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TWO NEW SPECIES OF *CHTHONERPETON* (AMPHIBIA:  
GYMNOPHIONA: TYPHLONECTIDAE) FROM BRAZIL

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ABSTRACT.—Nussbaum, R. A. and M. Wilkinson. 1987. Two new species of *Chthonerpeton* (Amphibia: Gymnophiona: Typhlonectidae) from Brazil. *Occ. Pap. Mus. Zool. Univ. Michigan*, 716: 1-X, figs. 1-3. Two new species of the *indistinctum*-group of *Chthonerpeton* are described from Minas Gerais and Bahia, Brazil. A brief synopsis and a key to the nine nominate species of *Chthonerpeton* are presented. It is suggested that the diagnostic characters of *C. corrugatum*, *C. erugatum*, and *C. hellmichi* are artifacts of preservation of the holotypes and that these three species are junior synonyms of *C. indistinctum*.

Key words: *Amphibia*, *Gymnophiona*, *Typhlonectidae*, *Chthonerpeton*, *caecilians*, *Brazil*, *new taxa*.

INTRODUCTION

The caecilian family Typhlonectidae consists of four genera (*Chthonerpeton*, *Nectocaecilia*, *Potomotyphlus*, *Typhlonectes*) and about 19 species confined to tropical South America. Lescure *et al.* (1986) partitioned *Typhlonectes* and named a fifth genus, *Pseudotyphlonectes*. We believe this action was not justified and consider *Pseudotyphlonectes* invalid (Nussbaum and Wilkinson, in prep.; Wilkinson, in prep.) Some of these genera are poorly defined, and the phylogenetic relationships among them are not understood. *Chthonerpeton* is the most distinctive of the four genera, and species of this

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genus can be recognized by (1) their relatively small, ovate to elliptical, narial openings (large and subtriangular in the other typhlonectid genera), (2) the position of the tentacular aperture nearly midway between the eye and the naris (close behind the naris in the other genera), and (3) the condition of the tentacular groove, which is not covered by bone (covered in the other typhlonectid genera). Species of *Chthonerpeton* lack fins and are less aquatic than *Potomotyphlus* and *Typhlonectes*. *Chthonerpeton* species may be found in wet soil far from permanent water. Some species of *Nectocaecilia* also lack fins and can be found away from water.

*Chthonerpeton* currently consists of seven nominal species. Six of the named species are confined to the southeastern tropics of South America (Argentina, Brazil, Uruguay), and the seventh and most recently named species (Nussbaum, 1986) occurs in northeastern Ecuador. There is a hiatus of about 4,250 km between the newly discovered Ecuadorian locality and the southeastern portion of the generic range. It seems likely that *Chthonerpeton* will eventually be discovered in the hiatus.

*Chthonerpeton* consists of two species groups (Nussbaum, 1986). The *indistinctum*-group contains *C. braestrupi*, *C. corrugatum*, *C. erugatum*, *C. hellmichi*, and *C. indistinctum*. These five species have a relatively short, stocky body form, few vertebrae (80-111), and relatively superficial choanal valves. The *indistinctum*-group is confined to the southeastern tropics of South America. The *viviparum*-group contains only two species: *C. viviparum*, confined to southeastern Brazil, and *C. onorei* from northeastern Ecuador. These two species have slender bodies, many vertebrae (more than 136), and relatively deeply recessed choanal valves. Nussbaum (1986) suggested that each of these groups appears to be monophyletic, based on similarity, but that additional study is needed to support or deny these tentative groupings. Because the phylogenetic position of the Typhlonectidae is uncertain (Nussbaum and Wilkinson, in prep.), it is not presently possible to identify outgroups that would allow polarization of characters of or within *Chthonerpeton*.

Studies of typhlonectid systematics led us to the discovery of two new species of *Chthonerpeton* from southeastern Brazil, one from Minas Gerais and the other from Bahia. These new species occur farther north than the other Brazilian species of *Chthonerpeton*.

*Chthonerpeton perissodus* n. sp.

