

First Record of Ostracods from the Upper Silurian Tambolar Formation, Argentine Precordillera

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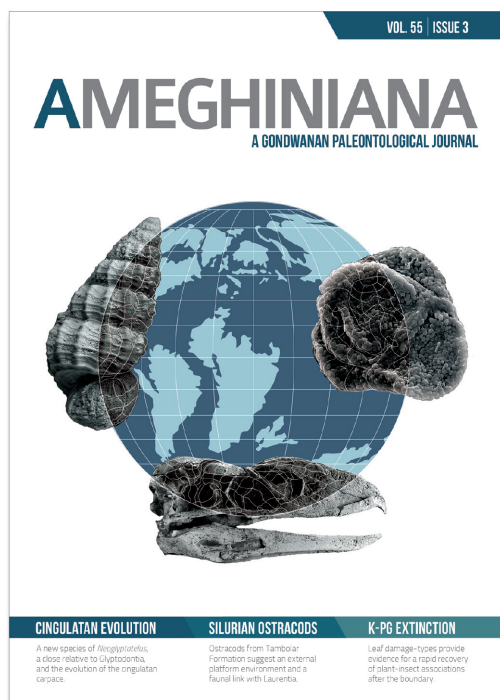
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FIRST RECORD OF OSTRACODS FROM THE UPPER SILURIAN TAMBOLAR FORMATION, ARGENTINE PRECORDILLERA

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Abstract. Ostracods have been recovered from the upper levels of the Pachaco Facies of the Tambolar Formation of the Argentine Precordillera. Four species, two of which are new (*Bollia* sp. nov., *Neothlipsura khiska* sp. nov.), are described. An evaluation of the conodont fauna suggests an late Silurian (Pridoli) to possibly Early Devonian (earliest Lochkovian) age for the unit. The ostracod fauna is characterized by the absence of dimorphic Palaeocopina, forms typically abundant during the Silurian, and by the presence of *Tricornina*, a thin shelled spinose genus, together with representatives of Binodicopina and Metacopina (Thlipsuroidea). The taxonomic composition of the ostracods corresponds to the Assemblage III of the Eifelian Mega-Assemblage or to a “mixed assemblage”, suggesting a deep subtidal environment close to the area of the storm wave base. This interpretation is consistent with an external platform environment proposed by other authors based on a stratigraphic analysis. The presence of ostracod taxa such as *Neothlipsura khiska* sp. nov. and *Tricornina*? sp. suggests a faunal link with the palaeocontinent of Laurentia.

Key words. Ostracods. Silurian. Taxonomy. Paleogeography. Argentina.

Resumen. PRIMER REGISTRO DE OSTRÁCODOS DEL SILÚRICO SUPERIOR DE LA FORMACIÓN TAMBOLAR, PRECORDILLERA ARGENTINA. Fueron estudiados los ostrácodos de los niveles superiores de la Facies Pachaco (Formación Tambolar) en la Precordillera Argentina. Se describieron cuatro especies, de las cuales dos son nuevas (*Bollia* sp. nov., *Neothlipsura khiska* sp. nov.). Una nueva evaluación de la fauna de conodontes registrada en la unidad sugiere una edad Silúrico tardío (Pridoliano)–?Devónico Temprano (Lochkoviano temprano) para la misma. La asociación de ostrácodos estudiada se destaca por la ausencia de Palaeocopina dimórficos, formas muy comunes durante el Silúrico y por la presencia de *Tricornina*, género de conchilla delgada y espinas, junto a Binodicopina y Metacopina (Thlipsuraceas). La composición taxonómica correspondería a la Asociación III de la Eifelian Mega Assemblage o “asociación de mezcla”, hecho que sugiere un ambiente de plataforma cercano a la línea de base de olas de tormenta. Esta interpretación es consistente con el ambiente de plataforma externa propuesto por otros autores a partir del análisis estratigráfico de la unidad. Respecto a las afinidades paleobiogeográficas el material estudiado sugiere relaciones faunísticas con Laurentia, debido a la presencia de *Neothlipsura khiska* sp. nov. y *Tricornina*? sp.

Palabras clave. Ostrácodos. Silúrico. Taxonomía. Paleogeografía. Argentina.

THE ostracod fauna of the Silurian of Argentina has been scarcely documented. Hitherto studies of ostracods from Argentina have focused mainly on Ordovician (Schallreuter, 1996; Salas, 2002a, b, 2003, 2007, 2011; Salas *et al.*, 2007; Salas and Vaccari, 2012) and Devonian faunas (Salas *et al.*, 2013; Salas, 2016).

