

# *Thecachampsa antiqua* (Leidy, 1852) (Crocodylidae: Thoracosaurinae) from Fossil Marine Deposits at Lee Creek Mine, Aurora, North Carolina, USA

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## ABSTRACT

Fossil remains of crocodilians at Lee Creek Mine have been few and fragmentary. Nevertheless, isolated teeth and dermal plates from the spoil piles are identifiable as *Thecachampsa antiqua* (Leidy). This species was established by Leidy on characters of teeth presumably from the Calvert Formation of Virginia (late early to early middle Miocene), but the species is now validated by skulls and numerous elements from the middle Miocene formations of the Chesapeake Group. The same form is common in the Florida early Pliocene, where it is represented by several fairly complete skeletons known as *Gavialosuchus americanus* (Sellards). It also is known from numerous skulls from early and middle Miocene formations near Lisbon, Portugal, as *Tomistoma lusitanica* (Vianna and Moraes). Teeth and a dermal scute indicating the same species have been collected from late early Miocene deposits. The resemblance among teeth, scutes, and skulls from the Chesapeake Group, Florida, and from Portugal indicates that these forms are conspecific. The earliest available name, *Thecachampsa antiqua*, has priority.

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## Introduction

A small collection of isolated and fragmentary remains of fossil crocodilians from Lee Creek Mine has accumulated in the collections of the National Museum of Natural History (which includes collections of the former United States National Museum (USNM)), Smithsonian Institution, over the past 25 years. The sample is a result of collecting from mixed tailings from the Pungo River Formation (late early to early middle Miocene; Gibson, 1983) and the overlying Yorktown

Formation (early Pliocene; Gibson, 1983; Hazel, 1983). It provides a first opportunity to study the Lee Creek crocodilian materials in relation to other similar forms of comparable geologic age. The purpose of this paper is to describe the Lee Creek Mine crocodilian specimens and to comment on the taxonomic status and paleozoogeographic implications related to the Lee Creek Mine occurrence and to occurrences of closely related forms elsewhere.

**ACKNOWLEDGMENTS.**—The Lee Creek Mine specimens cited in this report were collected and donated by P.J. Harmatuk, F. Hyne, and B. Hyne. I thank L.G. Barnes (Los Angeles County Museum of Natural History) for providing refresher information on the California specimens. S.D. Webb's (University of Florida) age estimations of the Florida localities were of great help. C. Repenning (United States Geological Survey) loaned crocodilian teeth from California. A. Sanders (The Charleston Museum) and B. Erickson (Science Museum of Minnesota) gave helpful advice. I am especially grateful to T. Deméré, at the San Diego Museum of Natural History, who permitted me to study the Museum's holdings of recent vertebrate paleontology literature.

## MATERIALS AND PROVENIENCE

The fossil crocodilian remains from Lee Creek Mine consist of approximately 24 isolated teeth, 15 unassociated vertebrae, two incomplete dermal scutes, three skull fragments, a mandibular fragment, a right maxilla fragment, and several bones and bone fragments from appendicular skeletons (Figures 1–5). These have been assigned USNM catalog numbers. Field data indicate that none of the specimens were collected in association or in situ. Adherent matrix indicates at least one specimen (fragment of right maxilla, USNM 307548) came from the Pungo River Formation, but, because the spoil piles

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consist of disturbed mixtures of sediments from the Pungo River Formation and the Yorktown Formation, others could equally well have come from the Yorktown Formation. The most that can be said at present is that the Lee Creek Mine crocodilian fossils are of late early Miocene and possibly early Pliocene age.

### Morphological Description

The appendicular elements, vertebrae, and skull fragments in hand are of little immediate diagnostic use below the family level. If, however, one may judge from the several robust vertebrae (USNM 412243, 412254) and the large size of the posterior fragment of a right maxilla (USNM 307548; Figure 2), which contains complete teeth, some of these animals probably attained greater sizes than most modern crocodilians.