Figs. 1, 2

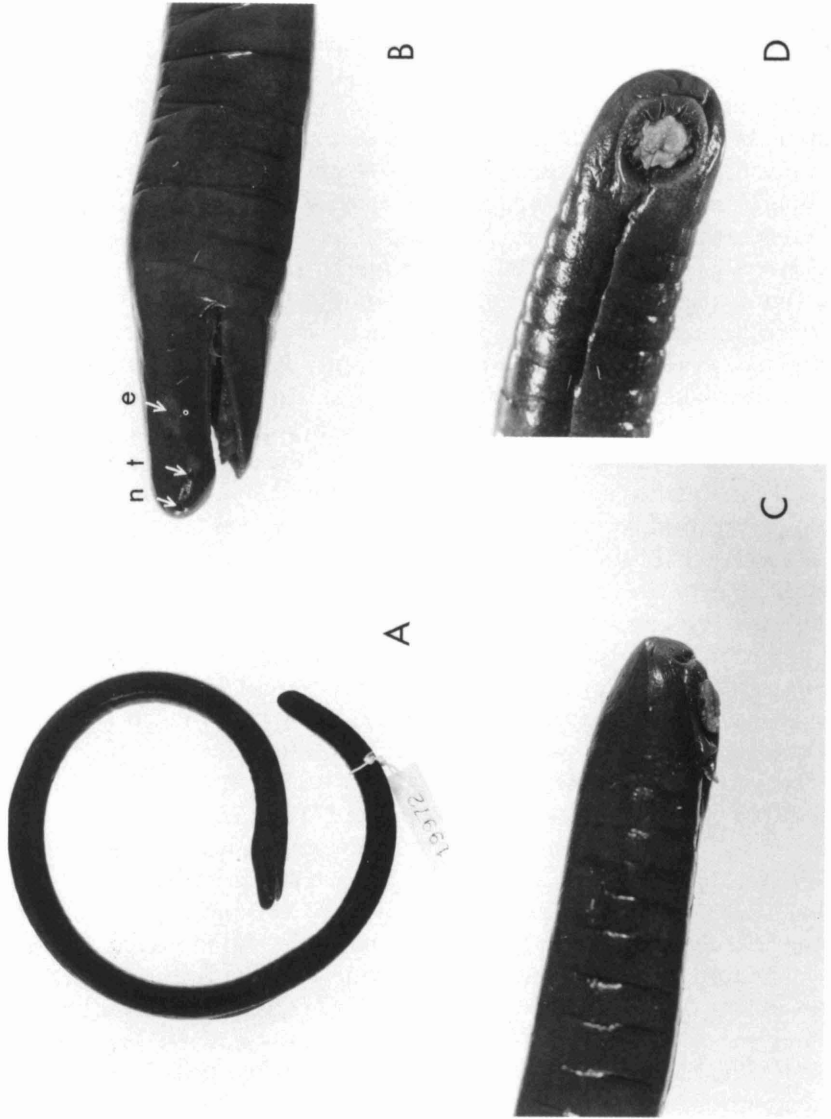
HOLOTYPE.—Museum of Comparative Zoology, Harvard University (MCZ) 19972, a mature male from Rio Pandeiro, Minas Gerais,

Brazil, collected by José Blaser, date of collection unknown.

PARATYPES.—MCZ 19973, same data as holotype; Naturhistorisches Museum, Wien (NMW) 9149, locality unknown.

DIAGNOSIS.—A *Chthonerpeton* with more primary annuli (95-101) and more vertebrae (103-108) than all members of the *indistinctum*-group (73-80; 80-88) except *braestrupi* (102; 111) and fewer primary annuli and vertebrae than all members of the *viviparum*-group (more than 126; more than 136). Differs from *braestrupi* in having relatively uniform, dark brown coloration (*braestrupi* is bicolored with a light venter); in having tentacular apertures closer to the nares than to the eyes (closer to the eyes in *braestrupi*); and in having more (41-46) premaxillary-maxillary teeth (35 in *braestrupi*).

