Toarcian (Lower Jurassic) brachiopods in Asturias (Northern Spain): Stratigraphic distribution, critical events and palaeobiogeography[§]

Les brachiopodes du Toarcien (Jurassique inférieur) des Asturies (Espagne du nord) : distribution stratigraphique, événements critiques et paléobiogéographie

Los Braquiópodos del Toarciense (Jurásico Inferior) en Asturias (Norte de España): Distribución estratigráfica, Eventos críticos y Paleobiogeografía

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Abstract

Brachiopod assemblages recorded in the Toarcian outcropping of the Asturian coast, between Gijón and Ribadesella, are described. In the Tenuicostatum Zone of the Early Toarcian, an assemblage dominated by *Gibbirhynchia cantabrica* nov. sp., which also includes some other species of North European affinities, has been recorded. Brachiopods disappear in the region at the end of this Zone, coinciding with a sedimentary episode of black shales, and they are not recorded again until the Variabilis Zone of the Middle Toarcian. Between this zone and the Aalensis Zone, several species appear with wide stratigraphic distribution but scarce representation, except for *Soaresirhynchia renzi*, which is very abundant, particularly in the Insigne Subzone. This assemblage differs from the ones recorded in other nearby Spanish basins and can be related to the ones described in part of the Lusitanian Basin (Portugal), Western Pyrenees and South-Western France. This similarity can be related to environmental characteristics, such as the existence in these cases of an external, relatively deep platform environment.

Keywords: Brachiopods; New species; Paleobiogeography; Lower Jurassic; Western Tethys

Résumé

Les associations de brachiopodes reconnues dans les affleurements toarciens de la côte asturienne (entre Gijón et Ribadesella) sont décrites. Dans la Zone à Tenuicostatum du Toarcien inférieur, on a reconnu une association dominée par *Gibbirhynchia cantabrica* nov. sp., dans laquelle on peut aussi trouver d'autres espèces caractéristiques du domaine Nord-européen. Les brachiopodes ont disparu de la région à la fin de cette zone, coïncidant avec un épisode sédimentaire de « black shales » et ne sont plus présents jusqu'à la Zone à Variabilis du Toarcien moyen. Entre cette zone et la Zone à Aalensis apparaissent plusieurs espèces à grande distribution stratigraphique mais faible abondance ; à l'exception de *Soaresirhynchia renzi*, très abondante surtout dans la sous-zone à Insigne. Cette association est différente de celles qui sont reconnues dans d'autres bassins espagnols, mais similaire à celles décrites dans une partie du Bassin Lusitanien (Portugal) et dans les Pyrénées occidentales ou le Sud-Ouest de la France. Cette ressemblance peut être attribuée à des caractéristiques environnementales, comme l'existence dans ces cas d'un milieu de plate-forme externe relativement profonde.

Mots clés : Brachiopodes ; Nouvelle espèce ; Paléobiogéographie ; Jurassique inférieur ; Tethys Occidentale

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Resumen

Se describen las asociaciones de braquiópodos reconocidas en los afloramientos de materiales toarcienses de la costa asturiana, entre Gijón y Ribadesella. En la Zona Tenuicostatum del Toarciense Inferior se ha reconocido una asociación dominada por *Gibbirhynchia cantabrica* nov. sp., en la que también se reconocen otras especies características del dominio paleobiogeográfico noreuropeo. Los braquiópodos desaparecen de la región al final de esta zona, coincidiendo con un episodio sedimentario de "black shales", y no vuelven a reconocerse hasta la Zona Variabilis del Toarciense Medio. Entre esta zona y la Zona Aalensis aparecen varias especies con amplia distribución estratigráfica pero escasa representación, salvo *Soaresirhynchia renzi*, que es muy abundante, particularmente en la Subzona Insigne. Esta asociación es diferente de la reconocida en otras cuencas españolas, y similar a la descrita en parte de la Cuenca Lusitánica (Portugal), en los Pirineos occidentales o en el suroeste de Francia. Esta afinidad se puede relacionar con características ambientales, como la existencia en estos casos de un medio de plataforma externa relativamente profunda.

Palabras clave : Braquiópodos; Nueva especie; Paleobiogeografía; Jurásico Inferior; Tethys Occidental

1. Introduction

In the Lower Jurassic of the Asturian coast, brachiopod fossils are frequently found, even abundantly in some intervals of the Upper Sinemurian and the Pliensbachian. However, during the Toarcian their record is scarce and irregular in vertical distribution, surely due to the physical-chemical conditions that have affected the platforms where they would settle.

The main goal of this paper is the study of brachiopods recorded in the Toarcian outcropping along the coast between the beach of El Puntal, near Villaviciosa, and the beach of Lastres, where the most representative sections of this stage can be found. It is also our aim to establish the causes of their discontinuous stratigraphic distribution and to compare the assemblages obtained with those that are known in other margins of the Iberian subplate (Lusitanian Basin in Portugal, Basque-Cantabrian Region, Pyrenees and Iberian Range).

