Intermediate between *Figures* 2 and 3. The yellow rings are moderately margined outside with black. Photographs courtesy of Dr. Afranio do Amaral.



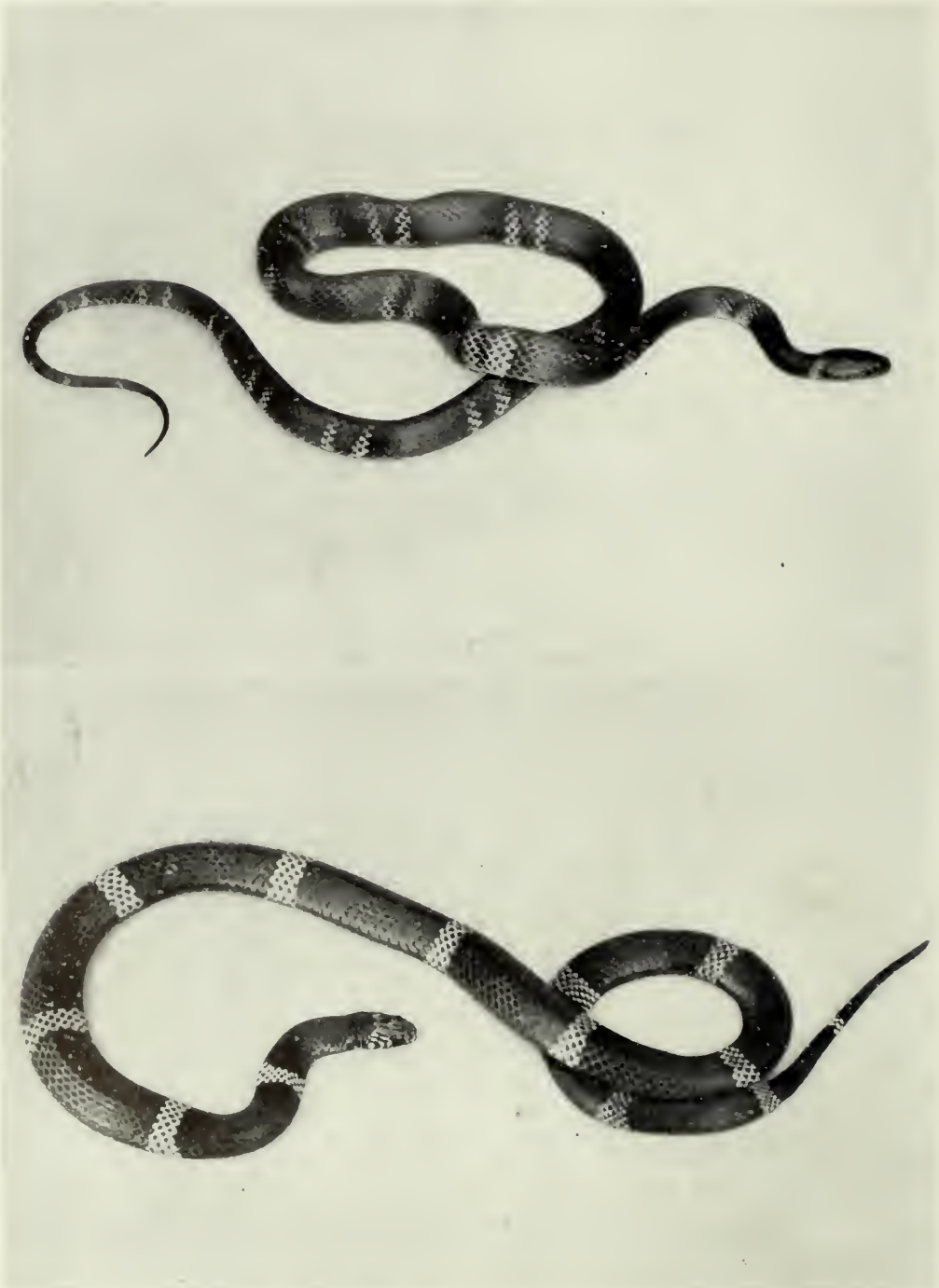
Upper—Fig. 5. Head of Coral Snake, *Micrurus*. Showing the very short poison fangs, which are permanently erect. This is a quite different development from that of the vipers (*Figures* 12, 13 and 14).

Lower—Fig. 6. Patterns of coral snakes—drawn by the author. The gray areas indicate the red. From right to left the patterns indicate: *M. fulvius*, southeastern United States; *M. euryxanthus*, southwestern United States and Mexico; *M. corallinus*, *M. lemniscatus* and *M. frontalis*, South America.

Fig. 7. Central American Coral Snake, *Micrurus nigrocinctus*. The average length of a large tropical coral snake is three feet. Occasional specimens are larger. These slender-bodied, narrow-headed serpents, with their pretty patterns of bright red, yellow and black, look anything but dangerous. In reality they are extremely poisonous, and related to the Old World cobras. They do not strike, but deliberately bite if touched or stepped on. Their venom attacks the nerve centers, and bites of such snakes are often fatal. Photograph by Anton Vesby.

Upper—Fig. 8. Coral Snake; Harlequin Snake, *Micrurus fulvius*. Occurs in the southeastern United States. It is secretive and of burrowing habits, though sometimes seen prowling after rains. It feeds upon the young of other snakes and small lizards.

Lower—Fig. 9. Sonoran Coral Snake, *Micrurus euryxanthus*. Found in the extreme southwestern United States and northern Mexico. These extremely dangerous and deceptively pretty reptiles form an extensive genus of considerably over two dozen species, ranging from the southern United States to Argentina.



Harmless Species Resembling Coral Snakes.

Upper—Fig. 10. A Brazilian serpent, *Pseudoboa trigeminus*, with pattern of red, black and yellow bands of remarkable similarity to that of the poisonous coral snake.

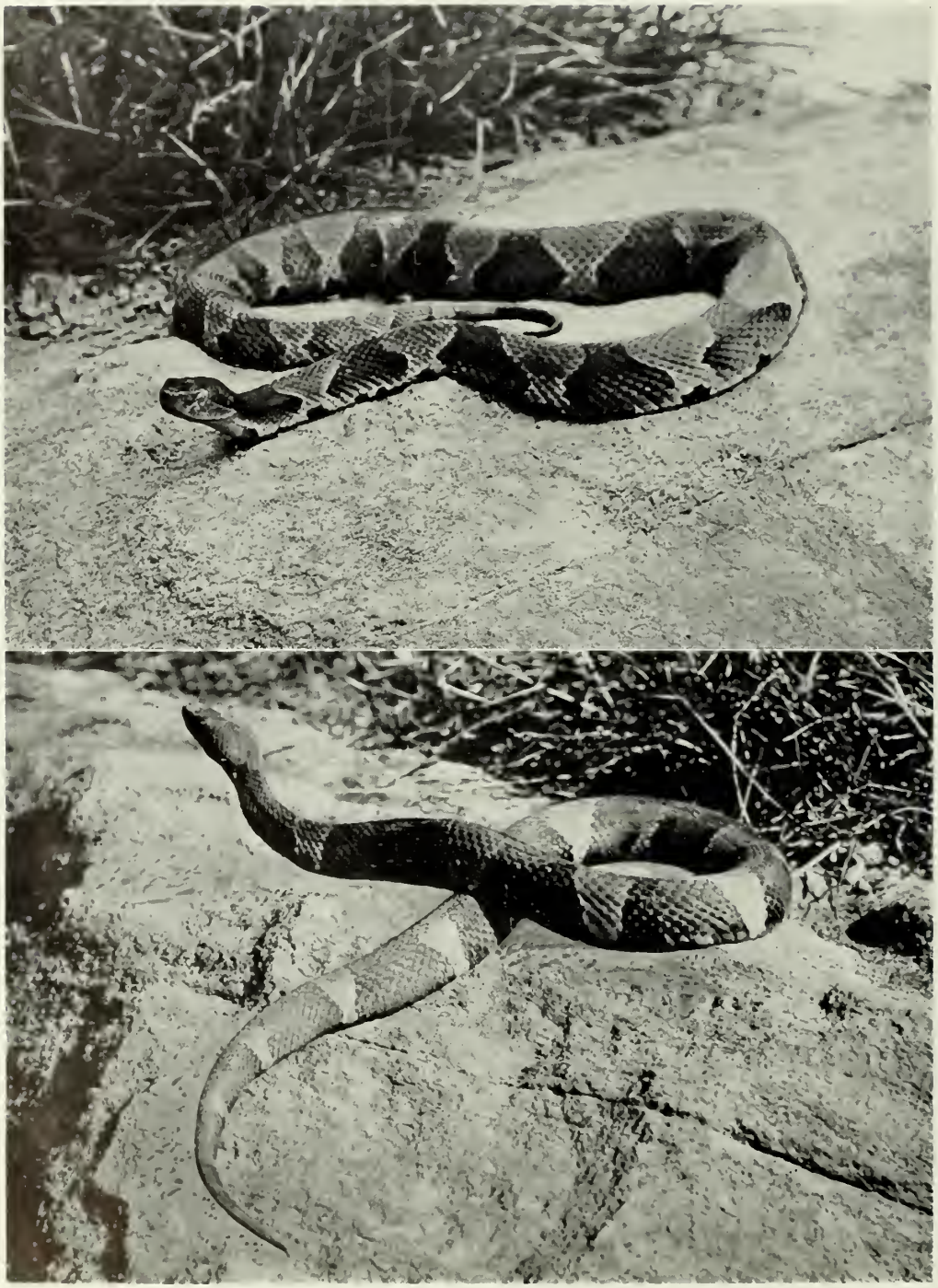
Lower—Fig. 11. Another Brazilian species, *Erythrolamprus aesculapii*, with red, black and yellow bands. There is similarity to the poisonous coral snakes in coloration, but the yellow rings are single and margined with black, a reverse from the usual pattern of the dangerous reptiles. Harmless "mimics" of the coral snakes are found wherever the latter occur. Photographs courtesy of Dr. Afranio do Amaral.