Most of the crocodilian teeth collected at Lee Creek Mine, including those in the maxillary (USNM 307548) and mandibular (USNM 437930) fragments, are in a state of excellent preservation and are of diagnostic importance (Figures 1–3). They are heavily built simple cones, elliptical to subcircular in cross section, with bluntly pointed apices. A carina of variable prominence occurs on anterior and posterior surfaces of the crowns. It typically extends basally from near the apex to about one-half the length of the crown, although carinal distance also is highly variable. The carinae divide the tooth subequally, such that the greater half of the crown lies toward the labial side. The longer teeth are slightly recurved, the shorter, stubbier ones are barely so. Labiolingual compression is exhibited especially in the shorter, presumably more posterior, teeth. The enamel is thin, variably transparent, and finely rugose, with a silky fibrous surface texture. Within the enamel can be seen various light and dark colored bands encircling the crowns horizontally at irregular intervals.

The two specimens of dermal plates or scutes (USNM 244391, 412252) also have diagnostically important characters (Figure 4). They are rectangular with one corner more or less rounded and with two edges more strongly beveled than the others. The external surface of the scute contains very large, irregularly rounded pits with no discernable pattern. In addition, the scutes have no keels (i.e., plate-like ridges that project at right angles from the pitted external surface), which commonly are found in the dermal scutes of most modern crocodilians.

### COMPARISON WITH OTHER MATERIALS

I confine my remarks to the North American Miocene and Pliocene and the Portuguese Miocene forms.

In their diagnostic characters, the crocodilian teeth and scutes are identical to numerous isolated teeth and scutes from the Miocene formations of the Chesapeake Group of Maryland and Virginia. They also closely resemble elements asso-

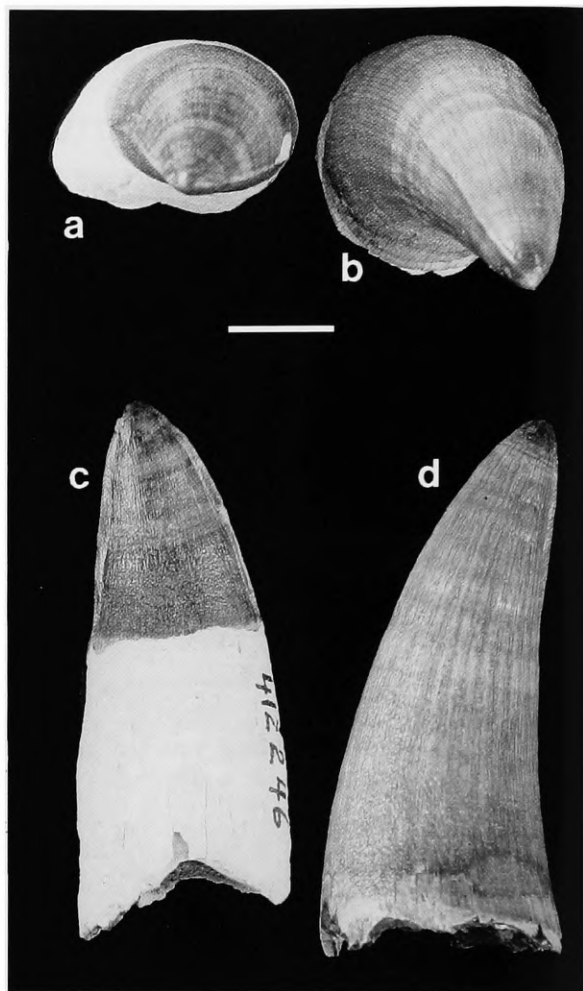


FIGURE 1.—Teeth of *Thecachampa antiqua* from Lee Creek Mine, North Carolina (a,c, USNM 412246; b,d, USNM 299794): a,b, apical view; c,d, lingual view. (Scale bar=1 cm.)

ciated with one well-preserved skull (USNM 25243; Figure 5b) from the Calvert Formation in northern Virginia (late early Miocene) and with at least several skulls from the Bone Valley Gravel and the Alachua formations (early Pliocene; S.D. Webb, pers. comm., 1967) of Florida. In addition, they do not differ in any consistent feature from teeth and dermal scutes associated with skulls from Miocene deposits near Lisbon, Portugal. Finally, the only crocodilian material known from late Tertiary marine deposits in southwestern California and in Baja California, one partial scute and more than a dozen teeth, compares favorably in detail with the Lee Creek Mine materials.

