

**BORODINOPRISTIS SCHWIMMERI, A NEW GANOPRISTINE SAWFISH
FROM THE UPPER BLUFFTOWN FORMATION (CAMPANIAN)
OF THE UPPER CRETACEOUS OF GEORGIA**

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ABSTRACT. A new and distinctive ganopristine sawfish rostral spine has recently been recovered from the upper Blufftown Formation (Campanian, Upper Cretaceous) at Hannahatchee Creek in Stewart County, Georgia. The spines are minute and have two or three specialized, "collared" barb-like appendages on the posterior border. Although these spines appear similar to *Ischyrhiza* (aside from the collared-barb feature), they probably have closer affinities with *Sclerorhynchus*. At present *Borodinopristis schwimmeri*, gen. et sp. nov., seems to be restricted to Mississippi and Georgia in the Atlantic and Gulf Coastal Plain Provinces.

INTRODUCTION

The most recent genus of the ganopristine sawfish group to be described is *Pucapristis* (Schaeffer, 1963) from the Upper Cretaceous of Bolivia. *P. branisi* Schaeffer (see Fig. 4e) is a rather large (averaging 7 cm in overall height), recurved rostral spine with a single barb on its posterior border. It has superficial similarities to the spines of *Onchosaurus* (see Fig. 4a) but is not necessarily related to that genus. The most recently described species of ganopristine rostral spines are *Ischyrhiza avoncola* Estes, 1964, and *Onchopristis dunklei* McNulty and Slaughter, 1962. The new genus and species *Borodinopristis schwimmeri*, based on a distinctive type of rostral spine, contributes one more addition to the ganopristine group, which also includes the genera *Ankistrorhynchus*, *Dalpiazia*, *Ischyrhiza*, *Marckgrafia*, *Onchopristis*, *Onchosaurus*, *Pucapristis*, *Schizorhiza*, and *Sclerorhynchus*.

GEOLOGY

The *Borodinopristis* material came from a 1-meter thick horizon of the uppermost few meters of the Blufftown Formation, in the lower Chattahoochee River Valley in west-central Georgia. This outcrop is located in Stewart County, mapped in the U.S.G.S. Union 7½-minute quadrangle. Con-

temporary fossiliferous Blufftown strata are exposed along a 1.5 km streamside outcrop at Hannahatchee Creek, at latitude 32° 8' 15" and ranging plus-or-minus 30" around longitude 84° 57' 40". The collecting site for the described specimens was the north creek bank, at approximate mean water level, longitude 84° 57' 58". Location maps and stratigraphic columns pertaining to this and similar outcrops are presented by Schwimmer (1981, 1986a, b).

The Blufftown Formation spans the entire Early Campanian interval in the study area (Sohl and Smith, 1981; Reinhardt, 1986), suggesting that the material under study is of mid-Campanian age. The strata enclosing the specimens are fine, micaceous, calcareous, silty sands, bedded in graded storm deposits. Partings between sequences of storm beds contain abundant shell hash composed of finely comminuted bivalve and *Lingula* shells and *Hamulus* tubes. This unit is designated Unit 3 in Schwimmer, 1986a. The upper Blufftown beds, in general, represent back-barrier marginal marine environments along a metastable shoreline. Unit 3 shows considerable evidence of storm activity, suggesting relatively low sea level and proximity to shoreline.

The vertebrate material in Unit 3 is relatively scanty. In addition to 4 rostral spines of *Borodinopristis schwimmeri*, 4.5 kg of sieved matrix yielded 3 oral teeth of *Ptychotrygon* sp., 1 oral tooth of *Lissodus* [*Lonchidion*] sp., a tooth of *Odontaspis* sp., and several skull and vertebral fragments from undetermined osteichthyans. Sieving was done with a #20 mesh screen.

An additional and noteworthy fossiliferous unit of the upper Blufftown Formation occurs 1.5 to 2 meters stratigraphically above Unit 3 and is exposed in the same stream banks and collecting sites. This overlying deposit (Unit 4 in Schwimmer, 1986a) is a residual phosphatic lag, comprising a

single erosional horizon and containing a diverse vertebrate and molluscan fauna. Fossil fish from this lag deposit are under study by D.R. Schwimmer and the author, and the fossil reptiles are under study by Schwimmer and D. Baird. The specimens from Unit 4 are evidently water-worn and concentrated by some form of current-transport depositional process, and the fauna is significantly more diverse than that of the *Borodinopristis*-bearing unit.

SYSTEMATIC PALEONTOLOGY

ORDER Batoidea
SUBORDER Ganopristinidea

FAMILY Sclerorhynchidae Cappetta, 1974
SUBFAMILY Ganopristinae Arambourg, 1940
Borodinopristis Case, gen. nov.

