BIOESTRATIGRAPHY OF SOUTHERN BRAZILIAN MIDDLE-UPPER TRIASSIC

CESAR LEANDRO SCHULTZ, CLAITON MARLON DOS SANTOS SCHERER AND MARIO COSTA BARBERENA

ABSTRACT The rocks of Middle/Upper Triassic from Southern Brazil (Paraná Basin) can be divided in three major and clearly distinct biostratigraphic units from the basis to the top: 1) Therapsid Cenozoone, dominated by Dicynodonts and Cynodonts; 2) Rhynchosauria Cenozoone, with an expressive presence of Rhynchosaurs and absence of Dicynodonts and 3) *Jachaleria* Level, marked by the presence of the Dicynodont *Jachaleria*. This last one is here proposed as an informal biostratigraphic unit, once that the number of fossils collected until now is low and the occurrence of this fossil assemblage is very restricted. This biostratigraphic framework is very similar to that occurs in Argentinean Triassic. Besides, in both sedimentary sequences it is not observed any evidence of significant hiatus between the different fossil levels, just a change from an anastomosed to a braided fluvial system towards the top of the package.

Keywords: Triassic, Biostratigraphy, Paleovertebrates, Paraná Basin;

INTRODUCTION The first proposal of a biostratigraphic zonation for the Triassic package that occurs in the southern portion of Paraná Basin was elaborated by Barberena (1977) and later enhanced by Barberena *et al.* (1985, 1991). In these last papers, the authors, looking for a larger geochronological resolution, characterized, to the south Brazilian Permo-Triassic package, seven Local Faunas, based on the faunal content from the rocks that outcrop in Paraná, Santa Catarina and Rio Grande do Sul States. Wilson (1950 in Simpson, 1971) introduced the concept of Local Fauna, as being a geobiotic unit constituted "by the totality of the species collected in some important outcrops or group of outcrops". To this definition, Simpson (*op. cit.*) added the following conditions: a) to be composed by organisms that lived in the same geologic time and in the same area; b) do not be representative of the totality of an extensive litho or chronostratigraphic unit.

Four of these faunas were included in rocks of Middle-Upper Triassic age and occurs in surface along an East-West strip (Fig. 1) in Rio Grande do Sul State: Pinheiros Local Fauna (Early Ladinian age), Chiniqua Local Fauna (Middle Ladinian age), Alemoa Local Fauna (Late Ladinian-Middle Carnian age) and Botucaraí Local Fauna (Early Carnian-Early Norian age).

Figure 1-Geographic location of the studied area.

In spite the reached progresses, mainly regarding to the chronocorrelation among the tetrapod paleofaunas from Brazil, Argentina and South Africa, Local Faunas, of course, are parastratigraphic units and, in most of the cases, are not proper to formal biostratigraphic approaches (*vide* Barberena *et al.*, 1985). Its occurrence in isolated outcrops precludes the statement of biohorizons, as well as difficult the clear delimitation of the strata in what they are included. Using Local Faunas one can only identify and separate geographically different faunistic assemblages, which do not provide information about its lateral or vertical extension in the rock package (a Local Fauna can be found and defined in a single outcrop),

as well as the temporal relationships among them. Therefore, any attempt of using it in biostratigraphical correlation becomes, in most of the cases, inconclusive. However, the identification of chronocorrelated horizons in continental sequences, as in the case of the Santa Maria Formation, is very difficult (Scherer and Holz, 1993; Schultz, 1995). Barberena *et al.* (1993), Scherer (1994) and Schultz *et al.* (1994), based on the discovery of various new fossiliferous outcrops, returned to the perspective of a formal biostratigraphy, through the individualization of Cenozones in the Medium-Upper Triassic package of Southern Brazil, as we will discuss to proceed.