DESCRIPTION OF HOLOTYPE.—Some morphometric and meristic data are given in Table 1. The specimen is in good condition except that the jaws have been cut and there is a ventral incision from the cloacal disk to a point about 5 cm anterior of the disk. The specimen is relatively thick-bodied and dorsoventrally flattened throughout, tapering slightly anteriorly and more substantially through the last 5 cm; ratio of total length to width at midbody 26.8; ventral body surface somewhat flattened throughout. The head is bluntly rounded in lateral and dorsal views. The eyes are dorsolaterally oriented and positioned just above the midlateral line of the head with the ventral margins of the eyes on the same level as the nares; the right eye is slightly elevated; both eyes are covered by white epidermis which extends forward over the tentacular groove towards the tentacular aperture forming an incomplete eye-tentacle stripe; the lens is visible only on the left side. The tentacular aperture consists of a small, horizontal groove partly covered posteriorly with a loose flap of epidermis; each aperture is surrounded by a broad whitish spot; the apertures are nearly equidistant between the eyes and nares (slightly closer to nares) and far below an imaginary line connecting the eye and naris and much closer to the lip (0.9 mm) than to either the eye (2.0 mm) or the naris (1.7 mm); the tentacular apertures are posterior to the anterior margin of the mouth and clearly visible from above. The naris is a horizontal oval with the narrow apex toward the eye; each naris is surrounded by a narrow, whitish ring; the nares are visible as slight notches from below, not visible in dorsal view. The mouth is recessed with the snout projecting 1.6 mm. The teeth are small, monocuspid, pointed, and recurved; the premaxillary-maxillary and vomeropalatine series of teeth extend equally far posteriorly with the posteriormost elements of the former series curving slightly inwards. The choanae are oriented diagonally in an antero-medial-posterolateral direction; the shortest distance between the cho-



anae, 1.2 mm, is slightly greater than their greatest width, 1.0 mm; the choanal depression is 1.7 mm long with relatively superficial valves 1.0 mm long; both anterior and posterior attachment points of the choanal valves are clearly visible. The tongue bears two darkly pigmented narial plugs complementary to the choanae. The tongue has a deep, longitudinal, central depression running forward to a point about level with both the posterior margins of the narial plugs and the last teeth of the dentary series. The nuchal region is wider than the head and the anterior body region; the two collars are of equal size, each 3.3 mm long; the three nuchal grooves that define the collars are incomplete dorsally but distinct laterally; ventrally the first two nuchal grooves are faintly apparent and the third is incomplete; each collar bears a transverse groove ventrally and laterally. The primary folds (100) are incomplete ventrally and widely incomplete dorsally. A distinct unsegmented terminal shield 5.1 mm long completely encompasses the cloacal disk; the terminal shield is bluntly rounded in dorsal view and slightly wedge-shaped in lateral view with the ventral surface facing somewhat posteriorly. The cloacal disk is circular, visible from behind, with the anterior edge depressed and the posterior edge elevated; the cloacal disk contains 10 denticulations, 5 anterior and 5 posterior, all of which are darkly pigmented; each of the two anterolateral denticulations bears a small white papilla. The cloacal disk is partly obscured centrally by the partially everted phallodeum (Fig. 1D). The white testicular lobes are well developed, indicating sexual maturity. The skin is uniform slate gray dorsally and slightly lighter in coloration ventrally; there are a few ventral light lines that may be scars; white lines border the upper and lower jaws. Numerous whitish skin glands of two distinct sizes are present throughout the body; the larger, more conspicuous glands are absent from the skin of the head.

VARIATION.—One of the paratypes, MCZ 19973, agrees with the holotype in most respects (comparative morphometric and meristic data in Table 1). It differs in having both eyes elevated and medially placed so that the nares are on the same level with the midpoints of the eyes. The lenses are not visible, and the white lines between the eyes and tentacular apertures are complete. The right naris is visible in dorsal view, the left only from ventral view. The cloacal disk is depressed centrally with the same pattern of pigmentation and denticu-

FIG. 1. Holotype (MCZ 19972) of *Chthonerpeton perissodus*: whole specimen (A), left side of head and neck (B), left side of body terminus (C), and ventral view of terminus illustrating partially everted phallodeum (D). n = external naris, t = tentacular aperture, e = eye. Measurements in Table 1.