Type Species: *Borodinopristis schwimmeri*, sp. nov.

Diagnosis: Rostral spines minute, with two to three collared barbs on the posterior surface.

Etymology: The generic name honors Paul D. Borodin, who has faithfully assisted the author in collecting fossil specimens for a number of years. The specific name acknowledges the contributions of Dr. David R. Schwimmer.

Borodinopristis schwimmeri Case, sp. nov.

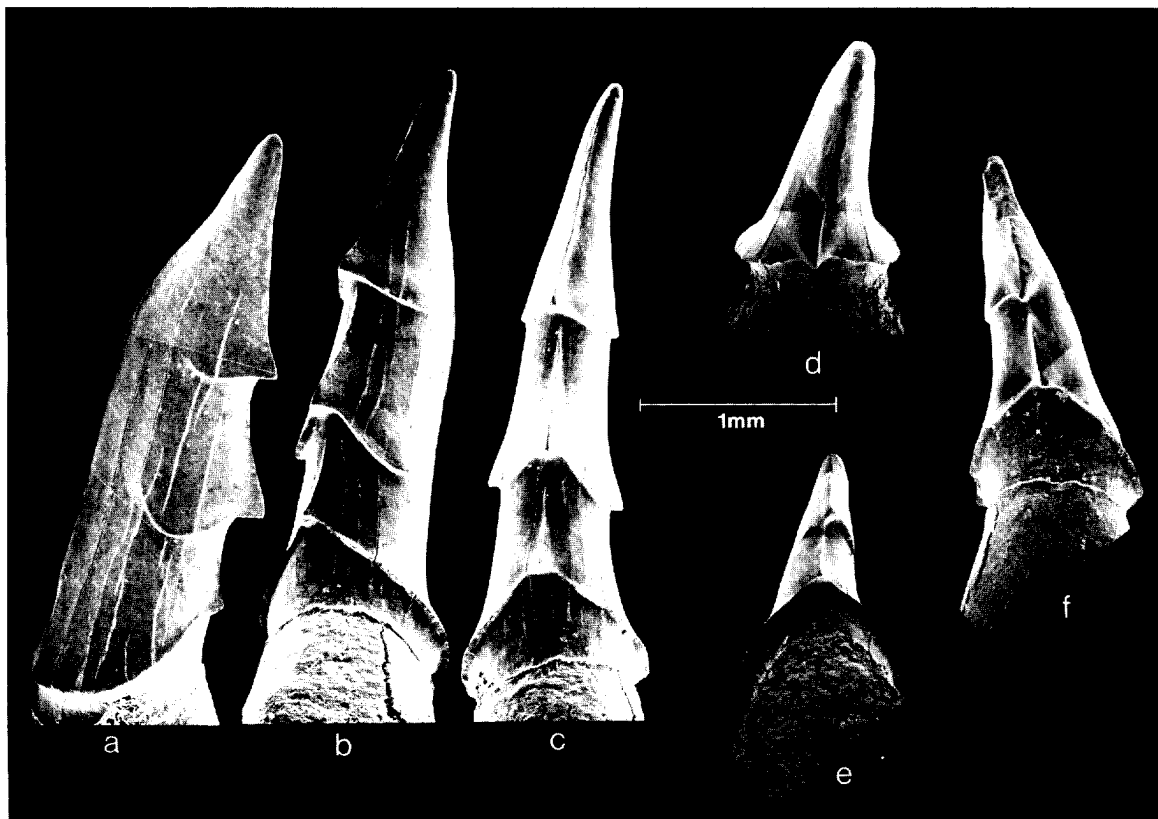


FIGURE 1a. AMNH12136 (Type). Lateral view of right side of crown of a complete specimen of rostral spine, showing the collared barbs. SEM (Composite pictures to make up the figure).

FIGURE 1b. AMNH12136 (Type). Three-quarter view showing part of the front and left lateral view of the spine's crown and its peculiar barb-like collars. SEM (Composite pictures to make up the figure).

FIGURE 1c. AMNH12136 (Type). Full frontal view of posterior edge of rostral spine showing the flaring collars. SEM (Composite pictures to make up the figure).

FIGURE 1d. AMNH12137 (Paratype 1). Full frontal view of a partial rostral spine (missing upper portion with one collared barb). SEM (Composite pictures to make up the figure).

FIGURE 1e. AMNH12137 (Paratype 1). Full frontal view tilted backwards to show the true nature of the collars. SEM (Composite pictures to make up the figure).

FIGURE 1f. AMNH12138 (Paratype 2). Full frontal view slightly tilted back to show the collared barbs. Specimen is also fragmented (missing upper portion with one collared barb). SEM (Composite pictures to make up the figure).