Heads of Viperine Snakes.

Upper—Fig. 12. Skull of Bushmaster, showing the poison fangs in upper jaw. These are hollow, with opening at tip like a large hypodermic needle. They fold back when the mouth is closed. There are double fangs on the right—one ready to be shed.

Lower left—Fig. 13. Head of Diamond-back Rattlesnake.

Lower right—Fig. 14. Head of Fer-de-lance, showing membranous sheath normally coverings the fangs and which is pushed upward in biting.



The Copperhead Snake, *Agkistrodon mokasen*. (Eastern and western phases.)

Upper Fig. 15. Ranging from Massachusetts to northern Florida and to the Mississippi Valley, the eastern phase is fairly constant in pattern, although the paler areas between the dark brown blotches vary from gray and tan to pinkish brown or reddish hue. When coiled, this serpent closely blends with fallen leaves and often seeks to hide where dead leaves carpet the ground.

Lower Fig. 16. A Texas Copperhead. The bands are fewer in number and much wider than with eastern specimens.

Upper Fig. 17. Water Moccasin; "Cotton-mouth" Snake, *Agkistrodon piscivorus*. Water snakes of several species inhabit the United States but this is the only poisonous aquatic serpent within that area. It is abundant in the Southeast and attains a length of five feet. The term "cotton-mouth" comes from the mouth parts being whitish. It will open its mouth and threaten an intruder.

Lower Fig. 18. Tropical Water Moccasin, *Agkistrodon bilineatus*. The pattern is highly decorative, as if the reptile were marked with white enamel. This is a savage and very dangerous snake, restricted to southerly Mexico and northern Central America.

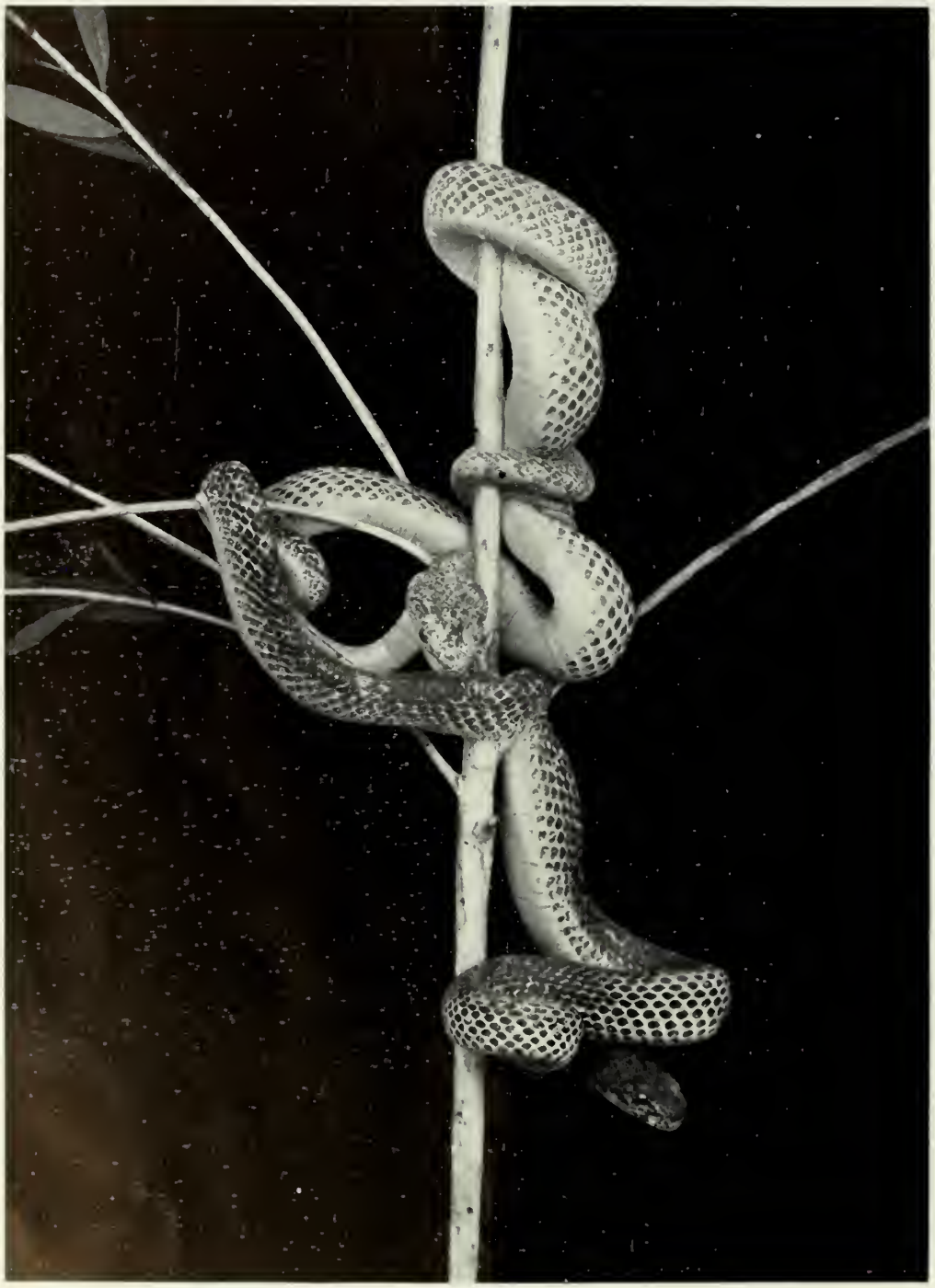
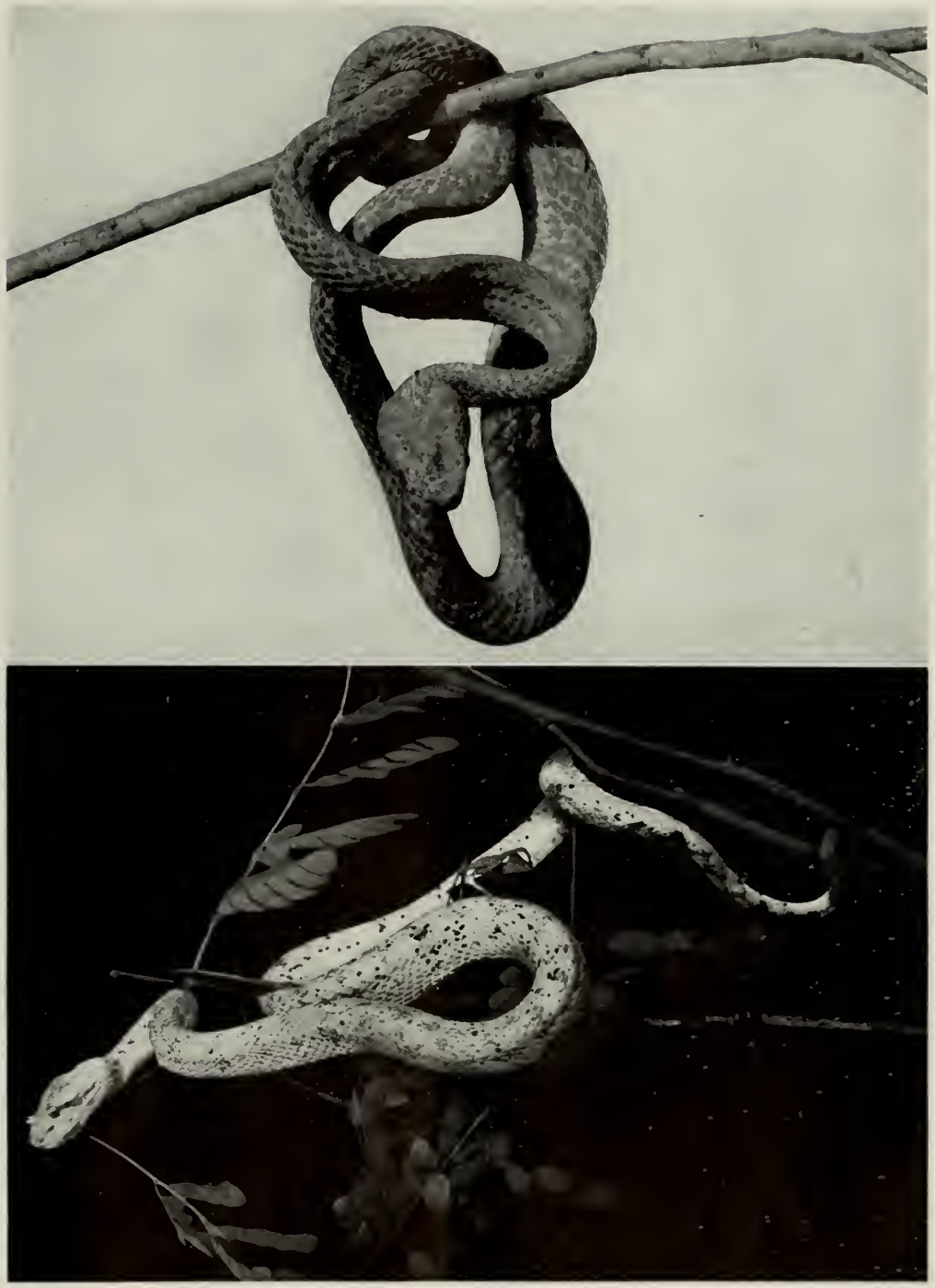
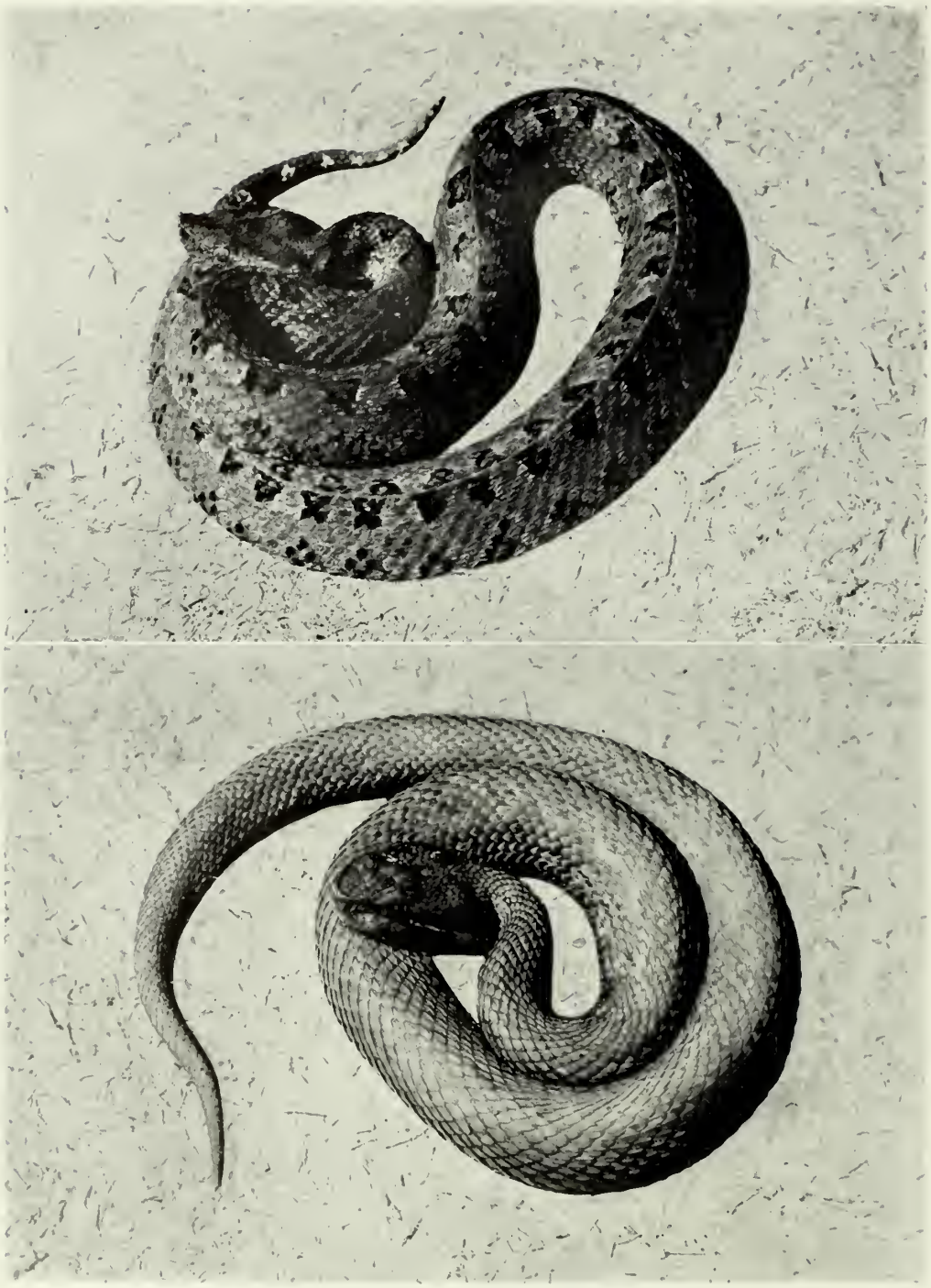


