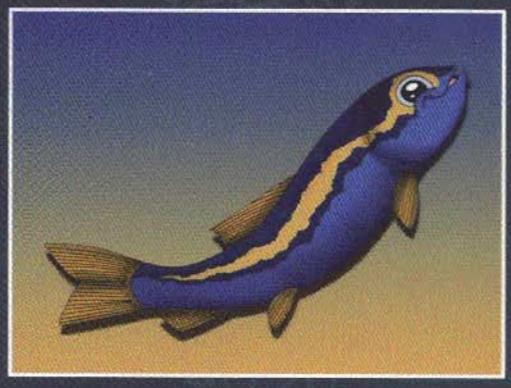

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REVISION OF THE SPHAGESAURIDAE KUHN, 1968 (CROCODYLIFORMES, MESOEUCROCODYLIA)

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ABSTRACT

The Sphagesauridae is a family of notosuchian with highly derived traits amongst the crocodyliforms. These animals possessed its posterior mandibular and maxillary teeth obliquely disposed with a single tuberculated keel, which provided a shearing mechanism associated to a propalinal movement of the jaw. The teeth are coated by coarse enamel and unlike most crocodilians the posterior teeth are anteroposteriorly compressed. Some of the Sphagesauridae teeth are worn in patterns that resemble those of herbivores and durophagous, reflecting a probable omnivory. By the date, these crocodilians are known strictly from the Adamantina Formation of the Bauru Basin, Upper Cretaceous (Turonian-Santonian), Brazil. Based on the new materials collected and described recently, the present contribution proposes a diagnosis emend of this family, which was based only on its posterior teeth morphology.

Key-words: Notosuchia, Sphagesauridae, Upper Cretaceous

RESUMO

Os Sphagesauridae são uma família de notossúquios com características altamente derivadas dentre os crocodiliformes. Esses animais possuíam dentes mandibulares e maxilares posteriores dispostos obliquamente com uma única quilha tuberculada, que proporcionam um mecanismo cisalhante associado a um movimento propalinal da mandíbula. Os dentes são revestidos por uma grossa camada de esmalte e diferentemente da maioria dos crocodilomorfos, os dentes posteriores são anteroposteriormente comprimidos. Alguns dentes dos Sphagesauridae apresentam desgastes em padrões semelhantes aos de herbívoro e durófagos, refletindo uma provável onivoria. Até o momento, esses crocodilomorfos são reconhecidos estritamente na Formação Adamantina da Bacia Bauru, Cretáceo Superior (Turoniano-Santoniano), Brasil. Com base nos novos materiais coletados e descritos recentemente, a presente contribuição visa propor uma emenda para a diagnose dessa família, baseada até então apenas na morfologia dos dentes posteriores.

Palavras-chave: Notosuchia, Sphagesauridae, Cretáceo Superior

1. INTRODUCTION

Some unusual teeth found in rocks of the Bauru Group were briefly described and figured by Huene in 1931, and tentatively assigned to some crocodilian, possibly an alligatoroid (Huene, 1931). The original material was lost, but two teeth undoubtedly similar to those figured by Huene were identified at the Divisão de Geologia e Mineralogia of the Departamento Nacional de Produção Mineral, Rio de Janeiro, and as a new genus and species, *Sphagesaurus huenei* Price, 1950, and identified as a Notosuchidae (Price, 1950). A distinct family, the Sphagesauridae, was erected by Kuhn (1968) for this single genus of Mesoeucrocodylia, poorly known by only a couple of teeth. The teeth seemed to be laterally compressed with short crowns, long roots with a heavy coat of coarse enamel cover and a single posterior keel with large tuberosities, and the posterior ones would have had oblique insertion (Price, 1950).

Remains of a snout of *Sphagesaurus* sp. was briefly reported (Kellner, *et al.*, 1995; Kellner & Campos, 1999), in which was observed that the actual orientation of the major axis of the teeth described by Price (1950) was oblique to the long axis of the jaw, and the posterolingual denticulated keels of the upper teeth joins the lower teeth keels, forming a powerful shearing mechanism (Kellner *et al.*, 1995). An almost complete skull regarded to *Sphagesaurus huenei* was described by Pol (2003), shedding some new light to the cranial osteology and relationships of this genus. More recently was described *Adamantinasuchus navae* Nobre & Carvalho, 2006, another crocodyliform species with teeth's major axis obliquely oriented and bearing large tuberosities as *Sphagesaurus huenei.* Another specimen related to *Sphagesaurus* was reported from Iturama, Minas Gerais State by Kellner *et al.* (1995), extending considerably the distribution of the Sphagesauridae in the Bauru Basin.

The present contribution objective is to compare this assemblage with Sphagesauridae crocodyliforms *sensu* Kuhn (1968), reviewing it and adding some new data to the systematic and paleoecology of this group.

Systematic Paleontology

Crocodylomorpha Walker, 1970

Crocodyliformes Hay, 1930

Mesoeucrocodylia Whetstone & Whybrow, 1983

Sphagesauridae Kuhn, 1968

2. MATERIAL

Institutional abbreviations - DGM, Divisão de Geologia e Mineralogia do Departamento Nacional de Produção Mineral, Rio de Janeiro, Brazil; MPMA Museu de Paleontologia de Monte Alto, Monte Alto, São Paulo, Brazil; RCL, Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil; UFRJ DG, Departamento de Geologia da Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; URC, Universidade Estadual Paulista, Campus Rio Claro, Rio Claro, Brazil.

