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Copeia, Vol. 1936, No. 2. (Jul. 31, 1936), pp. 103-110.

Stable URL:
http://links.jstor.org/sici?sici=0045-8511%2819360731%293%3A1936%3A2%3C103%3ATHTOTC%3E2.0.CO%3B2-L

Copeia is currently published by American Society of Ichthyologists and Herpetologists.

The Horned Toads of the *coronatum* Group

By L. M. KLAUBER

DURING the past year the San Diego Society of Natural History series of reptiles has been augmented by material from northern Lower California collected by Messrs. Chas. F. Harbison and Curtis W. Brown. Included were a number of horned toads from between San Quintin and Punta Prieta (Lat. 29° N.), an area previously unrepresented in collections. These specimens close the last extensive gap in the territorial distribution of available specimens of the *conoratum* group between Kennett, California, on the north, and Cape San Lucas on the south. It therefore appears opportune to examine this series to determine the validity of the several names which have been proposed for these coastal horned toads, and particularly the relationship between *coronatum* and *blainvillii*, the forms found at the southern tip of Lower California, and in upper California, respectively.

The following forms have been described:

1835 *Agama* (*Phrynosoma*) *coronata* Blainville, Nouv. Ann. Mus. Hist. Nat. Paris, 4: 284. Type locality "Californie" (generally assumed to be the Cape Region of Lower California). Type specimen in the Natural History Museum at Paris; collected by P. E. Botta.

1839 *Phrynosoma blainvillii* Gray, Zool. Beechey's Voyage: 96. Type locality "California" (generally assumed to be the vicinity of San Diego, California). Type specimen in the British Museum; presented to the museum by H. de Blainville.

1893 *Phrynosoma cerroense* Stejneger, N. Amer. Fauna, No. 7: 187 (foot note). Type locality Cerros (= Cedros) Island. Type specimen USNM 11977; collected by L. Belding.

1894 *Phrynosoma frontalis* Van Denburgh, Proc. Cal. Acad. Sci., Ser. 2, 4: 296. Type locality, Bear Valley, San Benito County, California. Type specimen, Stanford 93; collected by W. W. Price.

1921 *Phrynosoma schmidti* Barbour, Proc. N. Eng. Zool. Club, 7: 113. Type locality Cerros (= Cedros) Island. Type specimen MCZ 15142; collected by W. W. Brown.

1922 *Phrynosoma nelsoni* Schmidt, Bull. Am. Mus. Nat. Hist., 46: 666. Type locality, San Quintin, Lower California. Type specimen, AMNH 37585; collected by E. W. Nelson and A. E. Goldman.

1922 *Phrynosoma jamesi* Schmidt, Bull. Am. Mus. Nat. Hist., 46: 668. Type locality, San Bartolome, Lower California. Type specimen, USNM 64450; collected by H. Townsend.

1932 *Phrynosoma ochoterenai* Terron, Anales del Inst. Biol., 3: 109. Type locality, Tecate, Lower California. Type specimen from the collection of the National Museum of Natural History, Mexico, D. F.;[1] collected by J. M. Gallegos.

[1] The type is said to be no longer in the museum, according to del Campo, Anales del Inst. Biol., 5, 1934: 331.

Thus, we have to consider eight suggested forms, six mainland, and two island. Rearranged in territorial order from north to south with the approximate latitudes of the type localities, they are as follows:

	Mainland		
frontale	36° 30′ N.	*nelsoni*	30° 30′ N.
blainvillii	33° N. ?	*jamesi*	27° 40′ N.
ochoterenai	32° 40′ N.	*coronatum*	23° N. ?
	Island		
cerroense	28° 15′ N.	*schmidti*	28° 15′ N.

With the exception of *ochoterenai* the type localities are separated by about 3 degrees of latitude, or about 120 miles when allowance is made for the northwest-southeast trend of the coast. Altogether, these forms cover about 1400 miles of the Pacific Coast of the Californias.

Because of the inadequate descriptions of the two forms first described (*coronatum* and *blainvillii*), and their uncertain type localities, they were for a long time confused. Stejneger discussed the matter in 1893 (N.A. Fauna, 7: 187), and pointed out that *coronatum* was the proper name for the Cape form, while *blainvillii* was applicable to the horned toads of upper California. He considered them separate species.

