Copeia, 2001(3), pp. 700–704

New Species of Large Black Salamander, Genus *Bolitoglossa* (Plethodontidae) from Western Panamá

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A new species of plethodontid salamander is one of several large black species found in the Cordillera Talamanca-Barú of Panamá and Costa Rica. *Bolitoglossa anthracina* sp. nov. differs from others in this group in having a very large number of maxillary teeth and a moderate number of vomerine teeth.

En el presente trabajo se describe una especie nueva de salamandras del género *Bolitoglossa*. Esta especie es de tamaño grande y de color negro al igual que otras especies que habitan también en la Cordillera de Talamanca y Barú en Panamá y Costa Rica. *Bolitoglossa anthracina* sp. nov. difiere de las otras especies de aspecto similar en que tiene un número elevado de dientes maxilares y un número medio de dientes vomerinos.

MORE than 30 years ago, William E. Duellman, Charles W. Myers, and Linda Trueb mounted an expedition to obtain herpetological specimens from the poorly known Cordillera de Talamanca-Barú of western Panamá, principally on Cerro Pando near the Costa Rican frontier (Fig. 1). It had been more than a century since the legendary Josef Warszewicz and William M. Gabb independently collected amphibians and reptiles from the highlands of this same range (Savage, 1970), Warszewicz working to the east and Gabb to the northwest (in Costa Rica). The Cerro Pando collections, from an area about halfway between the routes of Warzewicz and Gabb, included a number of species that had not been collected since the time of these early explorers. In addition, several new taxa, including two species of plethodontid salamanders (Wake et al., 1973), were described from the later expedition material.

Among the Cerro Pando salamanders was a single large black animal, which Brame recognized early on as a distinctive, undescribed species. Although Wake et al. (1973) had described new species of salamanders from the Cerro Pando collections, they were reluctant to base the formal description of another new taxon on a single specimen in view of the problematic status of other large black *Bolitoglossa* from the Talamanca-Barú massif. Recent research has significantly clarified the taxonomic situation regarding this complex of large black salamanders (JH, DBW, and JMS, unpubl.). Coupled with the collection of two additional specimens conspecific with the unnamed Cerro Pando specimen, this leads us to describe it as new.

MATERIALS AND METHODS

Measurements were made using digital or dial calipers or a dissecting microscope fitted with an ocular micrometer; standard length (SL) was measured from the tip of the snout to the posterior angle of the vent. Limb interval equals the number of costal interspaces between the tips of appressed fore- and hind limbs, measured in one-half increments (e.g., 3.0, 3.5, 4.0, 4.5). Osteological accounts are based on radiographs of two preserved specimens. Counts of presacral (trunk) vertebrae do not include the first, or atlas, vertebra. Tooth counts are based on all visible tooth crowns. Numbers of maxillary and vomerine teeth in the holotype are provided for right and left sides; these counts are summed for each paratype. Institutional abbreviations are as listed in Leviton et al. (1985), except MVUP (Museo Vertebrados Universidad de Panamá).

DESCRIPTION OF NEW SPECIES

Bolitoglossa anthracina, sp. nov.

COAL BLACK SALAMANDER
Figure 2

Holotype.—KU 116671, an adult female from the north slope of Cerro Pando, Prov. Bocas del Toro, Panamá, elevation 1450 m, collected 13 May 1966 by Linda Trueb. Estimated coordinates are 8°58′N, 82°42′W.

Paratypes.—Both from Panamá: MVUP 883, an adult male from Río Chiriquí, Pligono de Protección de la Hidroeléctrica de Fortuna, Prov. Chiriquí, èlevation 1100 m, collected October 1988 by Fernando A. Arosemana; BYU 19148, an adult female from Rancho Mojica, near Río Changena, Prov. Bocas del Toro, 9°2′N, 82°41′W, elevation 1450–1700 m, collected 12 September 1961 by Vernon Tipton.

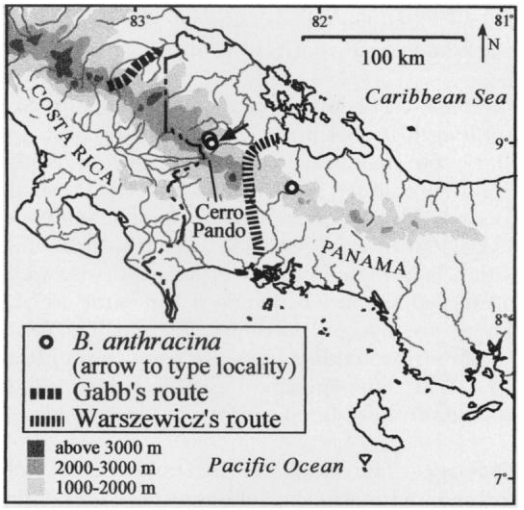

Fig. 1. Map of southeastern Costa Rica and western Panamá showing approximate routes of Warszewicz and Gabb, the location of Cerro Pando, and the three recorded localities for *Bolitoglossa anthracina.*