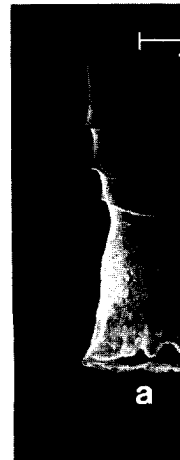


FIGURE 2a. AMNH12136 (Type). Entire rostral spine (lateral view).

FIGURE 2b. AMNH12136 (Type). Entire spine (frontal view).

FIGURE 2c. AMNH12136 (Type). Anterior aspect of the rostral spine.



FIGURE 2d. AMNH12137 (Paratype 1). Entire rostral spine (incomplete) (lateral view).

FIGURE 2e. AMNH12137 (Paratype 1). Entire rostral spine (incomplete) (frontal view).

FIGURE 2f. AMNH12138 (Paratype 2). Entire rostral spine (incomplete) (lateral view).

Diagnosis: As for *Borodinopristis*.
Material: The type specimen (AMNH 12136), complete rostral spine (AMNH 12137), rostral spine (AMNH 12138), rostral spine (AMNH 12139-12140).

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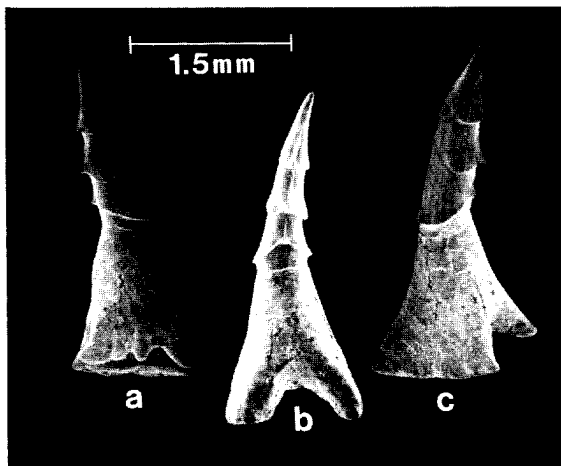


FIGURE 2a. AMNH12136 (Type). An overall view of the entire rostral spine (left lateral aspect). SEM.

FIGURE 2b. AMNH12136 (Type). An overall view of the entire spine (frontal view of the posterior edge). SEM.

FIGURE 2c. AMNH12136 (Type). Overall view of the right aspect of the rostral spine. SEM.

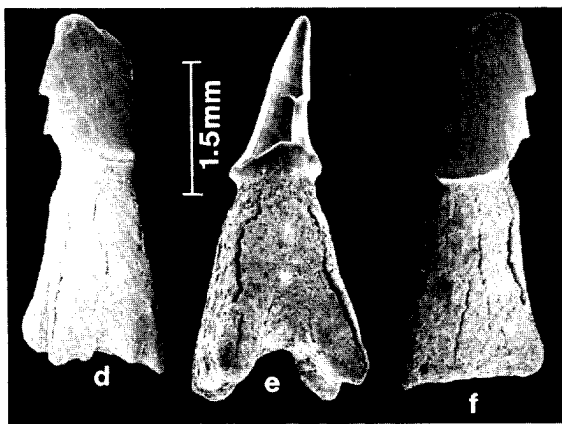


FIGURE 2d. AMNH12137 (Paratype 1). Overall view of entire (incomplete) rostral spine, left lateral aspect. SEM.

FIGURE 2e. AMNH12137 (Paratype 1). Overall view of entire (incomplete) rostral spine, frontal aspect of the posterior edge. SEM.

FIGURE 2f. AMNH12137 (Paratype 1). Overall view of entire (incomplete) rostral spine, right lateral aspect. SEM.

Diagnosis: As for the monotypic genus.

Material: The holotype (AMNH 12136), a complete rostral spine; two paratypes (AMNH 12137-12138), rostral spines missing small portions of their crown enamel. Two oral teeth (AMNH 12139-12140) are also referred.

Formation and age: Unit 3 of the upper Blufftown Formation, Late Cretaceous (Campanian).

Locality: North bank of Hannahatchee Creek in Stewart County, Georgia.

Description. The holotype spine (Figs. 1a-c, 2a-c, 3a, 4g) has three collared areas giving a superficial appearance of barbs along its posterior margin. These so-called barbs are in fact a series of "growth shoulders" (for lack of a better term) and are not typical barbs such as those on the rostral spine margins of such ganopristines as *Onchopristsis* (Fig. 4d), *Onchosaurus* (Fig. 4a), and *Sclerorhynchus* (Fig. 4b). Spines of the latter genera have sharply defined barbs or hooks, with no collaring or extensions onto the lateral surfaces of the spine such as are found in *Borodinopristsis schwimmeri* (see Figs. 1a-c and 4g).

