

REVISION OF A CONCHOSTRACAN FORM FROM THE LA AMARGA FORMATION (LOWER CRETACEOUS), NEUQUEN BASIN, ARGENTINA

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ABSTRACT – The Cretaceous conchostracan faunas from southern South America are poorly known, only five species were described from Argentina and Uruguay. In contrast, more than twenty seven species were reported from Brazil since the end of the 19th century. In this paper, *Euestheria* sp. A from the La Amarga Formation (Lower Early Cretaceous – Late Hauterivian to Barremian) in Neuquén Basin is re-studied and assigned to the genus *Pseudestherites* Chen. This finding found represents the sixth record of the genus in the world and the first second outside China. This study increases the Cretaceous conchostracans knowledge from southern South America and brings more evidence about the close relationship among the southern American, African and Asiatic conchostracan faunas.

Key words: Conchostraca, Lower Cretaceous, Neuquén Basin, Argentina.

RESUMO – As conchostracofaunas cretáceas do extremo sul da América do Sul são pouco conhecidas. Somente 5 espécies foram descritas para a Argentina e Uruguay. Entretanto as faunas do Brasil são conhecidas desde o fim do século XIX tendo sido descritas mais de 27 espécies. Neste trabalho se redescreve *Euestheria* sp. A proveniente da Formação La Amarga (Cretáceo Inferior – Hauteriviano superior a Barremiano) da bacia Neuquina, atribuindo-a ao gênero *Pseudestherites* Chen. Este achado representa o sexto registro do gênero a nível mundial e primeiro fora da China. Com este estudo, se aumenta o conhecimento dos conchostráceos sulamericanos aportando novas evidências sobre a estreita relação existente entre as faunas sulamericanas e asiáticas.

Palabras Claves: Conchostraca, Cretácico Inferior, Cuenca Neuquina, Argentina.

INTRODUCTION

The Cretaceous conchostracan faunas from southern South America are poorly known. At the moment, only five species were described from Argentina and Uruguay. *Euestheria* sp. A (Musacchio, 1970) from the La Amarga Formation (Lower Cretaceous, Argentina) in Neuquén province is redescribed here as *Pseudestherites musacchioi* sp. nov.. *Cyzicus? codoensis* Cardoso (in Chiappe *et al.*, 1998) from the Lagarcito Formation (Lower Cretaceous, San Luis province), is a new species of the genus *Dendrostracus* Chen and Hudson (Polygraptidae), after the revision of additional material from the Lagarcito Formation from San Juan province (Ballent *et al.*, 2002; Prámparo *et al.*, 2003, in press). In Uruguay Gallego *et al.* (1999) described two new species from the Lower Cretaceous, *Palaeolimnadiopsis hectori* (Palaeolimnadiopsidae) and *Tenuestheria canelonesensis* (Euesthe-

riidae) from the Castellanos Formation (Santa Lucía Basin, south Uruguay). Otherwise, Shen *et al.* (in press) re-studied *Migransia ferrandoi* (Herbst) (Fushunograptidae) from the Tacuarembó Formation, Upper Jurassic to ?Lower Cretaceous, of Uruguay.

In contrast, in Brazil more than twenty seven species had been described by different authors (see Tasch, 1987; Carvalho, 1993; Rohn and Cavalheiro, 1996) since the end of the 19th century.

In this paper, the species *Euestheria* sp. A (Musacchio, 1970) is redescribed based on the study of the original materials using scanning electron microscope (SEM), which provided new evidence of its taxonomic assignment. This species previously assigned to Lioestheriidae (Lioestheriinae) by Musacchio (1970) is now referred to the genus *Pseudestherites* (Antronestheriidae, Chen & Hudson, 1991) as a new species.

According to Musacchio (1970) the fossil samples came from Picún Leufú and Cerro China Muerta localities, but at the moment in the repository there are only five samples (MLP 11354-11357a-b, cited in Musacchio, 1970) that certainly came from Cerro China Muerta locality (level 27 of the profile from Musacchio 1971a, b). Probably, the samples from the level 38 from Cerro China Muerta and levels 4b and 9 from the Picún Leufú profile (Musacchio, 1971a, b) are missing, because all of these materials were never finally deposited in this repository.

