

A NEW SPECIES OF SPHENACANTHID (CHONDRICHTHYES, ELASMOBRANCHII) FROM THE RIO DO RASTO FORMATION (PARANÁ BASIN), SOUTHERN BRAZIL

VICTOR EDUARDO PAULIV

Programa de Pós-Graduação em Geociências, Instituto de Geociências, UFRGS, Campus do Vale,
91501-970, Cx.P. 15001, Porto Alegre, RS, Brasil. *vpauliv@gmail.com*

ELISEU VIEIRA DIAS

Laboratório de Geologia e Paleontologia, Centro de Ciências Biológicas e da Saúde, UNIOESTE, Rua Universitária 2069,
85819-110, Cascavel, PR, Brasil. *eliseu.dias@unioeste.br*

FERNANDO ANTONIO SEDOR

Museu de Ciências Naturais, Setor de Ciências Biológicas, UFPR, Centro Politécnico, Jardim das Américas,
81531-990, Cx.P. 19031, Curitiba, PR, Brasil. *sedor@ufpr.br*

ABSTRACT – The chondrichthyan skeletal structures with the greatest potential for fossilization are teeth, scales, fin and cephalic spines. In the Rio do Rasto Formation, the Chondrichthyes are represented by finspines and teeth attributed to sphenacanthids, hybodontids and xenacanthids. Herein is presented new finspines collected from an outcrop of the Serrinha Member of the Rio do Rasto Formation, in the Municipality of Jacarezinho, Paraná State. The studied material consists of two finspines that are gradually tapered distally, with convex anterior and lateral faces. The posterior proximal face is strongly concave forming a furrow; absence of pronounced median ridge in the posterior distal face; the lateral faces have non-pectinated ribs separated by intercostal grooves, some of them bifurcated and beaded with rows of rounded closely spaced tubercles are the features that allow the finspines to be ascribed to a new species of Sphenacanthidae.

Key words: Permian, Guadalupian, Paraná Basin, Sphenacanthidae, finspines.

RESUMO – As estruturas com maior possibilidade de fossilização do esqueleto dos Chondrichthyes são aquelas mais mineralizadas, tais como dentes, escamas, espinhos cefálicos e de nadadeiras. Na Formação Rio do Rasto, os Chondrichthyes estão representados predominantemente por dentes e espinhos de nadadeiras e dentes atribuídos a esfenacantídeos, hibodontídeos e xenacantídeos. Aqui são apresentados novos espécimes de espinhos coletados em um afloramento do Membro Serrinha da Formação Rio do Rasto no Município de Jacarezinho, Estado do Paraná. O material corresponde a dois espinhos de nadadeiras, que gradualmente se reduzem distalmente, com as faces, anterior e lateral, convexas. A face proximal fortemente côncava formando um sulco; face distal posterior não apresentando crista mediana pronunciada, faces laterais com costelas não pectinadas, separadas por sulcos intercostais, sendo algumas delas bifurcadas, com tubérculos pequenos e pouco espaçados são as características que permitem que os espinhos estudados sejam atribuídos a uma nova espécie de Sphenacanthidae.

Palavras chave: Permiano, Guadalupiano, bacia do Paraná, Sphenacanthidae, espinhos de nadadeira.

INTRODUCTION

The chondrichthyans from the Paleozoic are mainly known from teeth, scales, cephalic spines and finspines, as complete specimens are rare. In the Permian of Brazil, finspines occur in the Parnaíba Basin, Pedra de Fogo Formation (Richter, 1985, 2001, 2008; Alves *et al.*, 2008, 2009a,b; Alves, 2010) and in the Paraná Basin in the Rio Bonito (Silva-Santos, 1947), Tatui/Irati (Chahud *et al.*, 2010), Estrada Nova (Würdig-Macieli, 1975) and Rio do Rasto formations (Sedor *et al.*, 2009; Pauliv *et al.*, 2010a,b).

Gordon Jr. (1947) divided the Rio do Rasto Formation into two members: the Serrinha (lower) and the Morro Pelado (upper). This formation is considered to be of Permian age, spanning from the Wordian to Wuchiapingian (Holz *et al.*, 2010).

The Serrinha Member has some different interpretations; however, most of them propose a shallow lacustrine environment (*e.g.* Mendes, 1967). To Schneider *et al.* (1974) this unit is the result of progradational advances of clastics from coastal plain over tidal plains deposits, which characterize the transition from shallow water bodies of the Terezina Formation to continental deposits of the Morro

Pelado Member. According to Lavina (1991), the sedimentary rocks of the Serrinha Member were deposited in lacustrine and deltaic environments, with a predominance of large lakes influenced by storm waves. Recently, Holz *et al.* (2010) considered the Serrinha Member as deposited in shallow lakes, sometimes influenced by storm waves and fluvial incursions.