TABLE 1  
MORPHOMETRIC AND MERISTIC DATA FOR SELECTED HOLOTYPE AND PARATYPES OF *Chthonerpeton*

	<i>Chthonerpeton perissodus</i>		<i>Chthonerpeton exile</i>		<i>Chthonerpeton braestrupi</i>	
	MCZ 19972 holotype	MCZ 19973 paratype	NMW <sup>a</sup> 9149 paratype	ZMUC R0268 holotype	ZMUC R0284 holotype	
Sex	male	female	?	male	female	
Maturity	mature	?	?	mature	mature	
Total length (mm)	259	207	365±	250	350	
Body width (mm)	10	8	11	8	9	
Head length (mm)	11.0	9.3	13.4	8.4	12.9	
Head width (mm)	8.1	6.8	7.9	6.6	9.6	
Interorbital distance (mm)	4.2	3.7	4.2	3.3	5.3	
Internarial distance (mm)	3.1	2.4	2.6	2.0	3.2	
Eye-narial distance (mm)	3.2	2.8	4.0	2.5	3.8	
Eye-tentacle distance (mm)	2.0	1.7	2.7	0.9	1.5	
Tentacle-narial distance (mm)	1.7	1.4	1.5	1.5	2.0	

Premax-maxillary teeth	46	41	46	31	35
Vomeropalatine teeth	35	32	42	27	28
Dentary teeth	39	31	40	25	30
Splenia teeth	8	4	8	8	10
Primary annuli	100	95	101	88	102
Vertebrae	108	103	106	99	111

<sup>a</sup> Specimen poorly preserved, measurements and counts approximate, sex and maturity indeterminable.

lation as the holotype, but the disk is more oval in shape, and there are no papillae (Fig. 2B). The dorsal coloration is like that of the holotype, but the venter is lighter (light brown). There is a gradual transition laterally between the dorsal and ventral coloration. The light ventral coloration is interrupted by the darker disk pigmentation and a darker region on the chin. The premaxillary-maxillary tooth series do not curve inward posteriorly. MCZ 19973 is a female, either mature or maturing as indicated by the enlarged (but not yolked) oocytes.

The second paratype, NMW 9149, is in very poor condition and is not described beyond the morphometric and meristic data in Table 1.

ETYMOLOGY.—This species has more premaxillary-maxillary teeth than any other *Chthonerpeton*, hence the name *perissodus*, from *perissos* (Greek, more than the usual number of) and *odous* (Greek, tooth).

REMARKS.—Taylor (1968) reluctantly assigned the three specimens described here as *Chthonerpeton perissodus* to *C. braestrupi*, apparently because of similarities in the numbers of primary annuli and vertebrae. However, direct comparison of the holotype of *C. braestrupi* to the types of *C. perissodus* reveals differences in head shape, tentacle position, coloration, and tooth numbers. The holotype of *C. perissodus* has 11 more premaxillary-maxillary teeth, 7 more vomeropalatine teeth, and 9 more dentary teeth than the holotype of *C. braestrupi*. These differences cannot be attributed to variation in body size, because the holotype of *C. braestrupi* is almost 100 mm longer than the holotype of *C. perissodus* (see Table 1). Body size and tooth numbers covary positively, if at all, in caecilians, which is the opposite of the relationship observed here.

*Chthonerpeton exile* n.sp.

Fig. 3

HOLOTYPE.—Zoologisk Museum, Copenhagen (ZMUC) R0268, a mature female from "Bahia," Brazil, collector and date of collection unknown.

DIAGNOSIS.—A *Chthonerpeton* that differs from all members of the *indistinctum*-group in having the tentacular aperture more distant from the lip than is the eye, and from all members of the *viviparum*-group in having far fewer primary annuli (fewer than 127) and vertebrae (fewer than 137); differs further from all members of the *indistinctum*-group except *braestrupi* and *perissodus* in having more primary annuli (88) and vertebrae (99); differs from *braestrupi* in