The studied samples are housed in the Departamento Paleontología Invertebrados del Museo de Ciencias Naturales de La Plata (Argentina) prefixed by MLP. The SEM samples are housed in the Paleozoological Collection of the Facultad de Ciencias Exactas y Naturales y Agrimensura, Universidad Nacional del Nordeste (Corrientes, Argentina) prefixed by PZ-CTES.

GEOLOGICAL SETTING AND DEPOSITIONAL ENVIRONMENT

The conchostracans samples came (*sensu* Musacchio, 1970) from two localities: in “Picún Leufú” area, next to Picún

Leufú River and “Cerro China Muerta” type locality of the La Amarga Formation, Neuquén province (Southeastern border of the Neuquén Basin) Argentina (Figure 1). Both belong to the La Amarga Formation, dated as Early Cretaceous (Late Hauterivian – Barremian) by Musacchio (1989). The Barremian stage was dated by the presence of the charophytes *Atopochara trivolvris triquetra* Grambast, *Triclypella patagonica* Musacchio and *Mesochara cf. stipitata* Wang, and the ostracods *Cypridea (Ullwellia) australis* Musacchio, *C. (U.) subcuadrata* Musacchio, *C. (U.) modestissima* Musacchio and *Dryelba picunleufensis* Musacchio. The possible Hauterivian age was supported by local stratigraphical relations. The non-marine levels belonging to the La Amarga Formation are intertongued between marine sediments of the uppermost Agrio Formation (Musacchio, 1989). At the Picún Leufú locality, the La Amarga Formation is mainly composed of lacustrine gray and grayish-yellow marls including scarce limestones, variegated mudstones and siltstones, it overlies transitionally the Agrio Formation (Musacchio, 1989). Leanza & Hugo (1997) mentioned that La Amarga Formation unconformably overlies the transitional levels of the Agrio Formation. At the Cerro China Muerta locality, the lower