Fig. 19. Palm Vipers. The genus *Bothrops* forms the dominating group of venomous serpents in the New World tropics. It contains extremely dangerous species, including the fer-de-lance. The palm vipers are among its smaller members, and characteristic in being arboreal and having a prehensile tail. Their fangs are proportionately very long. Most of them are of greenish hues and difficult to detect amongst foliage. The examples shown represent March's Palm Viper, *Bothrops nigroviridis marchi*, of Honduras. Photograph by Anton Vestby.



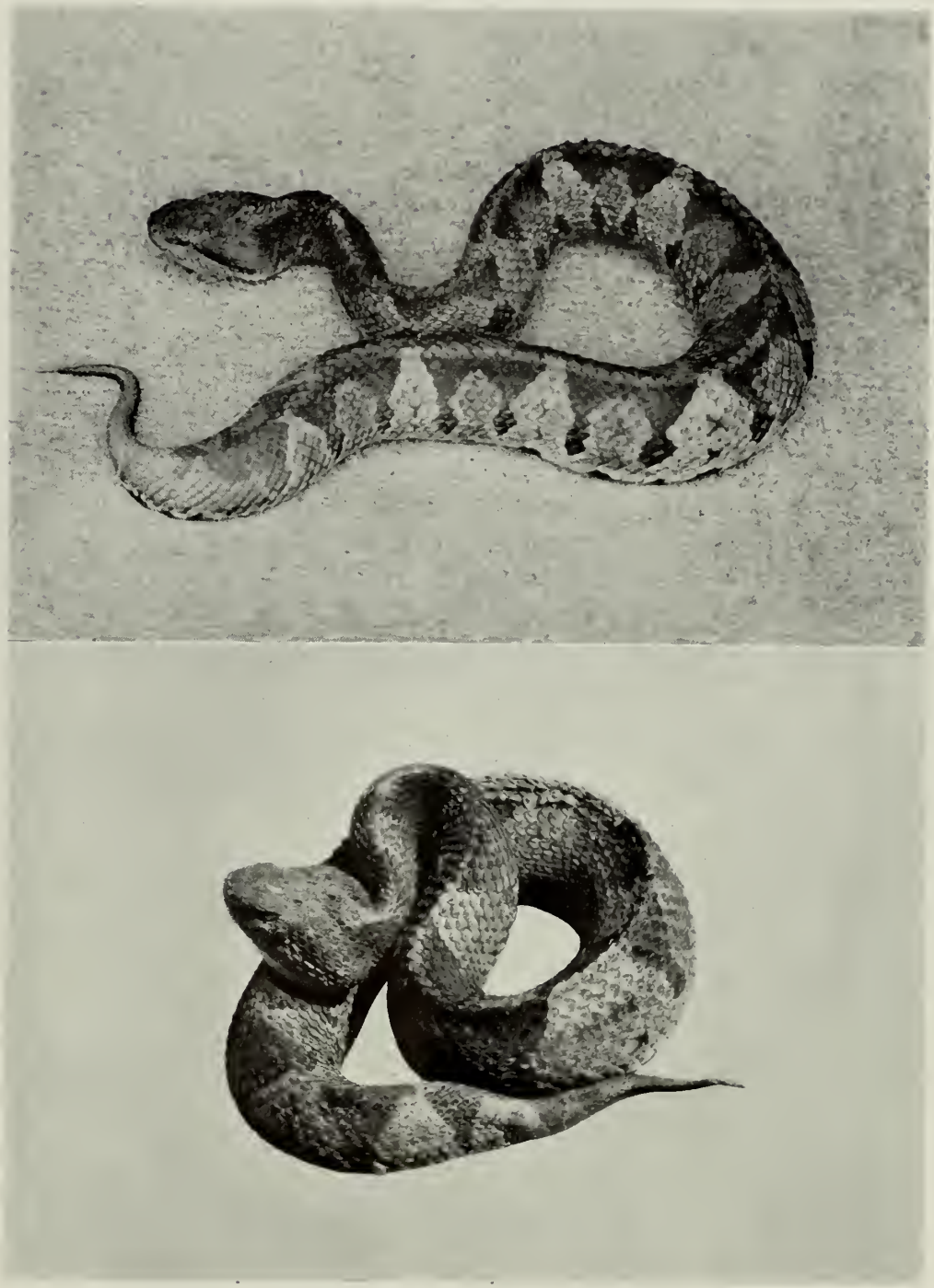
Upper—Fig. 20. March's Palm Viper, *Bothrops nigroviridis marchi*. The typical form occurs in Costa Rica and Nicaragua. Several fatal accidents occurred among a trail-cutting gang, owing to the difficulty in detecting these reptiles in the foliage.

Lower—Fig. 21. Schlegel's Palm Viper, *Bothrops schlegelii* (yellow phase). This arboreal viper has a wide range, occurring from Guatemala into northern South America. There are two color phases, one lemon-yellow, the other dark green, blotched with red. Spiny scales stand erect over the eyes, which character has produced another name—the eye-lash viper. Photographs by Anton Vestby.



Upper—Fig. 22. Nose-horned Viper, *Bothrops nasuta*. Central America, Colombia and Ecuador. There is fair variety of small members of *Bothrops*. This common serpent is rated as one of the most active of its genus, and can lurch its coil a foot forward. It is sometimes called "jumping viper," but the term properly belongs to the particularly vigorous species shown on the following plate.

Lower—Fig. 23. Godman's Viper, *Bothrops godmani*, of Central America. Length is under twenty-four inches. Photographs by Anton Vestby.



