



## Taphonomic aspects of vertebrate fossils from Bauru Group, Upper Cretaceous, Brazil

*Aspectos tafonômicos de vertebrados fósseis da parte oriental do Grupo Bauru, Cretáceo Superior, Brasil*

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### Resumo

A Bacia Bauru abrange aproximadamente 370.000 km<sup>2</sup>, ocupando parte dos estados de São Paulo, Paraná, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Goiás e ainda o nordeste do Paraguai. O preenchimento da bacia ocorreu em clima semi-árido a árido, durante o Cretáceo Superior. A Bacia está dividida em dois Grupos: Bauru e Caiuá, sendo que o primeiro possui maior quantidade de registros e é o foco deste estudo. Foram realizados trabalhos de campo na região de Marília e Monte Alto (SP) e Uberaba (MG), nos quais foram visitados afloramentos para a coleta de dados estratigráficos e de materiais fósseis, além da visita às coleções dos Museus de Paleontologia de Marília e de Monte Alto (SP), Museu dos Dinossauros de Uberaba (MG) e coleção de Paleontologia da Universidade de São Paulo (USP Ribeirão Preto). Nas formações Vale do Rio Peixe, Uberaba, Marília, São José do Rio Preto e Presidente Prudente foram identificadas quatro classes bioestratigráficas relacionadas à articulação/desarticulação. Classe I representa espécimes articulados praticamente completos, correspondendo principalmente aos crocodilos e tartarugas. A Classe II compreende espécimes parcialmente articulados como crânios com mandíbulas ou sequências de vértebras. Classes I e II são registradas nas Formações Vale do Rio do Peixe, Marília ( Membro Serra da Galga) e Presidente Prudente. A Classe III é representada por ossos isolados e a Classe IV por ossos fragmentados. Estas duas classes ocorrem em todas as formações estudadas. Para análises diagenéticas foram feitas 19 seções delgadas que indicam que em geral, as estruturas ósseas estão bem preservadas, há preenchimento por calcita espática e manutenção da matéria fosfática original. A Formação Marília, Membro Echaporã, é a que mais se diferencia das demais unidades da bacia pelo fato de ser mais carbonática. O estudo de lâminas petrográficas, considerando a estrutura óssea e o sedimento associado, pode auxiliar na contextualização paleoambiental.

Palavras-chave: Bacia Bauru; tafonomia; vertebrados

### Abstract

The Bauru Basin covers an area of about 370.000 km<sup>2</sup>, occurring in São Paulo, Paraná, Mato Grosso, Mato Grosso do Sul, Minas Gerais and Goiás states in Brazil, and also in the northeast of Paraguay. These upper Cretaceous sequence correspond to a semi-arid to arid climate and is divided in two groups, Bauru and Caiuá. The first one has the major record of fossils, being the focus of the taphonomic study. Field trips to Marília and Monte Alto municipalities (São Paulo State) and also to Uberaba city (Minas Gerais State) were made to check the depositional context and collect fossiliferous material. Vertebrate collections were visited, as the Museu de Paleontologia from Marília and Monte Alto (SP), Museu de Paleontologia da Universidade de São Paulo, as well as Museu dos Dinossauros, Centro de Pesquisas Paleontológicas Llewellyn Ivor Price from Peirópolis (MG). Four biostratigraphic classes related to articulated/disarticulated fossils were identified in Vale do Rio Peixe, Uberaba, Marília, São José do Rio Preto and Presidente Prudente formations. Class I represents articulated and almost complete specimens, corresponding mainly to turtles and crocodiles. Class II comprises partially articulated specimens of skull and jaw fossils, or sequences of vertebrae. Classes I and II were recorded in Vale do Rio do Peixe, Marília (Serra da Galga Member) and Presidente Prudente formations. Class III is represented by isolated bones, and Class IV by fragmented bones. These two last classes appear in all units of the basin. For diagenetic analysis, 19 thin sections were made showing that, in general, the bone structure is well preserved, with spatic calcite filling the bone and the presence of the original phosphatic material. Marília Formation, on Echaporã Member, is the most different unit of the basin, being more carbonatic. The study of thin sections, considering the osseous structure and the biostratigraphic analysis, match with the paleoenvironmental contextualization.

Key-words: Bauru Group; taphonomy; vertebrates

### 1. Introduction

The Bauru Basin covers an area of about 370.000 km<sup>2</sup>, occurring on São Paulo, Paraná, Mato Grosso, Mato Grosso do Sul, Minas Gerais and Goiás states (Brazil), and the northeast of Paraguay. The Upper Cretaceous sequence preserved on the Bauru Basin corresponds to a semi-arid to arid climate deposition.

The basin has accumulated a sandy sedimentary sequence over basalts of Serra Geral Formation (regional basement). The basin is represented by two groups, Caiuá and Bauru. The first one is constituted by Rio Paraná, Goio Erê and Santo Anastácio formations; and the second group is constituted by Vale do Rio do Peixe, Araçatuba, Uberaba, São José do Rio Preto, Presidente Prudente and Marília formations (Fernandes & Coimbra, 2000). On this work, the

Bauru Group was considered, by its importance on the occurrence of many vertebrate fossils (Fig.1).

