Pseudocriboconcha prinsi gen. et sp. nov. (Ostracoda) from the late Mississippian (Carboniferous) of the Cantabrian Zone (northern Spain)

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Key words – ostracods, *Pseudocriboconcha prinsi*, Carboniferous, Spain.
A new ostracod found in the Mississippian of the Cantabrian Mountains shows ornamental features similar to *Criboconcha* Cooper, hitherto known from Mississippian and Pennsylvanian strata of different parts of the world (especially from the U.S.A.). However, some features of this ostracod are very different from the typical characteristcs of the Healdiidae and support bairdiocyproidean affinities. The new genus *Pseudocriboconcha* (type species *Pseudocriboconcha prinsi* sp. nov.) is proposed. This species is distinguished by distinct pits on the lateral surface; a posterior ridge ending in dorsal and ventral spines; a rounded rim parallel to the borders of each valve; and a spine on this rim, above the anterior end and directed dorsally or anterodorsally.

Contents

Introduction and geological setting

The Cantabrian Zone is the most external area of the Iberian Massif. Cropping out throughout the area is a nearly complete succession of Carboniferous strata. Differences in the stratigraphical succession and facies of Palaeozoic rocks distinguish several units in the Cantabrian Zone (Fig. 1). The reader is referred to Sánchez de Posada *et al*. (1990) and Fernández *et al.* (2004) for summaries of the Carboniferous stratigraphy of the region.

A rather peculiar ostracod was found in late Mississippian limestones of the Cantabrian Zone, at the locality of Entrago (Teverga, Asturias, northern Spain). This ostracod is mainly represented by isolated valves (some of them broken) along with a few carapaces. The ornamental pattern of a posterior dorsoventral ridge ending in dorsal and ventral spines, and a pitted area in front of the ridge is strikingly similar to that of *Criboconcha* Cooper, 1941. However, the differences in the junction of the valves indicate that the ostracod studied in this paper belongs in the Bairdiocypridoidea Shaver, 1961.

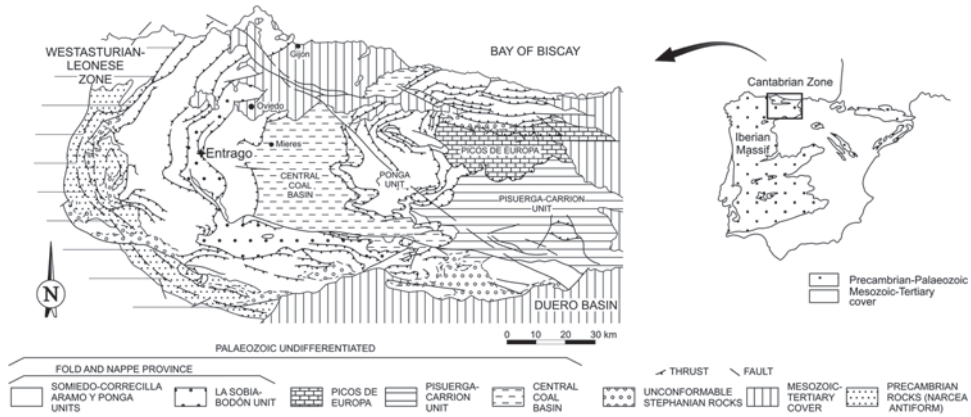

Fig. 1. Sketch map of the Iberian Massif showing the position of the Cantabrian Zone (right) and position of the Entrago Section within the Cantabrian Zone (left).

The fossils were obtained by processing silicified limestones with acetic and formic acids. The sample was collected at the section of Entrago (Menéndez-Álvarez, 1978, 1991), exposed in an abandoned quarry 2 km northeast of the village of Entrago (Teverga, Asturias, Spain; Fig. 1), on the southeast side of the road As 228 (today the route of the road at this point has been slightly changed) linking the village of Trubia to Puerto Ventana (Ventana Pass).