The only similarity to this collaring effect is seen in *Pucapristis branisi* (Fig. 4e), although in that form there is no actual flaring collar but rather a radiation of multiple striae toward the base or root of the spine. The condition in *P. branisi* is reminiscent of the crown of a cephalic hook of the shark *Hybodus* (Fig. 4f; Case, 1978). As the comparative illustration shows, neither *Pucapristis* nor *Hybodus* can compare exactly with the collared-barb configuration seen in *Borodinopristsis schwimmeri*.

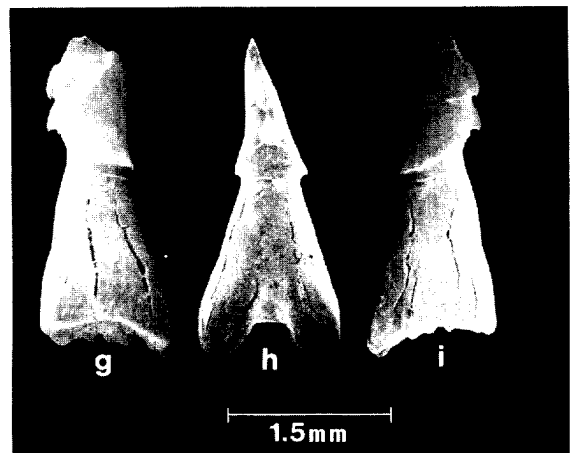


FIGURE 2g. AMNH12138 (Paratype 2). Overall view of entire (incomplete) rostral spine, left lateral aspect. SEM.

FIGURE 2h. AMNH12138 (Paratype 2). Overall view of entire (incomplete) rostral spine, frontal aspect of posterior edge. SEM.

FIGURE 2i. AMNH12138 (Paratype 2). Overall view of entire (incomplete) rostral spine, right lateral aspect. SEM.

Measurements of the holotype spine (AMNH 12136) are as follows:

- Length of crown (blade) 1.5 mm
- Length of root (base) 1.5 mm
- Width of crown 0.3 mm
- Overall length of spine 3 mm

The two paratype spines (AMNH 12137 and 12138; Figures 1d-f, 2d-i, 3b-c), are missing the tips of their crowns, including the uppermost collared

barb. Thus measurements cannot be made, but these specimens are essentially the same size as the type specimen.

Although the rostral spines of *Borodinopristis schwimmeri* appear superficially similar to those of *Onchopristis* (see Fig. 4d; also Stromer, 1917; Dunkle, 1948; McNulty and Slaughter, 1962; Case, 1965; Slaughter and Steiner, 1968) they differ significantly. The rostral spines of *Onchopris-*

tis have distinct *Borodinopristis* (*Pucapristis*).

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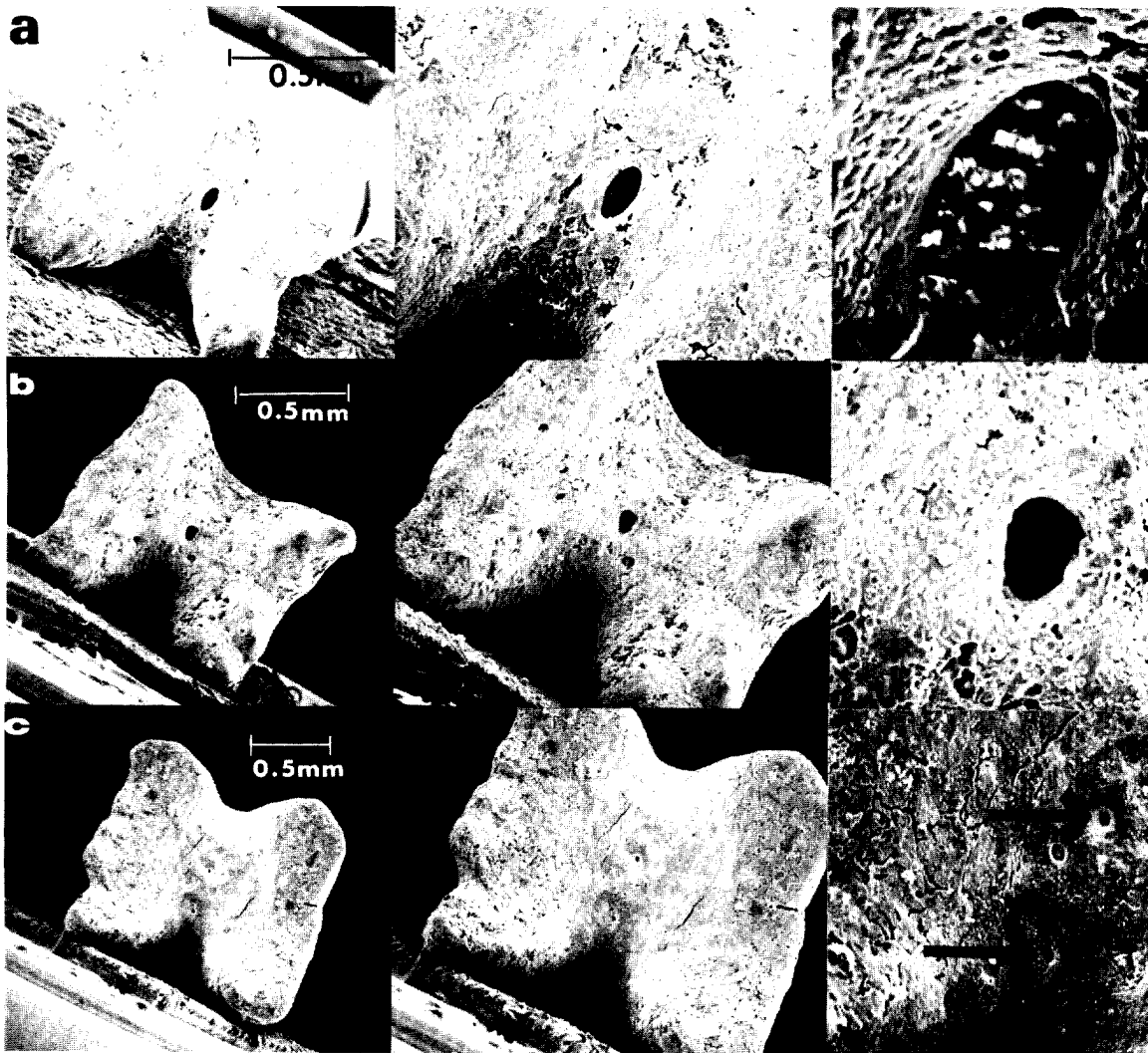