Considering the fossil record of the group, crocodiles and dinosaurs are most abundant, but there are also abundant records of turtles and fishes (e.g. Candeirol et al., 2004; Bertini et al., 2006; Laurini, 2007). Anura, Squamata, Aves and Mammalia are relatively rare (e.g. Baez & Peri, 1989; Bertini et al., 1993; Alvarenga & Nava, 2005; Candeirol et al., 2009). Ichnofossils, eggs, gastroliths and coprolites are also known from the group (e.g. Grellet-Tinner & Zaher, 2007; Fernandes et al., 2008) Since the Bauru Group is an important paleontological site (Azevedo, 2009; Candeirol et al., 2008; Candeirol et al., 2006), this work presents a taphonomic approach to vertebrate fossils found in the group.

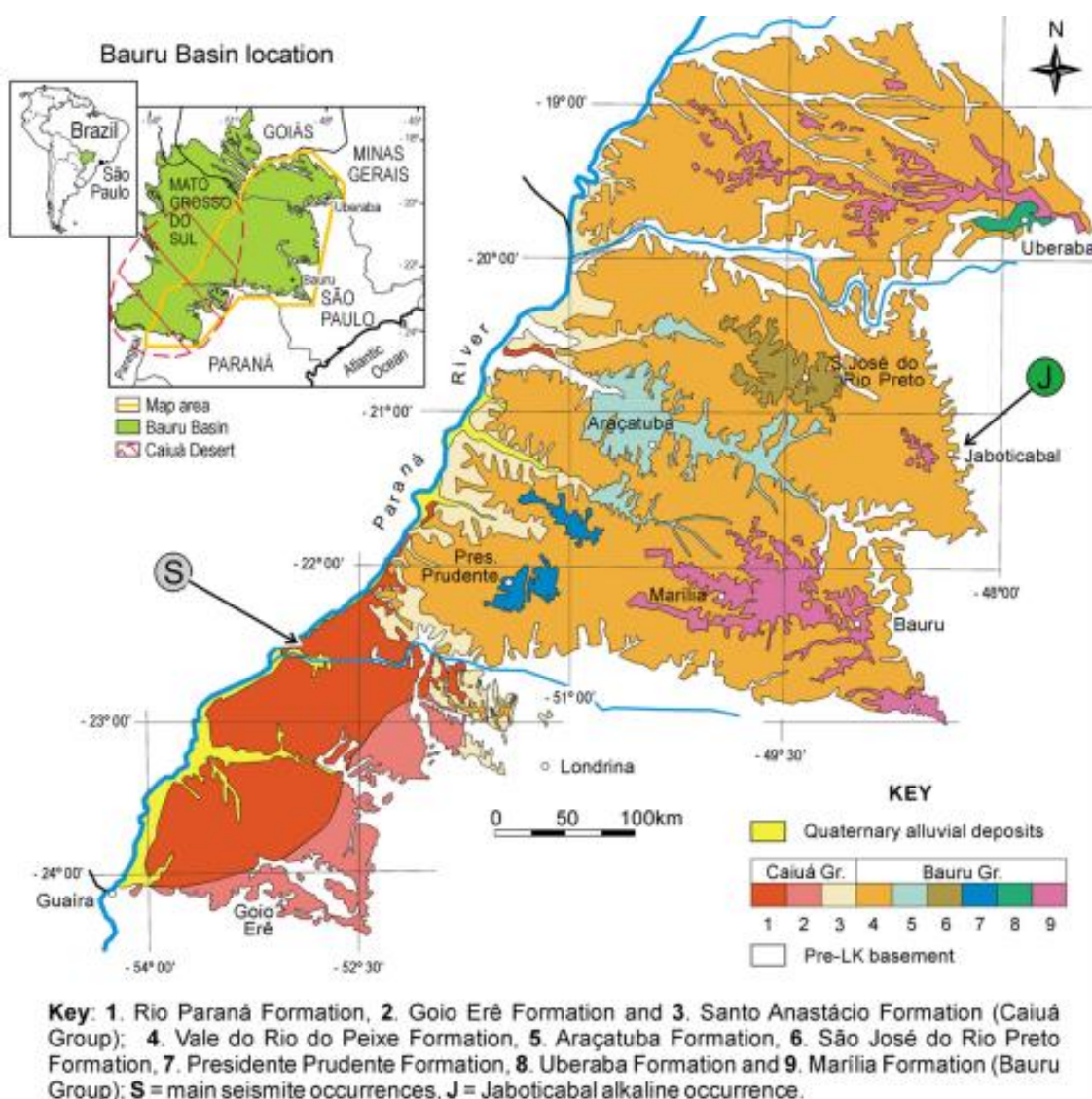


Figure 1 – Lithostratigraphic map of the Bauru Basin eastern part (after Fernandes, 2004).