In cases where skulls and other skeletal elements have been closely compared and described (i.e., from the Virginia Calvert Formation, Maryland St. Marys Formation, Florida Pliocene formations, and Miocene formations near Lisbon,

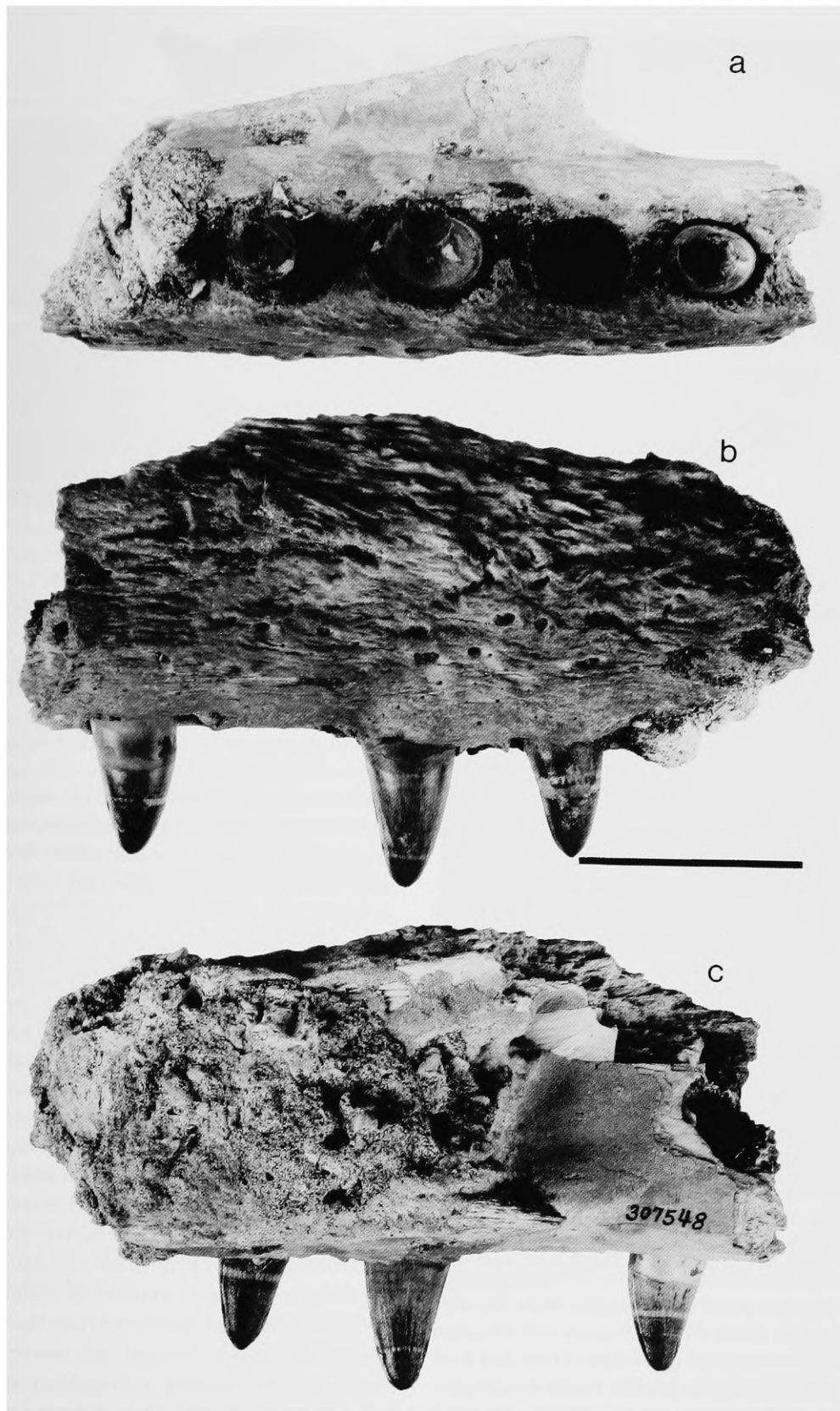


FIGURE 2.—Posterior fragment of right maxilla containing teeth