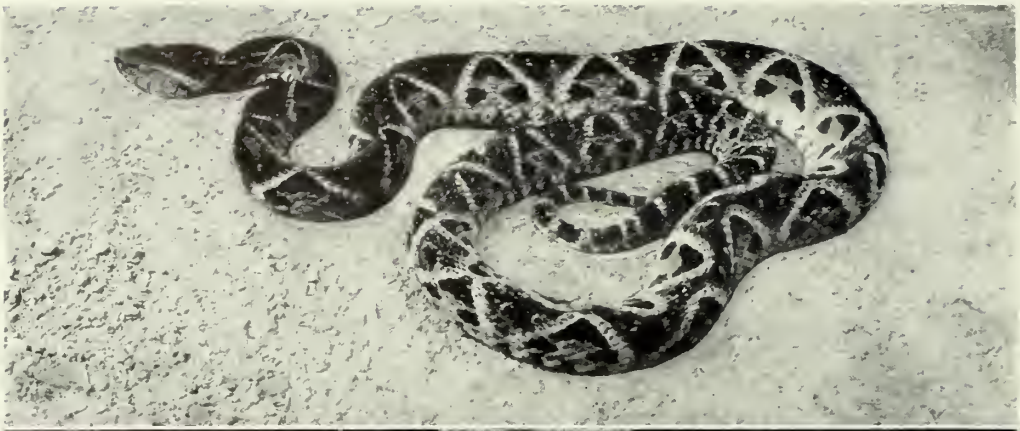
The Jumping Viper, *Bothrops nummifera*. (*Upper*, Fig. 24 and *Lower*, Fig. 25.) This Central American species is less than a yard in length, but grotesque in being the proportionately stoutest viper of the American tropics. It is also the most vigorous in biting, as it makes a striking jump when irritated, that may carry the whole body a full two feet forward, or to a greater distance if the snake strikes from the side of a log or bank where there is purchase to lurch its coils. The upper figure shows a young example with particularly bright pattern. Photographs by Anton Vestby.

Upper Fig. 26. Cotiarinha, *Bothrops itapetiningæ*. A small, brownish viper of southern Brazil. It is rather rare.

Lower Fig. 27. The Island Tree Viper, *Bothrops insularis*. Unique among South American serpents in restricted *habitat*. Occurs on an island of less than a square mile of surface, about forty miles from Santos, Brazil. Feeding entirely upon birds and requiring an exceptionally active poison to kill such elusive prey, this serpent is rated as the most poisonous of its genus. Photograph courtesy of Dr. Afranio do Amaral.

Upper—Fig. 28. Maximilian's Viper, *Bothrops neuwiedii*. One of the most widespread of the South American pit vipers. It rather closely resembles the fer-de-lance in form and habits, being irritable and quick to strike. Photograph courtesy of Dr. Afranio do Amaral.

Lower—Fig. 29. Maximilian's Viper, *Bothrops neuwiedii* (variety). Several distinct subspecies have been named. The blotches may be more closely crowded, or more vivid, owing to a paler body hue.



Upper—Fig. 30. Fer-de-lance. *Bothrops atrox*. The familiar common name originated among the Creole-French on the islands of Martinique and St. Lucia, where this serpent was once abundant but is now rare. In Central America it is known as "Barba amarilla" and in Brazil most commonly as "Jararaca."

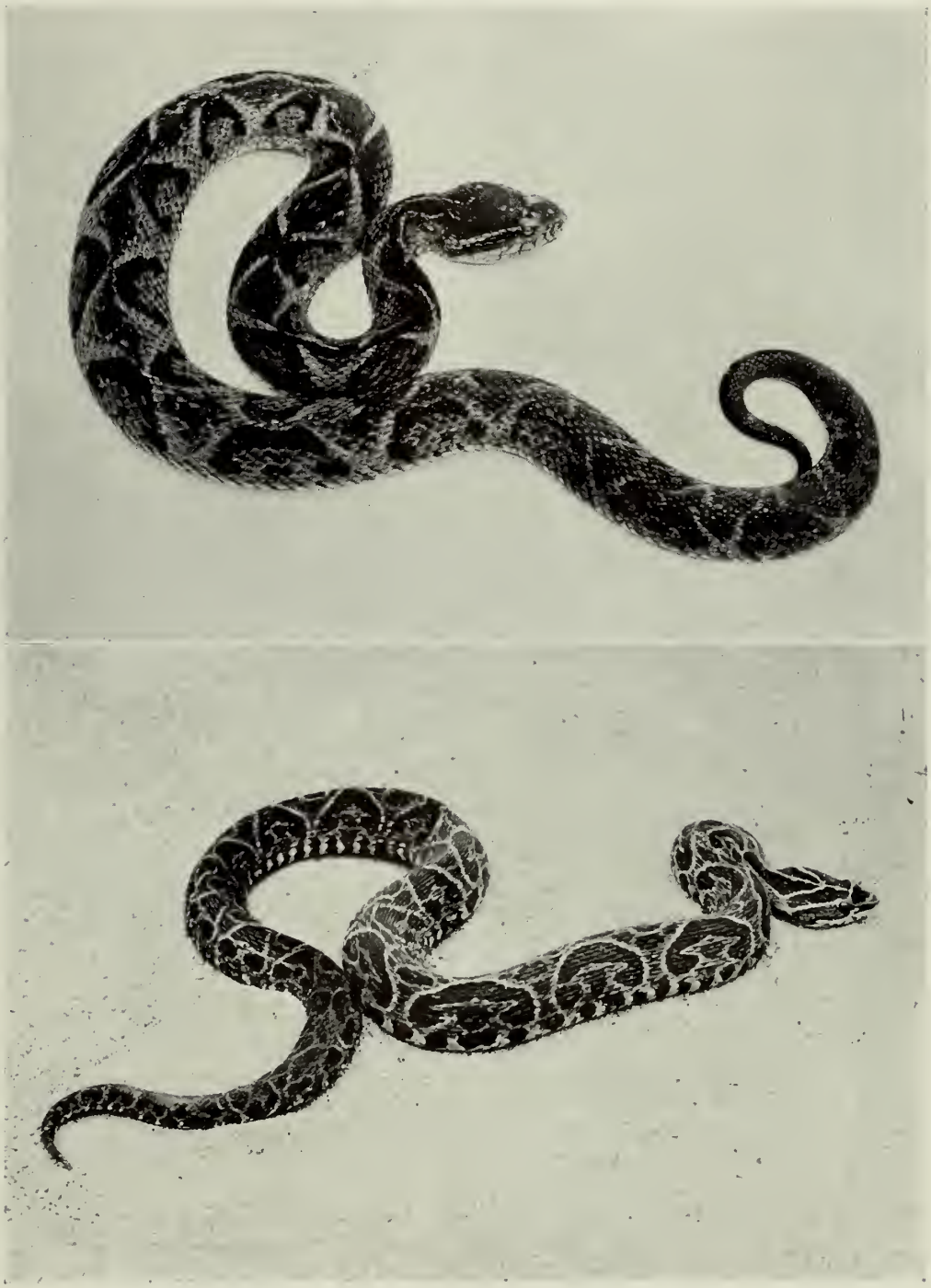
Lower—Fig. 31. A big specimen of barba amarilla or fer-de-lance, captured near Tela, Honduras. The exact length was eight feet and four inches. Photographs by Anton Vestby.

Upper—Fig. 32. Fer-de-lance or Jararaca. (Note Fig. 30.) The most commonly seen venomous serpent in the American tropics. There is considerable variation in the pattern and body hue. The latter is more frequently gray or greenish-gray, with darker, pale-edged blotches.

Lower—Fig. 33. Jararacucu. *Bothrops jararacussu*. Largely confined to southerly Brazil. It is a thicker-bodied serpent than the more widely distributed jararaca. (Note Figs. 34, 35 and 36.)

Upper—Fig. 34. Jararacucu, *Bothrops jararacussu*. While of the "fer-de-lance" type and similar on gross examination, the markings are more angular and the paler margins of the blotches dominate the pattern.

Lower—Fig. 35. Jararacucu. Gray-green or olive hues, splashed with yellow and darker blotches, form dangerously deceptive patterns when these creatures are lurking in low vegetation. They fortunately have a habit of warning of their presence by vibrating the tail, which produces a sharp, buzzing sound among the leaves.



Upper—Fig. 36. Jararacucu, *Bothrops jararacussu*. Showing the pattern viewed from above. (Note Figs. 33, 34 and 35.)

Lower—Fig. 37. Urutu, *Bothrops alternatus*. Southerly Brazil, Paraguay, Argentina and Uruguay. The most handsomely marked member of the *Bothrops* genus. The crescents are chocolate-brown, edged with white or yellow. It attains a length of five feet and is quite heavy of body.

Fig. 38. A Day-old Litter of Fer-de-lance.

There are over fifty infant serpents here, from one mother. With the exception of the bushmaster, the American vipers produce the young alive. The reason for the abundance of the fer-de-lance is the large number of progeny. The litters of three Honduran specimens were 64, 65 and 71. The young from a six-foot mother were twelve inches long. They are born fully provided with fangs. Photograph by Anton Vesthy.

Fig. 39. The Bushmaster; Surucucu, *Lachesis muta*. Attaining a length of twelve feet, this is the largest of the world's viperine serpents. Its range is southern Central America and tropical South America. The scales are very rough and protruding; the coloration ruddy brown or salmon hue, with black cross-bands. The latter reverse the pattern of the fer-de-lance group, being wide on the back and narrowing on the sides. (See Fig. 1.)

Upper—Fig. 40. Pygmy Rattlesnake. *Sistrurus miliarius.* Southeastern United States. The rattlesnakes of North America vary from this eighteen-inch species to the big diamond-backs of six to eight feet. Note the minute rattle, which can be scarcely heard a few feet away.