FIGURE 3a. AMNH12136 (Type). A series of 3 views of the basal aspect of the root of the rostral spine showing position of the blood vessel entry foramin. SEM.

FIGURE 3b. AMNH12137 (Paratype 1). Series of 3 views of the basal aspect of the spine's root showing entry foramin of blood vessel. SEM.

FIGURE 3c. AMNH12138 (Paratype 2). 3 views of the basal aspect of the spine's root showing two entry foramina (see arrows in last view) which may indicate entrance holes for both the blood vessel (nutrition) and the nerve sheathing. SEM. Note: The second and third views of each of the above figures are progressively larger magnifications and are 40 X and 120 X respectively from the scale of the first figure picture to the left.



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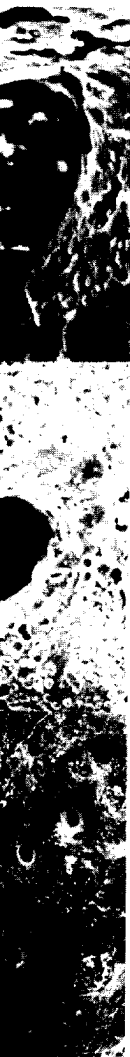
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tis have distinct barbs with no flaring collars (as in *Borodinopristis*) or radiating striae (as in *Pucapristis*). It appears that *Borodinopristis schwimmeri* is a distinctly new type of ganopristine sawfish rostral spine, and that its closest relationships are with *Sclerorhynchus*.

In his unpublished doctoral thesis, Meyer (1974, pp. 105, 109–110, Fig. 29c) figured and tentatively described what he called “?*Sclerorhynchus* sp. 2.” He believed these rostral spines with asymmetrical barbs to be related to the sclerorhynchids on the basis of their root configuration, but he did acknowledge them to be probably a new species. He found these unique and previously-undescribed spines are “contemporary with, but seldom associated with, *Sclerorhynchus atavus*,” and further observed that “the lack of association with *S. atavus* indicates that ?*S.* sp. 2 is not a positional variant of the former.”

Meyer’s Figure 29c shows a rostral spine in both left lateral and posterior aspects. Although the specimen seems to be slightly worn or abraded, one can readily see the collared barbs on the posterior margin. Their appearance is asymmetrical, whereas

in the Blufftown Formation material the collaring is symmetrical and clearly defined. This irregularity in Meyer’s specimen is believed to be merely an aberration or anomaly, perhaps caused by crowding of the spines along the border of the rostrum.

The author has recovered specimens quite similar to Meyer’s from the so-called “Eutaw” Formation of Georgia. Until additional specimens are recovered, however, it remains uncertain whether these spines represent *B. schwimmeri* or an undescribed species of *Borodinopristis*.