GEOLOGICAL SETTING The Paraná Basin was a site of extensive cratonic sedimentation during Paleozoic and most of Mesozoic times. It is situated in central/southeastern South America and comprises 1,100,000 square kilometers each of Uruguay, Paraguay and Argentina. Its lithologic record is constituted by an up to 8,000 meter-thick sedimentary and igneous package.

Two lithostratigraphic units compose the studied stratigraphical section: Santa Maria Formation (Ladinian-Carnian) and Caturrita Formation (Carnian-Norian). The Santa Maria Formation is divided into two members (Andreis *et al.* 1980): (1) Passo das Tropas at the base (fluvial conglomerates and coarse to medium sandstones) and (2) Alemoa Member at the top (fluvial mudstones and fine sandstones).

The basal Passo das Tropas Member eroded the underlying Sanga do Cabral Formation, forming incised valleys filled by lenticular sandstones and conglomerates with trough cross bedding and subordinate parallel lamination, besides complex cut-and-fill structures, suggesting a braided fluvial system (Faccini 1989).

Fonseca and Scherer (1998) and Scherer (2000) studied the Alemoa Member and the overlying Caturrita Formation in detail. The authors recognize three architectural elements: main channels (CH), crevasse splays (CS) and floodplain fines (FF). Lenses of fine sandstone with plane and trough cross-bedded sets and minor horizontal bedding form the element CH. At the margins of the channels fine sandstone and siltstone with climbing ripples occur, interpreted as levee deposits. The geometry of the channels cannot be identified, but they measure from 5 to 20 m of thickness and 50 to 100m's wide. These channels were ribbon-like at the base and more sheet-like at the top of the facies succession. In some channels, lateral accretion surfaces are identified. The element CH is sparse and separated by floodplain deposits at the base of the sequence, becoming abundant in the top. The general paleocurrent direction is northwards.

The element CS is formed by alternation of centimeter-thick layers of mudstone, siltstone and fine sandstone. Sandstone lenses, 1 to 3 meters thick, with cross bedding may occur. Bioturbation, rootmarks, desiccation cracks and paleosoils are common. The geometry is sheet-like, with hundreds of meters of width and up to 10m of thickness. The element CS is frequent in the lower part of the deposits (Santa Maria Formation), becoming rare towards the top (Caturrita Formation). The general orientation of the paleocurrents is perpendicular to the element CH, as visualized in several outcrops. The deposits of crevasse splays are interpreted as lateral avulsions of the main channels.

Siltstone and massive and laminated mudstone, with levels or nodules of caliche form the element FF. The presence of fossil vertebrates is also characteristic for this architectural element. The

geometry is sheet-like, with hundreds of meters of lateral extension and dozens of meters of thickness. The element FF is most frequent at the base of the succession, becoming rare in the top deposits.

The occurrence of deposits of ribbon-like channels (CH), isolated by deposits of floodplain and associated to deposits of crevasse splays (CS) indicates an anastomosed fluvial system for the Alemoa Member, with some meandering channels. The decreasing of elements FF and CS in direction to the top of the succession associated with the increase of the number of channels and with the greater abundance of the elements CS indicate a transition from an anastomosed to a braided fluvial system for the Caturrita Formation. The constant presence of desiccation cracks, paleosoils and caliche horizons in the elements CS and FF suggest that the lacustrine bodies associated with the floodplain had ephemeral character, indicating a seasonal climate, characterized by the alternation of dry and humid seasons during times of deposition of the Alemoa Member.

SOUTHERN BRAZILIAN TRIASSIC BIOSTRATIGRAPHY

The Alemoa Member of the Santa Maria Formation and the Caturrita Formation present three major and clearly distinct fossil assemblages that follow one to another along the time: Therapsid Cenozoone, Rhynchosauria Cenozoone and *Jachaleria* Level (informal biostratigraphic unit). These Cenozoones present some variations of its components from one outcrop to another, but a more accurate formal biostratigraphic separation is still not possible.