2. Previous works

Several authors, as Schulz (1858) and Mallada (1885) have mentioned numerous brachiopods from the Asturian Pliensbachian, but references to Toarcian brachiopods are very scarce. In this sense, Jiménez de Cisneros (1904) mentioned "*Terebratula Jauberti* Deslongchamps", together with species characteristic of Pliensbachian age. Dubar (1925) also makes reference to numerous species from the Lotharingian and from the Middle Lias of Asturias, between Gijón and the beach of Ribadesella, mentioning "*Rhynchonella amalthei* Quenstedt" from the Toarcian of Ribadesella. Dahm (1965) finds "*Rhynchonella* sp." in levels with *Dactylioceras commune* (Sowerby), followed by 14.5 m of azoic limestones and marls up to the Jurensis Zone.

Suárez-Vega (1974) quoted in El Puntal: "*Rhynchonella*" sp. in the lower part of the Pseudoradiosa Zone; in W. Rodiles:

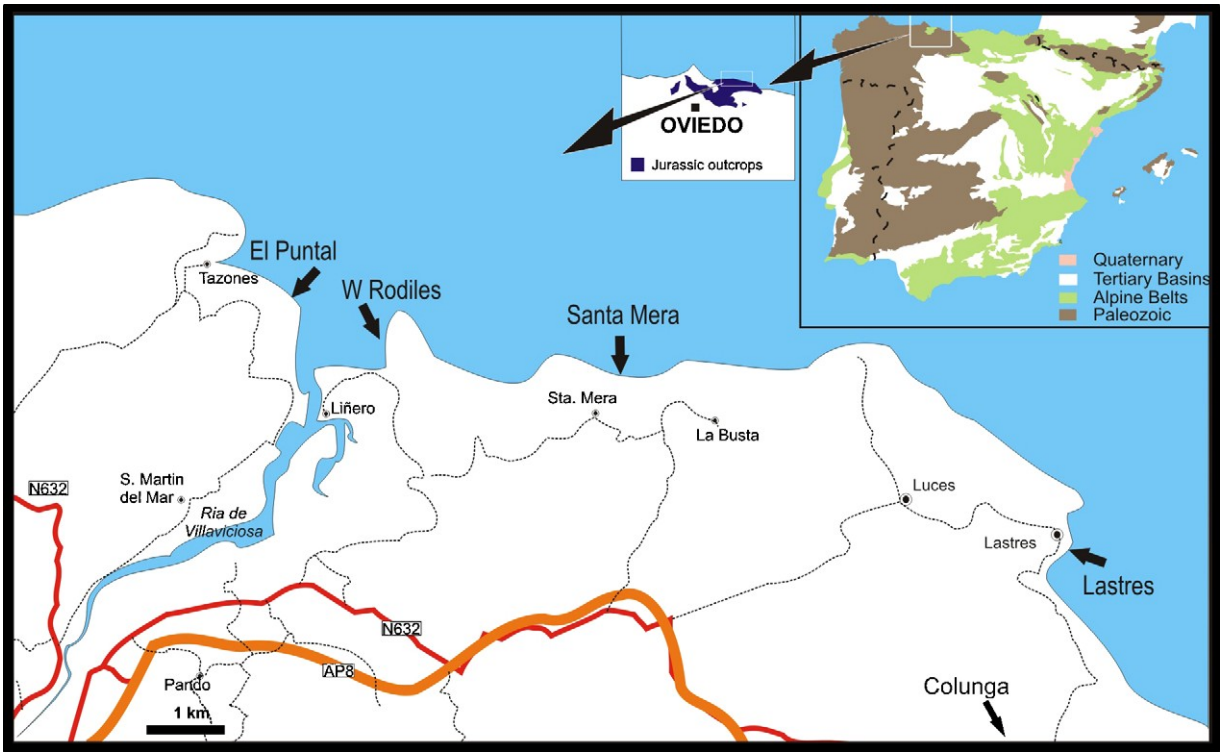


Fig. 1. Situation map of the studied localities.
Carte de situation des localités étudiées.

?*Pseudogibbirhynchia jurense* (Quenstedt) in the Thouarsense Zone; "*Rhynchonella*" sp. and *Zeilleria* sp. in the lower part of the Serpentinum Zone according to data of R. Mouterde; ?*Gibbirhynchia amalthei* (Quenstedt), *Spiriferina* sp. and "*Terebratula*" sp. in the Semicelatum Zone; in Santa Mera: "*Rhynchonella*" cf. *opalina* (Quenstedt) and "*Rhynchonella*" aff. *infirma* (Rothpletz) in the Aalensis Zone, "*Rhynchonella*" sp. in the Pseudoradiosa Zone and *Pseudogibbirhynchia moorei* (Davidson) in the Insigne Zone; and in Lastres: *Gibbirhynchia* sp. (*G.* gr. *micra*? Ager) in the Semicelatum Zone. Therefore, after this author's work the existence of brachiopods was known in the Tenuicostatum, base of the Serpentinum, the Thouarsense, the Insigne, the Pseudoradiosa and the Aalensis Zones; and they had not been found in most of the Serpentinum, nor in the Bifrons and the Variabilis Zones.