The rocks exposed in the quarry range in age from Famennian (Late Devonian) to Serpukhovian (Namurian in terms of regional western European Carboniferous stratigraphy), comprising the Baleas, Alba and Barcaliente formations with a total thickness of some 33 m, although a more extensive sequence of Carboniferous rocks can be recognised in the neighbouring area.

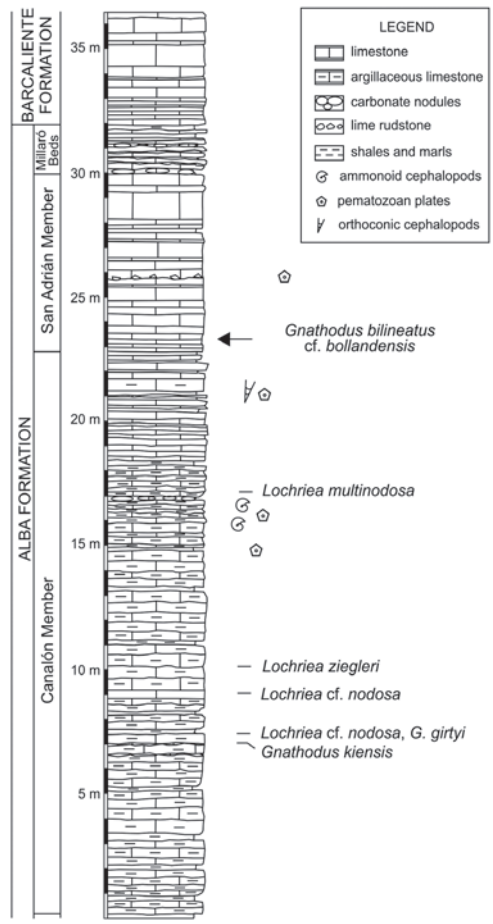

Fig. 2. Upper part of the Alba Formation and base of the Barcaliente Formation at the Entrago Section. First occurrences of some important conodont species are depicted in the figure.

Cephalopods (Delépine, 1943; Kullmann, 1962; Wagner-Gentis, 1963), conodonts (Higgins *in* Higgins *et al*., 1964; Budinger & Kullmann, 1964; Pello, 1972; Menéndez-Álvarez, 1978, 1991; Higgins & Wagner-Gentis, 1982; Sanz-López *et al*., 2004**),** tintinids (Cuvillier & Barreyre, 1964), trilobites (Gandl, 1977) and ostracods (Bate, 1968; Sánchez de Posada, 1987) have been recorded from this section. Menéndez-Álvarez (1978, 1991) investigated the conodonts of the Alba Formation in detail, and the strata below and above it, and discovered a complete succession of conodont zones ranging from Tournaisian to lower Namurian (Serpukhovian) (Fig. 2).

The ostracod here described comes from grey limestones (level J-2 of Menéndez-Álvarez, 1978, 1991) belonging to the San Adrián Member of the Alba Formation, although previous authors included it in the overlying Barcaliente Formation (Fig. 2). Conodonts found correspond to *Gnathodus bilineatus bilineatus*, *G. bilineatus* cf. *bollandensis*, *Lochriea nodosa*, *L. mononodosa, Pseudognathodus homopunctatus,* and *L. costata* (Menéndez-Álvarez, 1991, and new data). The presence of small elements of *G. bilineatus* cf. *bollandensis* in lower Serpukhovian beds of the Cantabrian Mountains was mentioned by Sanz-López *et al.* (2007). Two new mature elements associated with those small ones from sample J-2 show a shorter caudal parapet than that present in *Gnathodus bilineatus bilineatus*. Lower Namurian ammonoids (E1 Zone) coming from an unknown red nodular limestone bed below J-2 were reported by Wagner-Gentis (1963).

Systematic palaeontology

Class Ostracoda Latreille, 1802
Order Podocopida Sars, 1866
Superfamily Bairdiocypridoidea Shaver, 1961
?Family Pachydomellidae Berdan & Sohn, 1961
Genus *Pseudocriboconcha* Sánchez de Posada gen. nov.