of *Thecachampsa antiqua* from Lee Creek Mine, North Carolina, USNM 307548: *a*, dorsal view; *b*, lateral view; *c*, medial view. (Scale bar=5 cm.)

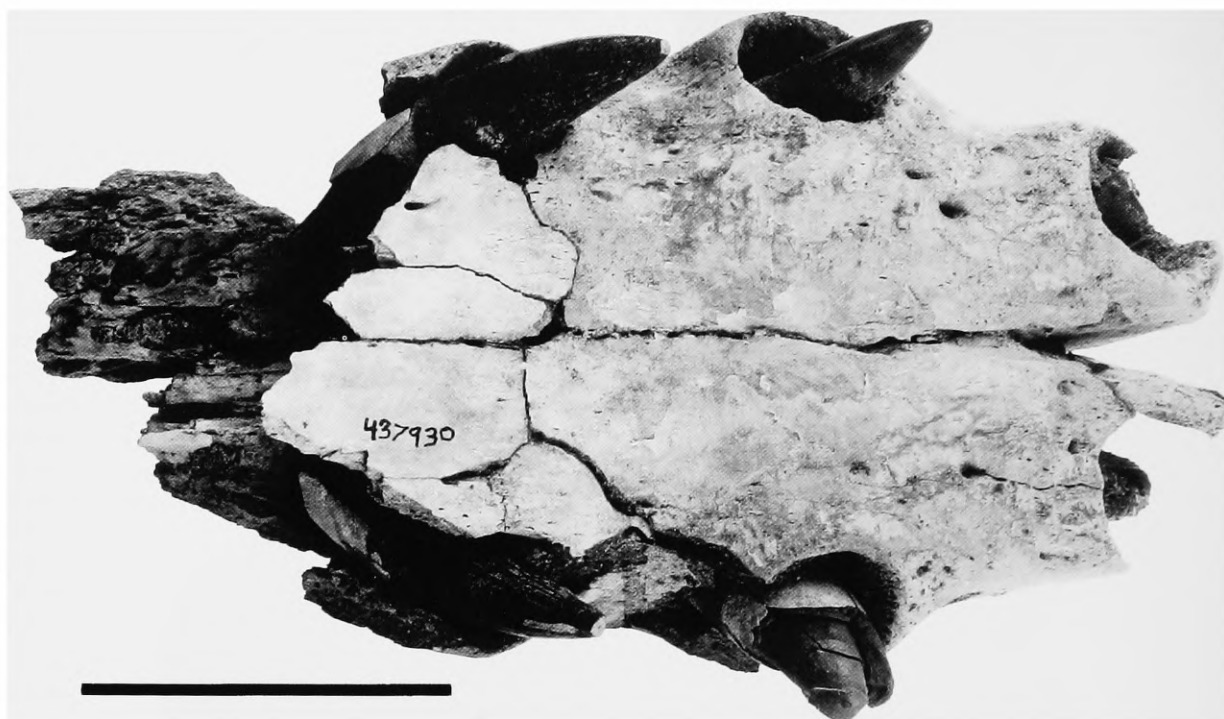


FIGURE 3.—Distal ends of mandibles of *Thecachampsia antiqua* from Lee Creek Mine, North Carolina, USNM 437930, dorsal view. (Scale bar = 5 cm.)