The sedimentary rocks of Morro Pelado Member were deposited in smaller lakes, alluvial plains, fluvial meandering streams and delta systems with interdistributary bays, as well as in small temporary water bodies (Lavina, 1991; Holz *et al.*, 2010). The rocks of the Morro Pelado Member were covered by aeolian sandstones, as indicated by the presence of dunes in the Piramboia Formation. The faunistic and floristic record in the Rio do Rasto Formation supports this paleoenvironmental interpretation.

The flora is diversified and the most common genera are *Schizoneura* Schimpmer & Mougeol, 1844, *Paracalamites* Zalessky, 1927, *Glossopteris* Brongniart, 1828 and *Pecopteris* Sternberg, 1825; there is also a palinologic record (*e.g.* Mendes, 1967; Rohn *et al.*, 1997; Rohn & Rösler, 2000; Neregato *et al.*, 2008). The invertebrates are mainly represented by bivalve mollusks, ostracodes and conchostracan crustaceans (*e.g.* Mendes, 1954; Ferreira-Oliveira & Rohn, 2008; 2009). The presence of conchostracans suggests freshwater conditions for the depositional environment for the whole of the Rio do Rasto Formation (Holz *et al.*, 2010). The vertebrates are also diversified and represented by fishes, amphibians, reptiles and ichnofossils (Dias, 2012).

The occurrence of two Sphenacanthidae from the Serrinha Member of Rio do Rasto Formation (Paraná State) reported by Pauliv *et al.* (2010a,b), which are detailed in this paper with the erecting of a new species for this unit. Knowledge about the chondrichthyan diversity may contribute to the comprehension of some paleoenvironmental and paleobiogeographical aspects.

MATERIAL AND METHODS

The studied material comprises two finspines collected from an outcrop of the Serrinha Member of Rio do Rasto Formation in the northeastern region of Paraná State, Jacarezinho Municipality, near km 20, west margin of road BR-

153, coordinates 23°10'08.40"S, 49°57'49.48"W (Figure 1).

The material is housed in the paleontological collections of the Museu de Ciências Naturais, Setor de Ciências Biológicas, Universidade Federal do Paraná under the numbers MCN.P.440 and MCN.P.703. The first specimen was collected in association with some isolated actinopterygian scales and with a xenacanthiform shark tooth (Pauliv *et al.*, 2010b).

The specimens were prepared by mechanical techniques with steel tips, under a stereomicroscope following the usual methodology for small vertebrate fossils (*e.g.* Camp & Hanna, 1937; Santos, 1985; Leiggi & May, 1994). The samples were impregnated with polystyrene dissolved in xylol to increase the fossil resistance, and were photographed with a Sony DSC H-7 8.1 megapixels digital camera and with an Olympus SZX9 stereomicroscope at the Laboratório de Microtécnica of the Universidade Positivo. Finally, the taxonomic determination of the specimens was mainly based on the revised diagnosis proposed by Maisey (1981, 1982) for some Paleozoic genera. The material used for comparison were: *Ctenacanthus gondwanus* Silva-Santos, 1947 (DGM 73-P, holotype of the species) and *C. maranhensis* Silva-Santos, 1946 (DGM 470-P, a series of fragments of finspines). **Institutional abbreviations:** DGM, Divisão de Mineralogia e Geologia; DNPM, Departamento Nacional de Produção Mineral; MCN, Museu de Ciências Naturais; UFPR, Universidade Federal do Paraná.

SYSTEMATIC PALEONTOLOGY

Class CHONDRICHTHYES Huxley, 1880

Subclass ELASMOBRANCHII Bonaparte, 1838

Infraclass EUSELACHII Hay, 1902 (*sensu* Ginter *et al.*, 2010)

Family SPHENACANTHIDAE Maisey, 1982

Sphenacanthus Agassiz, 1837 (*sensu* Maisey, 1982)

Type species. *Sphenacanthus serrulatus* Agassiz, 1837.