Holotype - DGM 332-R, an isolated maxillary or posterior dentary tooth named *Sphagesaurus huenei* by Price (1950) found in a railway between the cities of Santo Anastácio and Presidente Bernardes, São Paulo State, Brazil.

Referred Specimens - All the specimens here referred are from the São Paulo state; DGM 333-R, another isolated tooth assigned as *Sphagesaurus huenei* by Price (1950), found near the Catanduva

municipality; DGM 1411-R, an anterior portion of a snout of *Sphagesaurus* sp., reported by Kellner *et al.* (1995), from Presidente Prudente municipality; URC-R 015, is an isolated tooth reffered by Bertini *et al.* (1993) as *Sphagesaurus* sp. from the Locality 99 of the Adamantina Formation; RCL-100, is an almost complete skull and the anterior part of the mandible of *Sphagesaurus huenei*, from Buenópolis city (Pol, 2003); UFRJ DG 107-R, an almost complete skull of *Adamantinasuchus navae*, from the Marília County (Nobre & Carvalho, 2006); UFRJ DG 303-R and MPMA-64-0001-04 Sphagesauridae *indet.* from the municipality of General Salgado.

3. GEOLOGY

The Sphagesauridae is a group known exclusively from the Adamantina Formation of the Bauru Basin (Figure 1). With an area of roughly 370,000 km^2, the Bauru Basin covers part of the current Brazilian states of Paraná, São Paulo, Mato Grosso do Sul, Mato Grosso, Goiás and Minas Gerais (Fernandes & Coimbra, 1996, 1999). The deposits found in the Bauru Basin are of continental origin and usually composed of siliciclastics, including conglomerates, sandstones, siltites and shales. Fulfaro *et al.* (1994) considered that these sediments were deposited during the Aptian and Maastrichtian (Upper Cretaceous). They are generally included in two groups: the Caiuá and Bauru Groups (Soares *et al.*, 1980; Fernandes & Coimbra, 1992, 1996). Fernandes and Coimbra (1996) subdivided the Bauru Group in three formations, with different ages of deposition. The Adamantina Formation is the oldest one (Turonian–Santonian age, after Castro *et al.*, 1999). It is formed by a sequence of sandstones, mudstones, siltites and clayish sandstones. Batezelli *et al.* (1999) redefined the lowest portion of the Ada-

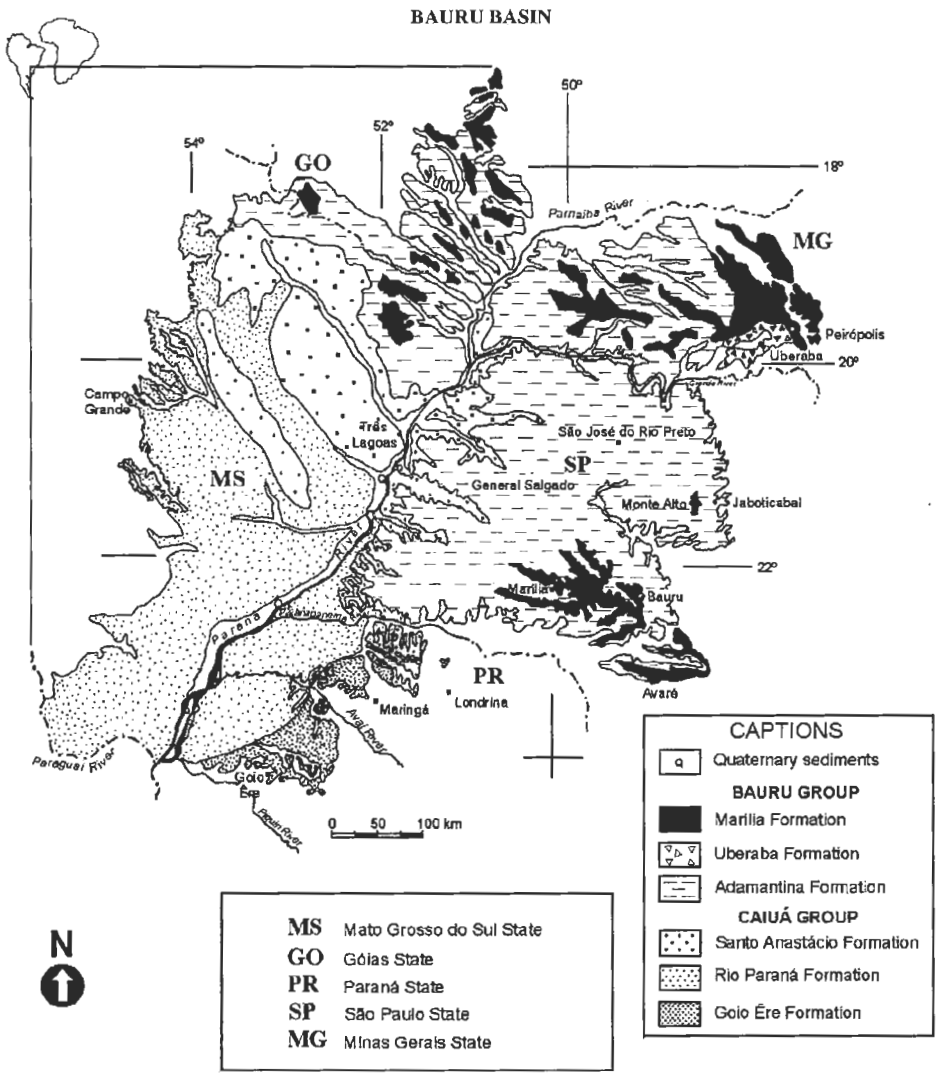

Fig. 1: Geological map of the Bauru Basin. Modified from Fernandes & Coimbra (1996).