## 2. Materials and methods

The outcrops studied was from Marília Formation, Echaporã Member (22°15'23,3" S 50°04'04,4" W) and from Vale do Rio do Peixe Formation (22° 20' 21"S; 49° 56' 39" W), both in Marília city (São Paulo). In Monte Alto (SP), one fossiliferous outcrop that corresponds to Vale do Rio do Peixe Formation was visited.

On Minas Gerais state, three fossiliferous outcrops were visited, all from Marília Formation. The first one corresponds to Serra da Galga Member and is known as Point 1 of Price (19° 43'27"S, 47° 44'47" W); the second outcrop corresponds to the same member and is located on BR050, km 153 (19°35' 33,3"S, 48°01'41,7" W); and the third is related to Ponte Alta Member at BR 262, km 780 (19° 43' 30" S, 47° 42' 55 " W).

Lithological profiles were made on the outcrops and were later related with the fossils that were found. All the fossils are catalogued at Laboratório de Paleontologia do Setor de Ciências da Terra, from Universidade Federal do Paraná. In the laboratory, the samples were checked in details for possible taxonomic and taphonomic classifications.

The scientific collections visited are Museu de Paleontologia de Marília, where it was possible to observe taphonomic aspects of fossils from Marília, Vale do Rio do Peixe and Presidente Prudente formations; the Museu dos Dinossauros, in Peirópolis (Minas Gerais), where it was possible to observe fossils from Uberaba and Marília formations; and the Museu de Paleontologia de Marília, where it was observed fossils from Vale do Rio do Peixe, Presidente Prudente and Marília formations. Nearly 240 samples of vertebrate fossils were analyzed in the museums, according to table 1.

**Table 1** – Approximate amount of vertebrate fossils analyzed of Bauru Group.

Formation/Member	Approximate amount of vertebrate fossils analyzed
Vale do rio do Peixe	50
Marília/Echaporã	40
Marília/Serra da Galga	100
Marília/Ponte Alta	15
Uberaba	5
Presidente Prudente	30
Total	240

In order to get a better analysis of the bone's preservation, thin sections were made from the material that was found in the field and from some samples given by the museums, and also from materials already deposited on the Laboratório de Estudos Sedimentológicos from UFPR (LabESed). Four petrographic laminas from Vale do Rio do Peixe Formation were analyzed, three from Uberaba Formation, ten from Marília Formation (five of those being from Serra da Galga Member and five from Ponte Alta Member) and two from Presidente Prudente Formation.

The laminae were analyzed at a petrography microscope under polarized and regular light from LabESed, in which digital photomicrographs of the osteologic structures and most relevant minerals were seen. The bone's samples were registered at Laboratório de Paleontologia from UFPR, as UFPR.... PV A and the thin sections as UFPR .....PV B. "UFPR" corresponds to the Universidade Federal do Paraná, and "PV" is attributed to "Paleontologia de Vertebrados".

## 3. Results

### 3.1. Biostratinomy

Considering biostratinomic data, in the materials collected during the field trips and observed on vertebrate collections, it was possible to identify four biostratinomic classes related to articulated/disarticulated fossils. Class I represents articulated and almost complete specimens; Class II comprises partially articulated specimens like skull and jaw, or sequences of vertebrae; Class III is represented by isolated bones; and Class IV by fragmented bones ( Fig. 2).

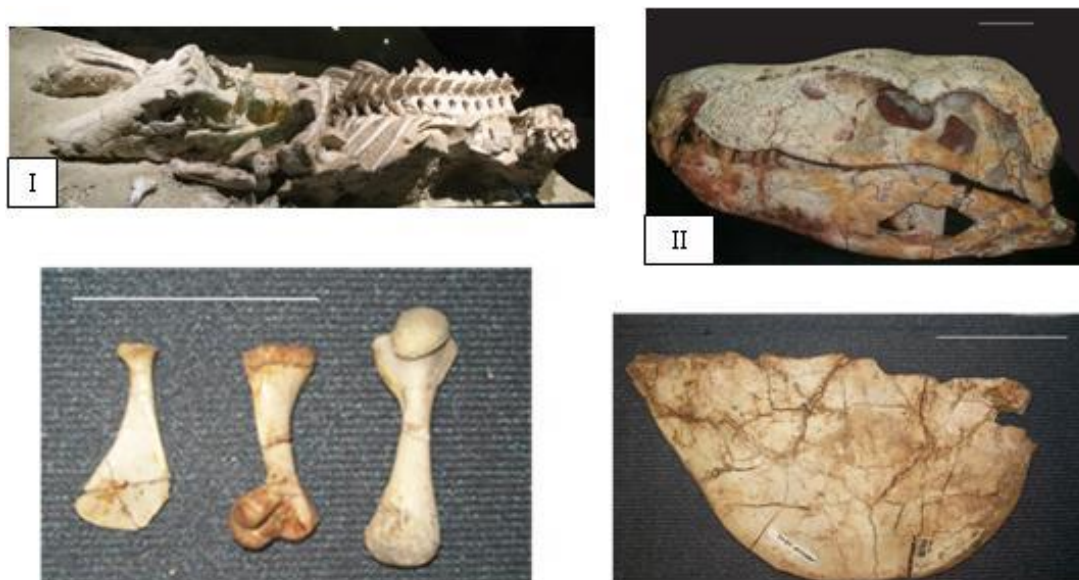
This classification is similar to that presented by Holz & Barberena (1994) for the Triassic paleoherpetofauna from South Brazil. Although, at the present work, the specimens were divided into "A" and "B", with "A" representing the fossils with dimensions smaller than 25 cm, and "B" that fossils bigger than "A" or with 25 cm. This artificial selection was used to separate bigger elements, such as femur of Titanosauria, from tiny elements, like post-cranial materials of Chelonia (Table 2).