Thomas (1905) was the first to study Silurian ostracods from Argentina, with a brief description of the species *Beyrichia argentina* Thomas, 1905 which was probably recovered from the upper levels of the Los Espejos Formation. More recently, Vannier *et al.* (1995) described five ostracod species in an analysis of upper Silurian–Lower Devonian

faunas from the Argentine Precordillera and the Bolivian Altiplano (Tarabuco and Santa Rosa formations). The precordilleran association that they described was collected from the upper part of the Los Espejos Formation at the Cerro del Fuerte section. This formation crops out extensively to the north of the San Juan River, encompassing most of the Central Precordillera. To the south, the Silurian deposits were classically named Tambolar Formation, the type locality for which is the Portezuelo del Tambolar section (Heim, 1952). Beresi (1980) extended this name to the Silurian deposits that overlie the San Juan Formation in the Pachaco area. Later, Peralta and León (1993) proposed the

name “Pachaco Facies” of the Tambolar Formation for these deposits, due to the litological differences between these sediments and those of the type section.

In this pilot study we report new records of Silurian ostracods retrieved from the upper levels of the Tambolar Formation (Pachaco Facies), cropping out south of the San Juan River in the Pachaco locality. The material is abundant but the nature of its preservation prevents the identification of some of it. Palaeobiogeographical and palaeoenvironmental inferences will be made based on this material.

GEOLOGICAL SETTING AND PROVENANCE OF THE MATERIAL

The Tambolar Formation is exposed in the San Juan River area, Central Precordillera. The unit unconformably overlies the San Juan Formation, which consists of Ordovician limestones (Serpagli, 1974) and it is overlain in apparent paraconformity by the Lower Devonian shale of the Tala-casto Formation. In its type section (Portezuelo de Tambolar) the Tambolar Formation is 60 m thick and comprises green and purple mudstones with green sandstone beds towards the top. The study area is located at the kilometer 91 of the National Road N° 20 between the cities of San Juan and Calingasta. The Silurian outcrops of the area are named “Pachaco Facies” of the Tambolar Formation, and are exposed 1000 m west of the Pachaco locality. The succession is 23 m thick and composed of a lower and upper member, both of which have green and purple mudstones. The upper member exhibits two bioclastic levels in the upper part of the section (Fig. 1).

Previous works on the Tambolar Formation, carried out in the Guanaco Muerto section (southern end of the outcrops) can be mentioned. Peralta and León (1993) carried out a stratigraphical analysis of the unit and proposed a distal platform environment, close to the storm weather wave base, for the upper beds of this unit. The authors suggested a lithostratigraphic correlation of the Tambolar Formation (Pachaco Facies) with the La Chilca and Los Espejos formations, that crop out to the north of the Precordillera. In contrast, based in part on the presence of ripple marks on top of the beds and on the hydrodynamic reworking of the fossils, Franciosi (1995) interpreted a shallower environment for these deposits, proposing a possible internal platform affected by storms for the sequence. Regarding

the age of the formation, Benedetto and Franciosi (1998) studied the brachiopod association recorded in the upper levels of the Pachaco Facies and suggested a Wenlock, Silurian age for these levels. The brachiopod association is composed of *Orthostrophella* n. sp. Benedetto and Franciosi, 1998, *Dedzetina* (*Notodedzetina*) *silurica* Benedetto in Benedetto *et al.* (1992), *Leangella* (*Leangella*) sp., *Leptaena* sp., *Australina* sp., *Howellella?* sp. and *Harringtonina?* sp. Mestre (2009) reported the first conodont record from the Tambolar Formation (Pachaco Facies) and proposed a Pridoli age for the unit.

The material that we studied comes from the northern part of the outcrop in La Horqueta Creek section, 1 km west of the Pachaco locality. The fauna was recovered from one fossiliferous horizon in the upper levels of the Pachaco Facies. The bed in question is 20 to 30 cm thick and consists of bioclastic sandstones with dispersed fragments of brachiopods and a high concentration of rugose corals and ostracods.

MATERIAL AND METHODOLOGY

The fossils studied were obtained by one of us (AM) when processing material to recover conodonts (Mestre, 2009). Approximately 4 kg of the bioclastic sandstone bed was dissolved in diluted formic acid using the techniques described by Stone (1987). The insoluble fraction of the sample was picked for ostracods and conodonts, resulting in the recovery of abundant ostracods and about 40 conodont elements. The ostracod valves are preserved as a replacement in silica and show a varied quality of preservation.