This view was reiterated by Van Denburgh in 1894 (Proc. Cal. Acad. Sci., Ser. 2, 4: 296), at which time he demonstrated that the San Diegan horned toad differed from that of central California; and, as the name *blainvillii* was presumed to be applicable to the former, he named the latter *Phrynosoma frontalis*. In 1897 (Occas. Pap. Cal. Acad. Sci., 5: 95) he suggested that if the two forms of upper California were found to intergrade, the northern form must be reduced to subspecific status as *Phrynosoma blainvillii frontale*. This view was confirmed by Bryant in 1911 (Univ. of Cal. Pubs. in Zool., 9: 38).

In 1922, Schmidt, with new material available and noting the wide territorial separation between *blainvillii* and *coronatum*, interposed between them the forms *nelsoni* and *jamesi* as full species.

More recently Linsdale (Univ. of Cal. Pubs. in Zool., 38, 1932: 367) concluded from additional specimens resulting from the Alexander acquisitions in Lower California, that the gap was closed between *blainvillii* and *coronatum*, all forms intergrading. He therefore visualized the group as

Phrynosoma coronatum coronatum — *Phrynosoma coronatum frontale*
Phrynosoma coronatum jamesi — *Phrynosoma coronatum cerroense*
Phrynosoma coronatum blainvillii

Linsdale omitted *nelsoni*, finding insufficient differences between *jamesi* and *blainvillii* to warrant the interposition of another race. Del Campo (Anales del Inst. de Biol., 5, 1934: 330) observed the affinity of *ochoterenai* Terron to this group and, following Linsdale, applied to it the name *P. c. ochoterenai*.

The Cedros Island form *cerroense* has usually been considered a valid species, although given subspecific status by Linsdale. *P. schmidti* was deemed a synonym of *cerroense* by Van Denburgh in 1922 (Occas. Pap. Cal. Acad. Sci., No. 10, 1: 40). The status of the Cedros Island forms has been difficult to determine because few specimens have been available.

I have now completed an examination and character tabulation of a

representative series of these horned toads, distributed as follows:

Central California	101
Southern California	179
Northern Lower California	41
Southern Lower California	54
Cedros Island	3
Total	378

Most of these specimens were adults; when sufficient numbers of adults were available from any area juveniles were not considered, since in the young the horns are so rudimentary that species differences are scarcely apparent.

That *blainvillii* and *coronatum* are closely allied there can be no question; the enlarged and pointed gulars which distinguish these species from others in the southwest, and a similarity in the arrangement of temporals and sublabials, indicate a close relationship. At the same time some differences between the two forms are readily evident; it remains only to determine whether there is a gradual territorial shift in these differences from one to the other, or an unfilled gap; and in either case how many regional races are to be recognized.

An initial survey of these differences indicates that the variations do not follow a logical geographic pattern; that is, the forms most widely separated territorially do not show the widest differentiation in characters. On the contrary the San Diegan specimens of *blainvillii* are more differentiated from the San Lucan *coronatum* than are the most northerly specimens of *blainvillii* from central California. These differences may be summarized as follows:

	coronatum (Cape Region)	*blainvillii* (S. D. Region)
1. Scales in frontal area	Black, flat, striated	Drab, convex, smooth
2. Occipital spines	Heavy, usually curving outward and upward	Narrow, usually straight
3. Inter-occipitals	Prominent	Small
4. Posterior temporals	Angle with center-line of body greater than 45°	Angle with center-line of body less than 45°
5. Anterior temporals	4th (counting forward)[2] prominent and sharp, pointing outward; much larger than next anterior (if the latter be present at all)	4th and 5th temporals of the same size, or the 5th slightly larger; both small and dull, insignificant compared with the posterior three
6. Supratemporals	Enlarged and pointed	Absent or rudimentary
7. Subrictal	Practically in line with sublabials like a sixth sublabial	Above the line of the sublabials and overlapping the 6th sublabial if it be present
8. Postrictal	Absent or rudimentary	Present

[2] This is really the 5th temporal but it would be confusing to refer to it as such, since the 4th is rudimentary or more often suppressed entirely, its position being indicated by a gap.