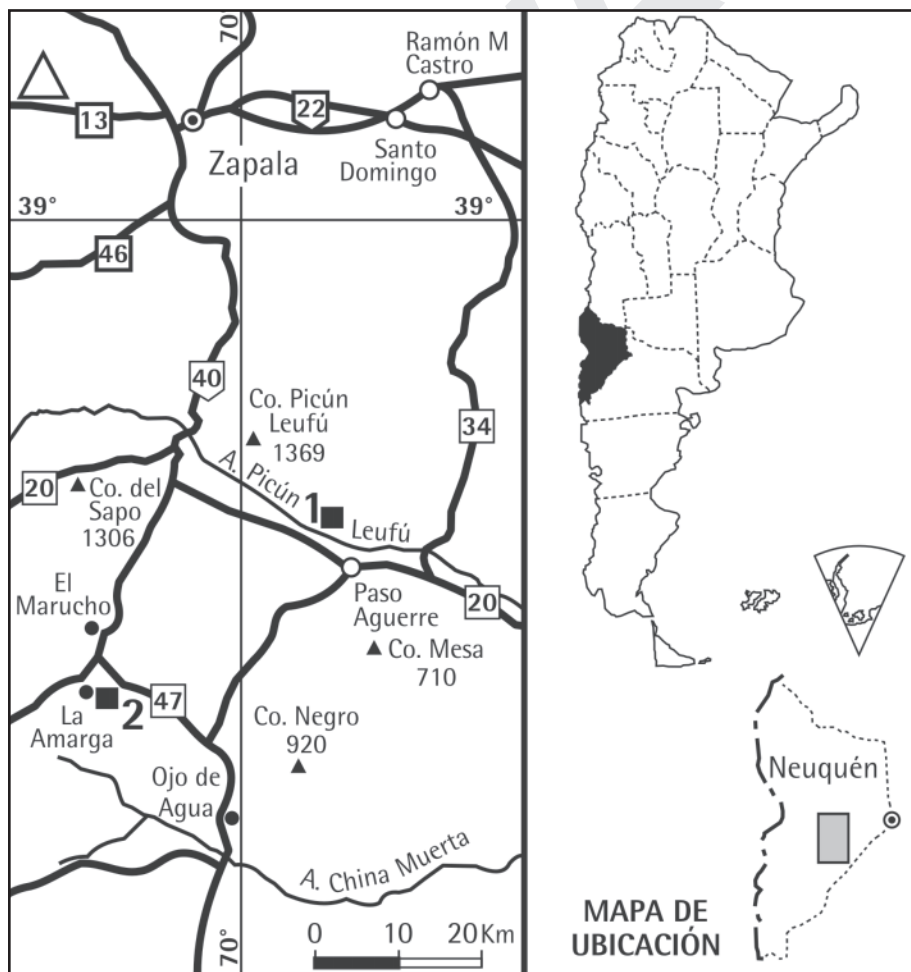


Figure 1. Location map of the fossiliferous localities of the La Amarga Formation, Neuquén Province, Argentina. 1. “Picún Leufú”, 2. “Cerro China Muerta”. (modified from Pramparo & Volkheimer, 2002 and Musacchio, 1971a).

part of the profile of the La Amarga Formation includes continental sandstones and conglomerates, and upwards many limestone levels, also of continental origin (Musacchio, 1989) (Figure 2). Leanza & Hugo (1995) divided the La Amarga Formation into three members: Puesto Antiguo (that provides remains of the sauropod dinosaur *Amargasaurus cazaui* Salgado and Bonaparte), Bañados de Caichigüe (that contains abundant fossils contents, such as conchostracans, ostracods, charophytes, pollen and megaspores) and Piedra Parada members. In Leanza & Hugo (1997), a complete stratigraphical sketch of this area is presented.

Musacchio (1971b) mentioned that the La Amarga Formation could be of continental environmental sediments based on the presence of ostracod *Cypridea* and other palaeontological evidence (such as plants *Equisetites* sp. and ostracod “*Gomphocythere*” *neuquenensis* Musacchio).

Di Paola (1969) suggested that the diagenetic association “zeolite-clays” that characterizes the sedimentary association from Cerro China Muerta, indicates warm climate conditions with a progressive dryness for the Cerro China Muerta area. According with this conclusion we observed the presence of thin pyrite layer covering the carapace of all conchostracan specimens that suggested an environment with anoxic conditions (high pH and cationic contents and restricted water circulation).

Pramparo & Volkheimer (2002) studied the palynological content of an outcropping section of the middle member (Bañados de Caichigüe Member) of the La Amarga Formation located 7 km east from La Amarga locality. They concluded that, based on the abundance of colonial Chlorococcales (*Scenedesmus* dominant), mainly large cenobia (24 to 32 cells), a lacustrine environment with a high nutrient content (eutrophic conditions) could be suggested for the studied formation.

The environmental conditions mentioned above are coincident with the low number of the specimens observed in the studied samples.

SYSTEMATIC DESCRIPTION

Order CONCHOSTRACA Sars, 1867

Suborder SPINICAUDATA Linder, 1945

Superfamily EOSESTHERIOIDEA Zhang and Chen

Family ANTRONESTHERIIDAE Chen and Hudson, 1991

Genus *Pseudestherites* Chen (in Zhang *et al.*, 1976)

Type species. *Pseudestherites qinghemensis* Chen (in Zhang *et al.*, 1976); Lower Cretaceous Shahai Formation, Qinghem, Fuxin city, Liaoning province, China.

Pseudestherites musacchioi sp. nov.
(Figures 3A-D, 4, 5)

1970, *Euestheria* sp. A, Musacchio, p. 315, Lám. II, Fig. 10.