mantina Formation as the Araçatuba Formation. The Uberaba Formation (Coniacian–Campanian age according to Goldberg & Garcia, 2000), which is restricted to the Triângulo Mineiro region (Minas Gerais State), is composed of thin sandstones interbedded with siltites, coarse sandstones, mudstones and volcanoclastic sediments. The last and most recent unit is the Marília Formation, composed of a sequence of conglomeratic sandstones, sandstones, mudstones and carbonatic levels (Soares *et al.*, 1980; Garcia *et al.*, 1999; Alves & Ribeiro, 1999; Andreis *et al.*, 1999). Based on biostratigraphic data obtained from carophytes and ostracods, this last unit is considered as Maastrichtian (Dias-Brito *et al.*, 2001).

4. SPHAGESAURIDAE EMENDED DIAGNOSIS

Posterior maxillary and mandibular teeth with large roots, short crowns and a coarse enamel coating with few irregularly spaced longitudinal carinae, as coined by Kuhn (1968), but not necessarily pebbled (Figure 2). The posterior teeth are mesioposteriorly compressed, posteriorly concave and with major axis oriented obliquely (Figure 3). The posterior maxillary teeth bears one or three keels (Figure 2) with few large tuberosities positioned posterolingually, while the posterior dentary ones possesses the same number of keels as the maxillary, but positioned anterolabially. The crown section of the premaxillary and anterior dentary teeth is circular, and the maxillary and dentary teeth's crown section is triangular. First dentary teeth may be oriented forward as observed in *Adamantinasuchus navae* and MPMA-64-0001-04. Number of teeth reduced to two or three in the premaxilla and seven or six in the maxilla. The jugal laterally expanded and dorsoventrally compressed (Figure 4). The Eustachian tube foramina are positioned in a straight horizontal transverse row. Snout is oreinirostral in cross-section, and the external naris is anterior. The mandibular symphyseal region is long and narrow (Figure 5). The prefrontal and the maxilla contact each other in the inner anteromedial region of the orbit (Figure 6).

5. DISCUSSION

Although Woodward (1896) pointed that *Notosuchus terrestris* Woodward, 1896 presents oblique disposed posterior maxillary and mandibular teeth, this character is much more evident in the Sphagesauridae. The tuberculated keels of the Sphagesauridae are disposed only posterolingually on the posterior maxillary teeth, or anterolabially on the posterior mandibular teeth, while *Notosuchus terrestris* bears both anterior and posterior carinae (Bonaparte, 1991). Another Notosuchidae, *Mariliasuchus amarali* Carvalho & Bertini, 1999, close related to *Notosuchus terrestris*, also possessed teeth with both anterior and posterior carinae (Carvalho & Bertini, 1999; Zaher *et al.*, 2006). Price (1950) noticed some pebbles on the teeth's enamel coating. Such pebbles are absent in *Adamantinasuchus navae*, UFRJ DG 303-R and MPMA-64-0001-04. *Mariliasuchus amarali* also possessed teeth with coarse enamel coating, pebbles and short crowns (Vasconcellos *et al.*, 2002; Zaher *et al.*, 2006), but the overall teeth morphology of this species is strikingly different from the Sphagesauridae.

The teeth disposition in the Sphagesauridae provided a powerful shearing scissors-like mechanism where the tuberculated keels of the upper teeth joins the tuberculated keels of the lower keels in a tooth-tooth occlusion (Kellner *et al.* 1995; Pol, 2003). Also, these crocodyliforms seems to have had a propalinal or fore-aft jaw movements and an alternate unilateral jaw occlusion pattern, supported by

the matching worn facets in the tuberculated keel area (Pol, 2003). The worn surfaces presents some parallel striae on the teeth may suggest that it was produced by a tooth-tooth occlusion (Osborn & Lumsden, 1978). The anteroposterior orientation of the striae suggests that the occluding movement included a large anteroposterior component (Pol, 2003). *Adamantinasuchus navae* does not present worn facets on the teeth, but it might be related to the known specimens being juvenile. The worn facets also may not be present due to a different type of diet, predominantly composed by soft and less abrasive food than the *Sphagesaurus* diet. The masticatory area of the posterior teeth of *Adamantinasuchus navae* also provide less occluding stress than in *Sphagesaurus huenei*, since the former possesses three tuberculated keels and the later one.