Institutional abbreviation. INGEO-MP, Instituto de Geología-Emiliano Aparicio, Universidad Nacional de San Juan, San Juan, Argentina.

CONODONT BIOSTRATIGRAPHY DISCUSSION

Mestre (2009) carried out the first study of conodonts from the upper part of the Tambolar Formation (Pachaco Facies), which was suggested to be of early Pridoli, Silurian age. The assemblage is the first conodont fauna of that age to be recognized from the Precordillera and Argentina. It consists of *Dapsilodus obliquicostatus* (Branson and Mehl, 1933), *Delotaxis* cf. *elegans* (Walliser, 1964), *Wurmiella* cf. *excavata* (Branson and Mehl, 1933), *Zieglerodina?* cf. *zellmeri* Carls, Slavík and Valenzuela-Ríos, 2007 and *Belodella* sp.

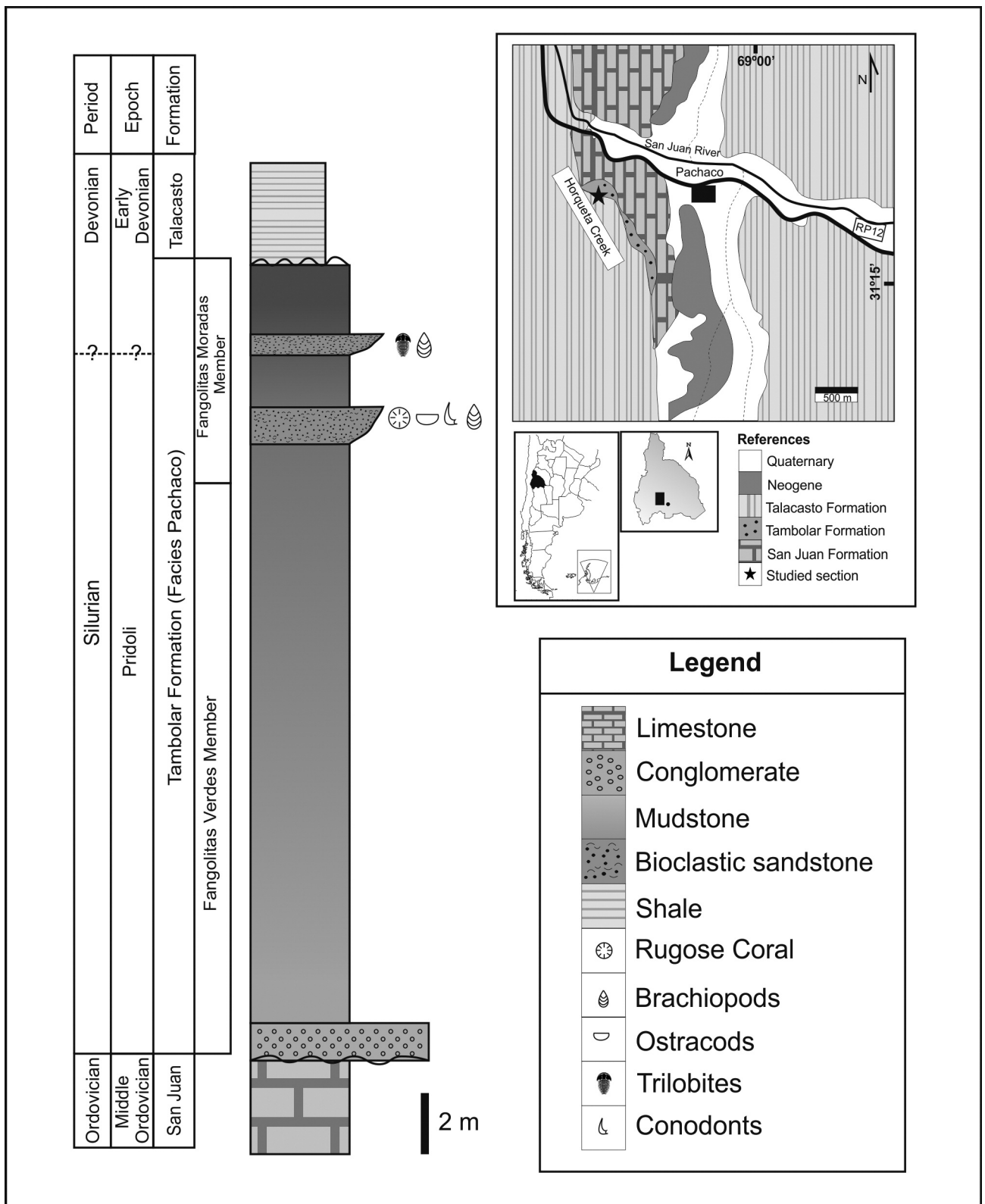


Figure 1. Map showing the geographical position of the fossiliferous site and a stratigraphical section of the Tambolar Formation (Pachaco Facies) indicating the ostracod-bearing levels. The black rectangle indicates Pachaco locality.