Therapsid and Rhynchosauria Cenozoones are both included in the Alemoa Member, but differ substantially in its fossil content. Therapsid Cenozoone (Fig. 2), which includes the Pinheiros and Chiniqua Local Faunas, presents the following ones percentiles of occurrence (Azevedo *et al.*, 1990): dicynodonts (61%), cynodonts (27%), thecodonts (11%), rhynchosaur (0, 7% - just two specimens)

and procolophonids (0, 3% - just one specimen). By its turn, Rhynchosauria Cenozoone (Fig. 3), which includes the Alemoa Local Fauna and part of the Botucara Local Fauna, is totally dominated by rhynchosaur (92%), being present also some cynodonts (2,7%), thecodonts (4,9%) and dinosaurs (0, 4%). New vertebrate fossils of all these groups have been founded in the last years, most of them have been still in study. Nevertheless, the only remarkable modifications on these rates are the increase of the number of cynodonts in the Therapsid Cenozoone and the discovery of some dinosaurs (Langer *et al.*, 1998 and Azevedo *et al.*, 1999) in the Rhynchosauria.

It is remarkable that the dicynodonts (mainly *Dinodontosaurus*), so abundant in Therapsid Cenozoone, are totally absent in Rhynchosauria Cenozoone. Rare and primitive forms in Therapsid Cenozoone ("Mariante Rhynchosaur"), becoming the dominant group in Rhynchosauria Cenozoone (Hyperodapedon and others) represent the rhynchosaur, for its time.

Based on the chronocorrelation with the Argentinean paleofaunas, an Early-Middle Chanarensen age can be attributed for the Therapsid Cenozoone, while a Late Chanarensen-Ischigualastense age is admitted for the Rhynchosauria Cenozoone.

At least in two outcrops of the Rhynchosaur Cenozoone, a peculiar form of rhynchosaur occurs: *Scaphonyx sulcognathus* Azevedo and Schultz, 1987. This taxon is known only in southern Brazil, and is not found associated to the typical Hyperodapedon-like forms which characterizes this Cenozoone. Instead, in all outcrops where *S. sulcognathus* occurs it was found in levels upper than those, existing a clear erosive surface between both rhynchosaur levels in one of the outcrops. So, it could be possible to subdivide the Rhynchosaur Cenozoone in two Subzones, but it would be necessary more paleontological and stratigraphical data to confirm it.

The third fossil assemblage (Fig. 4) occurs in a very restricted area,

Figure 2-Faunal content of Therapsid Cenozoone (It does not represent the whole taxa of this Zone, but just the better-known genera). All are reduced approximately to the same size. a, b, c) *Massetognathus* (dorsal, ventral, lateral). Modified from Barberena, 1981. d, e, f) *Probolesodon* (dorsal, ventral, lateral). Modified from Teixeira, 1982. g, h) *Belesodon* (dorsal, ventral). Modified from Huene, 1942. i, j) *Traversodon* (dorsal, lateral). Modified from Huene, 1942. k, l) *Chanaresuchus* (dorsal, lateral). Modified from Dornelles, 1992. m) *Barberenasuchus* (lateral). Modified from Mattar, 1989. n) *Prestosuchus* (lateral). Modified from Azevedo, 1991. o, p, q) *Dinodontosaurus* (dorsal, ventral and lateral). Modified from Cox, 1965. r, s) *Stahleckeria* (dorsal and lateral). Modified from Cox, 1965. t) *Ischigualastia* (lateral view). Modified from Peruzzo, 1990. u, v, w, x) "Mariante Rhynchosaur" (dorsal, ventral, lateral, mandible). Modified from Schultz and Azevedo, 1990. y, z, z') *Candelaria* (dorsal, ventral, lateral). Modified from Price, 1947.