Sphenacanthus riorastoensis sp. nov.
(Figures 2-3)

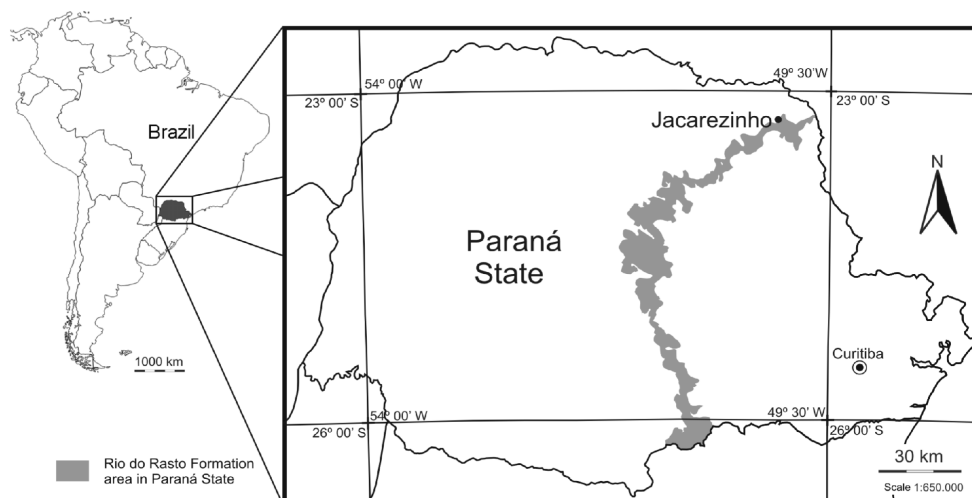


Figure 1. Distribution of the Rio do Rasto Formation in the Paraná State with the location of the collecting site in the Municipality of Jacarezinho (modified from Mineropar, 2006).

Etymology. Referring to the Rio do Rasto Formation.

Holotype. MCN.P.440, one incomplete finspine lacking part of the proximal and most distal extremities (Figure 2).

Paratype. MCN.P.703 corresponds to the median distal portion of a finspine with both extremities missing (Figure 3).

Type locality and horizon. Serrinha Member of the Rio do Rasto Formation (Wordian to Wuchiapingian following Holz *et al.* 2010), Passa Dois Group, Municipality of Jacarezinho, northeastern region of Paraná State, Southeastern Brazil.

Diagnosis. Chondrichthyan only known from finspines that present a gradually tapered distal portion; convex lateral face forming a narrow edge anteriorly with a single and smooth longitudinal rib; isosceles triangle-shaped in transverse section; posterior face with a deep concavity proximally and slightly concave distally, limited by posterolateral ribs with tubercles; twice as deep as broad cross-section; presence of prominent parallel ribs, which are separated by intercostal grooves as wide as or slightly smaller than the ribs' width; ribs branching irregularly in the posterior portion of the finspine; ribs beaded with rows of rounded drop-like tubercles, the diameters of which are bigger than the ribs' width; larger tubercles in the proximal portion of the finspine and the spacing of the tubercles is smaller than the tubercles' size.

Description. The maximum dimensions of specimen MCN.P.440 are 104 mm along its proximal-distal axis and 23 mm anteroposteriorly. Specimen MCN.P.703 is 16 mm in length along its proximal-distal axis while the anteroposterior axis is 9 mm proximally and 5 mm distally. The finspines of *Sphenacanthus riorastoensis* sp. nov. are laterally compressed, almost twice as deep as broad in transverse section, and present a convex lateral surface forming a narrow anterior edge that gradually tapers distally. In the proximal third of the finspine there is an oblique line slightly sigmoid in shape, which limits the intramuscular portion from the external body portion of the spine (Figure 2A). This proximal portion has only fine striations, while the external portion shows ribs and tubercles. In specimen MCN.P.440, this external portion is 93 mm in length anteriorly and 75 mm posteriorly (Figure 2A). The entire external portion of the finspines present parallel ribs (costae), and these ribs are beaded with closely spaced rows of rounded drop-like tubercles. The distance between the tubercles is equal to the tubercle size or, rarely, shorter, as seen on the proximal portion (Figures 2A-C), and slightly shorter than the tubercle size on their distal portions (Figures 3A-B). Among these ribs there are furrows (intercostal grooves), which are smooth and as wide as the ribs' width or slightly smaller. These ribs may branch on the proximal portion as seen in MCN.P.440 (Figure 2C) and also on the distal third as seen in MCN.P.703 (Figures 3A,B). Moreover, the tubercles of the proximal region are larger, presenting a gradual reduction in diameter along the spine and becoming more numerous distally. The anterior edge has a single narrow and smooth longitudinal rib, with only one visible tubercle on specimen MCN.P.703 (Figure 3C). In transversal cross-section the specimen shows a sub-circular median cavity (pulpal cavity) surrounded by a spongy region (Figures 3D,E), similar to that described by Maisey (1982) as trabecular dentine. The

proximal portion of the finspine presents on its posterior face a deep concavity forming a posterior furrow with rounded edges, as seen in basal view (Figure 2B). On its median region, this posterior furrow becomes shallow and probably the lateral edges join forming the pulpar cavity (Figure 3E). From the medial region to the apical portion the posterior face presents a slight concavity formed by posterolateral ribs with tubercles, one on each edge (Figures 3D-F). A pronounced posterior median ridge or convexity is absent, but shallow and short discontinuous furrows are present. Thus, from the medial to the apical region, the finspine has a subtriangular cross-section (Figures 3D-E).