Lower—Fig. 41. Massasauga. *Sistrurus catenatus.* This small brownish or grayish species occurs from western New York throughout the central states. It usually frequents swampy places.

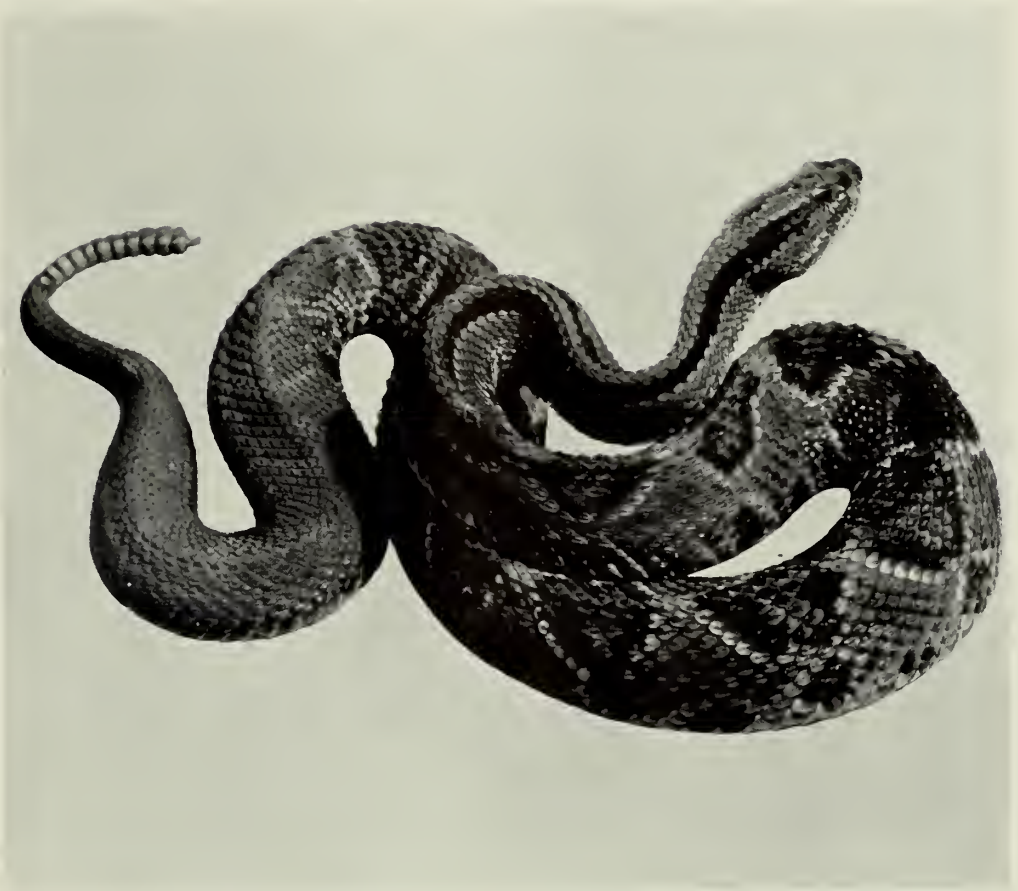
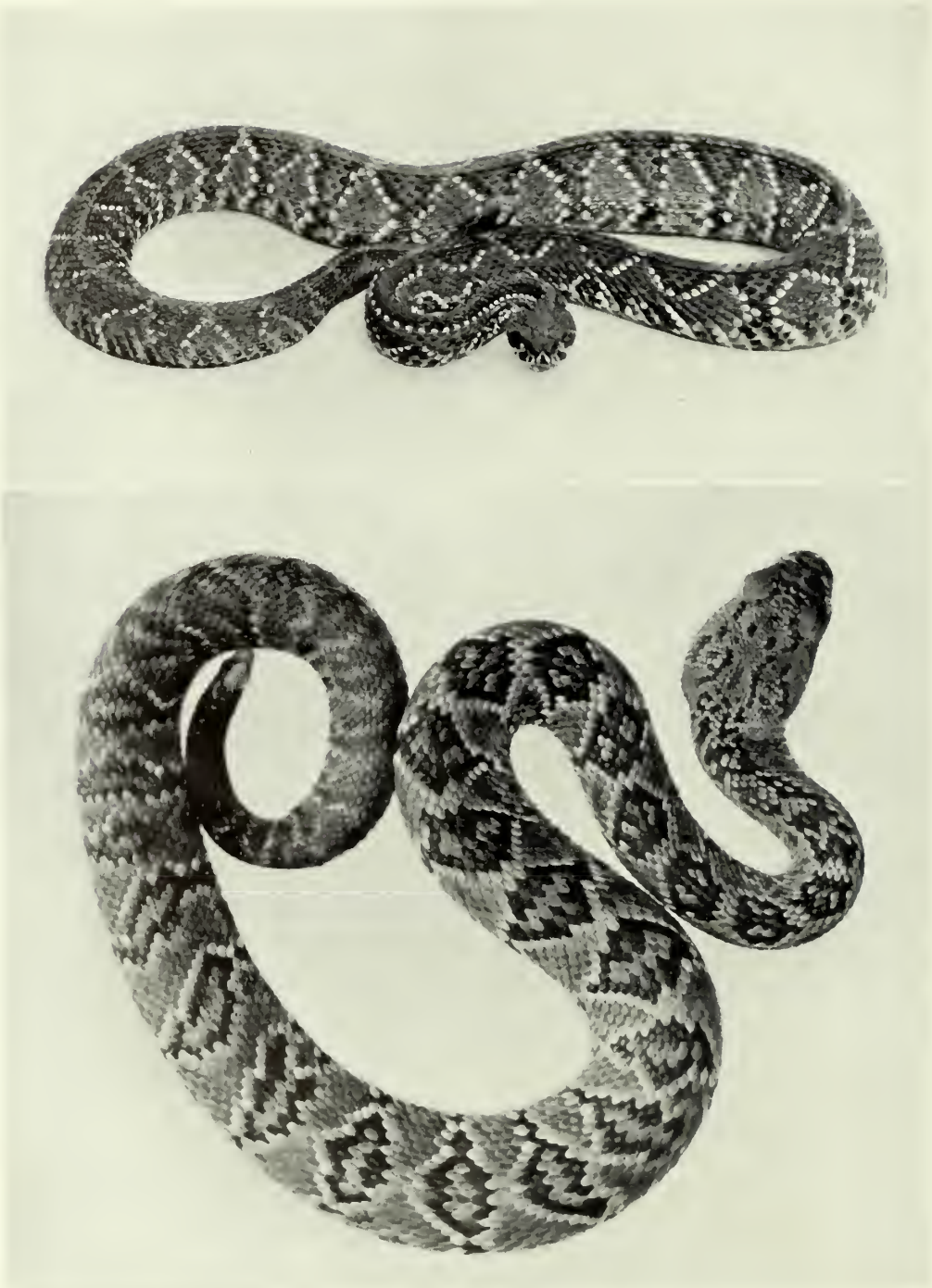
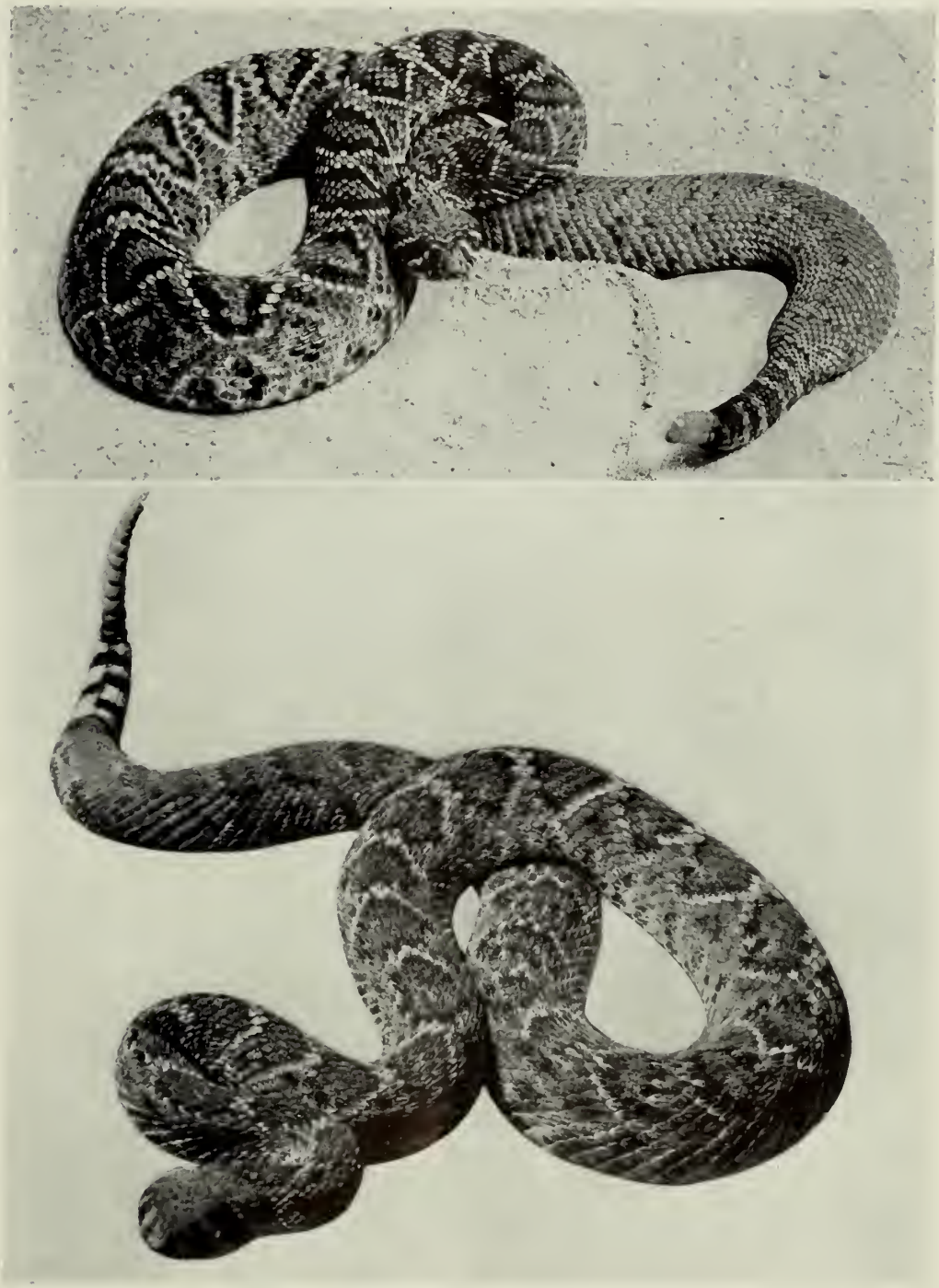


