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Early Oligocene (Whitneyan) snakes from Florida (USA), a unique booid

J. Alan HOLMAN, David L. HARRISON

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Abstract. A new genus and species of small booid snake, *Conantophis alachuaensis* is reported from the Early Oligocene (Whitneyan) I-75 Local Fauna (Florida Natural History Museum Locality AL018) near Gainesville, Alachua County, Florida, USA. This unique snake, represented by cervical and trunk vertebrae, is distinguished by its exceedingly dorsoventrally flattened vertebrae, especially those occurring in the posterior part of the trunk region, and by its massive, distinctively-shaped vertebral hemal keels. We are unable to identify this new genus to the subfamilial level with certainty, although we suggest there is some possibility that it may be related to the dwarf boa family Tropidophiidae.

Key words: Early Oligocene booid snake USA.

J. Alan HOLMAN, Michigan State University Museum, East Lansing, Michigan 48824-1045, USA; David L. HARRISON, Harrison Zoological Museum, St. Botolph's Road, Sevenoaks, Kent, TN13 3AQ, UK.

I. INTRODUCTION

This is the second of a series of three papers on the Early Oligocene snakes of the I-75 Site, near Gainesville in northern Peninsular Florida, USA. The first paper (HOLMAN, 2000) detailed two genera of small colubrid snakes, one a new genus and the other a new species of a previously known extinct genus. These two taxa represent the second oldest colubrid snakes known from the New World. The present paper deals with a unique new genus of small booid snake, not identified as to family, but with possible tropidophiid (dwarf boa) affinities. We plan a third and final paper to describe the remaining booid taxa of the site.

The I-75 Site, discussed more thoroughly by HOLMAN (2000), has yielded a surprisingly diverse assemblage of Early Oligocene (Whitneyan) vertebrates. The locality (see HOLMAN, 2000, fig. 1) was found during the construction of Interstate Highway I-75 near Gainesville, Alachua County, Florida. This site was undoubtedly a remnant of a fissure fill in the eroded limestone of the Crystal River Formation (Ocala Group).

The deposit was very small considering the abundant fossil vertebrates that it produced (PATTON, 1969). This local fauna not only yielded an abundant mammalian fauna, but fishes, amphibians, reptiles, and birds were also collected there (see HOLMAN, 2000). Bones were first recognized from the site by M. KONTROVITZ of the University of Florida in 1965 and a preliminary reported was made on the fauna by T. PATTON (1969).

During the Paleogene, the limestone platform that supports Florida was alternately submerged, partially submerged, or connected to the continent. The I-75 vertebrate assemblage is important as it has suggested that faunal connections occurred between Florida and other biotic regions in North America, especially the present Great Plains region. The colubrid species *Nebraskophis oligocenicus* for instance, reported from the I-75 fauna by HOLMAN (2000), was previously known only from the Middle and Late Miocene of Nebraska.

A c k n o w l e d g e m e n t s. We would like to express our thanks to B. ALBRIGHT, M. S. FRANC and S. D. WEBB of the Florida Museum of Natural History for allowing us to study the I-75 Local Fauna booid material. D. HARRISON made the drawings of the fossil booid snake of this paper. J. KAMINSKI made the drawing of the modern *Tropidophis* vertebra. J. C. RAGE made valuable comments on the mansuscript. Z. SZYNDLAR provided editorial help.

II. SYSTEMATIC PALEONTOLOGY

Although there are other opinions, the taxonomic nomenclature of the present paper follows that of RAGE (1984), except that we recognize the Tropidophiidae as a family (see MCDIARMID et al. 1900) rather than as a subfamily.

Class: Reptilia LAURENTI, 1768

Order: Serpentes LINNAEUS, 1758

Suborder: Alethinophidia NOPCSA, 1923

Superfamily: Booidea GRAY, 1825

Family indeterminate

Genus *Conantophis* gen. nov.

Type species: *Conantophis alachuaensis*

E t y m o l o g y. The name is in recognition of Roger CONANT for his comprehensive works on the systematics of modern snakes.

D i a g n o s i s. The diagnosis is the same as for the type and only known species.

Conantophis alachuaensis sp. nov.

Figs. 1-4

H o l o t y p e. A middle trunk vertebra: Florida Natural History Museum Number (UF) 190831 (Fig. 1) collected by Florida Natural History Museum field parties between 1966 and 1967.