COMPARISON AND DISCUSSION

For many years due to the similarity between the finspines of *Sphenacanthus* and *Ctenacanthus* Agassiz, 1837 these genera were considered as synonyms (Maisey, 1982) and *Sphenacanthus* placed in the Ctenacanthiformes (*e.g.* Zangerl, 1981). However, the discovery of more complete specimens of *Sphenacanthus* with association of finspines and teeth (*e.g.* Soler-Gijón, 1997; Dick, 1998; Krätschmer & Forst, 2005), allowed changes in the systematic determination of the family Sphenacanthidae. Soler-Gijón (1997) and Ginter *et al.* (2010) reallocated this family to *incertae sedis* in the Cohort Euselachii based on the similarity between the teeth of sphenacanthids and the teeth of the basal hybodontid *Trystichius* Portlock, 1843, and also demonstrated that they deeply diverge from the Ctenacanthiformes in tooth morphology. Thus, in modern systematics (based on tooth morphology) the *Sphenacanthus* belongs in the Euselachii while the Ctenacanthiformes are in the superorder Cladodontomorphi (Ginter *et al.*, 2010).

Here is presented a comparison between the studied finspines (MCN.P.440 and MCN.P.703) based on the diagnosis revised by Maisey (1981, 1982) for the following Paleozoic genera: *Ctenacanthus*; *Amelacanthus* Maisey, 1982; *Bythiacanthus* St. John & Worthen, 1875; *Eunemacanthus* St. John & Worthen; *Wodnika* Münster, 1843 and *Sphenacanthus*.

Ctenacanthus was first described by Agassiz (1837) based only on isolated finspines. Agassiz himself and other authors added many species based on finspines without a clear diagnosis, making the systematics of the group confuse (Maisey 1981, 1982). *Ctenacanthus* was restricted by Maisey (1981) to finspines with a similar ornamental pattern to that present in the type species *C. major* Agassiz, 1837. Comparing specimens MCN.P.440 and MCN.P.703 with the revised diagnosis of Maisey (1981), these are distinguished from *Ctenacanthus* by not having: (i) numerous closely spaced fine longitudinal ribs; (ii) closely pectinated ribs with minute transverse tuberculations often vertically striated and projected laterally from the raised ribs; and (iii) tubercles of adjacent ribs almost touching and sometimes interlocking like teeth on a zipper.

According to Maisey (1982), *Amelacanthus* presents the following features: (i) posteriorly divergent sides but almost flat, giving a subtriangular outline in cross-section; (ii) ornament of broad smooth ribs, which are heavily enameled and usually display growth lines; and (iii) ribs with narrow intercostal grooves. These features are not present in MCN.P.440 and MCN.P.703.

Bythiacanthus (*sensu* Maisey, 1982) presents: (i) robust finspines with a rhomboidal outline in lateral view; and (ii) longitudinal rows of rounded and striated tubercles, usually less than their own diameter apart. These features are absent in the Rio do Rasto Formation specimens. Moreover, *Bythiacanthus* presents a strongly concave posterior face, forming a deep posterior furrow, a distinct condition to that found in MCN.P.440, which is only slightly concave proximally, and in MCN.P.703, in which the posterior face is almost flat.

The finspines described here could not belong to *Eunemacanthus* (*sensu* Maisey, 1982), since they are not so laterally compressed and do not present a broad anterior margin with a wide enameled rib; thick irregular enameled lateral ribs interrupted by transverse ridges, or intercostal areas occupied by irregularly dispersed tubercles or short lengths of ribbing.

As *Wodnika* finspines present smooth ribs (Maisey 1982), none of the spines described here can be attributed to this genus.