Figure 3-Faunal content of Rhynchosaur Cenozoone (It does not represent the whole taxa of this Zone, but just the better-known genera). All are reduced approximately to the same size. a) *Proterochampsia* (dorsal). Modified from Barberena, 1982. b) *Aetosauroides* (osteoderms). Modified from Zacarias, 1982. c) *Staurikosaurus* (reconstitution of the skeleton), modified from Colbert, 1970. d) *Saturnalia* (reconstitution of the skeleton). Modified from Lunger et al., 1999. e, f, g) *Thrinaxodon brasiliensis* (dorsal, ventral, lateral). Modified from Barberena et al., 1987. This specimen is being re-studied by Bonaparte and Barberena (in prep.), which interpret it now as an ictidosaur (*Prozoostron*). h, i) *Exaeretodon* (ventral, lateral). Modified from Abdala and Barberena (in prep.). j-k) *Cerritosaurus* (lateral, dorsal). Modified from Dornelles, 1992. l) *Gomphodontosuchus* (ventral). Modified from Huene, 1942. m, n) *Therioherpeton* (dorsal, lateral). Modified from Bonaparte and Barberena, 1975. o, p, q) *Hyperodapedon* [*Scaphonyx*] (dorsal, ventral, lateral). Modified from Huene, 1942. r, s, t) "*Scaphonyx*" *sulcognathus* (dorsal, ventral, lateral). Modified from Azevedo and Schultz, 1987.

Figure 4-Faunal content of the Jachaleria Level (It does not represent the whole taxa of this unit, but just the better-known genera). All are reduced approximately to the same size. a, b, c) *Jachaleria* (dorsal, ventral, lateral). Modified from Araujo and Gonzaga, 1980. d) *Guaibasaurus* (parts of the skeleton). Modified from Bonaparte and Ferigolo, 1999.

at the basis of the Botucaraí Mountain (11-km West in the Caturrita Formation). It is characterized by the presence of the tuskless dicynodont *Jachaleria candelariensis* Araujo and Gonzaga, 1980, archosaurian (probably dinosaurian) teeth (Dornelles, 1990), limbs and other fragments of the primitive prosauropod dinosaur *Guaibasaurus candelariensis* (Bonaparte and Ferigolo, 1999) and a lot of other fragmentary (not yet described) remains, including a probable phytosaur. However, the number of fossils collected until now, as well as its quite restricted occurrence, makes unfeasible the individualization of a cenozoone, so that Scherer (1994) proposed an informal biostratigraphic unit denominated *Jachaleria* Level. Besides, fieldwork developed by one of the authors (Scherer, 1994) in the Candelaria region indicates that one of the outcrops placed in the Botucaraí Local Fauna by Barberena et al., 1985, in which were found *Proterochampsia nodosa* Barberena, 1982 and a splendid *Exaeretodon* skull (Abdala and Barberena, in prep.) is situated in a stratigraphic level further down than that of *Jachaleria* and *Guaibasaurus*. So, this outcrop does not belong to the *Jachaleria* Level and should be correlated to the levels containing *S. sulcognathus*, in the upper portion of the Rhynchosaur Cenozoone.

As pointed out by Benton (1986), rhynchosaurs would be had extinct at the end of Carnian, while some groups of mammal-like reptiles would have survived to the closing of the Triassic period. The extinction of rhynchosaurs, associated to the effective return of dicynodonts to the paleoenvironment, would reflect climatic changes occurred in Pangea (Scherer and Holz, 1995; Holz and Scherer, 1999).

Regarding to the temporary relationships between *Jachaleria* Level and Rhynchosauria Cenozoone, neither the faunal comparison with Argentina (Fig. 5), nor the stratigraphic studies accomplished by Scherer (1994) furnished any evidence of a significant hiatus. It is

STAGE	REPTIL AGE	LOCAL FAUNAS		CENOZOONES		LITOSTRATIGRAPHY		DEPOSITIONAL SEQUENCE
	ARGENTINA	ARGENTINA	BRASIL	BRASIL	ARGENTINA	BRASIL	BRASIL	
RHAETIC							MATA	III'
NORIAN		LA ESQUINA				LOS COLORADOS		
CARNIAN			BOTUCARAÍ	Jachaleria Level			CATURRITA	II
		ISCHIGUALASTENSE	ISCHIGUALASTO	RHYNCHOSAURIA	ISCHIGUALASTO			
LADINIAN			ALEMOA					
		CHANAÑARENSE	CHINIQUÁ			LOS RASTROS	SANTA MARIA	
		LOS CHANAÑARES	PINHEIROS	THERAPSIDA		LOS CHANAÑARES		