Of these items 1, 5, 7, and 8 are the most consistent and definite, although even in these we find territorial variations. Thus, as we go northward from the Cape to central Lower California, the temporal crown of spines of *coronatum* becomes less extreme in development; a postrictal [3] is usually present; the subrictal is above the line of the sublabials. Similarly, in *blainvillii,* outside of the immediate vicinity of San Diego, the frontals are flat, and striated or rugose. Yet even with these tendencies, when all the available specimens are arranged in territorial order from north to south, we do not find a gradual intergradation in all characters; on the contrary, there remains a definite break in several. This is particularly evident in the nature of the temporals, notably the 4th and 5th; in these all specimens of the two forms seem sharply separated, *coronatum* having a single outward pointing horn in this section (fig. 1), while *blainvillii* has two blunt spines of nearly equal size, directed backward (fig. 2).

Therefore, our first conclusion is that *coronatum* and *blainvillii* are distinct species. The most southerly available *blainvillii* are from the vicinity of Punta Prieta and the most northerly *coronatum* from near Calmallí in Lower California. About 60 miles separate these two points. It is hardly conceivable that more variation should occur in this short distance than in the 400 miles to the south or 1000 miles to the north. Whether there is an actual overlap in the territories occupied by the two forms will not be known until further collections are made in this area, but the possibility of intergradation appears remote indeed. This is further verified by the presence on Cedros Island of analogues of the two forms, as is subsequently discussed.

As to the division of these two mainland species into subspecies, we find the following: *P. blainvillii blainvillii* is a weakly differentiated subspecies centering about San Diego; it extends only from the San Bernardino Mountains, in San Bernardino County, south to extreme northern Lower California, where intergradation is shown with the next race to the south, at about Lat. 32° N. (San Miguel Mission and Ojos Negros). This San Diegan race differs from those adjoining it to the north and south in having smooth and usually convex frontal scales, whereas its neighbors have striated or rugose scales which are normally flat, but may be peaked. In fact, full differentiation is only evident in adult specimens, juveniles and subadults of both species generally having peaked and roughened head plates.

I have been unable to find any consistent differences between the populations lying to the northwest and to the south of the San Diegan area inhabited by *P. b. blainvillii.* Schmidt, in describing *nelsoni,* distinguished it from *frontale* by its possession of larger frontal scales and keeled scales on the vertebral line. With numbers of both forms for comparison, I do not find these differences consistent; some specimens from near the type locality of *frontale* in central California, are even more keeled on the vertebral line than those from near San Quintin, Lower California, and there is great variation in the size of the frontals. Similarly, the lower row of peripheral body scales is variable. As to the enlarged frontals, it is true, as might be expected, that specimens in proximity to *blainvillii* territory on either side

[3] The postrictal is just anterior to the lower tip of the aural slot.

have large frontals, for this is a character of *blainvillii* itself. But the more distant specimens of *frontale,* that is, those from the extreme north, are quite similar in the size, flatness, and roughness of the frontals to the specimens of *nelsoni* found in the southernmost areas reached by the latter. I therefore conclude that *nelsoni* is invalid and that *P. blainvillii frontale,* which must be the parent form of *blainvillii,* occupies two distinct areas separated by the mildly differentiated race, *P. blainvillii blainvillii.* These two areas are: (1) California (west of the Sierra Nevada), from San Francisco and Kennett south to the coastal plain in Los Angeles and Orange counties; and (2) Lower California (west of the Sierra de Juarez and Sierra San Pedro Mártir) from Lat. 32° N. south to Lat. 29°. As to Terron's *ochoterenai,* the describer's photographs show clearly that the type is a specimen of our common southern California horned toad, *P. b. blainvillii,* such as would be expected in the vicinity of Tecate. The temporals, subrictal, and postrictal afford a positive identification. The frontals seem slightly peaked but this is not unusual anywhere in *P. b. blainvillii* territory, particularly in young specimens.

It is important to note that the most southerly available specimens of *frontale,* that is, those from near Punta Prieta and El Marmol, seem to be no nearer *coronatum* than are those from around San Francisco; in other words, there is, in *frontale,* no consistent territorial tendency to vary toward the species occupying the area next to the south.

In *coronatum* this situation does not obtain, for here the northerly specimens do show *blainvillii* (or *frontale*) tendencies as compared to individuals from the type locality. When we compare individuals from San Ignacio and Calmallí, in central Lower California, with others from the Cape region, we find the temporal crown less prominent and a postrictal often present. Thus, while intergradation with *frontale* is not evident, we conclude that *jamesi* is a valid subspecies of *coronatum.* Intergradation between the two races occurs between Mulegé and Comondú; just where cannot be determined as specimens are not available from this stretch. However, that the two forms intergrade cannot be doubted from the extent and character of the variations shown in available specimens collected north and south of the gap; at best *jamesi* is only a moderately differentiated subspecies of *coronatum.*

Having discussed the characteristics of *coronatum* and *blainvillii,* I desire to return once more to the matter of the probable type localities of these two forms, which affect the applicability of the names as they are currently used.