Fig. 42. The Tropical Rattlesnake; Cascabel (Spanish); Cascavel (Portuguese), *Crotalus terrificus durissus*. The most poisonous of the rattlers as well as the most savage. The venom differs from northern rattlesnakes and other New World vipers in having a largely neurotoxic action and in being nearly colorless. The venom of this serpent, in fact, appears to be the most highly toxic of any New World viper, with the exception of the unique and isolated island viper, *Bothrops insularis*, found off the coast of Brazil. This rattlesnake has the widest range of any species of *Crotalus*, occuring from central Mexico to northern Argentina. It is the only known species of rattlesnake of Central and South America. Distribution follows the higher and drier areas and does not extend into the damp coastal country. There is thus but a slight overlapping of this serpent with the occurrence of the fer-de-lance, which prefers the low and more humid coastal regions. Photograph by Anton Vesthy.



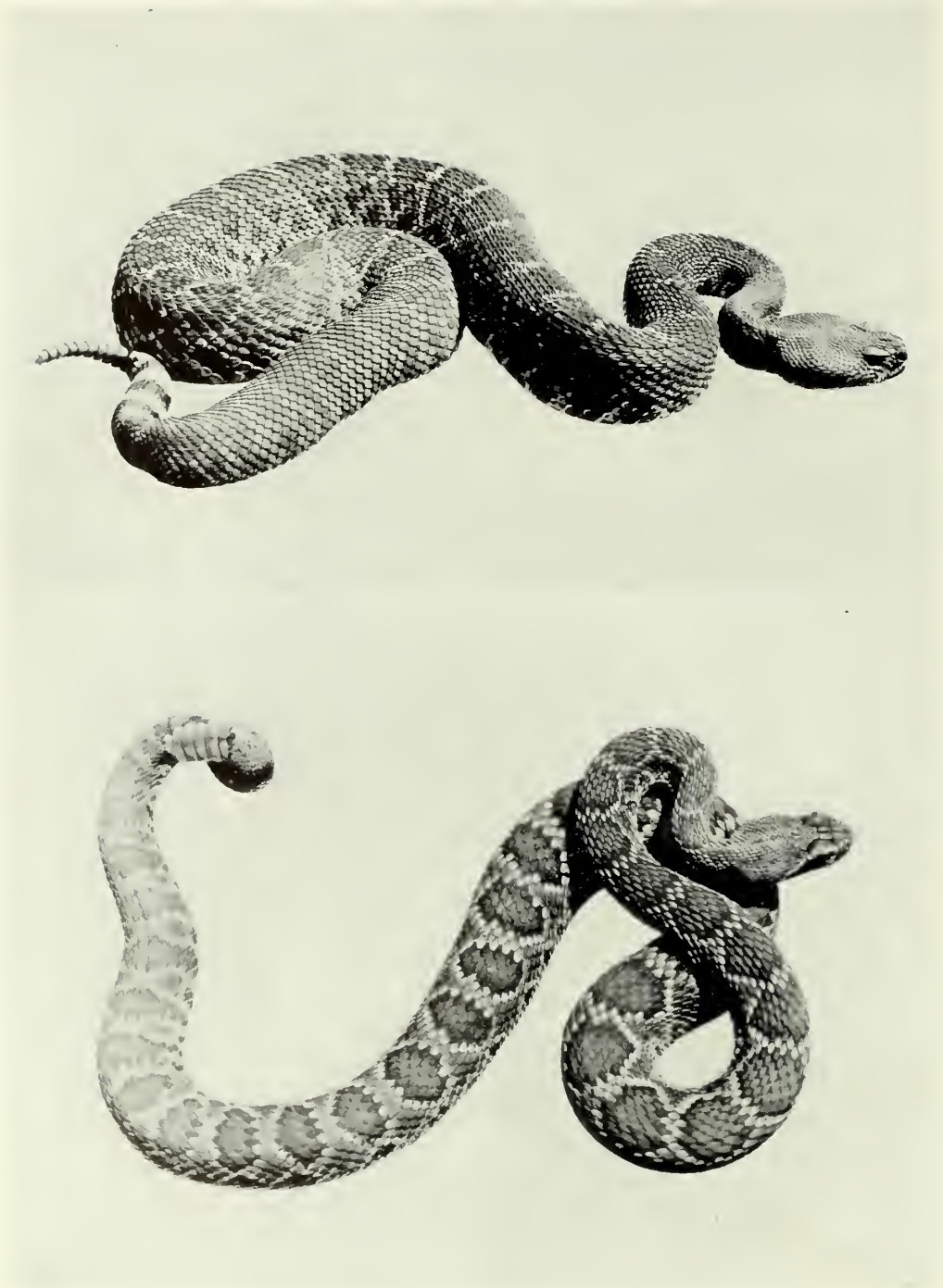
Upper—Fig. 43. Tropical Rattlesnake, *Crotalus terrificus terrificus* (the typical form). This specimen is from southern Brazil. The neck bands are shorter than with Central American specimens.

Lower—Fig. 44. Black-tailed Rattlesnake, *Crotalus molossus*. The boundary region of the United States, from Texas to Arizona inclusive; also Mexico. Appears to be closely related to the tropical species found southward. Photograph courtesy of Dr. A. H. Wright.



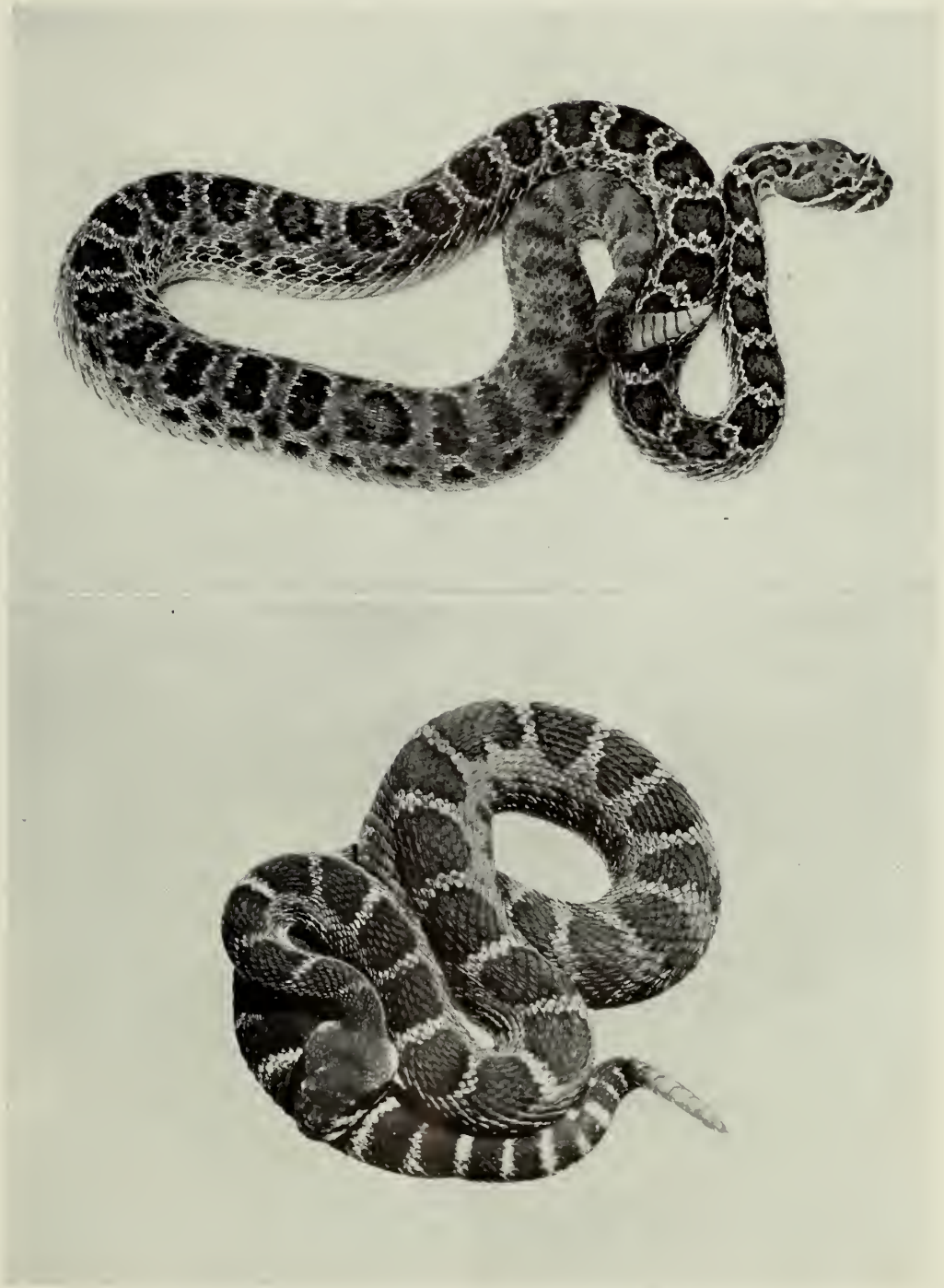
Upper—Fig. 45. Eastern Diamond-back Rattlesnake, *Crotalus adamanteus*. Largest of North American rattlesnakes. It attains a length of eight feet and weight of fifteen pounds. Occurs in coastal areas of the southeastern United States.