P a r a t y p e s. One cervical vertebra, UF 190835 (Fig. 2); one middle trunk vertebra, UF 190836 (Fig. 3); and one posterior trunk vertebra, UF 190834 (Fig. 4). All of these were also collected by Florida Natural History Museum field parties between 1966 and 1967.

T y p e l o c a l i t y a n d h o r i z o n. I-75 Local Fauna (Florida Natural History Museum Locality AL018), 1.5 km WSW Gainesville, Alachua County, Florida. Early Oligocene (Whitneyan).

E t y m o l o g y. The specific name refers to Alachua County, Florida, where the type material was collected.

D i a g n o s i s. A small, unique booid. The holotype trunk vertebra is massive in its construction, very short and wide, and very flat across the top; has its zygosphenal articular facets relatively small and very sharply tilted upward; has very large pre- and postzygapophyseal articular facets; has a very thick hemal keel that, in lateral view, is strongly bowed ventrally in a rounded, boat-like way; has deep subcentral grooves; has large subcentral foramina; and has a massive, indis-

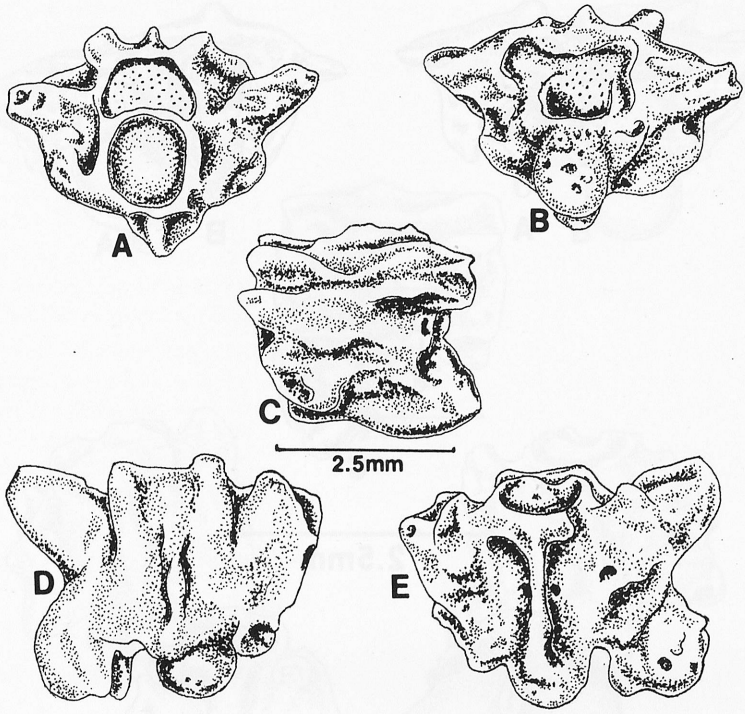

Fig. 1. Holotype trunk vertebra (UF 190831) of *Conantophis alachuaensis* gen. et sp. nov. from the Early Oligocene (Whitneyan) I-75 Local Fauna, Alachua County, Florida, USA.

tinctly divided synapophysis. The paratype cervical vertebra is much wider than long and has a short, terminally rounded hypapophysis. The paratype posterior trunk vertebra is exceedingly flat across the top, has the hypapophysis almost as wide as the condyle, and is also very much wider than long.

D e s c r i p t i o n o f h o l o t y p e. In anterior view, the zygosphenal articular facets are small and are very sharply tilted upward. The neural spine is broken off anteriorly. The prezygapophyses are sharply tilted upward. The neural canal is slightly smaller, but wider than the cotyle and is reniform in shape with its dorsal edge convex, its ventral edge concave. The cotyle is oval and somewhat compressed laterally. The right side of the sub-prezygapophyseal area is eroded and broken, but the left side of this area bears a deep pit that appears to lack a foramen. The synapophyseal areas on both sides are worn but massive. The hemal keel is thick and strongly bowed ventrally.

In posterior view, the top of the vertebra is very flat. The right zygosphenal area is sharply tilted upward, but the left zygosphenal area is barely visible in this view. The zygantral area is massive in construction. The walls of the neural canal are very eroded posteriorly, thus it is difficult to discern the shape of the canal in this view. The condyle is pitted, oval, and compressed. The synapophyses are worn but massive, and in this view, the right synapophysis appears to be very slightly divided.