Type species - *Pseudocriboconcha prinsi* Sánchez de Posada sp. nov.

Derivation of the name - The name refers to the resemblance between the new genus and *Criboconcha* Cooper, 1941.

Diagnosis. - Ostracods with ovoid, strongly asymmetrical carapaces. Lateral outline of left and right valves very different. Left valves ovoid, with distinctly arched dorsal border; right valves with straight dorsal border; dorsal overlap distinct. Hinge line straight, occupying the entire dorsal border, not significantly inclined in dorsoposterior direction as typical for *Healdia* Roundy, 1926, and *Criboconcha* Cooper, 1941. Dorsoventral ridge in the posterior part of the valve. A more or less extensive area anterior to the ridge covered with pits

Relations - See below.

***Pseudocriboconcha prinsi* Sánchez de Posada sp. nov.**
Pl. 1.

Derivation of the name - The species is named in honour of Dr. Cor Winkler Prins for his contribution to Carboniferous geology.

Type material – Holotype: a left valve, DGO 18001 (Pl. 1, figs. 1, 2). Paratypes: 24 left valves, DGO 18002 (Pl. 1, fig. 4); DGO 18003-18007, 18008, 18008a, b (Pl. 1, fig. 9), 18009, 13 right valves; DGO 18010 (Pl. 1, fig. 3); DGO 18011 (Pl. 1, fig. 5); DGO 18012-18016; and a carapace, DGO 18017 (Pl. 1, figs. 6-8). The material is housed with the palaeontological collections of the Department of Geology of the University of Oviedo, Spain (DGO).

Type locality – Abandoned quarry 2 km northeast of Entrago (Teverga, Asturias, Spain). Sheet number 52 (Proaza) of the Geological Map of Spain, scale 1:50.000.

Type horizon - Black limestones at the base of the San Adrián Member of the Alba Formation, Serpukhovian, late Mississippian (early Carboniferous).

Diagnosis - A species of *Pseudocriboconcha* with distinct pits covering a more or less extensive area of the lateral surface. Posterior ridge ending in dorsal and ventral spines. Each valve with a rounded rim subparallel to the borders. This rim bears a spine directed dorsally or anterodorsally and located slightly above the anterior end.

Description - Medium sized ostracods (maximum length of the largest valve about 1.5 mm) with suboval lateral outline. Dorsal border convex, devoid of dorsal angula-

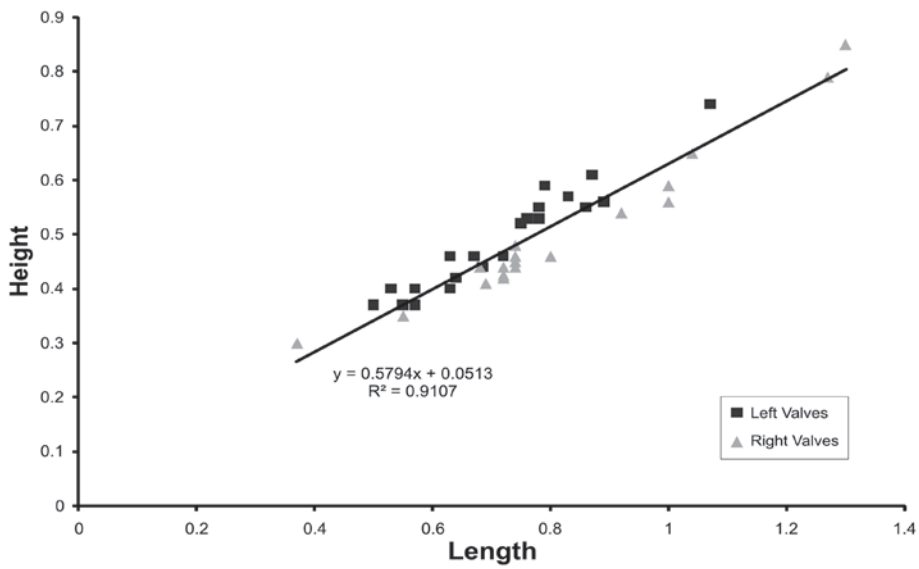

Fig. 3. Height/length diagram for 39 left and right valves of *Pseudocriboconcha prinsi* Sánchez de Posada gen. et sp. nov.