To summarize these occurrences: *Borodinopristis* occurs in the Tombigbee Sand Member of the Eutaw Formation (Late Santonian) at Newbern, Mississippi; in the Tupelo Tongue of the Coffee Sand (Campanian) near Tupelo, Mississippi (Meyer, 1974); in the upper Blufftown Formation (Campanian) in Stewart County, Georgia, and in the “Eutaw” Formation in Chattahoochee County, Georgia. The latter occurrence has been assigned a Middle Santonian age (Sohl and Smith, 1981; Christopher, 1982) but the fish fauna appears to me to be much younger, possibly of Campanian age.

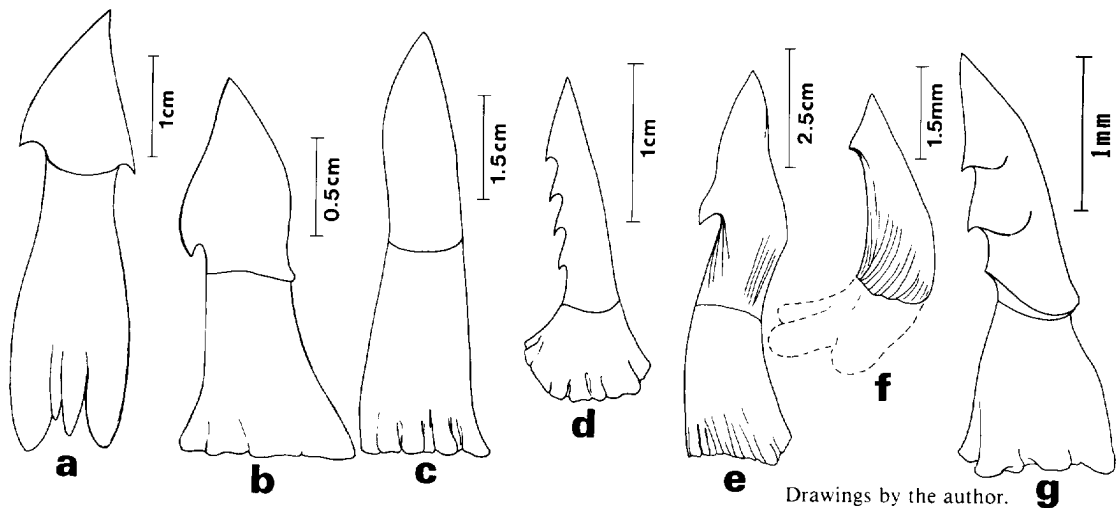


FIGURE 4a. Schematic drawing of the left lateral profile of the rostral spine of *Onchosaurus* (for comparison).

FIGURE 4b. Schematic drawing of the left lateral profile of the rostral spine of *Sclerorhynchus* (for comparison).

FIGURE 4c. Schematic drawing of the left lateral profile of the rostral spine of *Ischyrrhiza* (for comparison).

FIGURE 4d. Schematic drawing of the left lateral profile of the rostral spine of *Onchopristis* (for comparison).

FIGURE 4e. Schematic drawing of the left lateral profile of the rostral spine of *Pucapristis* (for comparison).

FIGURE 4f. Schematic drawing of the lateral profile of a cephalic hook of the shark, *Hybodus*. Dashed lines indicate a missing bony platform (not drawn to scale) which rests on the skull, just above the shark’s eyes (for comparison).

FIGURE 4g. Schematic drawing of the left lateral profile of the rostral spine of *Borodinopristis schwimmeri* nov. gen. and nov. sp.