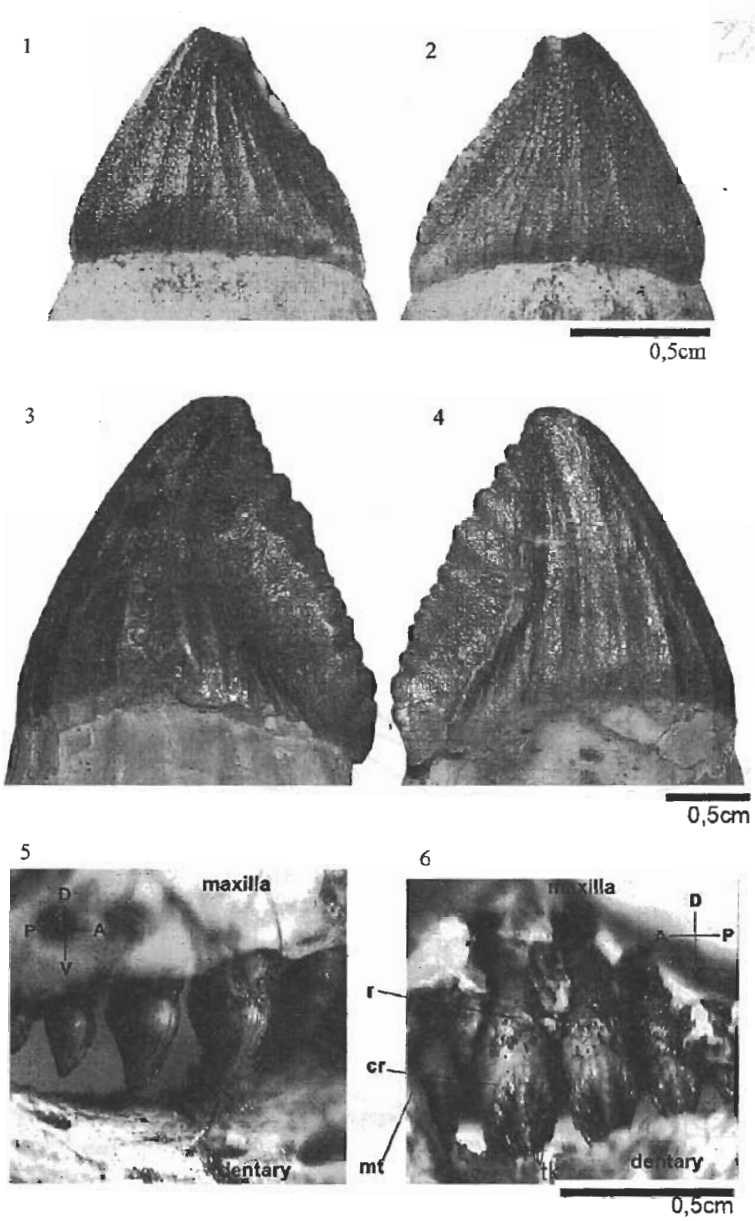

Fig. 2: Holotype of *Sphagesaurus huenei* DGM 332-R in anterior (1) and posterior view (2). Modified from Price (1950); Sphagesauridae indet. tooth UFRJ DG 303-R in anterior (3) and posterior view (4); maxillary teeth of *Adamantinasuchus navae* UFRJ DG 107-R in labial (5) and lingual view (6), r – root, cr – crown, mt – mandibular tooth, A – anterior, P – posterior, D – dorsal, V – ventral. Modified from Nobre & Carvalho (2006).