Diagnosis.—This is a large, uniformly black salamander. It is moderately robust yet gracile, with relatively long, slender limbs and digits. It differs from all other large black salamanders from Costa Rica and western Panamá in having an unusually large number of maxillary teeth, either in absolute terms or relative to body size (see Remarks). It differs most obviously from previously described species of large black plethodontid salamanders from the region by lacking the light basal tail ring characteristic of *Bolitoglossa robusta* and in having a narrower head and shorter tail than *Bolitoglossa nigrescens.*

Description.—This description is based on the holotype. This is a moderately large species; SL equals 70.8 mm. The head is moderately broad (SL is 7.0 times head width), and the snout is moderately well developed and bears only small protuberances at the termination of the nasolabial grooves. The head is relatively large; SL is 4.4 times head length. Nostrils are small. Eyes are prominent but relatively small; they do not extend laterally to the jaw margin. There are seven small premaxillary teeth, and these lie well inside the mouth, in the same series as the maxillary teeth. There are a total of 91 small maxillary teeth in series that extend caudally to a point that is nearly level with the posterior margin of the eyeball. The 39 vomerine teeth are borne in long, curved series that extend nearly 1 mm beyond the lateral margin of the

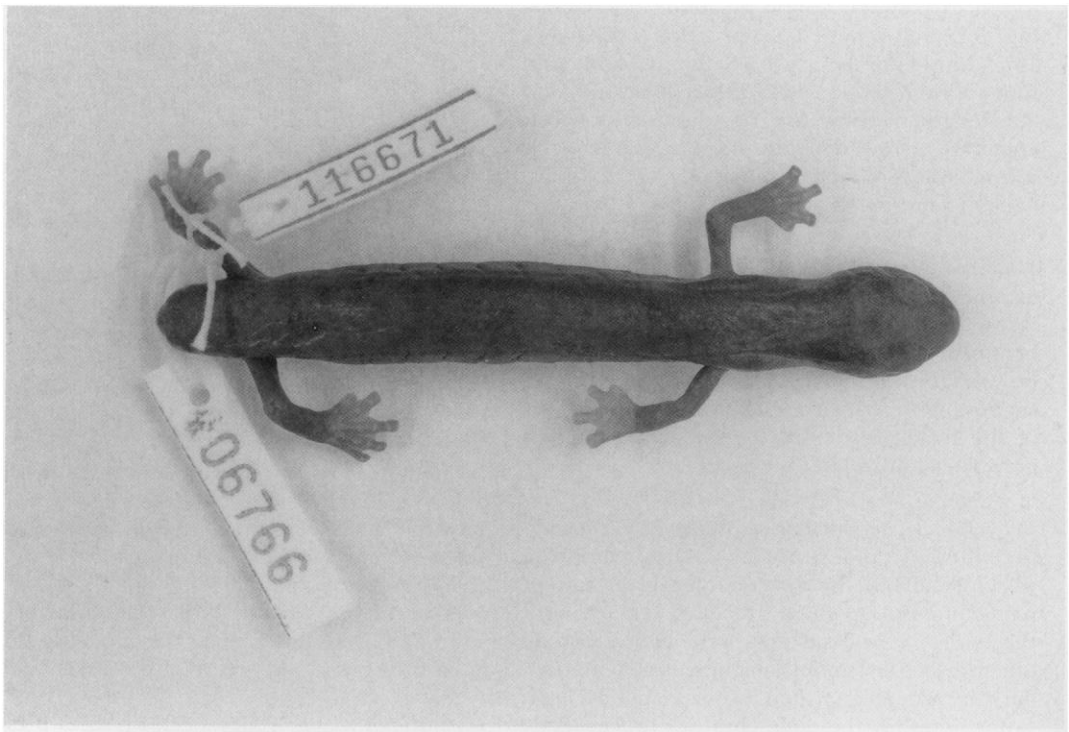

Fig. 2. Holotype of *Bolitoglossa anthracina,* KU 116671, from the northern slope of Cerro Pando, Panamá, seen in dorsal view. Standard length equals 70.8 mm. The tail was missing at the time of collection.

internal nares. Limbs are well developed but only moderately long; limb interval is 3. SL is 4.9 times the right forelimb length, 4.5 times the right hind-limb length, and 9.8 times the right foot width. Hands and feet are large and well developed, with stout, bluntly pointed digital tips. Webbing is reduced and extends no further distally than the joint between the first and second phalanges on the longest digits. Fingers, in order of decreasing length, are 3-4-2-1; toes are 3-4-2-5-1. Subdigital pads are strongly developed on all digits. The tail is missing. Postiliac glands are clearly evident as large, pale, ovoid spots.