Figure 5-Chronocorrelation between Brazil and Argentina, based on Paleoherpetafaunas.

observed, both in Brazil and Argentina, a faciologic change, marked by a progressive increase of the sandstone/mudstone ratio towards the top of the sedimentary packages, reflecting a transition from an anastomosed/meandered to a braided fluvial system (Holz and Scherer, 1999).

CONCLUSION Although the uniformity of the Middle/Upper Triassic lithofacies (Santa Maria and Caturrita formations) from

Southern Brazil, it is possible to divide this sequence in, at least, three different biostratigraphic units, on basis on its paleoherpetofauna (specially using rhynchosauroids and dicynodonts). This zonation, as well as the faunal content of each these zones, is very similar to that occurs in Argentina. Besides, there is no evidence of significant hiatus among the Zones in both countries, but just an increase in the ratio sandstone/mudstone towards the top of the sequences, reflecting a change in the depositional system.

References

- Abdala N.F., Barberena M.C., Domelles J.E.F. (in prep.) *Exaeretodon riograndensis*, n. sp., a new cynodont from the Triassic of Southern Brazil. (Submitted to *Journal of Vertebrate Paleontology*)
- Andres R.R., Bossi G.E., Montardo O.K. 1980. O Grupo Rosário do Sul (Triássico) do Rio Grande do Sul. In: SBG, Congresso Brasileiro Geologia, 31, Camboriú, *Anais*, 2:659-763.
- Araújo D.C. & Gonzaga T.D. 1980. Uma nova espécie de *Jachaleria* (Therapsida, Dicynodontia) do Triássico do Brasil. In: Congresso Argentino de Paleontologia y Bioestratigrafia, 2, and Congreso Latinoamericano de Paleontologia, 1, Buenos Aires, Ac/av, 1:159-174.
- Azevedo S.A.K. 1991. *Prestosuchus chiniensis* Huene 1942 (Reptilia, Archosauria, Thecodontia, Proterosuchia, Rauisuchidae) da Formação Santa Maria, Triássico do Estado do Rio Grande do Sul, Brasil. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, Ph.D. Thesis, 157p.
- Azevedo S.A.K. & Schultz C.L. 1987. *Scaphomys sulcognathus* sp. nov., um novo rincossaurídeo neotriássico do Rio Grande do Sul, Brasil. In: SBP, Congresso Brasileiro Paleontologia, 10, Rio de Janeiro, *Anais*, 1:99-113.
- Azevedo S.A.K., Schultz C.L., Barberena M.C. 1990. Novas evidências bioestratigráficas e paleoecológicas na análise da evolução explosiva dos rincossauroides no Triássico. *Paula-Coutiana*, 4:23-33.
- Azevedo S.A.K., Rosa A.A.S., Boelter R.A., Leal L. A. 1999. A prosauropod dinosaur from the Late Triassic of southern Brazil. *Paleontologia em Destaque*, SBP, 26:59.
- Barberena M.C. 1977. Bioestratigrafia preliminar da Formação Santa Maria. *Pesquisas*, 7:111-129, Porto Alegre.
- Barberena M.C. 1981. Novos materiais de *Traversodon stahleckeri* da Formação Santa Maria (Triássico do Rio Grande do Sul). *Pesquisas*, 14:149-162.
- Barberena M.C. 1982. Uma nova espécie de *Proterochampsia* (*P. nodosa* sp. nov.) do Triássico do Brasil. *Anais da Academia Brasileira de Ciências*, 54:127-141.
- Barberena M.C., Araújo D.C., Lavina E.L., Azevedo S.A. 1985. O estado atual do conhecimento sobre os tetrapodes permianos e triássicos do Brasil Meridional. *Coletânea de Trabalhos Paleontológicos*, MME-DNPM, série Geologia, Seção de Paleontologia e Estratigrafia, 27, 2:21-28.