Etymology. Dedicated to Dr. Eduardo Musacchio for his great

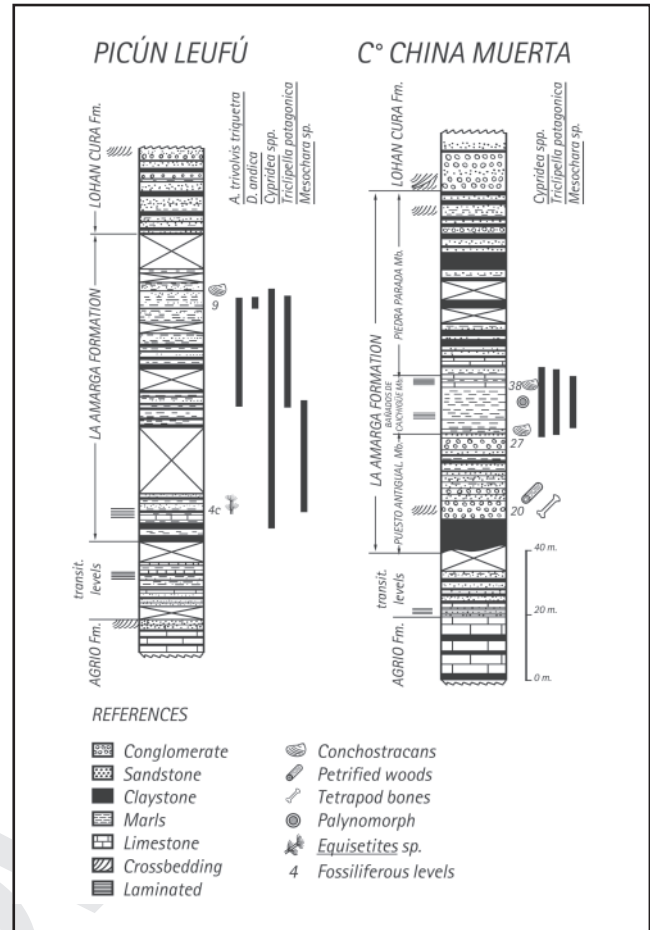


Figure 2. Stratigraphic section of the La Amarga Formation, showing the conchostracan levels and other fossiliferous horizons (modified from Musacchio, 1971a, 1989 and Pramparo & Volkheimer, 2002).

contribution to the micropaleontology of the Jurassic-Cretaceous continental sediments from Argentina.

Type locality. Cerro China Muerta, Neuquén Province, Argentina.

Holotype. MLP 11354. Dimensions (in mm): L= 8.2; H= 4.6

Paratypes. MLP 11355A, 11356, 11357a-b, PZ-CTES 7294; 10 complete specimens and 19 fragmentary ones.

Stratigraphic position. La Amarga Formation (probably Bañados de Caichigüe Member), level 27 from Musacchio (1971a).

Age. Early Cretaceous (Late Hauterivian – Barremian)

Diagnosis. Carapace valve elliptical to subtriangular? in outline, moderate in size, straight and long dorsal margin. Subterminal umbo not rising above the dorsal margin. Broad growth bands ornamented with minute punctuated or cavernous sculpture, fossae subcircular to elliptical mostly separated by a smooth surface, dimensions ranging from 0,04 to 0,006 mm, dorsally decreased in size. Last few growth bands ornamented with oblique radial anastomose striae, inclined posteriorly.

Description. Carapace valve elliptical to subtriangular? in outline, telliniform, moderate in size, 3.3 – 8.9 mm in length and 2.6 – 5.1 mm in height, straight and long dorsal margin (2/3 of length),