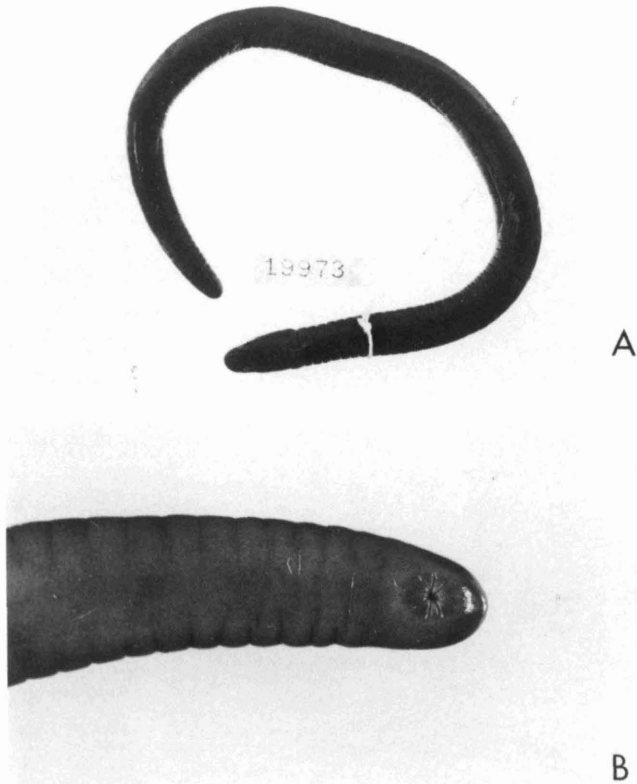
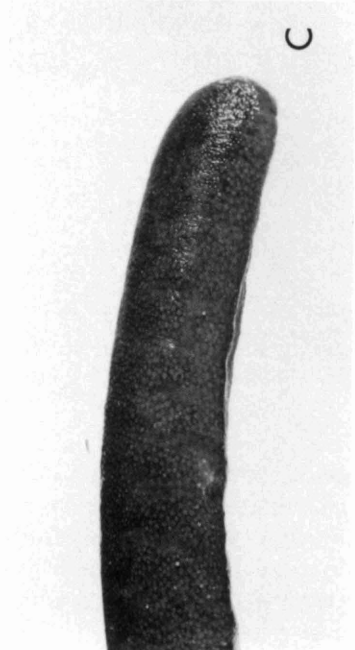
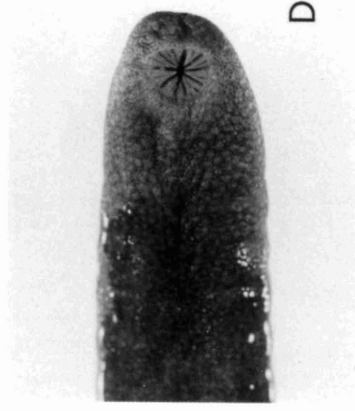
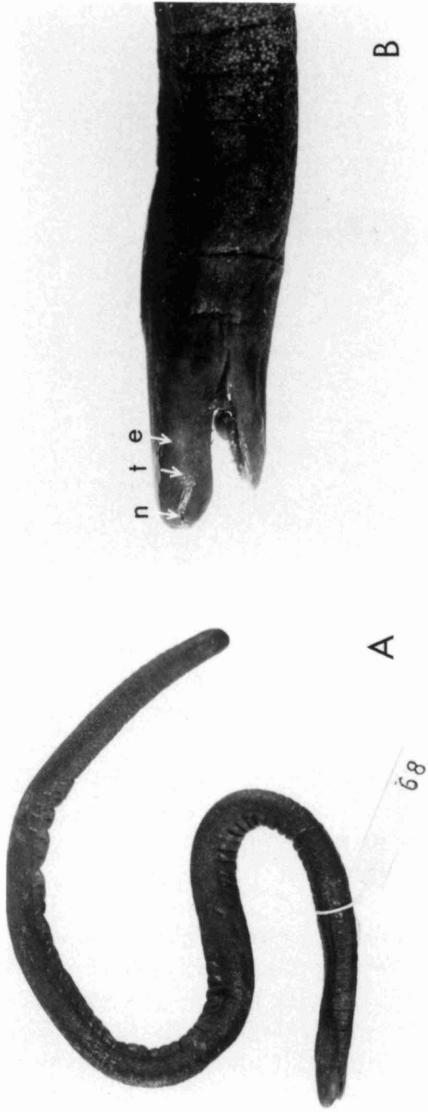


FIG. 2. Paratype (MCZ 19973) of *Chthonerpeton perissodus*: dorsal view of whole specimen (A) and ventral view of terminus (B). Measurements in Table 1.

having nearly uniform dark coloration (*braestrupi* is bicolor with a dark dorsum and a cream venter); differs from *perissodus* in having the tentacular aperture closer to the eye than to the naris (closer to naris in *perissodus*) and in having fewer (31 vs. 41-46) premaxillary-maxillary teeth, fewer (27 vs. 32-42) vomeropalatine teeth, and fewer (25 vs. 31-40) dentary teeth.