tion; ventral border also convex, less arched than the dorsal margin. Posterior margin convex, shorter than the more broadly convex anterior margin. Maximum height at the central third of the valve. Left valve larger than right valve and overlapping it. Bow-shaped projection at the posterior part of the ventral border. The lateral outline of left and right valves are very different. The left valves are ovoid in shape, with distinctly and regularly arched dorsal border. The right valves, in contrast, possess less curved, usually straight dorsal and ventral borders; the dorsal margin is provided with a dorsal angulation at the anterior end. On the whole, the lateral outline of right valves is more polygonal in shape than the outline of left valves (compare Pl. 1 figs. 1, 4 with figs. 3, 5). The left valves have a smaller L/H than the right ones (see Fig. 3).

A straight or nearly straight dorsoventral ridge similar to that of *Healdia* Roundy and *Criboconcha* Cooper exists in the posterior part of both valves. It extends from near the dorsal border to near the ventral border, delimiting a depressed posterior area. Two spines of variable length exist at the dorsal and ventral ends of the ridge. Sometimes the length of the spines exceed one third of the length of the valve. Judging from the specimens on hand with long, well preserved spines, the ventral spine is usually longer than the dorsal one. Nevertheless, the opposite is true in some specimens. Uncommonly, the spines are reduced to tubercles.

A more or less extensive area of the lateral surface anterior to the ridge is sculpted with rather big pits similar to those characteristic of *Criboconcha*. In some specimens (Pl. 1, fig. 3, for instance) the pitted area reaches the anterior fourth of the valve while in others it does not exceed the posterior third. On the whole, pits are more closely packed towards the posterior part of the carapace. In examples where the pitted area covers the middle region of the valve, pits are interrupted in the area of adductor muscle scars.

Each valve with a rounded rim subparallel to the borders. These rims are easily noticeable along the dorsal, anterior and posterior borders of isolated valves. At the posteroventral border the rim deflects from the border to the ventral surface of the valve and becomes smaller anteriorly. The rim of the left valve is wider and more rounded than that of right valve. At the borders the rim of the left valve lies beside the contact margin and the hinge. A narrow depressed area exists between the rim and the border of right valve (that of the dorsal area can be, in fact, an accommodation groove). Several valves show a spine at the anterior part of the marginal rim. Its absence in other valves is probably a preservational artifact.

As a consequence of silicification, the hinge can not be studied in detail, but some relevant traits are visible. A straight and wide furrow ventrally bounded by a continuous list is present on the left valve and, in its ventral position, a shallow sulcus and a discontinuous list seem to exist. The ventral furrow appears to continue in short anterodorsal and posteroventral depressions (hinge sockets?, *sensu* Adamczak, 1976) giving the hinge a tripartite condition, but this is uncertain.

Measurements (in mm) of figured specimens
Holotype DGO 18001: L=1.06; H=0.72.
Paratype DGO 18002: L=0.8; H=0.56.
Paratype DGO 18008b: L=1.0; H=0.6
Paratype DGO 18010: L=1.27; H=0.79.
Paratype DGO 18011: L=0.8; H=0.44.
Paratype DGO 18017: L=0.43; H=0.32.