In lateral view, the top of the vertebra is flattened. The neural spine is broken irregularly across the top. The zygospehnal articular facets are very sharply tilted upward. The left prezygapophyseal articular facet is sharply tilted upward. The left synapophysis is somewhat broken ventrally, but still appears to be slightly divided. The interzygosphenal ridge is strongly bowed upward at its middle. The subcentral ridge in strongly bowed upward. The hemal keel is so stronly bowed downward that it is in the shape of a rounded, boat-like keel, a condition that appears unique in snakes.

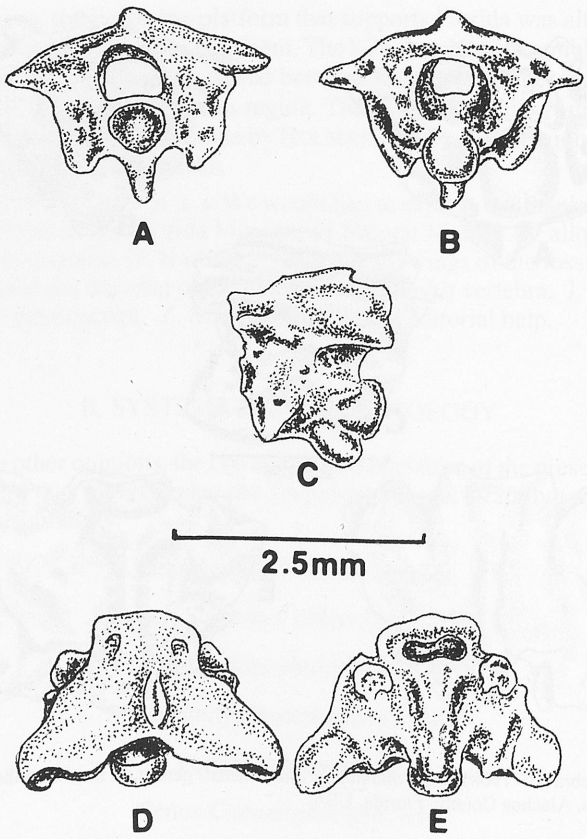

Fig. 2. Paratype cervical vertebra (UF 190835) of *Conantophis alachuaensis* gen. et sp. nov. from the Early Oligocene (Whitneyan) I-75 Local Fauna, Alachua County, Florida, USA.

In dorsal view, the vertebra is distinctively wider than it is long and is massively built. Both the prezygapophyses and the postzygapophyses are very large and there is very little intervertebral area between these structures. The left prezygapophyseal articular facet is ovoid the right one is broken off. The anterior edge of the zygosphene is irregularly broken. The neural spine, although broken, is thick. The posterior edge of the neural arch is irregularly broken away. The condyle is rounded in this view.

In ventral view, the left postzygapophyseal articular facet is ovoid the right one is broken off. The hemal keel is strong and wide and extends well onto the anterior part of the condyle which is rounded in this view. The subcentral grooves are very deep and two large subcentral foramina occur adjacent to the hemal keel at about the middle of its extent. The synapophyses are massive, but are indistict in this view.

Description of Paratypes. The paratypes of *Conantophis* are especially significant as each one represents a different part of the vertebral column.

A paratype cervical vertebra (UF 190835, Fig. 2) of *Conantophis* differs from those of other snakes in its depressed neural arch. In anterior view, the neural arch is very depressed. The neural spine is thick, but broken. The neural canal is reniform with its dorsal surface convex and its ventral surface slightly concave. The subrounded cotyle is approximately the same size as the neural canal. The postzygapophyses (the prezygapohyses are broken off, see Fig. 2D) extend laterally at nearly