According to the revised diagnosis of *Sphenacanthus* by

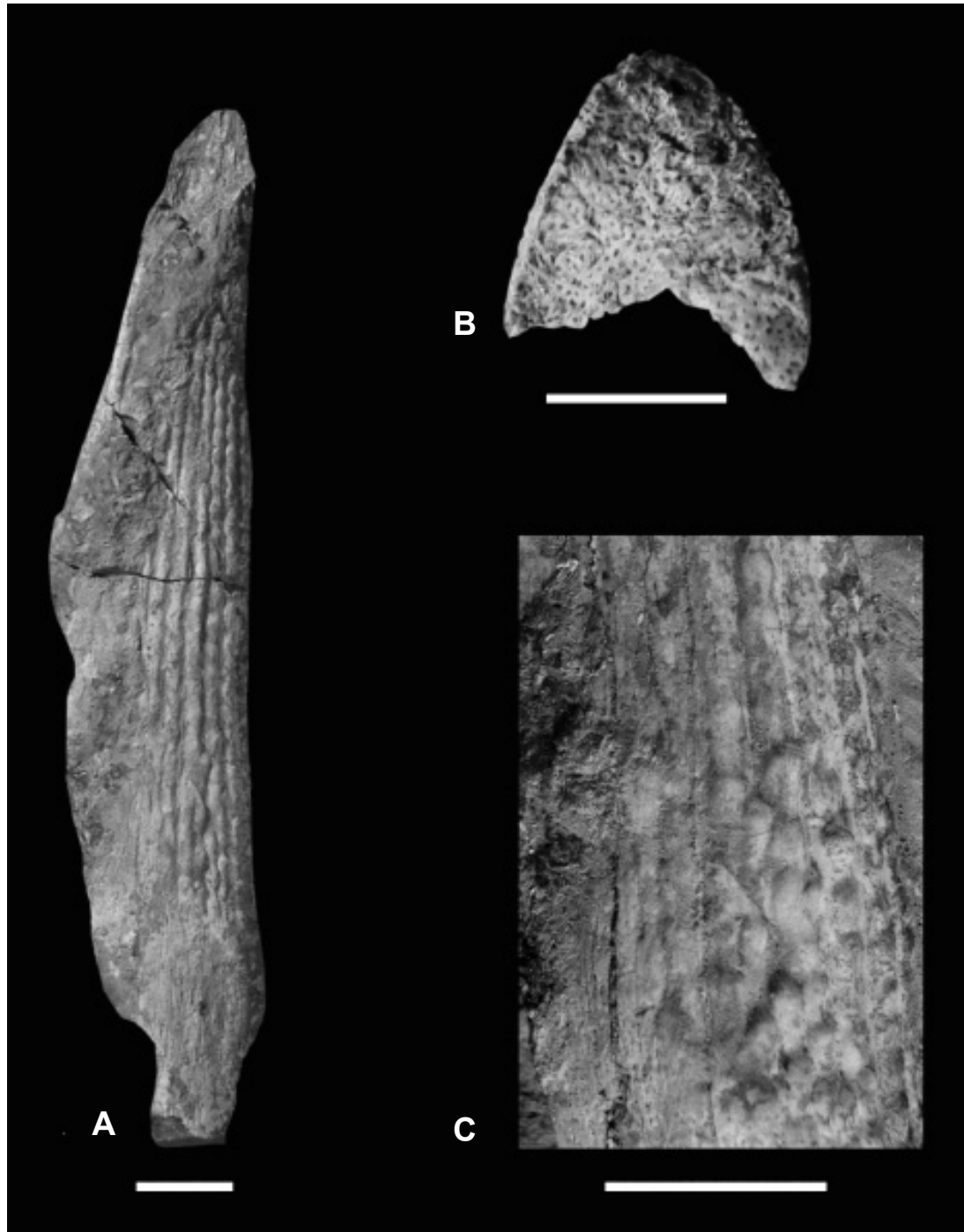


Figure 2. *Sphenacanthus riorastoensis* sp. nov., finspine, specimen MCN.P.440 (holotype). **A**, the finspine in lateral view; **B**, transverse section of the proximal portion; **C**, detail of the branching ribs and the tubercles of the proximal portion of the spine. Scale bars: A-C = 10 mm; B = 5 mm.