I forwarded to M. F. Angel of the Paris Museum, sketches showing typical San Diegan and Cape specimens, accentuating especially the differences in the temporals. He courteously advised me that de Blainville's type of *coronatum* is certainly of the southern form; in addition it has no postrictal. Thus there can be no doubt that Botta secured this specimen in the Cape region of Lower California, where he is known to have collected. This fully verifies Stejneger's conclusion reached in 1893.

Mr. H. W. Parker has been kind enough to examine the type specimen

of Gray's *blainvillii* in the British Museum and reports that it is undoubtedly of the northern form, possessing both 4th and 5th temporals, and a postrictal. The head scales are convex and slightly rugose, thus verifying the rather poor figure in "Zoology of Beechey's Voyage." Hence there is no doubt that *blainvillii* is the proper name for the coastal horned toad of upper California, as had been previously pointed out by Stejneger and Van Denburgh. But it is much less certain whether this name should be applied to the subspecies from the vicinity of San Diego currently referred to as *P. b. blainvillii* or that of central California, which modern authors refer to as *P. b. frontale.*

It might first be assumed that the type must have come from central California since Beechey visited San Francisco and Monterey but not San Diego. But as a matter of fact the type of *blainvillii* was not secured by the Beechey Expedition at all, although described in the monograph of that voyage; it was collected by Botta, just as was the type of *coronatum,* and was given to Gray by de Blainville, which explains why it was so named. Now, Botta collected not only at the Cape but also at San Diego and other points in upper California. He was in San Diego in April (1827), and horned toads are most plentiful at this time of year. That he must have secured some of his specimens from the immediate vicinity of San Diego is proved by his having collected *Lampropeltis californiae* in its most typical pattern, a form with an extremely limited range centering in San Diego. Therefore, while the type of *blainvillii* is a young specimen only 62 mm. in length, which cannot show conclusively the differences in the frontal plates which distinguish *P. b. blainvillii* from *P. b. frontale,* it is to be observed that they are convex and there is better than an even chance that the specimen did come from near San Diego. At any rate, in the face of this uncertainty Van Denburgh may be assumed to have designated the type subspecies and *P. b. blainvillii* is retained as the proper name for the San Diegan race.

There remain the two Cedros Island forms, *cerroense* and *schmidti.* The former is clearly an offshoot of *coronatum,* distinguished therefrom by a weaker temporal crown and an unusually large nostril. Only two specimens have been collected, the type, USNM 11977, and a second, kindly presented to me by Major Chapman Grant.

Dr. Doris M. Cochran has been good enough to examine the type for me and has confirmed the differential characters which are evident in the Grant specimen, namely the large nostril, weak lower lateral fringe, and relatively prominent fourth (or fifth) temporal.

Of *schmidti,* four specimens have been taken; I have seen two, a juvenile and a subadult. Mr. Benjamin Shreve has kindly examined the type and reported on certain critical points, and there remains no doubt that *schmidti* differs essentially from *cerroense,* as stated by Barbour. *P. schmidti* is an island analogue of *blainvillii,* and is in fact so similar to the mainland race, *P. b. frontale,* that I am unable to find consistency in the character differences which Barbour has employed in distinguishing it from the mainland form. His comparisons were evidently made with *P. b. blainvillii* of

the San Diegan area, and with these some of the characters do hold. But when compared with specimens of *P. b. frontale* from north-central Lower California, that is, the mainland habitat of the subspecies of *blainvillii* nearest Cedros Island, I find such variability in all of these characters that subspecific differentiation of *schmidti* appears unwarranted; at least until numbers of island specimens are available and it can be shown that there are average differences more than sufficient to controvert the individual variations which are apparent. Possibly the direction of the head spines (the post-temporals and occipitals), which lie flat along the body in the subadult paratype of *schmidti* which I have seen, is the most consistent differential character of *schmidti;* but while most specimens of *frontale* have these horns conspicuously elevated, this is not always true. Also it is a character which becomes accentuated with age.