DESCRIPTION OF HOLOTYPE.—Morphometric and meristic data are given in Table 1. The color is somewhat faded, the jaws have been cut, the right lower jaw has been dissected, and there is a small slit in the



posterior ventral part of the body, otherwise in good condition. The body shape is slender; the ratio of total length to midbody width is 31.1; the body is dorsoventrally compressed throughout and distinctly flattened ventrally along the last 4 cm, tapered slightly anteriorly and more so posteriorly. The snout is bluntly rounded in lateral view, flattened in dorsal view. The sides of the head converge slightly toward the snout. The eyes are not directly visible as they are covered by patches of opaque, white epidermis that extend forward along the eye-tentacle tracts to cover the tentacular apertures as well; the eyes are dorsolaterally oriented. The tentacular apertures have the typical form of a short groove with a posterior flap of epidermis; they are positioned relatively high, above an imaginary line between the jaw angle and naris; they are slightly more distant from the lip margin, 1.2 mm, than are the eyes, 1.0 mm, but closer to the lip margin than are the nares, 1.5 mm; the tentacular apertures are much closer to the eyes, 0.9 mm, than to the nares, 1.5 mm, and each is slightly below but touching a line between the eye and naris; a line between the tentacular apertures would pass well behind the anterior margin of the mouth; the tentacular apertures are visible from above but not from below. The nares are small ellipses with their long axes pointing to the eyes; they are laterally oriented (not clearly visible from above or below) and are surrounded by white pigment. The mouth is recessed, the snout projecting 1.7 mm. The teeth are small, monocuspid, pointed, and recurved; the premaxillary-maxillary and vomeropalatine series are coextensive and curve towards each other posteriorly. The choanae are diagonally oriented in an anteromedial-posterolateral direction, 1.2 mm long with relatively deep valves 0.7 mm long; the anterior attachment points of the valves are not clearly visible; the shortest distance between the choanae, 0.8 mm, is slightly greater than their maximum width, 0.7 mm. The tongue is distorted by partial dissection of the right side of the lower jaw; the narial plugs are unpigmented with their posterior margins anterior to the last element of the dentary tooth series; the tongue has a central, longitudinal furrow beginning between the narial plugs which is open posteriorly. The two nuchal collars are distinct, the second being longer (3.7 mm) than the first (2.0 mm); the three nuchal grooves that define the collars are all complete dorsally and only the second is complete ventrally; there is a dorsal

FIG 3. Holotype (ZMUC R0268) of *Chthonerpeton exile*: whole specimen (A), left side of head and neck (B), left side of body terminus (C), and ventral view of terminus and cloacal disk (D). n = external naris, t = tentacular aperture, e = eye position. Measurements in Table 1.

transverse groove on the second collar. The primary annuli (88) are well marked either by dark grooves anteriorly or lighter grooves posteriorly; they are complete ventrally and incomplete (fused) dorsally except for the first 10 which are complete dorsally; the posteriormost annulus is very close to the anterior margin of the cloacal disk and delimits the unsegmented terminal shield which is 4.1 mm long; the terminal shield is bluntly rounded in both lateral and dorsal views and distinctly flattened ventrally. The cloacal disk is subcircular, slightly depressed, and bears 10 denticulations, 5 anterior and 5 posterior; the distal edges of the denticulations are unpigmented, forming a whitish ring; centrally the disk has a brownish tinge; each denticulation except the anterior and posterior medial denticles has an incomplete subdivision; there are no cloacal papillae; the disk is not visible from posterior view. The ovaries contain many yolky oocytes up to about 1.0 mm in diameter. The outer epidermis has been lost over much of the body, and here the color is a rich brown dorsally grading to a paler brown ventrally; where the epidermis is intact, the color is more slate-gray than brown, which is presumably closer to the color in life; the head is a lighter shade than the body dorsally, with a whitish snout tip; the chin region is generally darker than the rest of the venter; both the upper and lower jaw margins are white. Skin glands of two sizes are present. Both kinds occur evenly and densely on the body, but the larger and whitest glands are few in number on the head.

VARIATION.—Known only from the holotype.

ETYMOLOGY.—The name *exile* (Latin, *exilis*) refers to the relatively slender, delicate shape of the body and head.