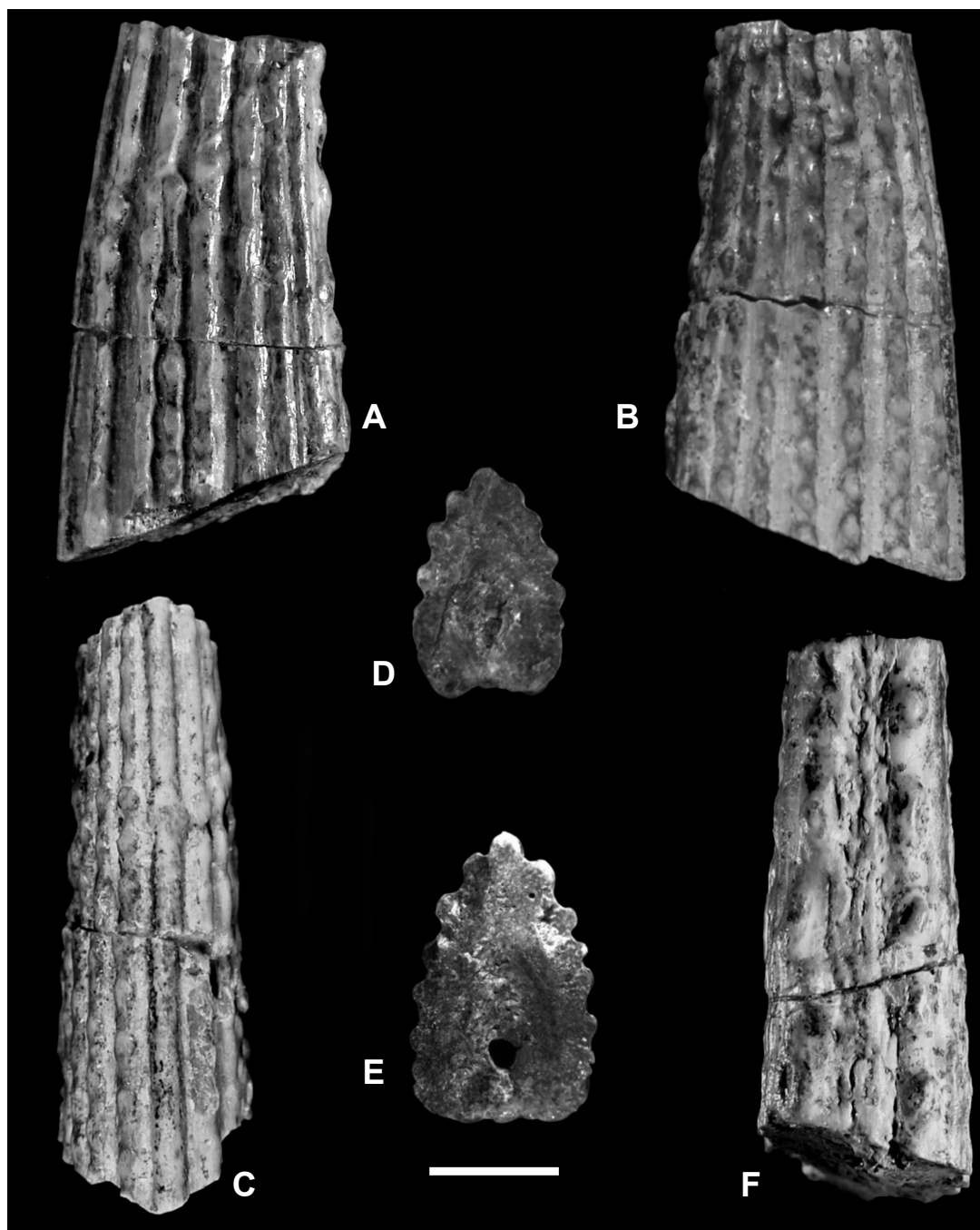


Figure 3. *Sphenacanthus riorastoensis* sp. nov., fin spine, specimen MCN.P. 703. **A**, left lateral view; **B**, right lateral view; **C**, anterior view; **D**, distal transverse cross-section; **E**, proximal transverse cross-section; **F**, posterior view. Scale bar = 5 mm.

Maisey (1981, 1982), some characteristics observed in the fin spines MCN.P.440 and MCN.P.703 are compatible with this genus. They share with *Sphenacanthus* the following features: (i) fin spines that gradually taper and are slightly curved posteriorly, often with a straight posterior profile; (ii) an acutely rounded anterior face and slightly convex lateral faces; (iii) the posterior face concave proximally as seen in MCN.P.440 and almost flat to slightly concave distally lacking a pronounced median ridge as seen in MCN.P.703; (iv) a cross-section approximately twice as deep as broad as seen in MCN.P.703; (v) the presence of prominent raised ribs

of variable distance apart; (vi) intercostal grooves generally as wide as or wider than the ribs (except in MCN.P.440 and posterior ribs of MCN.P.703, which present grooves slightly smaller than the width of the ribs); (vii) ribs that are nodose and discontinuous branching irregularly, with new ones sometimes appearing by intercalation or often by addition to the marginal ribs; (viii) nodose ribs that are never closely pectinated, but beaded with small and well-spaced tuberculations that may be thinly enameled; and (ix) posterolateral margins presenting a row of low tubercles directed posteriorly.