Lower—Fig. 46. Western Diamond-back Rattlesnake, *Crotalus atrox*. Second in size to the eastern diamond-back. The range is from Texas to California. Owing to its abundance and inclination to quickly strike, it holds first rank in the number of fatalities from rattlesnake bites.



Upper Fig. 17. Red Diamond Rattlesnake, *Crotalus ruber*. Southern California and lower California. A rather common and large rattler of ordinarily passive disposition. Accidents from it are seldom recorded. It is difficult to induce some specimens to sound the rattle.

Lower Fig. 18. Mohave Diamond Rattlesnake, *Crotalus scutulatus*. Recognized by the enlarged scales on the top of the head. Inhabits the arid Southwest, into northern Mexico. Photographs courtesy of Laurence M. Klauber.

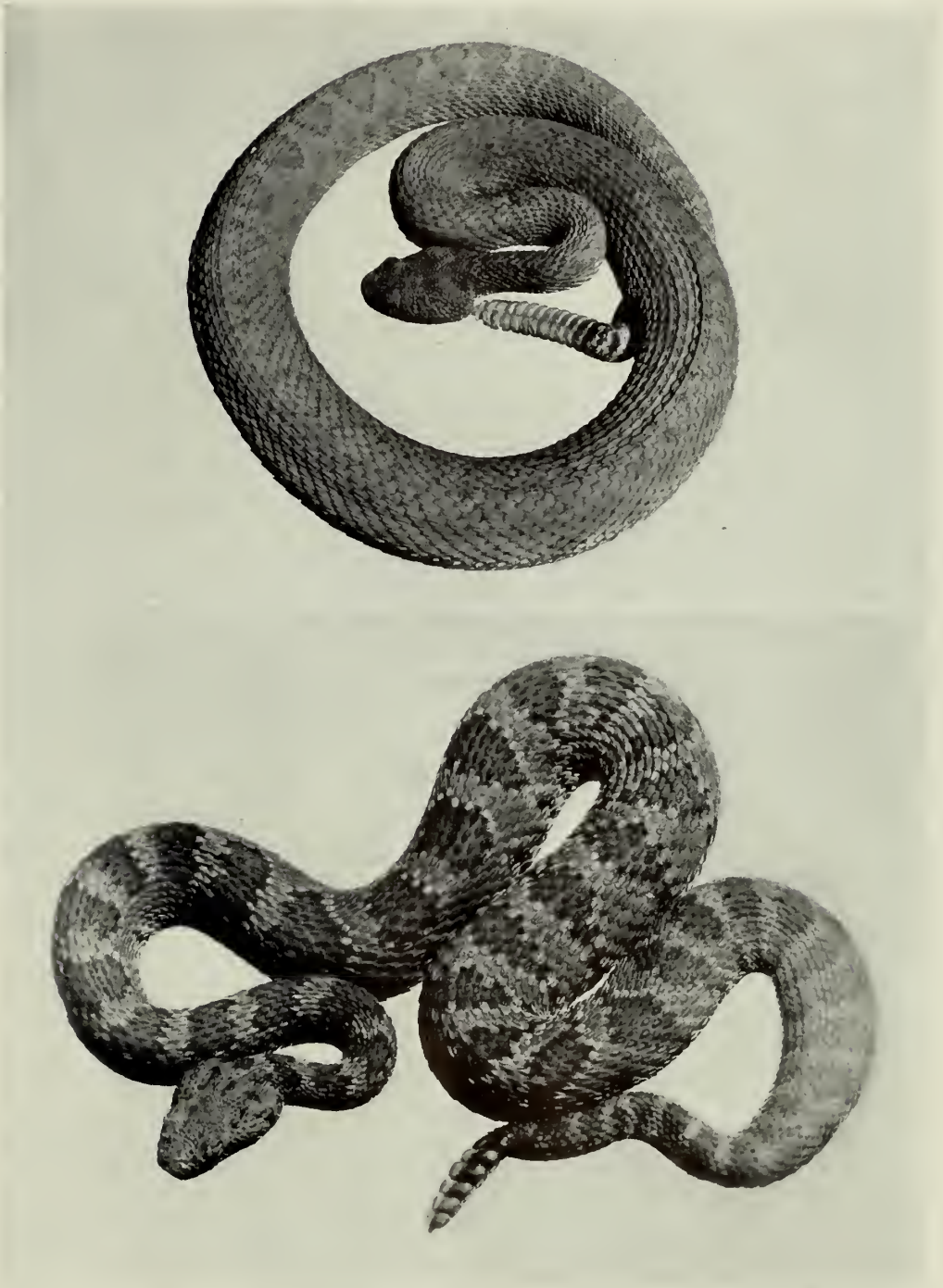


Upper—Fig. 49. The Prairie Rattlesnake, *Crotalus confluentus confluentus*. Its races or subspecies have the widest range of any of its genus. The common rattler of the plains.

Lower—Fig. 50. Pacific Rattlesnake, *Crotalus confluentus oreganus*. The common and only rattlesnake of the Pacific region north of southern California, in which latter area other species occur. Abundant over varied country embracing mountains, sea coast levels, inland plains and sterile areas. Coloration varies from brown, gray, greenish to black. Photograph courtesy of Laurence M. Klauber.

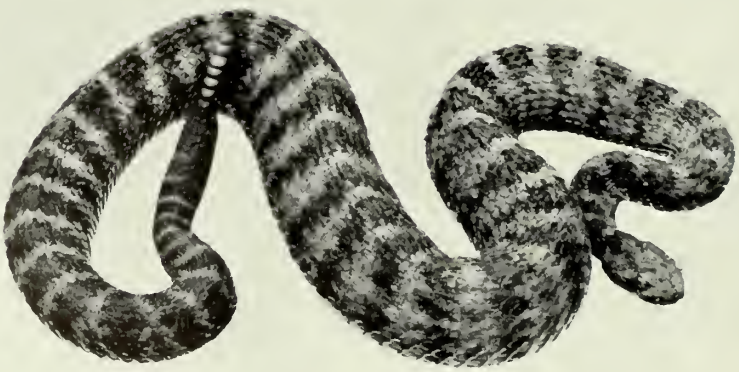
Upper Fig. 51. Pacific Rattlesnake, *Crotalus confluentus oreganus*, black phase. With black examples the blotches are fused out, the only pattern being their paler margins, forming a chain of whitish rhombs.

Lower Fig. 52. Great Basin Rattlesnake, *Crotalus confluentus lutosus*. The Plateau Region from the Rockies to the Sierras. Photographs courtesy of Laurence M. Klauber



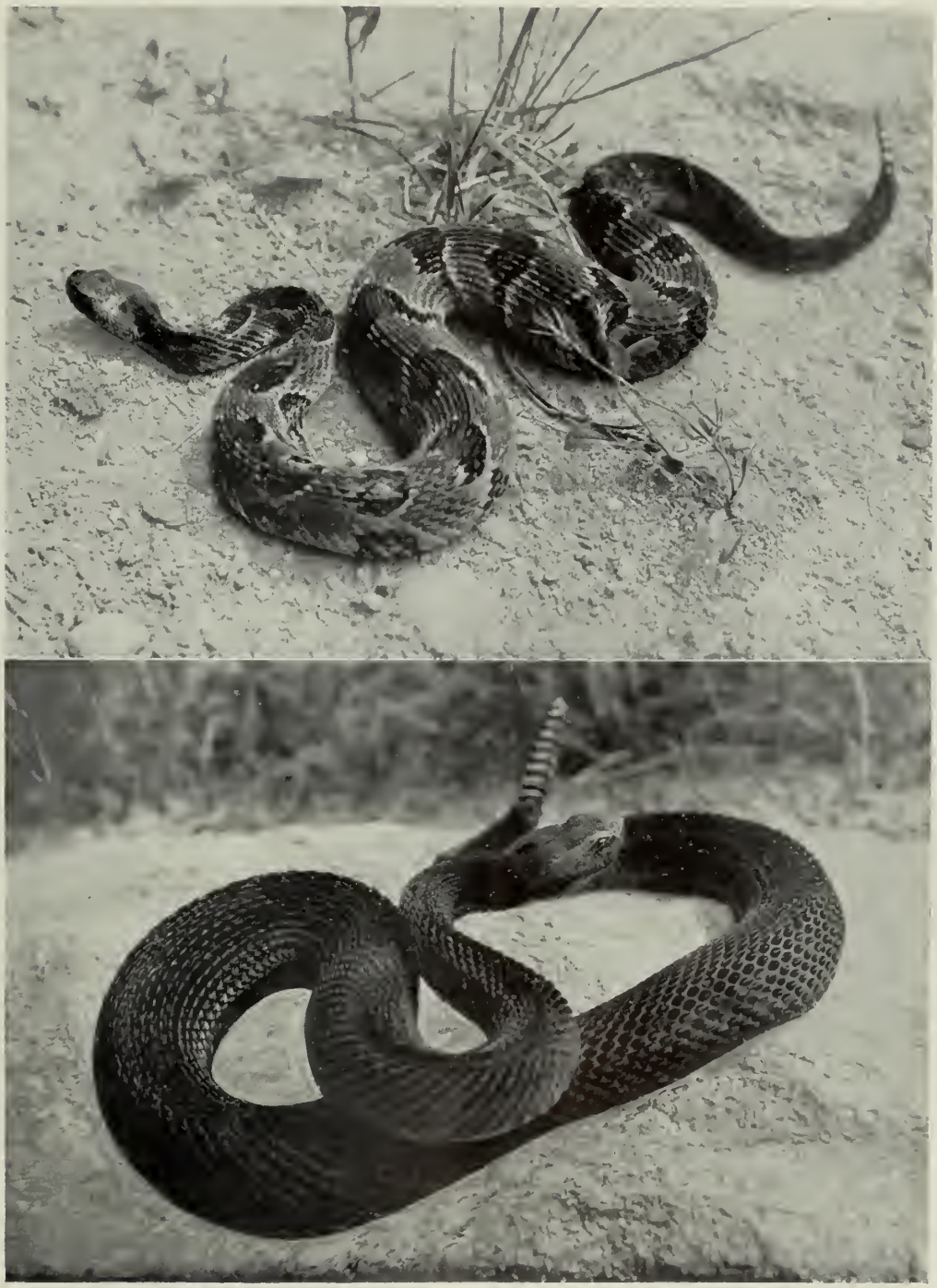
Upper—Fig. 53. Grand Canyon Rattlesnake. *Crotalus confluentus abyssus.* Observed only in the Grand Canyon of the Colorado, in Arizona. Distinguished by its vermilion or salmon coloration, and almost complete absence of pattern when adult.