Specimens of all biostratinomic classes were found on Vale do Rio do Peixe Formation and Serra da Galga Member (Marília Formation). Fossils from Ponte Alta and Echaporã members (Marília Formation) and São José do Rio Preto Formation are represented only by Classes III and IV (Table 2).

Ichnofossils, eggs and coprolites were not considered on this classification because they present a distinct taphonomic history from skeleton of vertebrates. However, they occur at Vale do Rio do Peixe, Uberaba and Marília formations.

The Biostratinomic Class I, represented by articulated skeletons, may be related to the ethologic behavior, quick buried or still to the carcass floating. As examples of this class are *Uberabasuchus terrificus* (Carvalho et al. 2004) and *Baurubatrachus pricei* (Baez & Peri, 1989).

The Biostratinomic Class II is represented by partially complete and articulated skeletons. Belong to this class the articulated skulls and jaws that are fairly common at Bauru Group, mainly among Crocodylomorpha. It is known that in the disarticulation sequence, usually, the articulation of the skull to the vertebrae (atlas-axis) is one of the first to disarticulate, that is, the organisms that present those elements had been buried in a time that allowed the loss of post-cranial elements.



**Figure 2** – Samples of biostratinomic classes. Class I. Articulated and almost complete specimens; Class II. Partially articulated specimens like; Class III. Isolated bones; Class IV. Fragmented bones. Scales bars: 5cm.

**Table 2** – Bauru Group formations and biostratinomic classes. A. < 25 cm B. ≥ 25 cm.

Formation/Classes	Class I		Class II		Class III		Class IV	
	A	B	A	B	A	B	A	B
Vale do Rio do Peixe	x	x	x	x	x	x	x	x
Uberaba							x	
Marília/ Serra da Galga Member	x	x	x	x	x	x	x	x
Marília / Ponte Alta Member						x	x	x
Marília/ Echaporã Member			x	x	x	x	x	x
São José do Rio Preto					x	x	x	x
Presidente Prudente				x	x	x	x	x

According to Holz and Barberena (1994), the fact of finding articulated skulls and jaws without appendicular skeleton may be related, in some cases, to the presence of scavengers, since they present a lower nutritional level. At the same way, at Bauru Group, there are few records of predatory spots (Kellner et al., 2006).

Articulated vertebrae, also inserted in Class II, are frequently seen at the unit (Squamata, Crocodylomorpha, Dinosauria and Chelonia). Articulated appendicular skeleton are rarely observed at Bauru Group and in some cases may be explained according to Holz and Barberena (1994) by mummification on arid environments.

So, on this work, Class II is represented by animals that, after death, had partial disarticulation, in some cases with the presence of biotic elements, such as trampling and scavengers.

The Biostratinomic Class III is represented by isolated bones. That is represented mainly by vertebrae and long bones (mainly from Dinosauria). Vertebrae are structures with porosity, that means they have high buoyancy with great dispersion in fluvial environments.

Otherwise, the Biostratinomic Class IV is the most abundant, represented by fragmented bones. Those elements were exposed to the weather for to long time before being buried. Bones may also be broken during transportation by high flows, trampling or scavengers. As mentioned above, at Bauru Group, there are few registers

of teeth marks on bones, like on the description of *Maxakalisaurus topai* (Kellner et al., 2006). However the storms and flows must be of very high energy to break bones of recently dead animals, because they appear to be flexible. Bown & Kraus (1981) studied a fossiliferous area in Wyoming (Estados Unidos) and found great part of the broken material as a result of high exposure, scavengers and rework at an environmental context of rainy plain. Behresmeyer (1978) also said that a bone of a recently dead animal suffers initially abrasion and rounding and after breaks. At Bauru Group mainly long broken bones were observed and also both kinds of fractures mentioned by Holz & Simões (2002), as fractures in bones of recently dead organisms and in pre-fossilized bones.

Analyzing the biostratinomic classes presented on this work and the Voohries groups, different bone elements are registered on different levels of hydraulic transportation, and those easily removed elements occur in every formation, while skulls and jaws only occur at Vale do Peixe, Marília (Serra da Galga Member) and Presidente Prudente formations.