However, the feature “intercostal grooves generally as

wide as or wider than ribs” mentioned in Maisey’s (1982) diagnosis is ambiguous in the studied specimens. MCN.P.440 presents intercostal grooves smaller than the width of the ribs; while in MCN.P.703, the anterior intercostal grooves are as wide as the ribs’ width, but narrower in the posterior ones. Thus, it seems that this feature is not obligatory in the genus, and its absence does not endanger the identification of the specimens as *Sphenacanthus*.

The *Sphenacanthus* genus has been known for almost two centuries when it was first described by Agassiz (1837) based on fossils from the Carboniferous of Scotland. The relationships between the sphenacanthids have been controversial until now, with less than ten species formally described. Below will be presented a short comparison between some Laurasian species followed by comparison with some Brazilian species that closely resemble *Sphenacanthus riorastoensis* sp. nov.

The description of *Sphenacanthus serrulatus* Agassiz, 1837 was based on a single badly preserved finspine, and many years later this genus were redescribed by Dick (1998) based on an almost complete specimen from the Viséan Upper Oil Shale Group of Scotland. *S. riorastoensis* sp. nov. differs from this species by the presence in *S. serrulatus* of fine crenulated ribs practically without tubercles, and the number of ribs on the lateral surfaces are proportionally greater.

Sphenacanthus carbonarius Giebel, 1848 is another Laurasian sphenacanthid proposed for the Puertollano Basin, Late Carboniferous of Spain (Soler-Gijón, 1997). Recently these species were also reported from the Top Breitenbach Formation (Stefan C) of the Saar-Nahe Basin by Krätschmer & Forst (2005). The finspines of this species present almost smooth ribs, sometimes with a few tubercles, and some of these tubercles occur in the intercostal grooves, which does not occur in *S. riorastoensis* sp. nov.

The occurrences of another Brazilian sphenacanthid and ctenacanthid finspines have been reported (e.g. Silva-Santos, 1946, 1947; Würdig-Maciel, 1975; Richter, 2001, 2008; Alves *et al.*, 2008, 2009a,b; Alves, 2010; Chahud *et al.*, 2010) and comparisons with these are presented below.

The finspines from the Pedra de Fogo Formation (Lower Permian of Maranhão State) described by Silva-Santos (1946) were attributed to *Ctenacanthus maranhensis*. This taxon was reevaluated by Maisey (1984), who suggested that its shape in transverse section and ornamentation pattern was not referable to *Ctenacanthus*, and may be closer to *Sphenacanthus* or to *Wodnika*. However, the emended diagnosis of *Wodnika* proposed by Maisey (1982) affirms that this genus exhibits smooth ribs, which is incompatible with *C. maranhensis*, so is here considered *Sphenacanthus maranhensis*. The finspines of *S. maranhensis* are very similar to specimen MCN.P.703 in general shape, in its posterior face morphology and in its tubercle distribution pattern, but *S. maranhensis* presents a higher number of ribs, smaller rib width and smaller tubercle diameter than specimen MCN.P.703.

For the same formation, Richter (2001, 2008) mentioned the occurrence of some ctenacanthiform finspines in the Pedra de Fogo Formation, Guaraí Municipality, Tocantins State. According to Richter (2008) these finspines are identical to

the Lower Permian *Ctenacanthus amblyxiphias* Cope, 1891, of Kansas (USA), diverging on the ornamentation pattern from *S. maranhensis* and consequently from *S. riorastoensis* sp. nov. The finspines studied by Richter (2008) were collected associated with a cladodont tooth attributed to *Glikmanius occidentalis* (Leidy, 1859) (= *Cladodus occidentalis* Leidy, 1859) previously known from the Pennsylvanian-Lower Permian of the USA, Late Carboniferous of England and Carboniferous of Russia, which suggests a possible synonym between these two species. New finspine occurrences from the same locality were mentioned by Alves *et al.* (2008, 2009a,b) and Alves (2010).