Remarks – The ornamentation of the valves and, to some extent, the lateral outline of the studied material are quite similar to those of *Criboconcha* Cooper, 1941. However, our specimens differ from that genus (and also from other Healdiidae) in several important features that, in turn, point to bairdiocypridoidean affinities. In fact, although the hinge cannot be studied in all the details, the differences and similarities in the hinge line of the Spanish material, and that of Healdiidae and Bairdiocypridoida, respectively, are remarkable, especially in the lateral right view of the carapaces. Compare, for instance, DGO 18017 (Pl. 1, fig. 6) with both the specimens of *Bairdiocypris* shown in Adamczak, 1976 (especially with *B. lamellaris* Adamczak, 1976, and *B. marginat*a Adamczak, 1976), on one hand, and the specimens of *Criboconcha* figured by Cooper (1941) on the other. Besides the apparent tripartite character of the hinge, the hinge line of *Pseudocriboconcha* extends along the whole dorsal border (and not just along the posterodorsal margin), with a roughly anteroposterior direction and not inclined towards the posterior as in Healdiidae. Moreover, a bow-shaped projection is present at the ventral border and the closure of the valves is far from the holosolenic contact characteristic of the Healdiidae.

Additional differences concern the shape. In the Spanish material, the right and left valves are rather unlike in lateral outline. In particular the right one, with a straight dorsal border, is quite different from *Criboconcha*.

The new genus differ from all known Bairdiocyipridoidea in its distinctive ornamentation. The asymmetrical, wide carapace of *Pseudocriboconcha* show affinities with Pachydomellidae. The spinose pachydomellids studied by Becker (2000) neither show a posterior ridge nor a pitted lateral surface.

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References

Adamczak, F. 1976. Middle Devonian Podocopida (Ostracoda) from Poland; their morphology, systematics and occurrence. *Senckenbergiana lethaea*, **57**: 265-247.

Bate, R.H. 1968. A new bairdiid ostracod from the Carboniferous of Spain. *Journal of Natural History*, **2**: 111-115.

Becker, G. 2000. Contributions to Palaeozoic Ostracod Classification [POC], No. 14. The Superfamily Bairdiocypridacea Shaver, 1961. 2. Family Pachydomellidae Berdan & Sohn, 1961, cont. Upper Palaeozoic spinose forms. *Neues Jahrbuch für Paläontologie und Geologie Abhandlungen*, **215**: 275-296.

Berdan, J. M. & Sohn, I. G. 1961. Family Pachydomellidae Berdan & Sohn, n. fam. *In*: Moore, R.C. & Pitrat, C.W. (eds.), *Treatise on Invertebrate Paleontology, Part Q, Arthropoda. **3**. Crustacea, Ostracoda*: Q373-Q374. Geological Society of America & University of Kansas Press, New York & Lawrence.

Budinger, P. & Kullmann, J. 1964. Zur frage von Sedimentationsunterbrechungen im Goniatiten- und Conodonten- führenden Oberdevon und Karbon des Kantabrischen Gebirges (Nordspanien). *Neues Jahrbuch für Geologie und Paläontologie Monatshefte*, **7**: 414-429.

Cooper, C.L. 1941. Chester ostracodes of Illinois. *Illinois State Geological Survey, Report of Investigation*s, **77**: 1-101.

Cuvillier, J. & Barreyre, M. 1964. Présence des tintinoïdiens dans le Viséen des Asturies. *Revue de Micropaléontologie*, **7**: 80-81.

Delepine, G. 1943. Les faunes marines du Carbonifère des Asturies. *Mémoires de l'Academie de Sciences, Paris*, **66**: 1-122.

Fernández, L.P., Bahamonde, J.R., Barba, P., Colmenero, J.R., Heredia, N., Rodríguez-Fernández, L.R., Salvador, C., Sánchez de Posada, L.C., Merino-Tomé, O. & Motis, K. 2004. Secuencia sinorogénica. *In*: Vera, J.A. (ed.), *Geología de España*: 34-42. Sociedad Geológica de España e Instituto Geológico y Minero de España, Madrid.

Gandl, J. 1977. Die Trilobiten der Alba-Schichten (Unter-Visé bis Namur A). *Senckenbergiana lethaea*, **58**: 113-217.

Higgins, A.C. & Wagner-Gentis, C.H.T. 1982. Conodonts, goniatites and biostratigraphy of the earlier Carboniferous from the Cantabrian Mountains, Spain. *Palaeontology*, **25**: 313-350.