Measurements of the holotype (in millimeters).—Head width 10.1; snout to gular fold (head length) 16.1; head depth at posterior angle of jaw 5.2; eyelid width 2.4; eyelid length 4.1; anterior rim of orbit to tip of snout 4.2; horizontal orbit diameter 2.7; distance between angle of eyes 4.6; interorbital distance 3.6; groove behind eye extends posteriorly 3.5; distance between nuchal groove and gular fold 3.0; snout to forelimb 20.2; distance separating external nares 3.0; snout projection beyond mandible 0.9; snout to posterior angle of vent (standard length) 70.8; snout to anterior angle of vent 64.5; axilla to groin 39.7; number of costal interspaces between appressed limbs 3; tail missing; forelimb length (to tip of longest finger) 14.6; hind-limb length 15.8; hand width 6.0; foot width 7.2; length of fifth toe beyond web 2.3; length of third toe 1.3; distance between vomerine teeth and parasphenoid tooth patch 0.7. Numbers of teeth: premaxillary 7; maxillary 46–45; vomerine 18–21.

Coloration of the holotype (in alcohol).—The ground color is uniformly coal-black on all surfaces except the hands and feet, which are brownish dorsally and light gray ventrally. Ventral surfaces of the trunk and gular region are slightly lighter than dorsal and lateral surfaces of the head and trunk. The postiliac gland is gray-black and relatively obscure.

Coloration in life.—Charles W. Myers recorded the following color notes for the living holotype (= CWM 6766): By day, uniform black except palms and soles, which are gray, but by night the entire ventral surfaces were lighter (medium gray). Iris (under magnification) mottled dark brown and golden bronze. Tail lacking. Color notes for the male paratype (MVUP 883) are available through the courtesy of Roberto Ibáñez. The body is black with small, golden-yellow dorsolateral markings. The venter is black and the throat is gray-brown.

Variation.—The male paratype is 46.0 mm SL; tail length is 58.4 mm. There are four premaxillary, 66 maxillary, and 24 vomerine teeth. Limbs are long: limb interval is 1.5. A small mental gland is present. The female paratype (BYU 19148) is 57.5 mm SL. Length of the tail, which is badly contorted in an otherwise well-preserved specimen, is about the same as SL. There are five premaxillary, 79 maxillary, and 30 vomerine teeth. Limbs are long: limb interval is 1.0. This specimen is now faded, but it appears to have been uniformly black in life.

Osteology.—The skull of the holotype is well formed, and anterior elements are generally well ossified and articulated. There is a single premaxillary bone. Paired frontal processes arise separately and remain separated for their entire length. They extend posterodorsally, articulating laterally with the nasals and posteriorly with the frontals, and are only modestly expanded posteriorly. The internasal fontanelle is relatively narrow. Nasal bones are somewhat protrusive anteriorly and articulate with the maxillaries, frontals, and premaxillaries. Maxillary bones bear small teeth nearly to their posterior tips. Septomaxillary bones are lacking. A small, ovoid prefrontal bone is present on the right side, but none can be seen on the left. There is no frontoparietal fontanelle. Preorbital processes of the vomer are long and bear teeth nearly to their tips. The oticoccipital bone lacks prominent crests. No columellar process of the operculum is evident on either side. There are 14 trunk vertebrae; all but the last bear ribs. There is a single sacral vertebra and two caudosacral vertebrae. Long bones of the limbs are relatively long and slender. There is no tibial spur. The hyoid apparatus and mesopodial elements remain cartilaginous. Phalanges are well ossified. The terminal phalanges are T-shaped, and the terminal expanded portion is relatively large and prominent.

The female paratype in general resembles the holotype in all relevant details. There are at least 33 caudal vertebrae (the tip is obscured). Transverse processes of the first caudal vertebra are swept strongly anteriorly, but they do not overlap the processes of the last caudosacral vertebra and are unbranched. The phalangeal formula is typical of the genus: 1-2-3-2; 1-2-3-3-2.