Another Brazilian shark finspine was collected in the Taió sandstone (Santa Catarina State), currently positioned in Rio Bonito Formation of Early Permian age, and described by Silva-Santos (1947) as *Ctenacanthus gondwanus* Silva-Santos, 1947. This species was also reevaluated by Maisey (1984) and may be referable to *Sphenacanthus* based on its ornamentation pattern. So is here adopted as *S. gondwanus* based on Maisey (1984). Specimen MCN.P.440 resembles *S. gondwanus* in some features such as: (i) equivalent size; (ii) intercostal grooves smaller than ribs; (iii) proximal tubercles more developed; and (iv) presence of branching ribs. Silva-Santos (1947) believed that this rib bifurcation could be an anomaly that would be not recorded in all sharks of this species. However, this feature was considered by Maisey (1982) to be diagnostic for the group and not an anomaly. Nevertheless, unlike in *S. gondwanus*, the finspines described here do not exhibit tubercles separated by distances equal to three times their diameter and ribs that becomes smooth distally. In both specimens (MCN.P.440 and MCN.P.703) the ribs have a row of tubercles throughout their extension.

Chahud *et al.* (2010) described a ctenacanthiform finspine collected in the transition between the Tatuí and Irati formations, Paraná Basin (São Paulo State), placing it in the Sphenacanthidae and proposing the species *Sphenacanthus sanpauloensis* Chahud, Fairchild & Petri 2010. This species shares some similarities with MCN.P.440 and MCN.P.703, such as: branching ribs, boundary between ornamented faces and intramuscular tissue having a sigmoid shape and lateral faces separated by only one anterior rib. But it differs from *S. riorastoensis* sp. nov. in that the ornamentation pattern of this species presents tubercles separated from each other by a distance twice that of their diameter, tubercles generally cylindrical and ribs separated by intercostal grooves equivalent to or slightly greater in width than half the width of the rib.

Würdig-Maciel (1975) described a shark finspine collected from an outcrop of the Estrada Nova Formation (actually this outcrop probably belongs to Terezina Formation, which is Early to Middle Permian *sensu* Holz *et al.*, 2010). Despite the poor preservation condition of this specimen, this finspine differs from MCN.P.440 and MCN.P.703 by having six large and smooth ribs that disappear near the posterior edge. This material was identified as *Ctenacanthus* by Würdig-Maciel (1975), but smooth ribs are incongruent with the revised diagnosis of the genus (Maisey, 1981) so, this specimen should not belong to *Ctenacanthus*.

Paleoenvironmental remarks

The genus *Sphenacanthus* was based on a single finspine collected in a freshwater limestone by Agassiz (1837). For Baird (1978), it is clear that many Paleozoic and Mesozoic sharks lived in freshwater environments. According to Zangerl (1981), ctenacanth (including *Sphenacanthus*) have been recovered from marine, paralic and freshwater deposits; consequently, these sharks can be considered as euryhaline (Silva-Santos, 1994). Dick (1998) suggested that *Sphenacanthus* was an inhabitant of fresh or brackish waters lagoons. Soler-Gijón (1997) mentioned that *S. carbonarius* of the Puertollano Basin was recovered from sediments deposited under a marine-influenced environment, based on the depositional features and the occurrence of acritarchs. However, this author mentioned the co-occurrence of valves of chonchostracans, smooth ostracodes and insect remains, which are strong evidence of fresh or brackish water conditions. In the case of the Puertollano Basin, the complexity of the paleoenvironment precludes a precise conclusion for the habitat of *S. carbonarius*.

The Rio do Rasto Formation has been interpreted as being deposited in a freshwater environment; for example, Ragonha (1989) based on the occurrence of dipnoan fishes and Holz *et al.* (2010) based on the record of conchostracans, megaplants and ferns. This allied with the whole paleontological record, as already mentioned, indicates freshwater and continental conditions for the Rio do Rasto Formation. So *Sphenacanthus riorastoensis* sp. nov. of the Serrinha Member presented here, the xenacanthid of the same horizon mentioned by Pauliv *et al.* (2010) and the hybodontid teeth studied by Laurini *et al.* (2009, 2010) from the Morro Pelado Member represent new freshwater records for each of these sharks.

CONCLUSIONS

The finspines described here are identified as belonging to the genus *Sphenacanthus* Agassiz (1837) and ascribed to a new species, *S. riorastoensis* sp. nov. This species closely resembles the finspines of *S. maranhensis*, *S. gondwanus* and *S. sanpauloensis*, all also described from Brazilian territory, which indicates endemism of these sharks in the Brazilian basins during the Permian age as already mentioned by Chahud *et al.* (2010).

The specimen MCN.P.440 described here as the holotype of *Sphenacanthus riorastoensis* sp. nov. was collected associated with another shark tooth preliminarily attributed to the Xenacanthiformes. This record suggests that these two fossil sharks lived together in the shallow freshwater environments of the Serrinha Member of the Rio do Rasto Formation.

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