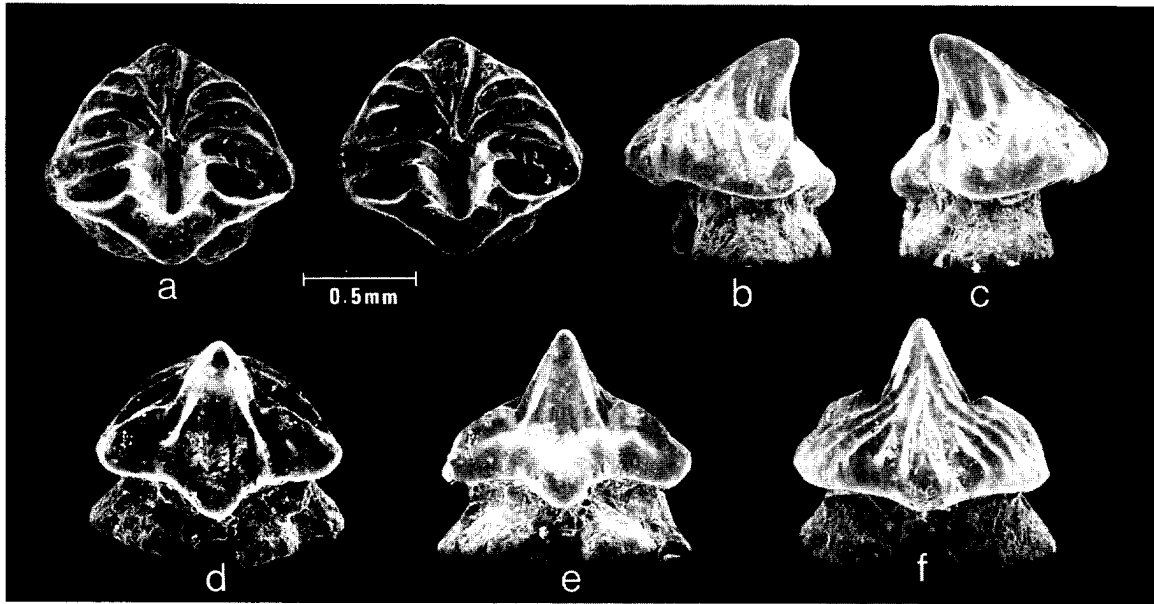


FIGURE 5a. AMNH12139 (Referred specimen 1). An occlusal view of an oral tooth of *Borodinopristis schwimmeri* nov. gen. and nov. sp., anterior position in the jaw. A stereo pair. SEM.

FIGURE 5b. AMNH12139. The same tooth in right profile view. SEM.

FIGURE 5c. AMNH12139. The same tooth in left profile view. SEM.

FIGURE 5d. AMNH12139. The same tooth in lingual-occlusal view. SEM.

FIGURE 5e. AMNH12139. The same tooth in lingual aspect. SEM.

FIGURE 5f. AMNH12139. The same tooth in labial aspect. SEM.

ORAL TEETH OF *BORODINOPRISTIS*

Two oral teeth (AMNH 12139–12140, Figs. 5a–f, 6a–b, from the Hannahatchee Creek locality appear to belong to *Borodinopristis schwimmeri*. They are of microscopic size: the anterior tooth (AMNH 12139) is less than 1 mm in maximum width while the anterior-lateral tooth (AMNH 12140) measures exactly 1 mm. These teeth are typically sclerorhynchid in design, with strong radiating sculpture on the occlusal aspect (cf. the stereo pair, Fig. 5a and Figs. 6a and 6b). They differ from *Sclerorhynchus* oral teeth in having a high central cusp on the crown, with vestigial side cusps formed by the first crenulated ridge (Figs. 5e and f). These side cusps show up well in the profile views of both specimens (Figures 5b–c and 6c–d). The root is typically ganopristinid, similar to those found in *Sclerorhynchus* and *Ischyrrhiza*, among others.

Discussion. The oral teeth here assigned to *Borodinopristis schwimmeri* fit well into the Sclerorhynchidae; they agree with *Sclerorhynchus* in such

features as the crown ornamentation but differ from that genus in their cusp height. Their physical association with the rostral spines described above as *Borodinopristis schwimmeri* makes their assignment to that species highly probable. As referred specimens, however, they are formally excluded from the type series.

GANOPRISTINE SAWFISHES: A BRIEF SURVEY

Arambourg (1940) figured a number of rostral spines (he called them rostral teeth) from various formations on the African continent. Among these were: *Onchosaurus pharao* from Niger, *Onchopristis numidus* from Egypt, *Marckgrafia* from Egypt, *Dalpiazia* from Tripolitania, and *Schizorhiza* cf. *S. weileri*, *Ganopristis leptodon*, and *Ctenopristis nougareti* from Morocco. *Ganopristis* has since been relegated to synonymy with *Sclerorhynchus* (Cappetta, 1974), and the genera *Marckgrafia* and *Dalpiazia* are currently in question; *Dal-*



FIGURE 6a. AMNH12139. Anterior view of an oral tooth of *Borodinopristis schwimmeri* nov. gen. and nov. sp., SEM.

FIGURE 6b. AMNH12139. Occlusal view. SEM.

FIGURE 6c. AMNH12139. Lingual view. SEM.

FIGURE 6d. AMNH12139. Lingual-occlusal view. SEM.

piazia in particular with *Onchosaurus*.