Recently, knowledge of Silurian conodonts biostratigraphy of the Precordillera has increased with the studies of Gómez (2015), Garcías (2016), Gómez *et al.* (2017) and Mestre *et al.* (2017). Mindful of these advances, we undertook a taxonomic review of the conodont association recovered by Mestre (2009). The presence of *Dapsilodus obliquicostatus*, *Wurmiella excavata*, *Oulodus elegans elegans*, *Zieglerodina* sp. and *Belodella* sp. allows us to propose a new interpretation of the age of the upper part of the Tambolar Formation (Pachaco Facies).

The genus *Zieglerodina* Murphy, Valenzuela-Ríos and Carls, 2004 has its first appearance in the Pridoli, and reach its acme and higher diversification at the Silurian/Devonian boundary (Carls *et al.*, 2007; Drygant and Szaniawski, 2012; Slavík *et al.*, 2012; Gómez, 2015; Corrigan *et al.*, 2016; Corradini and Corrigan, 2017; Huškova and Slavík, 2017). The conodont association and, especially, the presence of *Zieglerodina*, allows us to suggest a Pridoli–Lochkovian age for the upper part of the Tambolar Formation.

SYSTEMATIC PALEONTOLOGY

The taxonomic classification adopted herein follows that proposed by Mohibullah *et al.* (2014) and the references therein. The terms used for morphological features are based on Moore (1961) and Vannier *et al.* (1989). Abbreviations: **Lmax**, maximum length of the valve; **Lmax:Hmax**, maximum length/maximum height ratio; **L1–L4**, lobes from the anterior to posterior; **N1**, anterior node; **N2**, preadductor node; **S1–S2**, sulci from anterior to posterior.

Order BEYRICHIOCOPIDA Pokorný, 1954

Suborder PALAEOCOPINA Henningsmoen, 1953

Superfamily DREPANELLOIDEA Ulrich and Bassler, 1923

Family BOLLIDAE Bouček, 1936

Genus *Bollia* Jones and Holl, 1886

Type species. *Bollia uniflexa* Jones and Holl, 1886, middle Silurian, England.

Bollia sp. nov.

Figure 2.1–3

Material. INGEO-MP 01, INGEO-MP 02, INGEO-MP 03,

INGEO-MP 04, INGEO-MP 12, INGEO-MP 13, INGEO-MP 14. Seven internal and external molds of left and right valves.

Occurrence. The species is recorded from the upper levels of the Pachaco Facies in the Tambolar Formation, Pridoli–lower Lochkovian, in the La Horqueta Creek section, Pachaco area, Argentine Precordillera (Fig. 1).

Description. Subrectangular and amplete outline. Dorsal margin straight and long. Lmax reaching 1 mm. Anterior and posterior outline slightly rounded, ventral margin slightly convex. The cardinal angles are well defined and obtuse, between 120° and 130°. The valves bear two well developed, elevated lobes, which are straight, almost parallel, extend perpendicular from the dorsal margin to below valve mid-height, and are confluent below the adductor sulcus by a prominent connecting lobe. L1 wider and higher than L2, reaches the dorsal margin. S2 straight and narrow. Pseudovelum rounded, swollen, extends around the free margin, narrowed ventrally. A narrow furrow occurs around the lobate area. Marginal surface of the valve is wide and perpendicular to the lateral surface. Lateral surface smooth.