Higgins, A.C., Wagner-Gentis, C.H.T. & Wagner, R.H. 1964. Basal Carboniferous strata in part Northern León, NW Spain. *Bulletin de la Societé belge de Géologie, de Paléontologie et d´Hydrologie*, **62**: 206-248.

Kullmann, J. 1962. Die goniatiten der Namur-Stufe (Ober-karbon) im Kantabrischen Gebirge, Nordspanien. *Abhandlungen der mathematisch-naturwissenchaflichen klase, Akademie der Wissenschaften und der Literatur*, **6**: 260-377.

Latreille, P.A 1802. *Histoire naturelle, générale et particulière des Crustacés et des Insectes*. **3**. *Ostrachoda*: 17. Dufart.

Menéndez-Álvarez, J.R. 1978. Conodontos de la formación Genicera en el corte de Entrago (Teverga, Asturias). *Breviora Geologica Asturica*, **22**: 1-7.

Menéndez-Álvarez, J.R. 1991. *Conodontos del Carbonífero inferior y medio de la Cordillera Cantábrica*. Unpublished Ph.D. thesis, University of Oviedo: 283 pp.

Pello, J. 1972. *Estudio geológico de la región central de Asturias*. Unpublished Ph.D. thesis, University of Oviedo: 198 pp.

Roundy, P.V. 1926. The Mississippian formations of San Saba County. Part II. The Micro-fauna. *U.S. Geological Survey Professional Paper*, **146**: 5-17.

Sánchez de Posada, L.C. 1987. *Gruendelella*, a new Carboniferous ostracod genus from the Namurian of the Cantabrian Mountains (N. Spain). *Journal of Micropalaeontology*, **6**: 103-108.

Sánchez de Posada, L.C., Martínez-Chacón, M.L., Méndez, C., Menéndez–Álvarez, J.R., Truyols, J. & Villa, E. 1990. Carboniferous pre-Stephanian rocks of the Asturian-Leonese Domain (Cantabrian Zone). *In*: Dallmeyer, R.D. & Martínez García, E. (eds.), *Pre-Mesozoic Geology of Iberia*: 24-33. Springer Verlag, Berlin.

Sanz-López, J., Blanco-Ferrera, S. & García-López, S. 2004. Taxonomy and evolutionary significance of some *Gnathodus* species (conodonts) from the Mississippian of the northern Iberian Peninsula. *Revista Española de Micropaleontología*, **36**: 215-230.

Sanz-López, J., Blanco-Ferrera, S., Sánchez de Posada, L.C. & García-López, S. 2007. Serpukhovian conodonts from northern Spain and their biostratigraphic application. *Palaeontology*, **50**: 883-904.

Sars, G.O. 1866. Oversigt af norges marine ostracoder. *Forhandlinger i vindenskabs-selskabet i Christania*, **1865**: 1-130.

Shaver, R. 1961. Family Bairdiocyprididae Shaver, n. fam. *In*: Moore, R.C. & Pitrat, C.W. (eds.), *Treatise on Invertebrate Paleontology, Part Q, Arthropoda* **3,** *Crustacea. Ostracoda*: Q364-Q367. Geological Society of America & University of Kansas Press, New York & Lawrence.

Wagner-Gentis, C.H.T. 1963. Lower Namurian goniatites from the Griotte Limestone of the Cantabric Mountain Chain. *Notas y Comunicaciones del Instituto Geológico y Minero de España*, **69**: 5-42.