### 3.1. Diagenesis

According to the microscopic analysis, the bone material is well preserved, with phosphate composition in most of the cases.

Analyzing the work from Holz and Schultz (1998), that made a taphonomic analysis on Triassic vertebrates from Paraná Basin, the 19 materials analyzed on Bauru Group on this work are better preserved. In most of the cases, it is possible to recognize concentric lamination, lamellae and osteocytes lacunae, with some peculiarities according to the formation, as discussed below.

At Vale do Rio do Peixe Formation occurs sparry calcite, and it is possible to visualize the bone microstructures (Fig. 3.1). There are also fragments of igneous rocks, probably related to the Serra Geral Formation (stratigraphically on the base) (Fig. 3.2).

At Uberaba Formation, the cementation (oxides/hydroxides) occurs in a larger quantity and it is posterior to calcitic (Fig. 3.3). This occurs probably because it is close to the basalts at Serra Geral Formation. The presence of these oxides had already been commented by Goldberg (1995). On all thin sections of this formation, there is a mineral related to silica (Fig. 3.4). In one petrographical thin section, there is probably zoned dolomite crystals (Fig. 3.5).

At Serra da Galga Member, on Marília Formation, all thin sections were made with materials collected on the outcrop from Km 153, BR 050, between Uberaba and Uberlândia cities (MG). At this place, fossils are found in several stratigraphical levels, mainly in all the exposed section, almost always disarticulated and fragmented, with the exception of the dinosaur *Uberabatitan ribeiroi* (Salgado & Carvalho, 2008). On the petrographical analysis, the structure of the bones is well preserved, firstly with the entrance of immature detritic material, later the spatic carbonate and finally a percolation of oxides/hydroxide (Fe and Mn). Considering that, in this outcrop, most of the records is characterized by fragments, that means transportation and exposure and, on the other hand, because of the good preservation of the structures that were observed on the lamina, it can be assumed that there must have been rework of the material, previously buried and fossilized, in agreement with Fernandes's (1998) idea for the interpretation of the presence of rivers, with flows at certain points (Figs. 4.1 and 4.2).

Considering the diagenesis, Echaporã Member (Marília Formation) is the one that shows more differences related to the other formations, since at this unit the preservation of the phosphate composition is smaller, and was replaced by calcite (Fig. 4.3). On the bone fragments analyzed, a larger quantity of immature sedimentary material was noticed filling blanks in the bones's structure, which means that those bones are more exposed and were broken before buried, allowing the entrance of material (Fig. 4.4).

Fernandes (1998) has also emphasized that at Echaporã Member the calcite highly replaced osseous material, as a result of more availability of Ca and CO<sub>3</sub> in the environment. Fernandes (2010) studied the calcretes genesis at this unit and concluded that they are mainly from freatic origin, an environmental context which agrees with the replacement of phosphate for carbonate. In spite

of the intense carbonatic cementation at this member, the original outlines of bones were visible, making it possible to identify the bone structures.

On studied material from Presidente Prudente Formation, there is observed a good preservation of bone structures. Firstly, there was a filling of sparry calcite, which was later melted, and in its place oxide appeared with irregular and acicular aspects (Fig.4.5).

Field trips and thin sections from São José do Rio Preto Formation were not made. Fernandes (1998) claimed that such unit has predominance of Titanosauria dinosaurs and crocodiles, that usually occur on sandy levels with pelitic intraclasts. The depositional environment assumed by the author was one of extensive sandy plains, periodically crossed by fluvial flows, that remobilized the organisms and concentrated the rests in sandy bars. On petrographical analysis, Fernandes (1998) verified that osteons were also filled by sparry carbonate, as the author observed at Presidente Prudente Formation, and also observed in this work, in all formations.

#### 4. Discussion/conclusion

The presence of sparry calcite in all samples could be attributed to the interior continental semi-arid to arid environment, assumed by previous studies of sedimentary evolution at the basin (Fernandes, 1998, Fernandes & Coimbra, 2000). Rainy times interchanged with dry periods, and during this last one, water evaporated quickly, favoring carbonate's precipitation (Holz & Schultz, 1998).

The depositional environment interferes directly on the preservation of organisms, as observed at Bauru Group, where the taphonomic and geological records are related to each other.