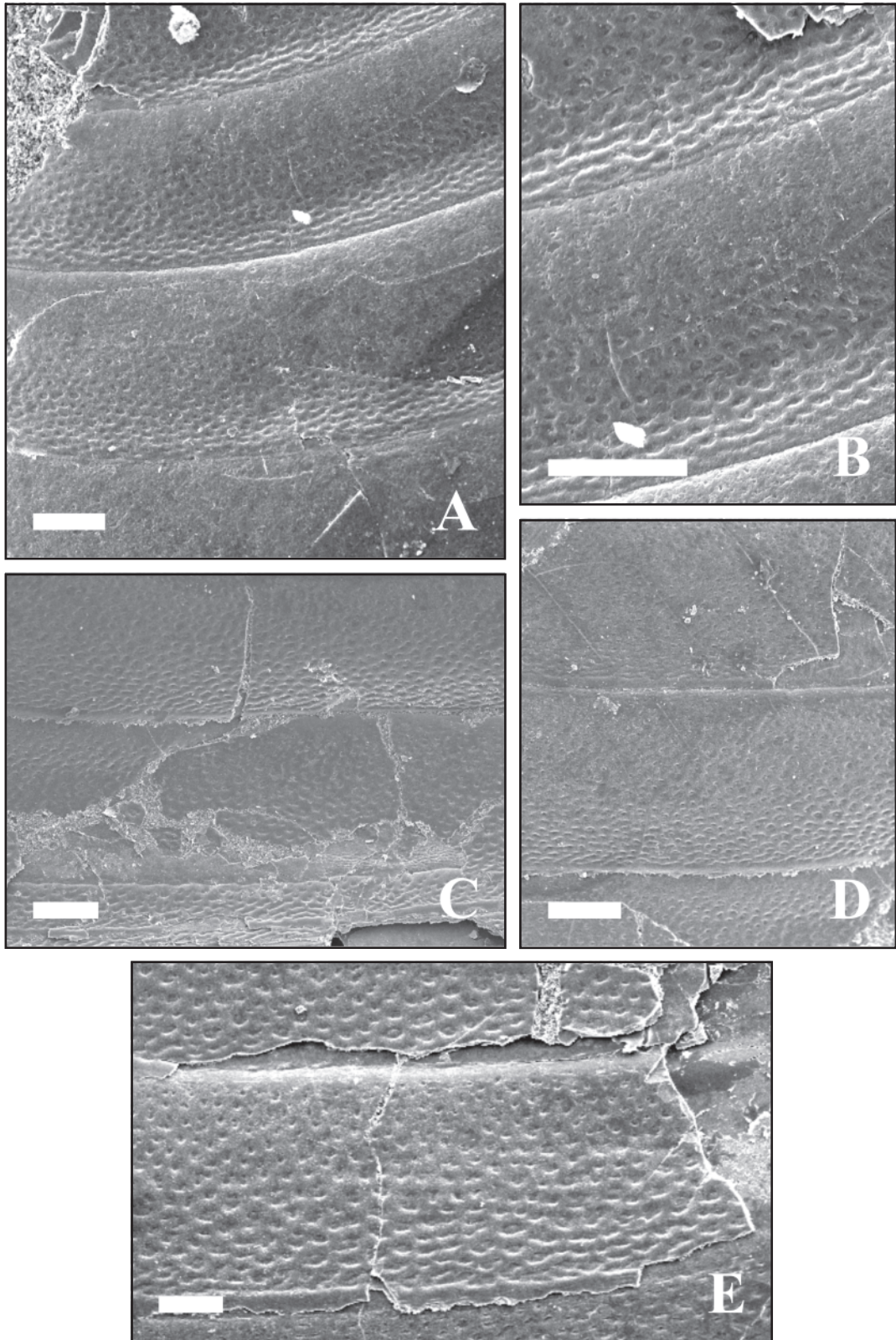


Figure 4. *Pseudestherites musacchioi* sp. nov., paratype, PZ-CTES 7294 (A-B from Fig. 3A/ MLP 11354, C-D from Fig. 3B/ MLP 11356, and E from Fig. 3C/ MLP 11355). **A.** middle-dorsal detail of a valve, showing cavernous ornamentation on the growth bands, weak at the upper part, scale bar= 0,05 mm. **B.** middle-dorsal detail showing the ornamentation changed downward with larger size from subcircular to elliptical cavities, scale bar= 0,05. **C.** ventral detail showing the transition between the elliptical cavities to oblique radial anastomose striae (as strong meshes), scale bar= 0,1 mm. **D.** middle-posterior detail of a valve, showing the transition between small elliptical cavities to punctuated ornamentation upward, scale bar= 0,1 mm. **E.** middle-anterior detail of a valve showing elliptical cavities changed into punctuated ornamentation upward, scale bar= 0,05 mm.