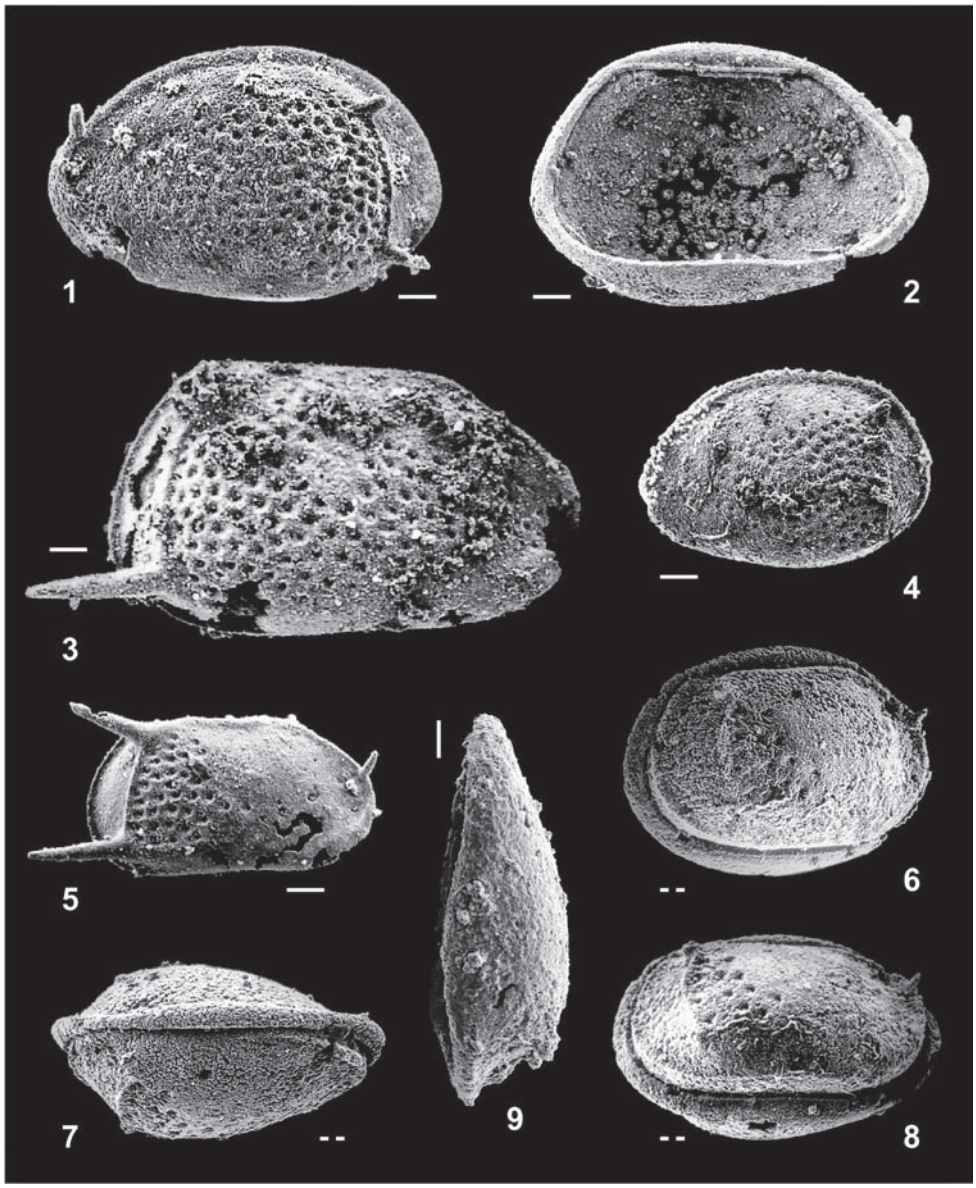

Plate 1

Pseudocriboconcha prinsi Sánchez de Posada gen. et sp. nov.

Figs. 1, 2. Holotype, left valve, DGO 18001, lateral (1) and inner views.
Figs. 3, 5. Lateral views of right valves, paratypes DGO 18010 and DGO 18011, respectively.
Fig. 4. Lateral view of left valve, paratype DGO 18002.
Figs. 6-8. Right (6), dorsal (7) and tilted views of carapace, paratype DGO 18017.
Fig. 9. Ventral view of left valve, paratype DGO 18008b.
Scale bars: single bar represents 100 microns; double bar represents 10 microns (each bar).