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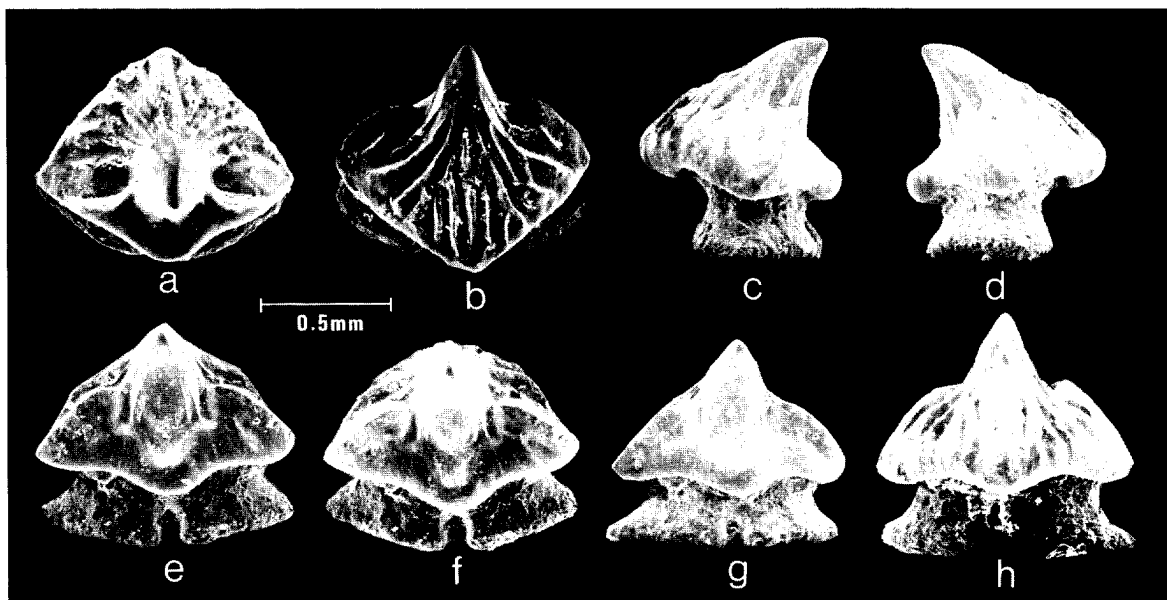


FIGURE 6a. AMNH12140 (Referred specimen 2). An occlusal view of an oral tooth of *Borodinopristsis schwimmeri* nov. gen. and nov. sp., antero-lateral position in the jaw. SEM.

FIGURE 6b. AMNH12140. The same tooth in another occlusal view. SEM.

FIGURE 6c. AMNH12140. The same tooth in right profile view. SEM.

FIGURE 6d. AMNH12140. The same tooth in left profile view. SEM.

FIGURE 6e. AMNH12140. The same tooth in lingual-occlusal view. SEM.

FIGURE 6f. AMNH12140. The same tooth in another lingual-occlusal view. SEM.

FIGURE 6g. AMNH12140. The same tooth in lingual aspect. SEM.

FIGURE 6h. AMNH12140. The same tooth in labial aspect. SEM.

piazia in particular seems to have a closer affinity with *Onchosaurus*.

Three of these Old World ganopristines have shown up in the New World: *Onchosaurus* cf. *O. radicalis* from the Turonian of Ecuador (Dunkle, 1951); *Schizorhiza* cf. *S. weileri* from the Escondido Formation of Texas (Dunkle, 1948); and *Sclerorhynchus atavus* from the Ozona Member (Campanian) of the Taylor Formation of Texas (Slaughter and Steiner, 1968). Slaughter and Springer (1968) discuss *Sclerorhynchus* rostral tooth replacement in comparison with that of the saw-shark, *Pristiophorus*.

Dunkle's (1948) "*Onchopristsis* cf. *O. numidus*" from the Woodbine Formation (Cenomanian) of Texas is not, however, a valid occurrence of an Old World ganopristine in the New World. McNulty and Slaughter (1962) have pointed out that the lack of a complete crown leaves the possibility that other barbs were present on Dunkle's specimen. They

accordingly erected a new species, *Onchopristsis dunklei*, based upon new and much more complete spines (with additional barbs) from the same formation. Case (1965) reported a second occurrence for *O. dunklei*, in the Coleraine Formation (Cenomanian) of Minnesota.

Thurmond (1971, p. 224) erected a new subspecies, *Onchopristsis dunklei praecursor*, from the Lower Albian of Texas. This action was unjustified, as paleontological subspecies are in disfavor, particularly when based upon scrappy material. Thurmond's specimen, a rostral spine lacking part of the crown, is probably just *O. dunklei*. Furthermore, Thurmond's conjecture that his *Hypolophus mcultyi* material might be the oral teeth of *Onchopristsis* is untenable, since the genus *Hypolophus* (renamed *Pseudohypolophus* by Capetta and Case, 1975a) is in fact a ray and not a sawfish. Keyes (1977) has applied Thurmond's subspecies name to material from Late Cretaceous

rocks in New Zealand, but what he has would appear to be a valid new species.

The genus *Ischyrrhiza* (Fig. 4c) appears to be restricted to the New World. North American occurrences are too numerous even to list here, but see, e.g., Cappetta and Case (1975b); Case (1978 and 1979); and McNulty and Slaughter (1964). In most formations where the oral teeth and rostral spines of *Ischyrrhiza mira* are found, the minute rostral denticles or spines of *Ischyrrhiza avonicola* Estes (1964) occur in association with them.

ACKNOWLEDGEMENTS

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