Lower—Fig. 54. Panamint Rattlesnake, *Crotalus confluentus stephensi.* A pallid, desert form, recorded from Nevada and eastern California. Photographs courtesy of Laurence M. Klauber.



Upper Fig. 55. White Rattlesnake; Bleached Rattlesnake, *Crotalus confluentus mitchellii*. Deserts of Arizona, southern and Lower California. The arid Southwest is the headquarters of the rattlesnakes. Over a dozen species occur in that region. Elsewhere over the far-flung area inhabited by such serpents, from Canada to Argentina, there is no such grouping of species, two or three being the maximum number overlapping in distribution.

Lower Fig. 56. Tiger Rattlesnake, *Crotalus tigris*. Another resident of the Southwest. Photographs courtesy of Laurence M. Klauber.



Upper Fig. 57. Banded Rattlesnake; Timber Rattlesnake, *Crotalus horridus*. The common rattler of the eastern United States. Particularly abundant in northeastern areas. Frequents ledges on hills and mountains and congregates during the autumn near specific crevices, which are the hibernating shelters or "dens." It is not a savage species and records of bites are comparatively rare.

Lower Fig. 58. Banded Rattlesnake, *Crotalus horridus* (black phase). There is much variation in hue and intensity of pattern.

Upper—Fig. 59. Spotted Rattlesnake, *Crotalus triseriatus*. A small, grayish species of the Southwest including northern Mexico.

Lower—Fig. 60. Green Rattlesnake, *Crotalus lepidus*. Readily distinguished by its greenish-gray hue, marked by widely separated rings of black. Of small size and found only in the Southwest. Photograph courtesy of Dr. A. H. Wright.

Upper—Fig. 61. Head of the Horned Rattlesnake, *Crotalus cerastes.*

Lower—Fig. 62. Horned Rattlesnake; "Sidewinder," *Crotalus cerastes.* Deserts of the Southwest. Characteristic in having a horn-like scale over each eye. Living on dry and yielding sand, it progresses by throwing lateral loops of the body forward, which cause it to move off at an oblique angle to the direction in which the head is pointing—hence the name "Sidewinder."

Snake pit at Sao Paulo, Brazil. This extensive and pretentious pit is surrounded by a water moat. It is part of the Instituto Soro Therapico, where large quantities of serum are prepared for snake bite accidents in Brazil.

The snake pit at Tela, Honduras. The object of the numerous shelters is to enable the extremely nervous reptiles to hide or otherwise they would soon die. The scientific worker is particular about wearing leather leggings on entering the pit. This pit is contained in the large structure shown on page 98.

General Information

Membership: Membership is available to all persons who are interested in the work of the Society and wish to lend financial aid toward its support, and cooperate in the future development of the Zoological Park and the Aquarium.

Classes: General membership in the Society is $10.00, payable annually; by payment of $200 anyone can become a Life Member; a contributor of $1,000 becomes a Patron; $2,500 an Associate Founder; $5,000 a Founder; $10,000 a Founder in Perpetuity, and $25,000 a Benefactor.

Benefits of Membership: All classes of members of the Society are entitled to receive every publication, the privileges of the Administration Building, lectures, open meetings, entertainments, exhibitions and free admission to the Aquarium and the Zoological Park every day throughout the year. Complimentary coupon ticket books are issued to each member for use at the Park on the two days of each week when admission is charged, and which were set aside primarily for the benefit of the members and their friends so that the collections might be seen to the best advantage.

Forms: Information concerning membership can be obtained at the Aquarium or the Zoological Park, where application forms will be furnished on request. Signed applications for membership may be given to the Director of the Zoological Park, the Director of the Aquarium or mailed directly to the Secretary, William White Niles, 101 Park Avenue, New York City, for action by the Executive Committee of the Society.

Zoological Park: The Park is open every day in the year from 10 o'clock in the morning until one-half hour before sunset; admission to the Park is free every day except on Mondays and Thursdays when an admission fee is charged. All holidays are free.

New York Aquarium: The Aquarium is open every day, April 1 to September 30, from 9 o'clock in the morning until 5 o'clock in the afternoon; and October 1 to March 31, from 9 o'clock in the morning until 4 o'clock in the afternoon. No admission is charged.

Publications

Annual Report: Documents and reports of the various departments. Early editions contain articles of scientific value. Illustrated.

Zoologica: Scientific contributions of the New York Zoological Society. Technical and generally taxonomic description. Volumes I, II, III, IV, V, VI completed. Other volumes in preparation. Irregular. Issued as subjects are presented. Illustrated.

Zoopathologica: Scientific contributions of the New York Zoological Society on the diseases of animals. Technical and generally taxonomic description. Volume I completed. Volume II in preparation. Irregular. Issued as subjects are presented. Illustrated.

Bulletin: Official publication of the New York Zoological Society; devoted to the work of the Park and the Aquarium. Popular natural history profusely illustrated. Thirty-one volumes completed. Volume XXXIII in preparation. Issued bi-monthly.

Heads and Horns Brochure: Devoted to the collection of Heads and Horns Museum. Nos. 1 and 2 completed. Illustrated. Publication temporarily discontinued.

Guide Book: Official guide to the Zoological Park Collections (Hornaday). Profusely illustrated. 21 editions issued. Published as needed.

Animals: Art Stamps; 32 pp. 120 color stamp ills.
Child's Book: Wild Animals; 96 pp. 50 color ills.
View of Park: Book; 24 pp. 75 color ills.
Post cards: 63 subjects in colors.
Panorama: Bird's-eye View, Zoological Park.
Photogravures, Enlargements, etc.

Pets and How to Care for Them (Crandall); 303 pp. 59 ills.
Pheasants: Their Lives and Homes (Beebe); 2 vols. 4 ills.
Galapagos: World's End (Beebe); 444 pp. 107 ills., 24 in color.
The Arcturus Adventure (Beebe); 449 pp. 77 ills.
Tropical Wild Life (Beebe; Hartley; Howes); 504 pp. 143 ills.

For all publications, other than those referring to the Aquarium or Aquatic Life—address: H. R. Mitchell, *Chief Clerk, 185th St. and Southern Boulevard, New York City.*

Guide Book: Official guide to the Aquarium collections (Townsend). Profusely illustrated, three editions issued. Published as needed.
Sea Shore Life (Mayor); 181 pp. 119 ills. Out of print. To be re-issued.
Cultivations of Fishes (Townsend); 27 pp. 17 ills.
Northern Elephant Seal (Townsend); 17 pp. 21 ills.
Porpoise in Captivity (Townsend); 11 pp. 14 ills.
Whale Shark (Gudger); (*out of print*)
Gaff-topsail Catfish (Gudger); 45 pp. 12 ills.
Galapagos Tortoises (Townsend); 82 pp. 45 ills.
Locomotion of Fishes (Breder); 138 pp. 45 ills.
Marine Fishes (Nichols-Breder); 192 pp. 263 ills.
Fishes in the Home (Mellen); 178 pp. 63 ills.
The Public Aquarium (Townsend); 97 pp. 47 ills.
Color Changes of Fishes (Townsend); 58 pp. 11 figs. and 27 color plates.

For all Aquarium publications or any work relating to Aquatic Life, address the New York Aquarium, *Battery Park, New York City.*

A completely classified list of the publications of the Society, with the subject headings of the various articles printed in the Reports, Zoologica, Zoopathologica, and re-prints from them will be furnished on request. Some of the publications have become exhausted and orders for any issues will be governed by this circumstance. Back numbers of the Bulletin can not be supplied. Address: H. R. Mitchell, *Manager, Zoological Park, 185th St. and Southern Boulevard, New York City.*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