Discussion. This material is clearly assigned to *Bollia* based on its lobal and adventral morphology. The material also shows affinity with *Harpabollia* Schallreuter, 1990 (Upper Ordovician of Baltoscandia, Bohemia, Carnic Alps and Argentina), mainly *Harpabollia harparum* (Troedsson, 1918) (in Schallreuter, 1990; Meidla, 1996, 2007) by its lobal features. However in *Bollia* sp. nov. L4 is clearly lacking and the adventral structure corresponds to the pseudovelum. The new species recalls *Bollia bicollina* Jones and Holl, 1886 (in Siveter, 2009) from the Silurian of England in its strong and rounded lobes. However in the new species the outline is more subrectangular, the adductor sulcus S2 is narrower and longer. L1 is well developed and somewhat swollen dorsally while in *B. bicollina* L1 is too narrow ventrally and bulb like dorsally. Respect to *Bollia talacastensis* Salas, 2016 from the Talacasto Formation (Lower Devonian), of San Juan, Argentina, the new species differs in its narrow extralobular surface and in its rounded pseudovelum, which is ridge like in the Devonian species. Compared with European and North African species all of them have a narrow extralobular surface and a rounded and well developed pseudovelum, however in *Bollia lavibadia* Becker, 1996 from the Lower Devonian of Spain the lobes are tilted to the anterior margin of valves and are bulb-like dorsally. Compared

to *Bollia bezagora* Becker, 2004 (in Becker *et al.*, 2004; Dojen, 2005; Dojen *et al.*, 2007), from the Devonian of Spain, France and Morocco, the new species differs in the size of its lobes and in having a more pronounced pseudovelum. In addition in the new species the lobes and the adductor sulcus are distinctly perpendicular to the dorsal margin while are tilted in *B. bezagora*. *Bollia* sp. nov. is similar to *Bollia azagora* Becker, 2004 (in Becker *et al.*, 2004; Dojen, 2005) in having different width of the lobes and in the rounded pseudovelum; however in the new species the lobes are wider, the extralobulate surface is a furrow and the outline of the valves is subrectangular. *Bollia* sp. nov. is also similar to *Bollia* sp. B *sensu* Zagora, 1968 (in Dojen *et al.*, 2004) but the lobes are narrower. The formal erection of a new species is postponed because of the poor preservation and the scarcity of specimens.

Genus *Ulrichia* Jones, 1890

Type species. *Ulrichia conradi* Jones, 1890, Middle Devonian, United States of America.

Ulrichia? sp.

Figure 2.4–5

Material. One left, INGeo-MP 05 and one right valve, INGeo-MP 06.

Occurrence. The species is recorded from the upper levels of the Pachaco Facies in the Tambolar Formation, Pridoli–?lower Lochkovian, in the La Horqueta section, Pachaco area, Argentine Precordillera (Fig. 1).

Description and discussion. This material recalls the genus *Ulrichia* in having two dorsal rounded nodes, a well-developed pseudovelum all around the free margin of the valves, an amplete outline and straight dorsal and ventral margins, anterior and posterior ends rounded, and a coarsely punctate lateral surface. However, as it is represented by only two poorly preserved valves this material is recorded in open nomenclature.

Superfamily unknown

Family TRICORNINIDAE Blumenstengel, 1965

Genus *Tricornina* Bouček, 1936

Type species. *Tricornina navicula* Bouček, 1936, Silurian, Czech Republic.

Tricornina? sp.