Habitat and range.—This species is known from three localities in western Panamá; all are in the Caribbean Tropical Premontane Rainforest

zone (Holdridge, 1967; Fig. 1). The holotype is from the Atlantic (northeast) slope of Cerro Pando, which lies on the border with Costa Rica. The female paratype is from nearby, almost certainly within 10 km of the type locality and at approximately the same elevation. Both sites are within either La Amistad International Park or the adjoining Palo Seco Forest Reserve. The male paratype is from the Pacific (southern) versant, approximately 55 km to the east-southeast, at the Centro de Investigaciones Tropicales, Cuenca de La Fortuna. This disjunct distribution is not unexpected; the Fortuna area lies south of a low point (1200 m) in the Continental Divide and supports a herpetofauna characteristic of the Atlantic (Caribbean) slope (Myers and Duellman, 1982). The known elevational range for *B. anthracina* is from 1100 m at Fortuna to 1450 m, or possibly a little higher, on Cerro Pando.

Two of the three known specimens were collected in forest while active at night. The holotype was collected on a leaf, about a meter above the ground. The male paratype was found on a palm, 2 m above the ground. Comparable data are unavailable for the third specimen.

Etymology.—The species name is derived from the Greek word *anthrakinos,* meaning coal-black, in reference to the very dark coloration of this salamander.

Remarks.—Bolitoglossa anthracina may occur in sympatry with *B. robusta* at all known localities for the new species. *Bolitoglossa robusta* is known from the north slope of Cerro Pando between 830 and 910 m, and it has been recorded from Cerro Silencio near Fortuna, between 2000 and 2121 m. Total numbers of maxillary teeth are similar in adults of *B. robusta* (mean 84.6, range 60–102, in eight females; mean 67.7, range 31–100, in nine males) and *B. anthracina* (mean 85.0, range 79–91, in two females; 66 in the single male), but adult *B. robusta* are much larger (mean SL exceeds 105 and 85 mm in females and males, respectively). In adults of comparable size, maxillary tooth counts are much higher in *B. anthracina.* The only other species of salamander that is likely to occur with *B. anthracina* is *B. colonnea,* whose known range includes those elevations recorded for *B. anthracina.* Adult *B. colonnea,* however, are much smaller than *B. anthracina* (maximum recorded SL, 54 mm), and they have fully webbed hands and feet (vs reduced interdigital webbing in *B. anthracina*) and a distinctive, dermal ridge that extends between the eyes at their anterior margins.

Bolitoglossa anthracina also is distinct from several species of large black plethodontid salamanders that occur elsewhere in Costa Rica and Panamá. Female *B. nigrescens* (no known males) have many fewer maxillary teeth (mean 53.7, range 42–73, in three adults) than either *B. anthracina* or *B. robusta.* Features that distinguish *B. anthracina* from three undescribed species will be discussed in detail in a separate publication (JH, DBW, and JMS, unpubl.). However, the combined ranges of total maxillary tooth counts for these new species (females 25–77; males 20–49) are well below the corresponding mean values for *B. anthracina* (see above) and do not even overlap the ranges of maxillary tooth counts in that species.

Discussion

The salamander fauna of the Caribbean (Atlantic) slope of Cerro Pando is large. Nine species have been reported previously from the mountain, which attains a peak elevation of 2468 m (Wake et al., 1973). Three moderate-sized species of *Bolitoglossa* (*compacta, marmorea,* and *minutula*) and *Oedipina grandis* are known from within the Lower Montane Rainforest zone at altitudes between 1810 and 2100 m. On the lower slopes (830–910 m), *Bolitoglossa biseriata, B. colonnea, B. robusta, Bolitoglossa schizodactyla,* and *Oedipina collaris* are found in Caribbean Tropical Premontane Rainforest. The former set of species are endemic to the Talamanca-Barú massif, whereas the premontane rain-forest species have relatively broad distributions in lower Central America.

The formal description of *B. anthracina* adds a 10th named species to this fauna and one whose elevational distribution fits between the two salamander communities reported previously. The known distribution of *B. anthracina* suggests that it too is a montane endemic likely to be found at intermediate elevations along the nearly impenetrable forests on the steep and forbidding windward slopes of the mountains of southeastern Costa Rica and northwestern Panamá. The occurrence of this species in the Fortuna area on the Pacific versant of southwestern Panamá further supports this idea, because the Fortuna herpetofauna includes many taxa otherwise known from the Caribbean slope (Myers and Duellman, 1982). In addition, these data suggest that *B. anthracina* occurs in a relatively narrow belt within the upper portion of the Caribbean Tropical Premontane Rainforest zone (upper limit about 1500 m).

ACKNOWLEDGMENTS

We thank C. Myers and W. Duellman for data from their field notes. R. Ibáñez called our attention to the male paratype and provided relevant color notes. J. Sites loaned the female paratype and obtained additional data from the collector. J. Simmons arranged loans of the holotype and provided related information. G. Parra-Olea provided a Spanish version of the abstract. K. Klitz prepared Figure 1, and M. Shapiro helped prepare Figure 2.

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