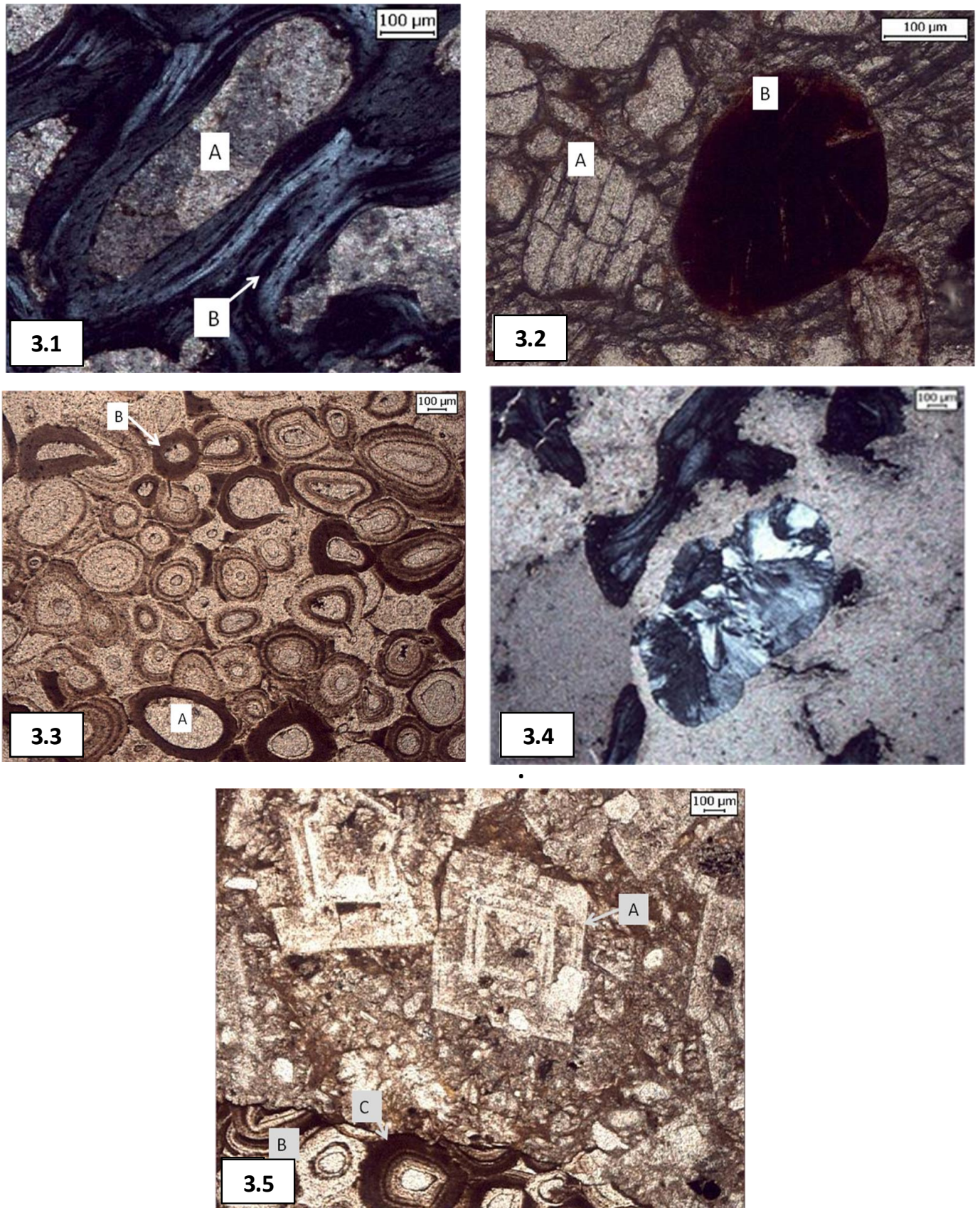
The Vale do Rio do Peixe Formation is mainly compounded by sand sheets with dunes and interdunes (Fernandes & Coimbra, 2000). The Formation has several fossils at weathering level more advanced, presenting brands and fractures. This fact may be related to long time of residence, for example on sandy sheet plains.

Uberaba Formation, on which just fragments were observed, but that also has dinosaurs eggs preserved, is characterized by sand bars, being its environment considered as fluvial braided (Fernandes & Coimbra, 2000).