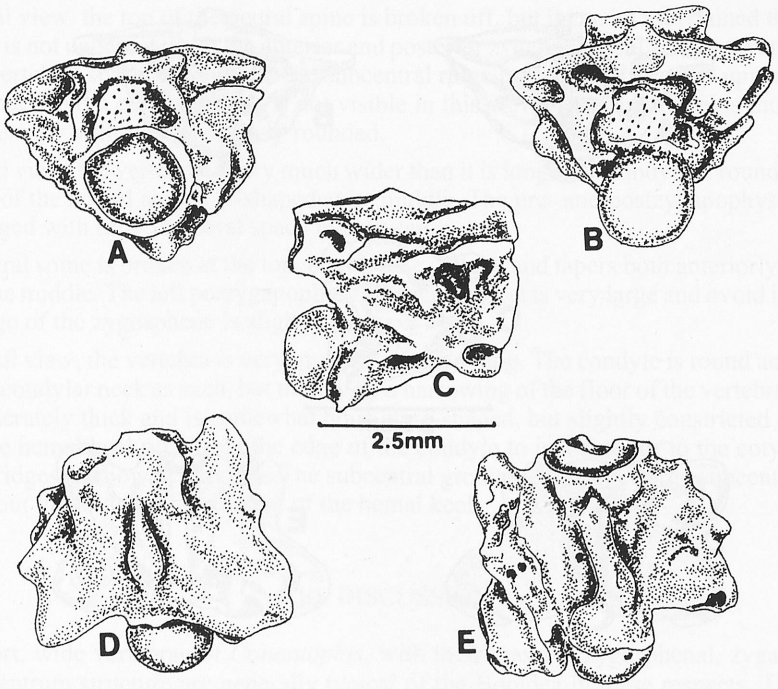

Fig. 3. Paratype trunk vertebra (UF 190836) of *Conantophis alachuaensis* gen. et sp. nov. from the Early Oligocene (Whitneyan) I-75 Local Fauna, Alachua County, Florida, USA.

right angles to the long axis of the centrum. The synapophyses project well below the level of the centrum. The base of the hypapophysis is more than one-third the width of the cotyle.

In posterior view, the neural arch is very depressed. The neural spine is broken but is thick. The neural canal is subrounded and larger than the rounded condyle. The left zygantral articular facet is roughly triangular in shape, the right one is eroded and worn. The synapophyses are undivided.

In lateral view, the neural arch is very depressed. The neural spine is broken throughout much of its extent, but it may be ascertained that its posterior border is distinctly undercut.

The posterior portion of the lateral wall of the vertebra is well excavated from under the postzygapophyseal area forward to about the middle of the vertebra. A large foramen lies just anterior to this excavated area. The hypapophysis is about as long as the condyle is deep and has its tip rounded.

In dorsal view, the cervical vertebra appears oddly short and wide, but this is probably due to the fact that much of the prezygapophyseal area is missing on both sides. The condyle is rounded. The posterior border of the neural arch is broadly U-shaped at its center. The neural spine is broken, but it is thicker at its middle than it is at either end. Two, somewhat shallow, ovoid excavations occur on the roof of the anterior part of the neural arch.

In ventral view, the very short appearance of the vertebra again reflects the fact that the prezygapophyseal areas on both sides have been broken off. The condyle is rounded in this view and has a distinct, thick neck. Well marked excavations occur on either side of this condylar neck. Both postzygapophyseal articular facets are well-preserved and are well-developed and ovoid in shape. The cotylar excavation appears irregular and worn in this view.

A paratype trunk vertebra of *Conantophis* (UF 190836, Fig. 3) has a very flat-topped vertebra and a thickened hemal keel as in the holotype specimen, although the hemal keel of the paratype has been broken off anteriorly. The zygosphenal area of the paratype is more massive than in the holo-

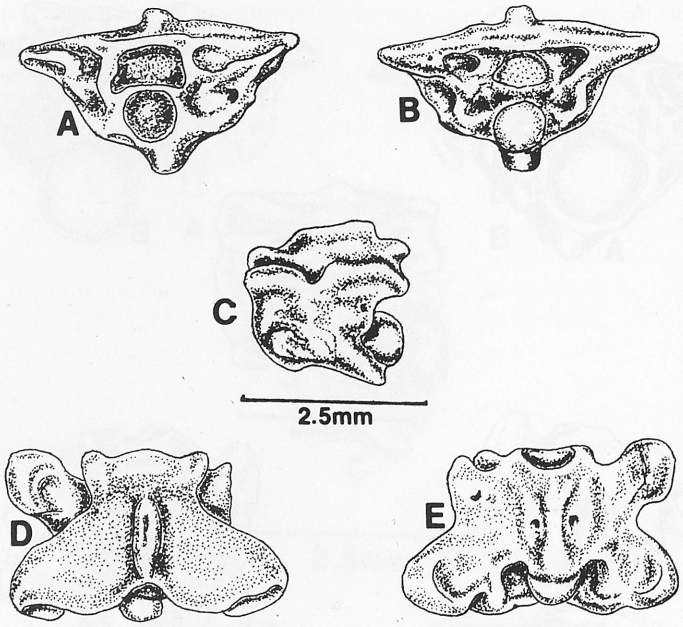

Fig. 4. Paratype posterior trunk vertebra (UF 190834) of *Conantophis alachuaensis* gen. et sp. nov. from the Early Oligocene (Whitneyan) I-75 Local Fauna, Alachua County, Florida, USA.

type, but this appears to be due, at least in part, to the fact that there is quite a bit of erosion in this area in the holotype (see Fig. lB).