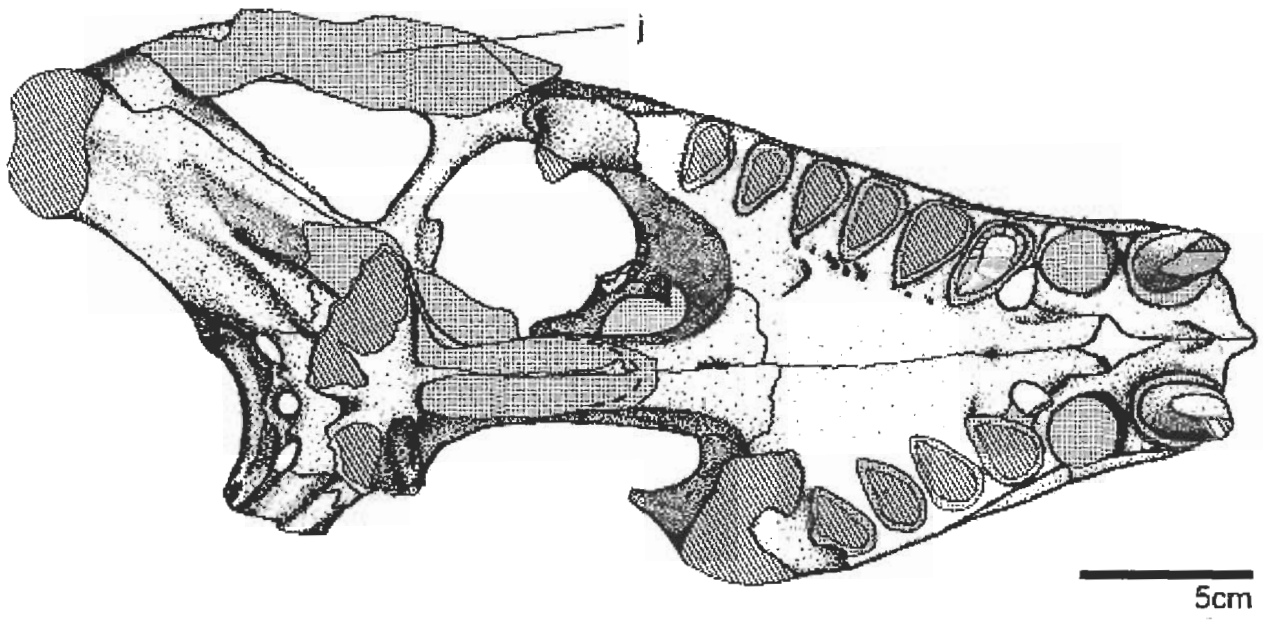

Fig. 3: Palatal view of *Sphagesaurus huenei* RCL-100, showing the oblique pattern of the maxillary teeth and jugal (j) laterally expanded. Modified from Pol (2003).

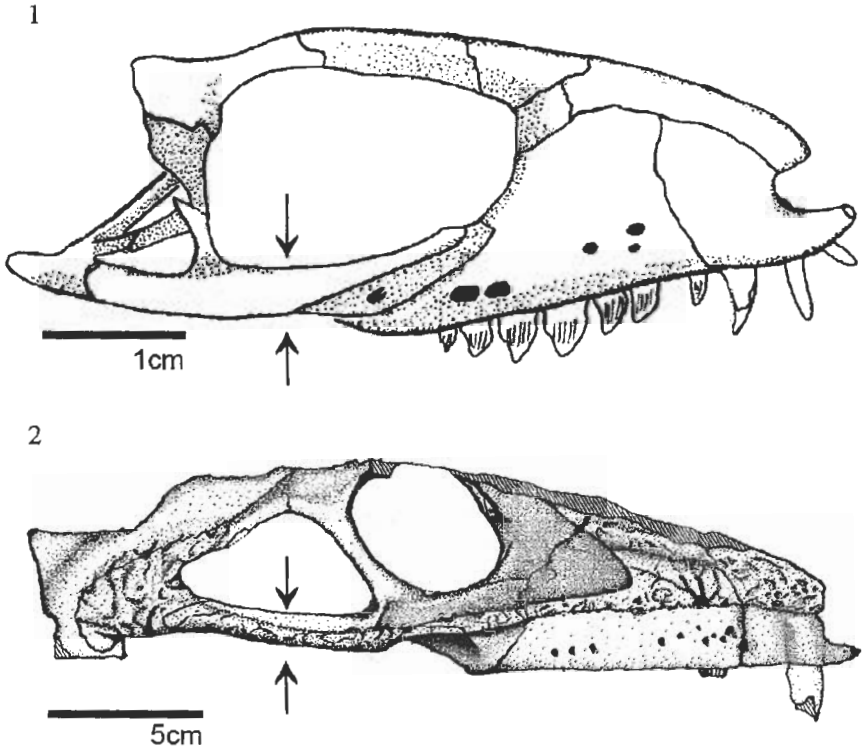

Fig. 4: Right lateral view of the skulls of *Adamantinasuchus navae* (1) and *Sphagesaurus huenei* (2). Arrows point to the dorsoventral compression of the jugal. Modified from Nobre & Carvalho (2006) and Pol (2003).