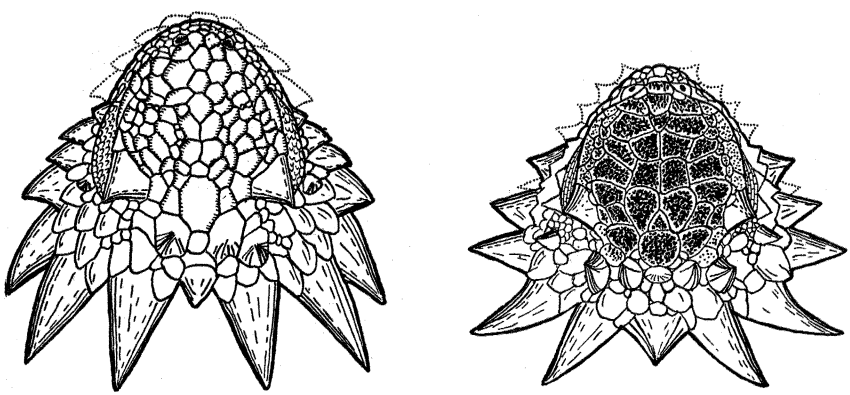

Fig. 1. *Phrynosoma coronatum coronatum*
(sublabials dotted to avoid confusion with temporals).
Fig. 2. *Phrynosoma blainvillii blainvillii.*

The fact that both *coronatum* and *blainvillii* are represented by allies or subspecies on the small island of Cedros and still retain their individualities, may be taken as confirmation of the specific separation of these two forms on the mainland.

My thanks for assistance and the loan of material are due the following individuals and organizations: Drs. Joseph Grinnell and Jean Linsdale, Museum of Vertebrate Zoology, University of California, Berkeley; Mr. J. R. Slevin, California Academy of Sciences; Dr. Doris M. Cochran, U. S. National Museum; Mr. Arthur Loveridge and Mr. Benjamin Shreve, Museum of Comparative Zoology; Mr. H. W. Parker, British Museum; M. F. Angel, Museum d'Histoire Naturelle, Paris; Major Chapman Grant; Dr. R. B. Cowles, Dr. Walter Mosauer, and Mr. Chas. M. Bogert, University of California at Los Angeles; Mr. H. R. Hill, Los Angeles Museum; Miss Esther Guthrie, Sacramento City Schools. The sketches were executed by Mr. Norman Bilderback.

Summary and Key

The Pacific Coast horned toads allied to *Phrynosoma coronatum* may be divided into the following species and subspecies:

Phrynosoma coronatum coronatum (Blainville), 1835

Cape region of Lower California north to Lat. 26° N.

Phrynosoma coronatum jamesi Schmidt, 1922

Central Lower California between Lat. 26° N. and Lat. 28½° N.

Phrynosoma cerroense Stejneger, 1893

Cedros Island.

Phrynosoma blainvillii blainvillii Gray, 1839

Southern California and extreme northern Lower California west of the desert from southwestern San Bernardino County, California, south to Lat. 32° N.

Phrynosoma blainvillii frontale Van Denburgh, 1894

California, west of the Sierra Nevada, from the San Francisco Bay region and the northern Sacramento Valley to the Los Angeles basin; also northern Lower California west of the Sierra de Juárez and Sierra San Pedro Mártir, from Lat. 32° N. south to Lat. 29° N.; also Cedros Island.

The following forms are placed in synonymy:
Phrynosoma schmidti Barbour, 1921. Synonym of *P. b. frontale.*
Phrynosoma nelsoni Schmidt, 1922. Synonym of *P. b. frontale.*
Phrynosoma ochoterenai Terron, 1932. Synonym of *P. b. blainvillii.*

Key

A Fourth (or fifth) temporal horn (counting forward) sharply pointed and greatly exceeding fifth (or fourth) in length
- B Nasal orifices large; distance between inner edges less than 1¾ times maximum orifice diameter ..... *P. cerroense*
- BB Nasal orifices moderate; distance between inner edges more than 1¾ orifice diameter
  - C Postrictal spine absent or rudimentary .. *P. coronatum coronatum*
  - CC Postrictal spine present ..... *P. coronatum jamesi*

AA Fourth and fifth temporal horns dull; of nearly equal size or the fifth slightly larger
- B′ Frontal plates in adults smooth and convex ..... *P. blainvillii blainvillii*
- BB′ Frontal plates in adults rough, striated or rugose, and flat or peaked ..... *P. blainvillii frontale*

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