Other structures in UF 190836 are basically similar to the holotype except that the hemal keel (although warped leftward) appears to be significantly thicker than in the holotype. Parenthetically, we are not sure whether the pronounced warping in the hemal kel is due to diagenetic changes or to predepositional injury to the snake. The hemal keel warping is significant enough so that view of the left subcentral foramen is blocked, while the right one remains distinct.

The thicker hypapophysis may be due to individual variation or the fact that the paratype comes from a different region in the trunk series. We suspect that the latter is true, for the condyle and the cotyle of the paratype trunk vertebra (see Fig. 3A and B) are both significantly larger and rounder than those structures in the holotype. Such intercolumnar variations are seen in modern booid snakes.

A paratype vertebra (UF 190834, Fig. 4) that we interpret as coming from the posterior part of the trunk region, probably very near the cloacal region, is the most bizarre snake vertebra the senior author has ever seen, as the entire vertebra is very depressed as well as being very flat on top. Moreover, it is very much wider than it is long. In fact, we were tempted to designate this vertebra as the holotype, were it not for the fact that it is from an area of the vertebral column that is usually not used for the selection of holotype vertebrae in snakes.

In anterior view, the vertebra is very flat on top and is generally highly depressed. The zygosphene is only moderately thick and is also flat dorsally. The neural canal is vaguely reniform in shape and it is wider than high. The prezygapophyses are relatively thin in this view and are slightly tilted upward. The cotyle is circular. The hypapophysis is almost as thick as the cotyle. The synapophyses are rather smoothly worn in this view, but there is no indication that they are divided.

In posterior view, the vertebra is very flat on top and is generally highly depressed. The postzygapophyses are directed very nearly laterally The zygantral articular facets are triangular. The neural canal is ovoid and slightly smaller than the rounded condyle.

In lateral view. the top of the neural spine is broken off, but it can be ascertained that its posterior, border is not undercut. Both the anterior and posterior zygapophyseal areas are very large, with very little vertebral space in between. The subcentral ridge is moderately bowed upward. The condyle is rounded and a condylar neck is not visible in this view. The hemal keel is moderately enlarged posteriorly with its tip narrowly rounded.

In dorsal view, the vertebra is very much wider than it is long. The condyle is rounded. The posterior edge of the neural arch is U-shaped at its middle. The pre- and postzygapophyseal areas are much enlarged with little vertebral space in between.

The neural spine is broken at the top, but its base is thick and tapers both anteriorly and posteriorly from the middle. The left prezygapophyseal articular facet is very large and ovoid in shape. The anterior edge of the zygosphene is slightly convex.

In ventral view, the vertebra is very much wider than long. The condyle is round and is not supported by a condylar neck as such, but merely by a narrowing of the floor of the vertebra. The hemal keel is moderately thick and is somewhat hour-glass-shaped, but slightly constricted at its middle portion. The hemal keel runs from the edge of the condyle to just anterior to the cotylar rim. The subcentral ridges are bowed laterally. The subcentral grooves are deep. Large subcentral foramina occur at about the middle of the extent of the hemal keel.

III. DISCUSSION

The short, wide vertebrae of *Conantophis*, with their massive zygosphenal, zygantral, neural arch, and centrum structure are generally typical of the Booidea in these respects. The two most unique structures of *Conantophis* are the very flat-topped vertebrae (extremely flat-topped in the posterior trunk region) and the very thickened, ventrally-bowed, boat-like hemal keel.

It is possible that the closest modern relatives to *Conantophis* are in the Neotropical dwarf boa family Tropidophiidae. Tropidophiids are mainly small ground forms that are typically nocturnal and terrestrial species. These animals occur from Mexico, the Bahamas, and the Greater Antilles into south tropical South America. Unfortunately, they are very poorly known in the North American fossil record.

The genus *Tropidophis*, which has 15 species that are mainly confined to the Caribbean region shows a few vertebral similarities to *Conantophis*. These include the following. The vertebrae are very depressed (Fig. 5) but not so much as those of *Conantophis*, especially in the posterior part of the trunk region where not only is the neural arch depressed but the entire vertebra is very flattened.

A very robust, squarish hemal keel (Fig. 5C) in *Tropidophis* has been referred to by some as a "hypapophysis." The very robust, ventrally bowed, hemal keel of *Conantophis* might be considered by some to be well-developed enough to be referred to as a hypapophysis, but the structure in *Conantophis* is differently shaped than in *Tropidopis*. The zygosphenal articular facets are tilted upward (Fig. 5A) in *Tropidophis*, but not as much so as in *Conantophis* (see Fig. 1A).