Portugal), I have not been able to identify consistent morphological differences. They all have long robust snouts that are gradually tapered from strongly built skulls (Figure 5b). Among other unifying features, they share the same or similar sutural patterns, bone proportions, tooth counts, and serial tooth diameter differentiation patterns.

### Taxonomy

Although this is not the place for a revision of the European and North American thoracosaurine crocodiles, the fossil skulls are distinctly different in generic features from the modern false gavial, *Tomistoma schlegelii* Müller, of south-east Asia. Several studies (Toula and Kail, 1885; Mook, 1921, 1924; Vianna and Moraes, 1945; Auffenberg, 1954) have carefully pointed out that the European and North American “tomistomines” of Miocene–Pliocene age represent a genus separate from *Tomistoma*. Modern workers who have accepted evidence for a separate genus have used the name *Gavialosuchus* to designate the more robust Miocene and Pliocene forms. The name *Gavialosuchus* dates from Toula and Kail (1885). Mook (1921) referred the Florida fossils to *Gavialosuchus*, but Antunes (1994) continues to use the more conservative name *Tomistoma lusitanica* (Vianna and Moraes) for the Portuguese fossils.

Until a partial skeleton with skull, teeth, and dermal scutes (USNM 25243; Figure 5) was collected from the Calvert Formation in Virginia, in the late 1960s, it was not possible to show that *Gavialosuchus americanus* and *Tomistoma lusitanica* were junior synonyms of Leidy’s species, based on the tooth characteristics, and that *Gavialosuchus* was a junior synonym of Cope’s genus *Thecachampsia*, in which taxon Cope included Leidy’s species *antiqua* in 1869.

From my own study of USNM 25243 and other Chesapeake Group specimens, however, it now seems apparent that the four species of *Thecachampsia* (*antiqua*, *sericodon*, *sicaria*, and *contusor*) recognized by Cope on the basis of differences in tooth shape should be naturally combined under one name by virtue of the variation in teeth exhibited along the tooth rows of *Thecachampsia antiqua* skulls. In addition, considering that there seem to be no important morphological differences between skulls of different nominal species, in my opinion there is no useful purpose in maintaining taxonomic distinctions between specimens from the Chesapeake Group, Florida, and Lisbon, Portugal (and presumably now from Lee Creek Mine and possibly from southern and Baja California). I therefore consider these taxa to be conspecific and propose the following taxonomic scheme, which follows Steel (1973) in part.



## CROCODYLIDAE

## THORACOSAURINAE

*Thecachampsia* Cope, 1867*Thecachampsia antiqua* (Leidy, 1852)*Crocodylus antiquus* Leidy, 1852*Thecachampsia sericodon* Cope, 1867*Thecachampsia contusor* Cope, 1867*Thecachampsia antiqua* (Leidy).—Cope, 1869*Thecachampsia sicaria* Cope, 1869*Tomistoma americana* Sellards, 1915*Gavialosuchus americana* (Sellards).—Mook, 1921*Gavialosuchus americanus* (Sellards).—Auffenberg, 1954*Gavialosuchus americanus* (Sellards) var. *lusitanica* Vianna and Moraes, 1945*Tomistoma lusitanica* (Vianna and Moraes).—Antunes, 1961**Paleozoogeography of *Thecachampsia antiqua***

The earliest known occurrences of this species in North America are from the Kirkwood Formation of New Jersey and the Calvert Formation of Maryland and Virginia (both late early to early middle Miocene, Gibson, 1983). This is probably a little later than the early Burdigalian appearance of the species in Portugal (Antunes, 1961; Benson, 1998).

A fragment of a right maxilla (USNM 307548) from the Pungo River Formation at Lee Creek Mine establishes a new southern record for eastern North America for *Thecachampsia antiqua* in the middle Miocene. Further, if some of the other specimens are from the Yorktown Formation at Lee Creek Mine, then these would establish the most northern extension in the early Pliocene. *Thecachampsia antiqua* remains have been collected from the St. Marys Formation (Chesapeake Group), but none have yet been reported in the Yorktown Formation (early Pliocene) in Virginia.