- Barberena M.C., Bonaparte J.F., Teixeira A.M.S. 1987. *Thrinaxodon brasiliensis* sp. nov., a primeira ocorrência de cinodontes gaúchos para o Triássico do Rio Grande do Sul. In: SBP, Congresso Brasileiro de Paleontologia, 10, Rio de Janeiro, *Anais*, 68:76.
- Barberena M.C., Araújo D.C., Lavina E.L., Faccini U.F. 1991. The evidence for close paleofaunistic affinity between South America and Africa. In: International Gondwana Symposium, 7, São Paulo, 1988. *Proceedings*, 455-467.
- Barberena M.C., Faccini U.F., Scherer C.M.S. 1993. Situação atual e perspectivas da bioestratigrafia da Formação Santa Maria. In: Simposio sobre Cronoestratigrafia da Bacia do Paraná, 1, Rio Claro, *Anais*, 100-101.
- Benton M.J. 1986. More than one event in the late Triassic mass extinction. *Nature*, 321:857-861.
- Bonaparte J.F. 1982. Faunal replacement in the Triassic of South America. *Journal of Vertebrate Paleontology*, 2:362-371.
- Bonaparte J.F. & Barberena M.C. 1975. A possible mammalian ancestor from the Middle Triassic of Brazil (Therapsida, Cynodontia). *Journal of Paleontology*, 49:931-936.
- Bonaparte J.F. & Barberena M.C. (in prep.) A morphological review of the advanced cynodonts *Therioherpeton* and *Prozostrodon*. (submitted to *Journal of Vertebrate Paleontology*)
- Bonaparte J.F. & Fengolo J. 1999. A new Early Late Triassic saurischian dinosaur from Rio Grande do Sul State, Brazil. Gondwanan Dinosaur Symposium, 2, Tokyo, *Proceedings*, 15:89-109.
- Colbert E.H. 1970. A saurischian Dinosaur from the Triassic of Brazil. *American Museum Novitates*, 2405, 39p. New York.
- Cox C.B. 1965. New Triassic Dicynodonts from South America, their origins and relationships. *Philosophical Transactions of the Royal Society of London*, 248:457-514.
- Domelles, J.E.F. 1990. Registro sobre a ocorrência de denies de arcoossauroides para a Formação Caturrita, Triássico Superior do Rio Grande do Sul, Brasil. *Ciência & Natura*, 12:99-101, Santa Maria.
- Domelles, J.E.F. 1992. *Cerritosaurus binsfeldi* Price 1946 e *Chanarsuchus* sp. (Thecodontia, Proterosuchia, Cerritosauridae) da Formação Santa Maria, Triássico do Estado do Rio Grande do Sul, Brasil. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, M.Sc. Thesis, 81p.
- Faccini U.F. 1989. *O Permo-Triássico do Rio Grande do Sul: uma análise sob o ponto de vista das seqüências deposicionais*. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, M.Sc. Thesis, 121p.
- Fonseca M. & Scherer, C.M.S. 1998. The Middle and Late Triassic of South Brazilian Gondwanaland: a process-orientated analysis on the fluvial deposits. *Hallesches Jahrbuch für Geowissenschaften*, B(5):51-52.
- Holz M. & Scherer C.M.S. 1998. Sedimentological and paleontological evidence of paleoclimatic change during the Southbrazilian Triassic: the register of a global trend towards a humid paleoclimate. *Zentralblatt für Geologie und Paläontologie*, Teil 1 (7-8), 1998(3): 1589-1611.