Figure 2.6

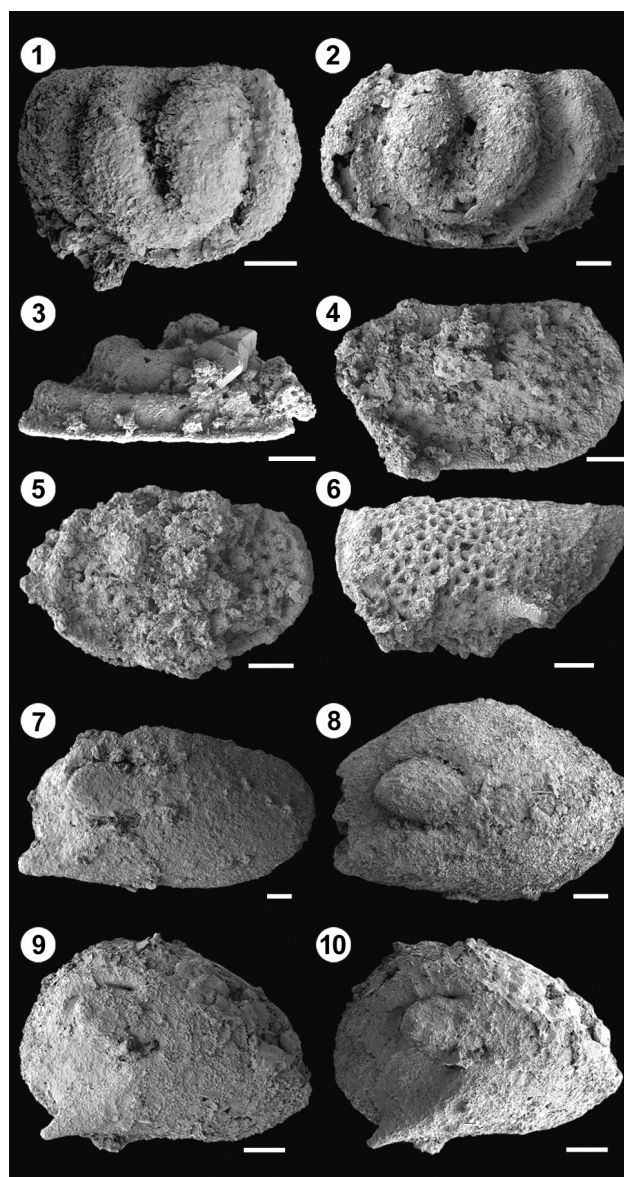


Figure 2. Ostracods from upper levels of Tambolar Formation (Pachaco Facies), Pridoli–?earliest Lochkovian, La Horqueta Creek section, Pachaco. 1–3, *Bollia* sp. nov.; 1, lateral view of right valve, INGeo-MP 02; 2, lateral view of left valve, INGeo-MP 03; 3, ventral view of right valve, INGeo-MP 04. 4–5, *Ulrichia?* sp.; 4, lateral view of right valve, INGeo-MP 06; 5, lateral view of left valve, INGeo-MP 05. 6, *Tricornina?* sp., lateral view of left valve, INGeo-MP 07. 7–10, *Neothlipsura khiska* sp. nov.; 7, paratype, lateral view of right valve, INGeo-MP 09; 8, paratype, lateral view of right valve, INGeo-MP 11; 9–10, holotype, right valve, lateral and posterolateral views, INGeo-MP 10. Scale bars= 100 μ m.

Material. IN GEO-MP 07 and IN GEO-MP 08. Two left valves.

Occurrence. The species is recorded in the upper levels of the Pachaco Facies in the Tambolar Formation, Pridoli–?lower Lochkovian, in the La Horqueta section, Pachaco area, Argentine Precordillera (Fig. 1).

Description. The valves are preplete and have a triangular outline ($L_{\max} = 0.76$ mm; $L_{\max}:H_{\max} = 1.9$). The anterior outline is broadly rounded and the posterior one is gently rounded. The dorsal margin is straight and coincides with the maximum valve length. Cardinal angles well defined; the anterior one is obtuse and the posterior acute. Posteroventrally the valves bear a small, posteriorly directed spine. Anterior and posterior ends are slightly flattened. Lateral surface coarsely pitted.

Discussion. This form is known from only two poorly preserved specimens. The material resembles *Tricornina* in its triangular outline, the presence of a spine and the slightly flattened ends. The lack of a dorsal spine leaves the generic assignment in doubts (see Gründel, 1966; Stone and Berdan, 1984).

Order PODOCOPIDA Müller, 1894

Suborder METACOPINA Sylvester-Bradley in Benson *et al.*, 1961

Superfamily THLIPSUROIDEA Ulrich, 1894

Family THLIPSURIDAE Ulrich, 1894

Genus *Neothlipsura* Krandijevsky, 1968

Type species. *Neothlipsura confluens* (Swartz, 1932), posterior designation, from the Shriver Formation, Lower Devonian, of Pennsylvania.

Neothlipsura khiska sp. nov.

Figure 2.7–10

Derivation of name. From quechua language “khiska” meaning spine.

Diagnosis. *Neothlipsura* species with a low outline, narrow posterior sulci, well developed medium lobe and ventral lobe extended into a spine.

Holotype. IN GEO-MP 10, right valve, $L_{\max} = 0.72$ mm (Fig. 2.9–2.10).

Paratypes. IN GEO-MP 09, right valve, $L_{\max} = 1.08$ mm (Fig. 2.7); IN GEO-MP 11, right valve, $L_{\max} = 0.84$ mm (Fig. 2.8).

Type locality and age. Upper levels of the Pachaco Facies,

Tambolar Formation, Pridoli–?lower Lochkovian, in the La Horqueta Creek section, Pachaco area, Argentine Precordillera (Fig. 1).

Material. IN GEO-MP 15–IN GEO-MP 27. Five left valves and eight right valves in addition to the illustrated material.

Occurrence. Only known from the type locality.