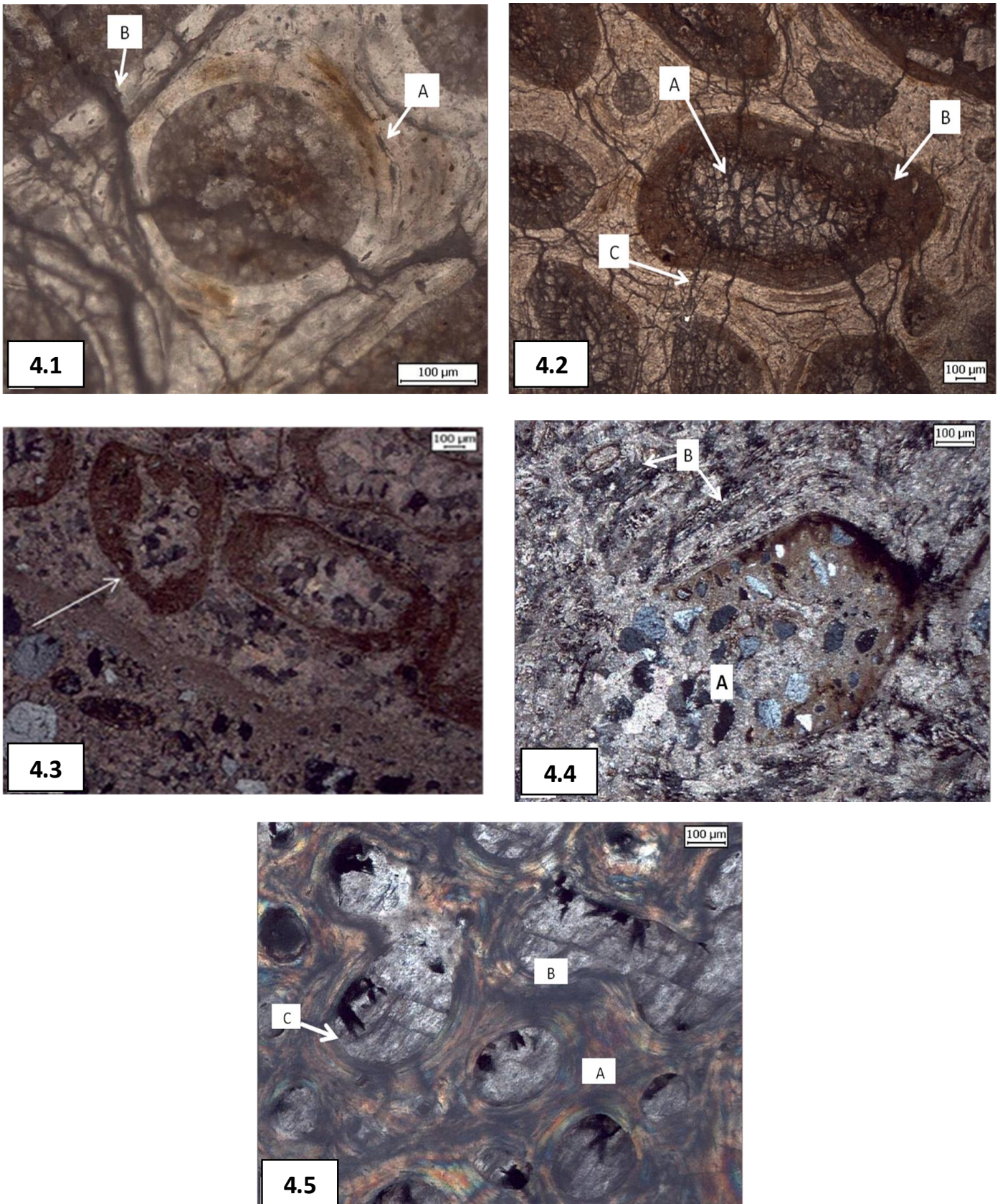
On the Marília Formation, the three units (Serra da Galga, Ponte Alta and Echaporã members) are distinct in relation to the depositional environment.

The Serra da Galga Member presents coarse to fine arenites, usually conglomeratic, and the depositional environment is interpreted as fluvial braided system (Fernandes & Coimbra, 2000). This unit has the biggest quantity of vertebrate fossil record, even being most of it fragmented.

In relation to the Ponte Alta Member, that it is very similar to Serra da Galga Member, but more cemented. From this member, just fragments were observed, probably due to the difficulty of prospection caused by the cementation.



**Figure 3.1** – Photomicrography of the material UFPR 0157 PV B, crossed polarizers, Vale do Rio do Peixe Formation. A. Spatic Calcite B. Osteocytes lacunae. Figure 3.2 - Photomicrography of the material UFPR 0155 PV B, Vale do Rio do Peixe Formation. A. Feldspar. B. Fragment of igneous rock. Figure 3.3 – Photomicrography of the material UFPR 0159 PV B, Uberaba Formation. Presence of osteons. A. Calcite. B. Oxide. Figure 3.4 - Photomicrography of the material UFPR 0160 PV B, crossed polarizers, Uberaba Formation. In the middle of the photo, there is the mineral related to silica. Figure 3.5 - Photomicrography of the material UFPR 0159 PV B, Uberaba Formation. A. Dolomite. B. Osteons. C. Oxide.



**Figure 4.1** – Photomicrographs of the material UFPR 0129 PV B, Marília Formation, Serra da Galga Member. 1. A. Osteocytes lacunae. B. Microfractures. Figure 4.2 - photomicrographs of the material UFPR 0129 PV B, Marília Formation, Serra da Galga Member. A. Sparry carbonate . B. Micritic carbonate. C. Microfractures. Figure 4.3 - Photomicrography of the material UFPR 0122 PV B, crossed polarizers, Marília Formation, Echaporã Member. Note the presence of osteons. Figure 4.4 – Photomicrography of the material UFPR 0123 PV B, crossed polarizers, Marília Formation, Echaporã Member. A. Immature sediment. B. Bone structure. Figure. 4.5 – Photomicrography of the material UFPR 0126 PV B, Presidente Prudente Formation. A. Bone structure. B.Sparry Calcite. C. Oxide with acicular aspect.

The Echaporã Member is composed by sand sheets deposits (Fernandes & Coimbra, 2000). Residual lakes have fragments of vertebrate fossil records, but there are also isolated bones. The preservation of the bone structure is smaller, that might be related to fewer deposition, for instance on the deflation plains and therefore long time of residence of the fossils.