Although the species is well represented in the Bone Valley Gravel and Alachua formations in Florida (early Pliocene), it is surprising that there is no record of the species from the Hawthorn Formation (middle Miocene, Webb, pers. comm., 1967). These results may indicate that the *T. antiqua* populations were vacating Maryland-Virginia waters by the beginning of Yorktown deposition and may not have come to inhabit coastal areas of Florida in force until late in the Miocene.

The sparse remains that seem to place this or a related species on the southwestern coast of North America have been collected from Barstovian Age (Calvert equivalent?) marine deposits in California and deposits in Baja California of possible early Pliocene age (Barnes, pers. comm., 1988). The lack of crocodylians in otherwise abundantly rich fossiliferous marine and coastal deposits of late Miocene age is enigmatic. The problem is still under investigation.

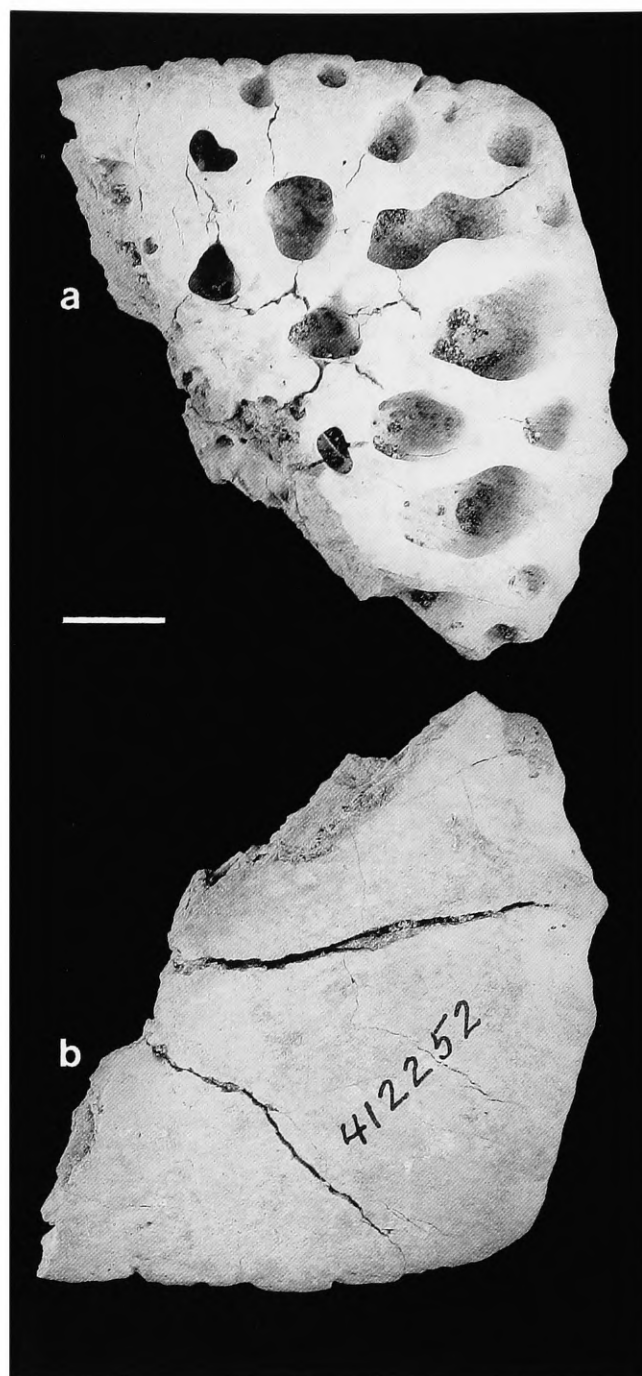


FIGURE 4.—Partial dorsal dermal scute of *Thecachampsia antiqua* from Lee Creek Mine, North Carolina, USNM 412252: a, dorsal view; b, ventral view. (Scale bar=1 cm.)