REMARKS.—The holotype had been identified as *Chthonerpeton indistinctum*, but it differs from that species in having a less robust body form, tentacular apertures much closer to the eyes and more distant from the lips than are the eyes, and in having 8 more primary annuli and 11 more vertebrae than any known specimen of *C. indistinctum*. *C. exile* is tentatively assigned to the *indistinctum*-group, although it is more slender and has more deeply recessed choanal valves than other members of the group.

SYNOPSIS OF *CHTHONERPETON*

## Typhlonectidae Taylor

*Chthonerpeton* PetersI. *indistinctum*-group

1. *Chthonerpeton braestrupi* Taylor  
"Brazil"
2. *Chthonerpeton corrugatum* Taylor  
uncertain distribution, probably Brazil
3. *Chthonerpeton erugatum* Taylor  
unknown distribution
4. *Chthonerpeton exile* Nussbaum and Wilkinson  
Bahia, Brazil
5. *Chthonerpeton hellmichi* Taylor  
Punta Lara, Brazil
6. *Chthonerpeton indistinctum* (Reinhardt and Lütken)  
Southern Brazil, Northern Argentina, Uruguay
7. *Chthonerpeton perissodus* Nussbaum and Wilkinson  
Minas Gerais, Brazil

II. *viviparum*-group

8. *Chthonerpeton onorei* Nussbaum  
Napo, Ecuador
9. *Chthonerpeton viviparum* Parker and Wettstein  
Santa Catarina, Brazil

KEY TO THE SPECIES OF *CHTHONERPETON*

1. More than 126 primary annuli and more than 136 vertebrae ...2  
Fewer than 127 primary annuli and fewer than 137 vertebrae ...3
2. Tentacular aperture much closer to eye than to  
naris ..... *C. viviparum*  
Tentacular aperture equidistant between eye and naris  
or slightly closer to naris ..... *C. onorei*
3. More than 80 primary annuli and more than 88 vertebrae .....4  
Fewer than 81 primary annuli and fewer than 89 vertebrae ....6
4. Distinctly bicolor with a dark dorsum and a white or cream  
venter ..... *C. braestrupi*  
Not bicolor, venter may be a lighter shade of gray or brown  
than the dorsum, but not white or cream .....5
5. Tentacular aperture closer to the naris than to the eye;  
40 or more premaxillary-maxillary teeth ..... *C. perissodus*

- Tentacular aperture closer to the eye than to the naris,  
 fewer than 40 premaxillary-maxillary teeth..... *C. exile*
6. Cloacal disk semicircular, the anterior edge  
 transverse..... *C. hellmichi*  
 Cloacal disk circular .....7
7. Body subcylindrical, not strongly flattened ..... *C. indistinctum*  
 Ventral body surface flattened.....8
8. Skin smooth..... *C. erugatum*  
 Skin extremely wrinkled or corrugated in adults, less so  
 in young ..... *C. corrugatum*

## DISCUSSION

We examined the holotypes or lectotypes of all species of *Chthonerpeton*. Although we include them in the key and synopsis, we believe that the three species *C. corrugatum*, *C. erugatum* and *C. hellmichi* are probably synonymous with *C. indistinctum*. The holotype of *C. corrugatum* (ZMH A00265) is distinguished from the lectotype of *C. indistinctum* (ZMUC R0235) primarily by its wrinkled skin, and the holotype of *C. erugatum* (ZMUC R0238) differs primarily in the flattened ventral body surface. Both of these features seem to be attributable to the poor states of preservation of these holotypes. *C. hellmichi*, known only from the holotype (ZSM 1/1964), differs from *C. indistinctum* only by having a semicircular rather than circular cloacal disk (Taylor, 1968); but we find variation in the shape of the cloacal disk of *C. indistinctum* with some individuals approaching the condition of *C. hellmichi*. Prigioni and Langone (1983) also doubted the validity of *C. hellmichi*. Further investigations of these species are planned. The validity of the remaining species is fairly certain.

Of the species in the *indistinctum*-group, only *Chthonerpeton indistinctum* is known from more than three specimens. Variation in annular count in *C. indistinctum* is small (73-80), and this distinguishes it from *C. braestrupi* and *C. perissodus* which have many more annuli (102, 95-101), and which differ from each other in coloration and dentition. *C. exile* is known only from the holotype and the variation in annuli may prove, with more specimens, to overlap that of *C. indistinctum*.

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