The São José do Rio Preto Formation is composed by sand and residual lakes. Its depositional environment was interpreted as fluvial linked deposition (Fernandes & Coimbra, 2000). In this case, the presence of bone fragments and other bioclasts are relatively common at the conglomeratic levels, record mainly formed by transported bones and carcasses.

The Presidente Prudente Formation, according to Fernandes and Coimbra (2000), has evidences of filled channel and crevasse splays, characterizing a meandering fluvial system. At the facies of flood plains and crevasse splays, as Fernandes and Coimbra (2000) had already said, there might be more articulated organisms, like turtles. According to the same authors, bone fragments with remobilized clasts can be found at facies of channel fill.

Araçatuba Formation is not considered on this work, since the fossiliferous content is composed mainly by microfossils and invertebrates. The paleoenvironmental

context is interpreted as ephemeral palustrine (Fernandes & Coimbra, 2000).

Considering the taphonomic data of Bauru Group, correlation between biostratinomic and diagenetic features, as well as depositional environment, from each unit is presented on Table 3.

The depositional context of the semi-arid climate of Bauru Basin besides determining the level of fossils preservation has also influenced on its distribution. Life has developed on humid places, like flood plains and residual lakes (Bauru Group), while in arid climates, as at Caiuá Group, there are less fossil records.

It is clear, as Fernandes (1998) had already observed, that there is lack of information about the depositional environment at Bauru Basin, which is found on a few paleontological studies, but without details.

Considering the preservation of a great quantity of fragmented and disarticulated fossils, the absence of taxonomic classification makes difficult taphonomic proposals.

The discussion about the preservation level of fossils is done according to their description, with lack of deeper and more specific taphonomic works. There are some attempts in using isotopes for paleoenvironmental discussion and also microscopic analysis of the preservation, which shows many possibilities of studies at the basin.

**Table 3** – Vertebrate taphonomic aspects from units of Bauru Group . A. < 25 cm. B. ≥ 25 cm.

Lithostratigraphic units	Lithology	Depositional setting/main lithofacies	Biostratinomic classes	Textural and diagenetic features
Vale do Rio do Peixe Fm.	Fine to very fine sandstones, sometimes interlayered with mudstones	Sand sheet plains with small Aeolian dunes and wadis/laterally massive continuous beds, sometimes with cross-bedding or muddy lenses intercalations	I (A,B); II (A,B); III (A,B); IV (A,B)	Bone framework are well preserved, in immature sediments (matrix), sometimes with fragments of igneous rock; cavities are filled by sparry calcite and ferruginous cement
Uberaba Fm.	Very fine sandstones and silty mudstones	Braided fluvial systems/sandy bars and floodplains deposits	IV (A)	Bone framework are well preserved, in immature sediments (matrix); bone cavities are filled by sparry calcite and a lot of ferruginous cement
Marília Fm. Serra da Galga Mb.	Coarse to fine sandstones, often conglomeratic	Braided fluvial systems, of alluvial fans distal parts, residual inter-lobe lakes /sandy and gravel bars deposits	I (A,B); II (A,B); III (A,B); IV (A,B)	Bone framework are well preserved, in immature sediments (matrix); bone cavities are filled by sparry calcite and ferruginous cement
Marília Fm. Ponte Alta Mb.	Strongly carbonate-cemented sandstones	Braided fluvial systems, of alluvial fans distal parts/sandy and gravel bars deposits	III (B); IV (A)	–
Marília Fm. Echaporã Mb.	Fine to medium sandstones, with minor intercalations of sandy mudstones, and calcretes horizons	Sand sheet plains with wadis/laterally massive continuous beds with muddy lenses intercalated	III (A,B); IV (A,B)	Bone framework are bad preserved, in immature sediments (matrix); bone cavities are filled by sparry calcite and ferruginous cement
São José do Rio Preto Fm.	Coarse to fine sandstones, often conglomeratic	Braided fluvial systems/Sandy bars, floodplains and residual lake deposits	III (A,B); IV (A,B)	–
Presidente Prudente Fm.	Fine to very fine sandstones	Sandy meandering fluvial systems/large-scale lensoid sand bodies encased in fine-grained deposits, cut-and-fill channel	II (A,B); III (A,B); IV (A,B)	Bone framework are well preserved, in immature sediments (matrix); bone cavities are filled by sparry calcite and ferruginous cement



Discussion on literature concerning the sedimentation of paleoenvironments and lithofacies are rare on paleontological works, avoiding studies on biostratigraphy and taphonomy. The material deposited in museums most of the time reflects this problem, since it doesn't bring details according to the origin of such materials such as stratigraphic levels, spatial density, diagenesis, or what materials were found on the same level. On this way, most of the published work and data obtained by analysis of the material from collections prevent a detailed taphonomic study. Therefore, future works that may consider

biostratigraphic aspects may help to increase the taphonomic refinement of the Bauru Group.

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