- Huene F. von 1942. *Die Fossilen Reptilien des Südamerikanischen gondwanalandes*. C.H. Beck'sche Verlag, (Oscar Beck), München, 1942.
- Langer M.C., Abdala N.F., Richter M., Benton M.J. 1999. A sauropodomorph dinosaur from the Upper Triassic (Camian) of Southern Brazil. *Earth & Planetary Sciences*, 329:511-517.
- Mattar L.C.B. 1989. Descrição osteológica do crânio e segunda vertebra cervical de *Barherenasuchus brasiliensis* Mattar 1987 (Reptilia, Thecodontia) do Mesotriássico do Rio Grande do Sul, Brasil. *Anais da Academia Brasileira de Ciências*, 61:319-333.
- Peruzzo, C.S. 1990. A presença do gênero *Ischigualastia* Cox 1962 (Reptilia, Synapsida, Therapsida, Anomodontia, Dicynodontia) na Formação Santa Maria, Rio Grande do Sul, Brasil. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, *Dissertação de Mestrado*, 186p.
- Price, L.I. 1947. *Um procolofonídeo do Triássico do Rio Grande do Sul*. DNPM, Rio de Janeiro, 26p.
- Scherer C.M.S. 1994. Análise faciologica e bioestratigrafica do Triássico Superior (topo da Formação Santa Maria) na região de Candelária-RS. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, M.Sc. Thesis, IOOP.
- Scherer C.M.S. 2000. Bacia do Paraná - Sucessão Mesozoica. In: M. Holz & C.M.S. Scherer (eds.) *Geologia do Rio Grande do Sul*, Porto Alegre, Editora da UFRGS (in press).
- Scherer C.M.S. & Holz M. 1993. Elaboração do arcabouço cronoestratigrafico em seqüências continentais: uma proposta metodologica. In: Simposio Sobre Cronoestratigrafia da Bacia do Paraná, 1, Rio Claro, 1993. *Boletim de Resumos*, 99-100.
- Scherer C.M.S. & Holz, M. 1995. Aspectos climáticos do Triássico Superior: uma visão global. *Comunicações do Museu de Ciências e Tecnologia*. UBEA/PUCRS, ser. Ciências da Terra, 1:33-42, Porto Alegre.
- Schultz C.L. 1995. Subdivisão do Triássico do RS com base em macrofósseis: problemas e perspectivas. *Comunicações do Museu de Ciências e Tecnologia*. UBEA/PUCRS, ser. Ciências da Terra, 1:25-32, Porto Alegre.
- Schultz C.L. & Azevedo S.A.K. 1990. Dados preliminares sobre a ocorrência de uma nova forma de rincossauroides para o Triássico do Rio Grande do Sul - Brasil. *Paula-Coutiana*, 4:35-44, Porto Alegre.
- Schultz C.L., Scherer C.M.S., Barberena M.C. 1994. Uma nova proposta de zoneamento estratigrafico para o Triássico Superior sul-rio-grandense. In: Congresso Brasileiro de Geologia, 38, Camboriú-SC, *Boletim de Resumos*, 107-108.
- Simpson G.G. 1971. Gasification, terminologia y nomenclatura provinciales para el Cenoicoico mamalifero. *Revista de la Asociacion Geologica Argentina*, 26:281-297, Buenos Aires.
- Teixeira A.M.S. 1982. Um novo cinodonte carnívoro (*Protelesodon kitchingi* sp. nov.) do Triássico do Rio Grande do Sul, Brasil. *Comunicações do Museu de Ciências da PUCRS*, 24:1-31, Porto Alegre.
- Zacarias J.D. 1982. Uma nova espécie de tecodonte aetossaurídeo: *Aetosauroides subsulcatus* sp. nov. da Formação Santa Maria, Triássico do Rio Grande do Sul, Brasil. Instituto de Geociências, Universidade Federal do Rio Grande do Sul, M.Sc. Thesis, 67p.

Contribution IGC-064
Received February 2, 2000
Accepted for publication April 30, 2000