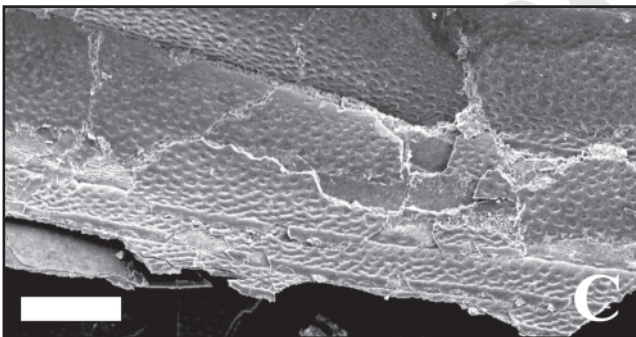
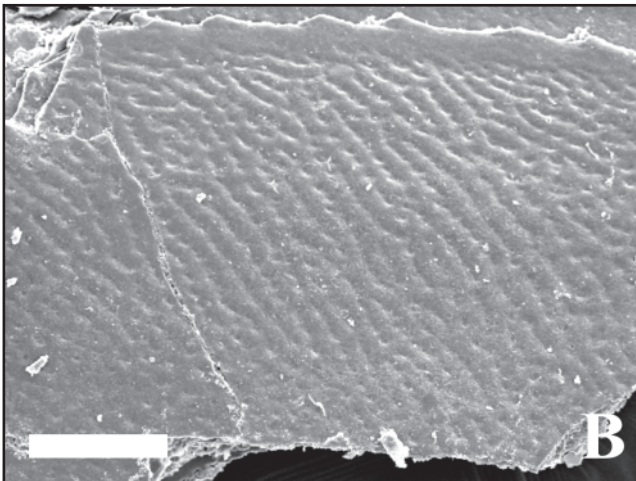
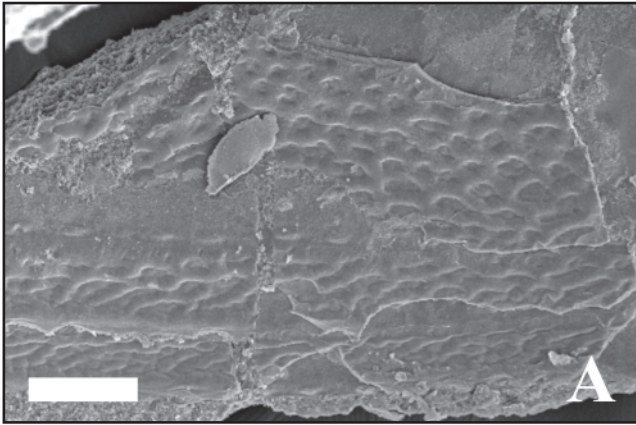


Figure 5. *Pseudestherites musacchioi* sp. nov., paratype, PZ-CTES 7294 (A from MLP 11357a, B from Fig. 3A/ MLP 11354, and C from Fig. 3B/ MLP 11356), **A-C.** Three different aspects of ornamentation on the ventral part of a valve, **A, C.** showing ornamentation changing from subcircular or elliptical cavities to oblique radial anastomose striae (as strong meshes), scale bar= 0,1 mm. **B.** ventral broad growth band with oblique radial anastomose striae, posteriorly inclined, scale bar= 0,05 mm.

Remarks. This is the first record of the genus *Pseudestherites* Chen outside China, but there is a second form, still unpublished, from the Lagarcito Formation (Albian), Argentina (Prámparo *et al.*, in press). The latter differs from *P. musacchioi* sp. nov. in its ovate outline, subcentral umbo, equal anterior and posterior height and growth bands ornamented only by small ovate cavities. Both forms

are quite similar in dimensions and form of the cavities that decrease in size upward in each growth bands.