Yet, it seems possible that *Conantophis* might be related to the Caribeean tropidophiids. The only fossil record of the genus *Tropidophis* that we are aware of if that of cf. *Tropidophis* from the Early Pleistocene of the Leisey Shell Pit, Hillsborough County, Florida (MEYLAN, 1995).

The only other putative fossil record of the family Tropidophinae that we are aware of is that of *Dunnophis* HECHT, 1959. This genus occurs in the Eocene and Oligocene of Europe and the Eocene of North America (RAGE, 1984). *Dunnophis*, on the other hand (see plates in HECHT, 1959), has a very poorly-defined hemal keel, and otherwise has a much different vertebral form than *Conantophis* or *Tropidophis*.

Relative to the extreme dorsoventral flattening of the vertebrae of *Conantophis*, we can only say that it must allow for the snake itself to have become very flattened, at least toward the posterior end of the body where the most flattened trunk vertebrae occur. Perhaps it allowed the snake to squeeze through very thin cracks to pursue prey or to find shelter.

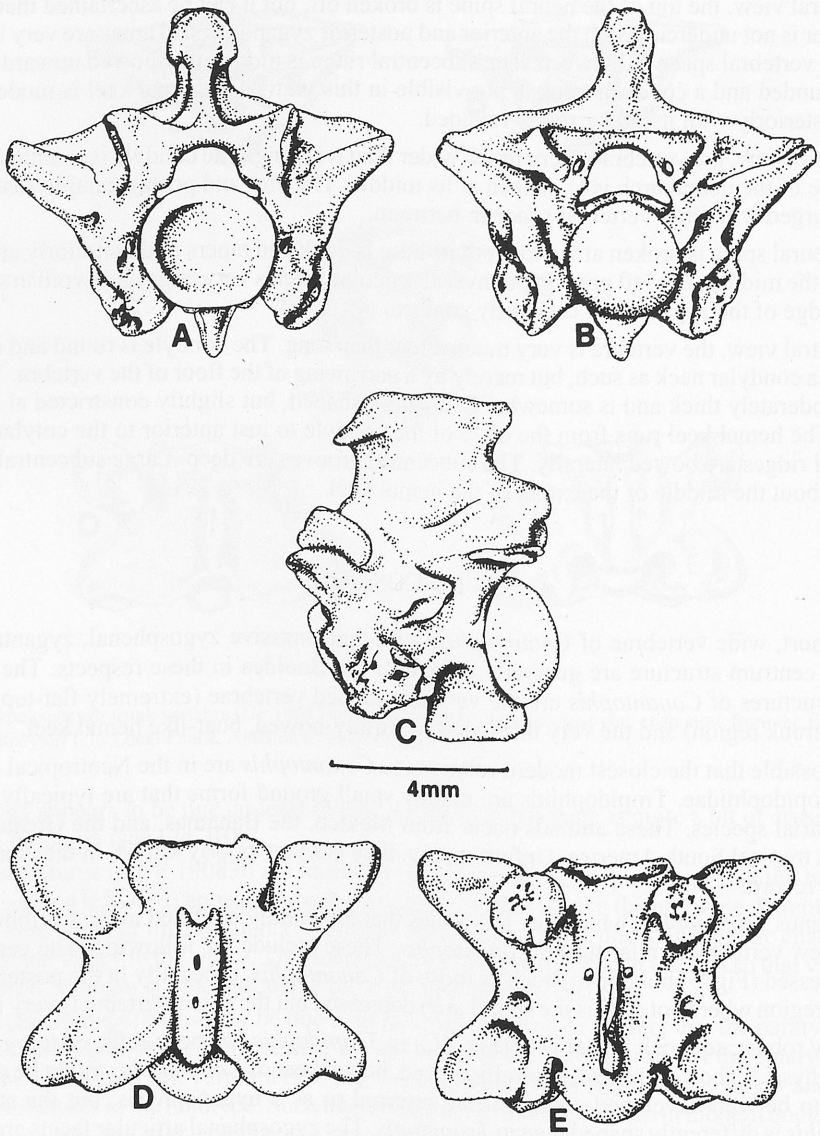

Fig. 5. Trunk vertebra of modern *Tropidophis melanurus* SCHLEGEL, 1837 (Michigan State University Museum Herpetological Skeletal Collection No. 241).

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