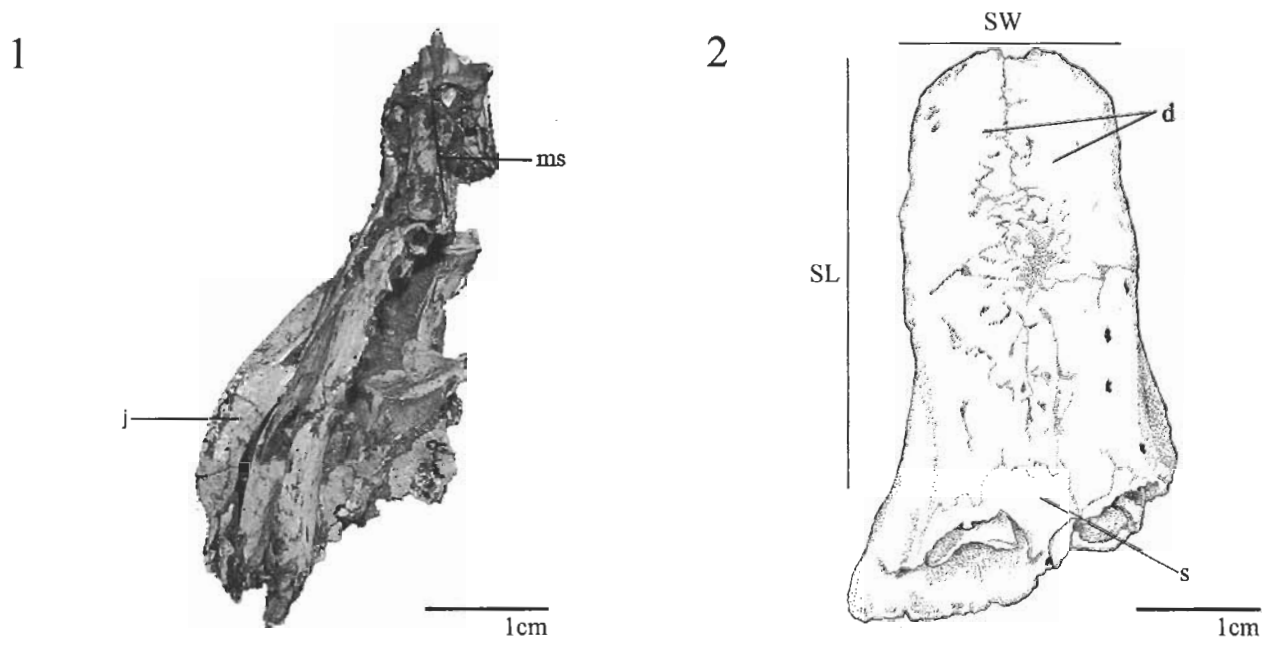

Fig. 5: (1) Ventral view of holotype of *Adamantinasuchus navae*, showing the laterally expanded jugal and long and narrow mandibular symphysis; (2) ventral view of the partial mandible of the Sphagesauridae *indet.* MPMA-64-0001-04. ms – mandibular symphysis, j – jugal, SW – symphysis width, SL – symphysis length , d – dentary, s – splenial, r – root. Ilustration by Deverson da Silva.

The incisiviform mandibular teeth of *Mariliasuchus amarali* resemble in position those of *Adamantinasuchus navae* and the Sphagesauridae *indet.* MPMA-64-0001-04. Those anterior facing teeth are not seen in *Sphagesaurus huenei* (Pol, 2003), therefore, this character is not diagnostic of either the Sphagesauridae or Notosuchidae. The function of these teeth might be related to an underground foraging habit (Vasconcellos *et al.*, 2002). Considering this habit on the Sphagesauridae it is plausible to think that these animals might have fed on mollusks, arthropods or even roots, pines and other plant material. The omnivory of *Sphagesaurus huenei* was also been proposed by other authors, based on the enamel coating and teeth weariness, shearing mechanism provided by the disposition of the posterior teeth and propalinal movement of the jaw (Kellner *et al.*, 1995; Pol, 2003). Other notosuchian like *Candidodon itapecuruense*, Carvalho & Campos, 1988, *Chimaerasuchus paradoxus* Wu, Sues & Sun, 1995 and *Simosuchus clarki* Buckley, Brochu, Krause & Pol, 2000 might have had plants on their diets or even would have been strict herbivores (Carvalho, 1994; Wu *et al.*, 1995; Wu & Sues, 1996; Buckley *et al.*, 2000), as well as the extant alligatorid, *Caiman latirostris* Daudin, 1802, that has fruits as part of its diet (Brito *et al.*, 2002). The teeth disposition may also be related to the feeding on desiccated carcasses, shearing the bones with a small amount of flesh, which would honor the name *Sphagesaurus*, meaning "butcher reptile".

The oreinirostral snout and anterior external nares and geological settings of the findings, reflect a terrestrial living habit near braided fluvial systems in a semi-arid climate, among mollusks, fishes, theropod and sauropod dinosaurs, and other crocodilians like, baurusuchids, peirosaurids and notosuchids (Bertini *et al.*, 1993; Dias-Brito *et al.*, 2001).

Chimaerasuchus paradoxus is often positioned as a sister taxon of *Sphagesaurus huenei* (Pol, 2003), and even within the Sphagesauridae (Sereno, 2005). This proposition seems to be based on the presence of two premaxillary teeth, major axis obliquely disposed on the posterior maxillary teeth and anterior process of the jugal with a broad shelf with a depression underneath it. These derived traits are shared between different taxa of Crocodyliformes (Pol, 2003) and may be the indicative of evolutionary convergences. The multicuspid tritylodontid-like teeth and laterally expanded ventral portion of the maxillary wall of *Chimaerasuchus paradoxus* (Wu *et al.*, 1995; Wu & Sues, 1996) should be considered as autapomorphies of a monotypic Chimaerasuchidae family.

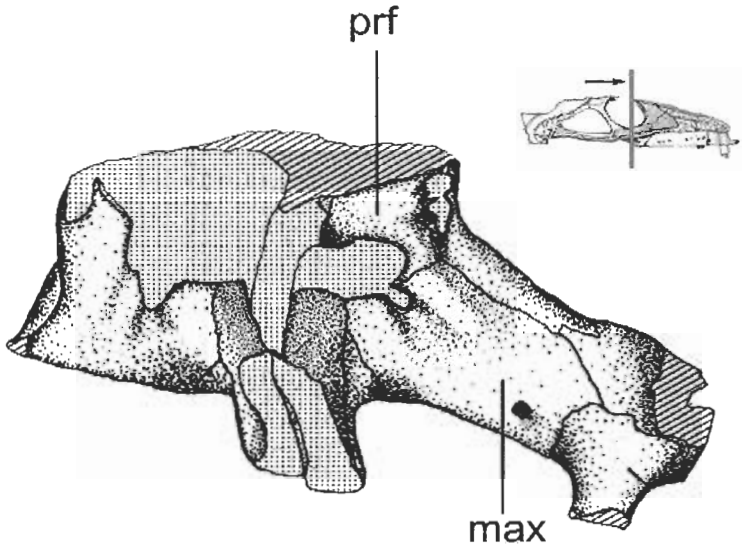

Fig. 6: Posterior view of the inner anteromedial region of the orbit of *Sphagesaurus huenei*, where the contact between the prefrontal and the maxilla can be seen. Prf – prefrontal, max – maxilla. Modified from Pol (2003).