Description. Subovate, slightly postplete outline; small instars are more subcircular. Dorsal margin strongly curved to sub-triangular, anterior part slightly longer than the posterior part. Ventral margin almost straight. Anterior and posterior outline curved, anterior outline sharper than the posterior. Maximum length in the ventral half of the valve, L_{\max} reaches 1.13 mm, $L_{\max}:H_{\max}$ ca. 1.69. Carapace is convex overall, except in the posterior part of the valves, which is depressed. The depressed area extends anteriorly to valve mid-length as two deep, narrow furrows. The dorsal furrow is curved, the ventral furrow is straight. In lateral view the furrows separate three horizontal lobes that merge forward into the general surface of valves. The dorsal lobe is inconspicuous, like a continuation of the valve. The middle lobe is well developed with its posterior end rounded and prominent in the central posterior half of the valve. The ventral lobe is narrow, long and extended as a spine that overreaches the posterior outline of the valve. Lateral surfaces smooth.

Discussion. The genus *Neothlipsura* was established by Krandijevsky (1968), who included some North American species previously assigned to *Thlipsura* Jones and Holl, 1869. Lundin and Petersen (1975) reviewed species assigned to *Thlipsura* and *Neothlipsura*. In the material described herein diagnostic features such as the hinge and contact margin are unknown due to poor preservation. However, the valve outline and details of its lobation and sulcation justifies placement of the Argentinian material in *Neothlipsura*.

Neothlipsura khiska sp. nov. has features in common with *Neothlipsura furca* (Roth, 1929) from the Haragan Formation, Lower Devonian, of Oklahoma (Lundin, 1968). Both species have two straight furrows with three lobes. However, in the new species the outline of the adult valves is lower, the furrows are more incisive, the middle lobe is more developed than in *N. furca* and the ventral lobe is a spine. *Neothlipsura jachalensis* Vannier, Racheboeuf and Benedetto, 1995, a species also recorded from the Silurian of the Precordillera Argentina (Los Espejos Formation, Cerro

del Fuerte section), differs in the position of the furrows, which are parallel in the new species and oblique in *N. jachalensis*; the middle lobe is rounded occupying all the surface between furrows. Both *Neothlipsura robusta* (Ulrich and Bassler, 1913) and *Neothlipsura robusta* var. *tricornis* (Swartz, 1932), from the Lower Devonian of Pennsylvania, have two straight sulci like those of the new species. However, in the North American forms, the sulci are short and the lobes are poorly developed. Other known congeneric species include *Neothlipsura confluens*, *Neothlipsura furcoides* (Bassler, 1941), *Neothlipsura thyridioides* (Swartz and Swain, 1941) and *Neothlipsura whiteavesi* (Copeland, 1962) from the Lower Devonian of the United States and Canada, and *Neothlipsura primitiva* (Roth, 1929) from the Silurian of the United States. *Neothlipsura khiska* differs from these taxa in having straight sulci and a less complicated pattern of sulci and lobes in the posterior half of the valve.

GENERAL DISCUSSION

The study of Silurian ostracods of Argentina, and in general throughout South America, is still in its infancy. Although the Silurian successions of Precordillera Argentina yield great numbers of fossils, ostracod faunas have attracted little attention until now. The present material from the Tambolar Formation in the Pachaco area, and the species described by Vannier *et al.* (1995) from the Los Espejos Formation, Cerro del Fuerte section, are the only Silurian species recorded so far. The material identified here is scarce and of low diversity, consisting of only four species. In addition, the species recorded by Vannier *et al.* (1995) are *Hemsiella argentina* (Thomas, 1905), *Hemsiella helgae* Vannier, Racheboeuf and Benedetto, 1995, *Zorotoxis* n. sp. Vannier, Racheboeuf and Benedetto, 1995, *Australobollia fuertensis* Vannier, Racheboeuf and Benedetto, 1995, *Petrisigmoopsis* sp., *Neothlipsura jachalensis* and *Neothlipsura* sp.; this makes for 10 species altogether. This diversity is relatively high considering that in other basins from Argentina and South America Silurian ostracods are virtually unknown. In addition to the Argentinian forms, Silurian ostracods have also been reported from Bolivia, Venezuela and Brazil. Přibyl (1984) described six species from different localities of Bolivia (Union, Cordillera Real and Catavi formations in the Cochabamba and La Paz departments); however, this fauna requires a modern taxonomic revision.