In China there are five species of the genus *Pseudestherites*, that were found in five localities: *P. qinghemensis* Chen from the Lower Cretaceous (Hauterivian) Sahai Formation, western Liaoning province (Zhang *et al.*, 1976) and Xiagou Formation, Hexi Corridor, Gansu province (Shen *et al.*, 1982, pl. 18, fig. 11); *P. elliptica* Dong from the Lower Cretaceous Hengtongshan Formation, southern Jilin province (Dong, 1988); *P. jianchangensis* W. Wang from the Lower Cretaceous Sahai Formation, Jianchang, Liaoning province (Wang, 1987, pl. 22, figs. 5-12); *P. zhangwuensis* W. Wang (Wang, 1989, p. 307, pl.1, fig. 3; pl.2, fig. 1) and *P. leijiaensis* W. Wang (Wang, 1989, p. 307-308, pl. 2, fig. 2) from the Lower Cretaceous Sahai Formation, Zhangwu, Liaoning province (NE China).

The new species is quite similar to the type species *Pseudestherites qinghemensis* Chen (in Zhang *et al.*, 1976, p. 152, pl. 39, figs. 7-9) in cavernous sculpture, but the latter shows subquadrate shape, umbo rising above the dorsal margin and it exhibits different ornamentation, the subcircular fossae the cavernous ornamentation in the dorsal region of the growth band not changed into transversally elliptical in the ventral region. The present species approaches to *Pseudestherites elliptica* (Dong, 1988, pl. 1, figs.1, 2) in the elliptical outline and ornamentation with radial striae in the postero-ventral region of the valve. But differs from the latter in its ornamental change on the same growth bands that is also distinguishing from *Pseudestherites jianchangensis*, *Pseudestherites zhangwuensis* and *Pseudestherites leijiaensis*.

The new species shows similarities to the euestherid *Tenuestheria canelonesensis* Gallego from the Lower Cretaceous (Albian) of Uruguay in outline, straight dorsal margin, subterminal umbo, dimensions and H/L ratio. The latter differs from the present species in the areolar ornamentation, meshes of 0.02 mm diameter, medium height and clearly different anterior and posterior margins.

It is also compared with other Lower Cretaceous species, "*Pseudestheria*" *abaetensis* (Cardoso, 1971) from the Areado Formation in Brazil and *Cyzicus (Euestheria) anomala* (Jones) Tasch (1987) from Uitenhage Series in South Africa. Both forms share with the present species *Pseudestherites musacchioi* n. sp. similar outline, comparative characteristics between anterior and posterior margins, dimensions (with "*P.*" *abaetensis*) and the location of the umbo, which is not rising above dorsal margin. They differ in the larger length of the dorsal margin (hingeline), abruptly joined with the posterior one, highest at the middle region, minor H/L ratio and growth bands with areolar or minute granular ornamentation. In other hand, due to their close similarities, probably "*P.*" *abaetensis* Cardoso is a synonymous of *C. (E.) anomala* Jones.

Cyzicus (Euestheria) lefranci (Tasch, 1987) from the Upper Cretaceous of Algeria (Africa) shares elliptical outline, straight dorsal margin, posteriorly inclined, joined slightly with the posterior margin and spacing growth bands. But it differs from the present species in subovate specimens, terminal umbo (subterminal in ovate forms), larger H/L ratio, smaller size and

growth bands ornamented with fine reticulate pattern. This form may preserve partly soft parts, such as claspers and digestive tuber (p. 155, pl. 3, fig. 4).

CONCLUDING REMARKS

This finding represents the sixth record of the genus *Pseudestherites* in the world and the first one outside China. This study increases the Cretaceous conchostracans knowledge from southern South America and brings more evidence about the close relationship among the South American, African and Asiatic conchostracan faunas (Shen *et al.*, in press).

Additionally, we found a probable specimen of the genus *Estheriina* sp. (may be *Palaeolimnadia*) associated with *Pseudestherites musacchioi* sp. nov. (see fig. 3E-F). This genus has large record in the Cretaceous sediments of South America, included Brazil and Argentina (Lagarcito Formation, Lower Cretaceous; Prámparo *et al.*, 2003).

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