6. CONCLUSIONS

The Sphagesauridae are a monophyletic group of notosuchian crocodyliforms, based on its unique dental features. This family can be defined as the most inclusive clade of Notosuchia (*sensu* Ortega *et al.*, 2000) containing *Sphagesaurus huenei* Price, 1950, *Adamantinasuchus navae* Nobre & Carvalho, 2006 and its close relatives, but not *Chimaerasuchus paradoxus* Wu, Sues & Sun, 1995, *Notosuchus terrestris* Woodward, 1896, *Mariliasuchus amarali* Carvalho & Bertini, 1999, *Uruguaysuchus aznarezi* Rusconi, 1933, *Uruguaysuchus terrai* Rusconi, 1933, *Comahuesuchus brachybuccalis* Bonaparte, 1991, *Simosuchus clarki* Buckley, Brochu, Krause & Pol, 2000, *Baurusuchus pachecoi* Price, 1945, *Sebecus icaeorhinus* Simpson, 1937, *Candidodon itapecuruense* Carvalho & Campos, 1988.

Adamantinasuchus navae is definitely a Sphagesauridae, sharing many sinapomorphic traits with *Sphagesaurus huenei*. The new specimens known and figured by the date provided consistent information about the dental and cranial morphology of the Sphagesauridae, allowing a more complete diagnosis for the family. Also, the morphology observed on the specimens described before Kuhn (1968) reflects a feeding habit composed by some abrasive and hard material, and probably omnivory.

Considering that *Chimaerasuchus paradoxus* is not a Sphagesauridae, this family is known strictly from the Upper Cretaceous of Brazil.

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8. REFERENCES

Alves, J.M.P. & Ribeiro, D.T.P. 1999. Evolução diagenética das rochas da Formação Marília—Minas Gerais, Brasil. *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 327–332.

Andreis, R.R.; Capilla, R. & Reis, C.C. 1999. Considerações estratigráficas e composição dos arenitos da Formação Marília (Cretáceo Superior) na região de Uberaba (MG). *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 449–455.

Batezelli, A.; Perinotto, J.A.J.; Etchebehere, M.L.C.; Fulfaro, V.J. & Saad, A.R. 1999. Redefinição litoestratigráfica da unidade Araçatuba e da sua extensão regional na Bacia Bauru, Estado de São Paulo, Brasil. *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 195–200.

Bertini, R.J.; Marshall, L.G.; Gayet, M. & Brito, P. 1993. Vertebrate fauna from the Adamantina and Marília formations (Upper Bauru Group, late Cretaceous, Brazil) in their stratigraphic and paleobiogeographic context. *Neues Jahrbuch fur Geologie und Palaontologie Abhandlungen, 188*: 71–101.

Bonaparte, J. F. 1991. Los vertebrados fósiles de la Formación Rio Colorado, de la ciudad de Neuquén y cercanias, Cretácico Superior, Argentina. *Revista Del Museo Argentino De Ciencias Naturales "Bernardino Rivadavia"*, *4*(3): 123p.

Brito, S.P.; Andrade, D.O.V. & Abe, A.S. 2002. Do caimans eat fruits? *Herpetological Natural History*, *9*(1): 95-96.

Buckley, G.A.; Brochu, C.A.; Krause, D.W. & Pol. D. 2000. A pug-nosed crocodyliform from the Late Cretaceous of Madagascar. *Nature, 405*: 941–944.

Carvalho, I.S. 1994. *Candidodon*: um crocodilo com heterodontia (Notosuchia, Cretáceo Inferior—Brasil). *Anais da Academia Brasileira de Ciências, 66*: 331–346.

Carvalho, I.S. & Bertini, R.J. 1999. *Mariliasuchus*: um novo Crocodylomorpha (Notosuchia) do Cretáceo da Bacia Bauru. *Geología Colombiana, 24*: 83–105.

Castro, J.C.; Dias-Brito, D.; Musacchio, E.A.; Suarez, J.; Maranhão, M.S.A.S. & Rodrigues, R. 1999. Arcabouço estratigráfico do Grupo Bauru no oeste Paulista. *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 509–515.

Dias-Brito, D.; Musacchio, E.A.; Castro, J.C.; Maranhão, M.S.A.S.; Suárez, J.M. & Rodrigues, R. 2001. Grupo Bauru: uma unidade continental do Cretáceo do Brasil—concepções baseadas em dados micropaleontológicos, isotópicos e estratigráficos. *Revue de Paléobiologie, 20*: 245–304.

Fernandes, L.A. & Coimbra, A.M. 1992. A cobertura cretácea suprabasáltica no Estado do Paraná e Pontal do Paranapanema. *In*: CONGRESSO BRASILEIRO DE GEOLOGIA, 37, 1992. *Resumos Expandidos*, 2, p. 506–508.