Vannier *et al.* (1995) considered at least four of the species described by Přibyl (1984) as indeterminate palaeocopes because of their poor preservation (only internal molds) and inadequate descriptions and illustrations. More recently, Hansch (1994) described two species of beyrichiacean palaeocopes from the Kirusillas Formation in the Bolivian Andes, as *Hemsiella?* n. sp. and an indeterminate palaeocope. Additionally, Martinsson (1964) reported the presence of *Hemsiella andincola* Martinsson, 1964 from the Silurian of Venezuela (Cordillera de Merida) and Clarke (1899) identified other two ostracods in Silurian deposits of Río Trombetas, Brazil. Clarke's material also needs taxonomic revision even though the affinities of *Bollia lata* var. *brasiliensis* Clarke, 1899 were recently discussed by several authors (Becker *et al.*, 1994; Salas, 2016).

Compared to the fauna recorded from the Silurian section in Cerro del Fuerte (Los Espejos Formation) we point out the lack of dimorphic palaeocopes in our fauna; such forms are very common in the Silurian. In the Cerro del Fuerte locality the fauna is characterized by the abundance of the palaeocopes *Hemsiella* Martinsson, 1962 and *Zorotoxis* Siveter, 1980 (Vannier *et al.*, 1995). Palaeocopes were also recorded in Silurian levels of Bolivia (Přibyl, 1984; Hansch, 1994) and *Hemsiella andincola* is, until now, the only Silurian species recorded in Venezuela (Martinsson, 1964). Although the absence of dimorphic palaeocope groups may be due to a collection bias, a large quantity of specimens was collected and notably none correspond to a palaeocope. Another difference is the presence, in the Pachaco section, of a possible species of *Tricornina*. The remaining composition of the faunas is similar in both sections of Precordillera, with binodicopes represented by *Bollia* and possibly *Ulrichia?* in the present fauna and by *Australobollia* Vannier, Racheboeuf and Benedetto, 1995 and *Petrisigmoopsis* Pinto and Purper, 1981 in the Cerro del Fuerte section. Metacopina (Thlipsuracea) are also represented in both sections by *Neothlipsura*, although the species recorded are different.

This report is preliminary and only a limited number of taxa are described. Nevertheless, the ostracods from the Pachaco Formation correspond in general taxonomic composition to 'Assemblage III' of the Eifelian Mega Assemblage of Casier (1987) or to a "mix assemblage" of Becker and Bless (1990) as described by Vannier *et al.* (1995) for the Los Espejos Formation, because of the absence of dimorphic

palaeocopes and the presence of binodicopes and metacopes. The Assemblage III indicates a deep subtidal environment, deposits between the fair weather and maximum storm wave base (Casier, 1987). The observed taxonomic composition, mainly the presence of metacopes, together with the possible presence of *Tricornina*, a genus with a thin carapace and spines, would suggest the deeper sector of the assemblage (Cassier, 1987; Becker and Bless, 1990; Vannier *et al.*, 1995). This interpretation is consistent with the environment of a possible internal platform affected by storms proposed by Franciosi (1995).

Regarding paleobiogeographical affinities, the studied material would suggest a faunal link with Laurentia (North American mid-continent *sensu* Siveter, 1989 or Appohimchi Province *sensu* Berdan, 1990): taxa such as *Neothlipsura khiska* sp. nov. and *Tricornina?* sp. indicate this relationship. *Neothlipsura*, recorded in the studied section and also in Los Espejos Formation (Vannier *et al.*, 1995), is a common genus in the upper Silurian and mainly Lower Devonian of the United States (Oklahoma, Pennsylvania, Tennessee and West Virginia) and Canada (New Brunswick) (Lundin and Petersen, 1975 and references cited therein). *Tricornina* is hitherto recorded in the upper Silurian of North America and Thuringia (Gründel, 1966; Copeland, 1977; Hansch, 1993). On the other hand *Bollia* and *Ulrichia* are both geographically and temporally widespread genera. This relationship agrees with the proposal by Vannier *et al.* (1995), who suggested that the ostracod fauna of the Los Espejos Formation (Cerro del Fuerte section) showed faunal links at the generic and specific level between South America, Laurentia (Appohimchi Province *sensu* Berdan, 1990) and Avalonia-Baltica (Baltic-British Province *sensu* Berdan, 1990).

Because knowledge of the Silurian ostracod faunas from Argentina is still in a preliminary stage, further conclusions based on comparisons of ostracod assemblages among different sections and basins and their paleobiogeographical affinities should be treated cautiously.

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