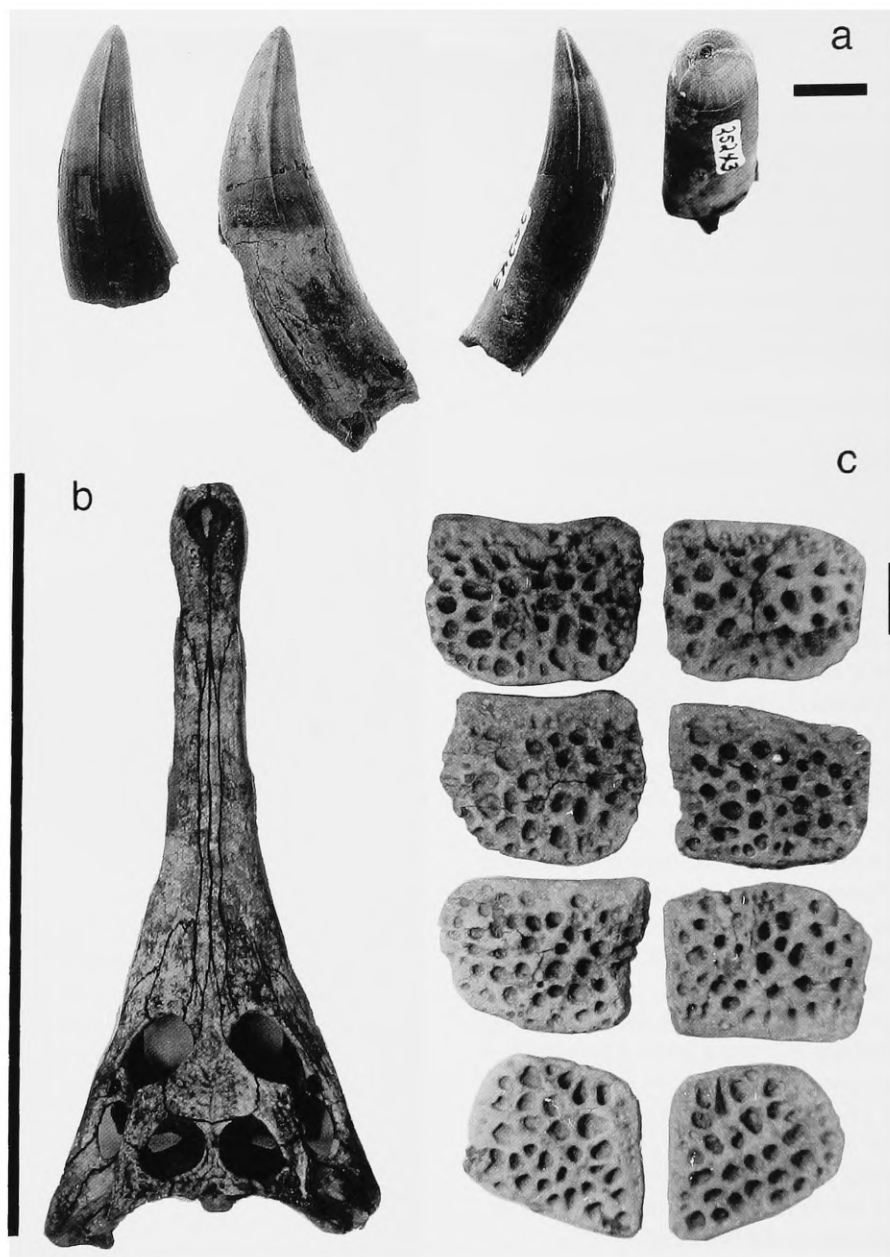


FIGURE 5.—Partial skeleton of *Thecachampsia antiqua* from the Calvert Formation of Virginia, USNM 25243: *a*, teeth (4) (scale bar=1 cm); *b*, skull, dorsal view (scale bar=1 m); *c*, dorsal dermal scutes (8), dorsal view (scale bar=3 cm).

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