Fernandes, L.A. & Coimbra, A.M. 1996. A Bacia Bauru (Cretáceo Superior, Brasil). *Anais da Academia Brasileira de Ciências, 68*: 195–205.

Fernandes, L.A. & Coimbra, A.M. 1999. Paleocorrentes da parte oriental da Bacia Bauru (KS, Brasil). *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 51–57.

Fulfaro, V.J.; Perinotto, J.A.J. & Barcelos, J.H. 1994. A margem goiana do Grupo Bauru: implicações na litoestratigrafia e paleogeografia. *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 3, 1994. *Boletim*, Rio Claro, UNESP, p. 81–84.

Garcia, A.J.V.; Rosa, A.A.S. & Goldberg, K. 1999. Paleoenvironmental and paleoclimatic controls on early diagenetic processes and fossil records in continental Cretaceous sandstones in Brazil: a petrologic approach. *In*: SIMPÓSIO SOBRE O CRETÁCEO DO BRASIL, 5, 1999. *Boletim*, Serra Negra, UNESP, p. 491–495.

Goldberg, K. & Garcia, A.J.V. 2000. Palaeobiogeography of the Bauru Group, a dinosaur-bearing Cretaceous unit, northeastern Paraná Basin, Brazil. *Cretaceous Research, 21*: 241–254.

Huene, F. 1931. Verschiedene mesozoische Wierbeltierreste aus Südamerika. *Neuen Jahrbuch für Mineralogie, Geologie, Paläontologie, Beil-Bd., 66*(B): 181-198.

Kellner, A.W.A.; Campos, D.A. & Price, L.I. 1995. New material of *Sphagesaurus* (Sphagesauridae, Crocodilia) from the Late Cretaceous of Brazil. *In*: CONGRESSO BRASILEIRO DE PALEONTOLOGIA 14, *Atas*. p. 70–71.

Kellner, A.W.A. & Campos, D.A. 1999. Vertebrate Paleontology in Brazil – a review. *Episodes, 22*(3): 238-251

Kuhn, O. 1968. *Die Vortzeitlichen Krokodile*. Verlag Oeben, Krailing, München, 124 p.

Nobre, P.H. & Carvalho, I.S. 2006. Adamantinasuchus navae: a new Gondwanan Crocodylomorpha (Mesoeucrocodylia) from the Late Cretaceous of Brazil. *Gondwana Research, 10*(4): 370-378.

Ortega, F.; Gasparini, Z.; Buscalioni, A. D. & Calvo, J.O. 2000. A new species of *Araripesuchus* (Crocodylomorpha, Mesoeucrocodylia) from the Lower Cretaceous of Patagonia (Argentina). *Journal of Vertebrate Paleontology, 20*(1):57–76.

Osborn, J.W. & Lumsden, A.G.S. 1978. An alternative to "thegosis" and a re-examination of the ways in which mammalian molars work. *Neues Jahrbuch für Geologie und Palaontologie Abhandlungen, 156*: 371–392.

Pol, D. 2003. New remains of *Sphagesaurus huenei* (Crocodylomorpha: Mesoeucrocodylia) from the Late Cretaceous of Brazil. *Journal of Vertebrate Paleontology, 23*(4), 817–831.

Price, L.I. 1950. On a new Crocodilia, SPHAGESAURUS from the Cretaceous of the State of São Paulo, Brazil. *Anais da Academia Brasileira de Ciências, 22*: 77–83.

Sereno, P. C. 2005. Stem Archosauria – TaxonSearch <http://www.taxonsearch.org/Archive/stem-archosauria-1.0.php > version 1.0, 2005 November 7. Access in April 7th, 2007.

Soares, P.C.; Landim, P.M.B.; Fulfaro, V.J. & Sobreiro Neto, A.F. 1980. Ensaio de caracterização estratigráfica do Cretáceo no Estado de São Paulo: Grupo Bauru. *Revista Brasileira de Geociências, 10*: 177–185.

Vasconcellos, F.M.; Carvalho, I.S. & Nobre P.H. 2002. Aspectos ecológicos de *Mariliasuchus amarali* (Crocodylomorpha) do Cretáceo Superior da Bacia Bauru. *In*: PALEO 2002, Rio de Janeiro, p. 43-44.

Woodward, A.S. 1896. On Two Mesozoic Crocodilians *Notosuchus* (Genus Novum) and *Cynodontosuchus* (Genus Novum) from the Red Sandstone of the Territory of Neuquén (Argentine Republic). *Anales del Museuo de la Plata, Paleontologia Argentina, 6*: 1-20.

Wu, X.C. & Sues, H.D. 1996. Anatomy and phylogenetic relationships of *Chimaerasuchus paradoxus*, an unusual crocodyliform reptile from the Lower Cretaceous of Hubei, China. *Journal of Vertebrate Paleontology, 16*(3), 688–702.

Wu, X.C.; Sues, H.D. & Sun, A. 1995. A plant-eating crocodyliform reptile from the Cretaceous of China. *Nature, 376*, 678–680.

Zaher, H.; Pol, D.; Carvalho, A. B.; Riccomini, C.; Campos, D. & Nava, W. 2006: Redescription of the cranial morphology of *Mariliasuchus amarali*, and its phylogenetic affinities (Crocodyliformes, Notosuchia). *American Museum Novitates, 3512*: 1-40.