3. Stratigraphic context

Toarcian rock records in Asturias are included in the Villaviciosa Group (Valenzuela, 1988), inside the Santa Mera Member of the Rodiles Formation (Valenzuela et al., 1986; Meléndez et al., 2002; Robles et al., 2004). It is composed of rhythmic alternations of micritic and marly limestones with an intercalated episode, near its lower part, in which the black and brown marls prevail, punctually enriched in organic matter (black shales). The study of Toarcian brachiopods has been carried out from specimens sampled in several partial sections, which allow for observation and sampling of all deposited levels. In the coast outcrops, almost all of the levels have a remarkable lateral continuity and can be recognized in the whole studied area, between Gijón and Ribadesella. The selected reference sections are between the creek of Villaviciosa and Colunga (Fig. 1). They were studied by Suárez-Vega (1974) and, more recently, by García-Ramos et al. (1992), Goy et al. (1997b), Gómez and Goy (2000) and Gómez et al. (2008).

The Lower Toarcian (Tenuicostatum to Bifrons Zones) has been studied in the Section of W. Rodiles (located in the NE cliff of the Rodiles beach, to the West of the Rodiles Tip) and in the Section of Lastres (located in the West cliff of the beach of Lastres, to the foot of the town). In the stratigraphic column (Fig. 2), the represented interval includes the upper part of the Spinatum Zone, the Tenuicostatum Zone and the basal part of

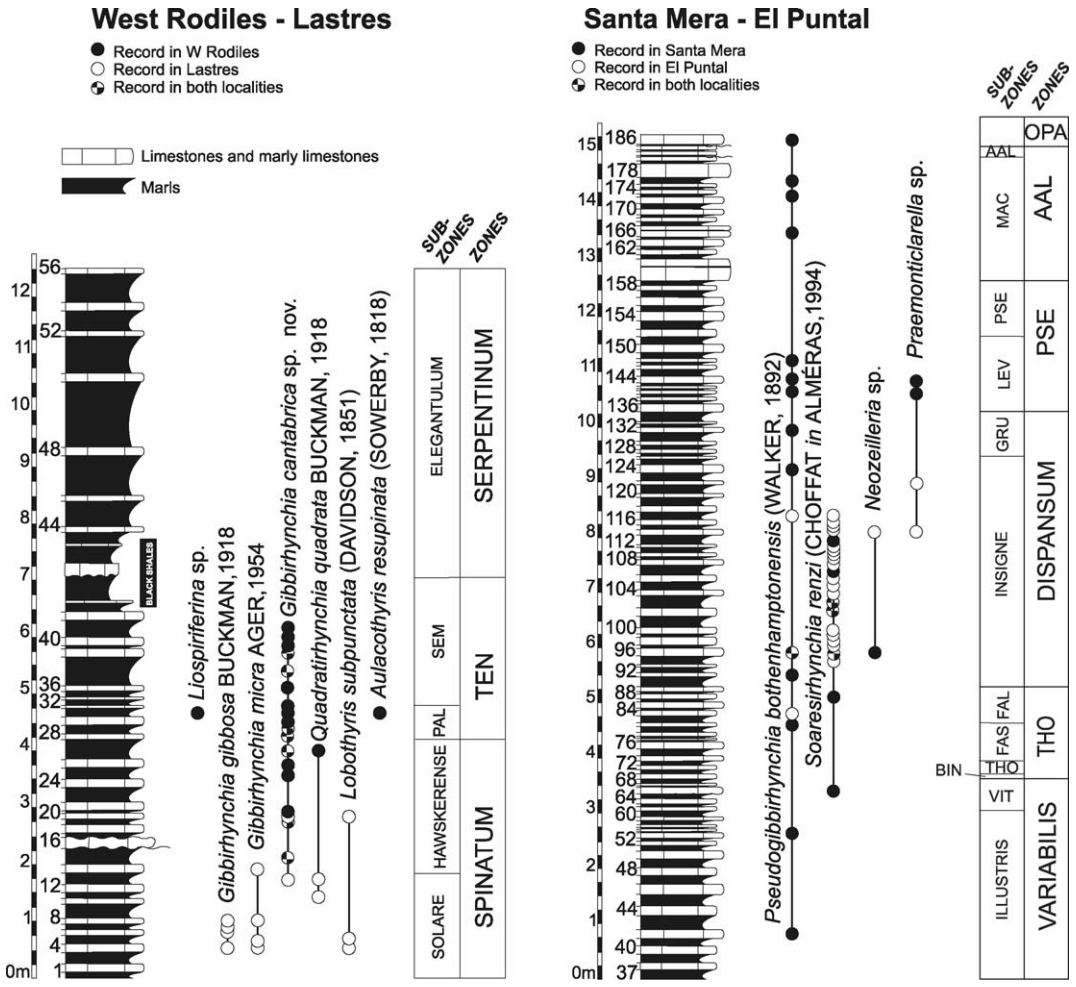
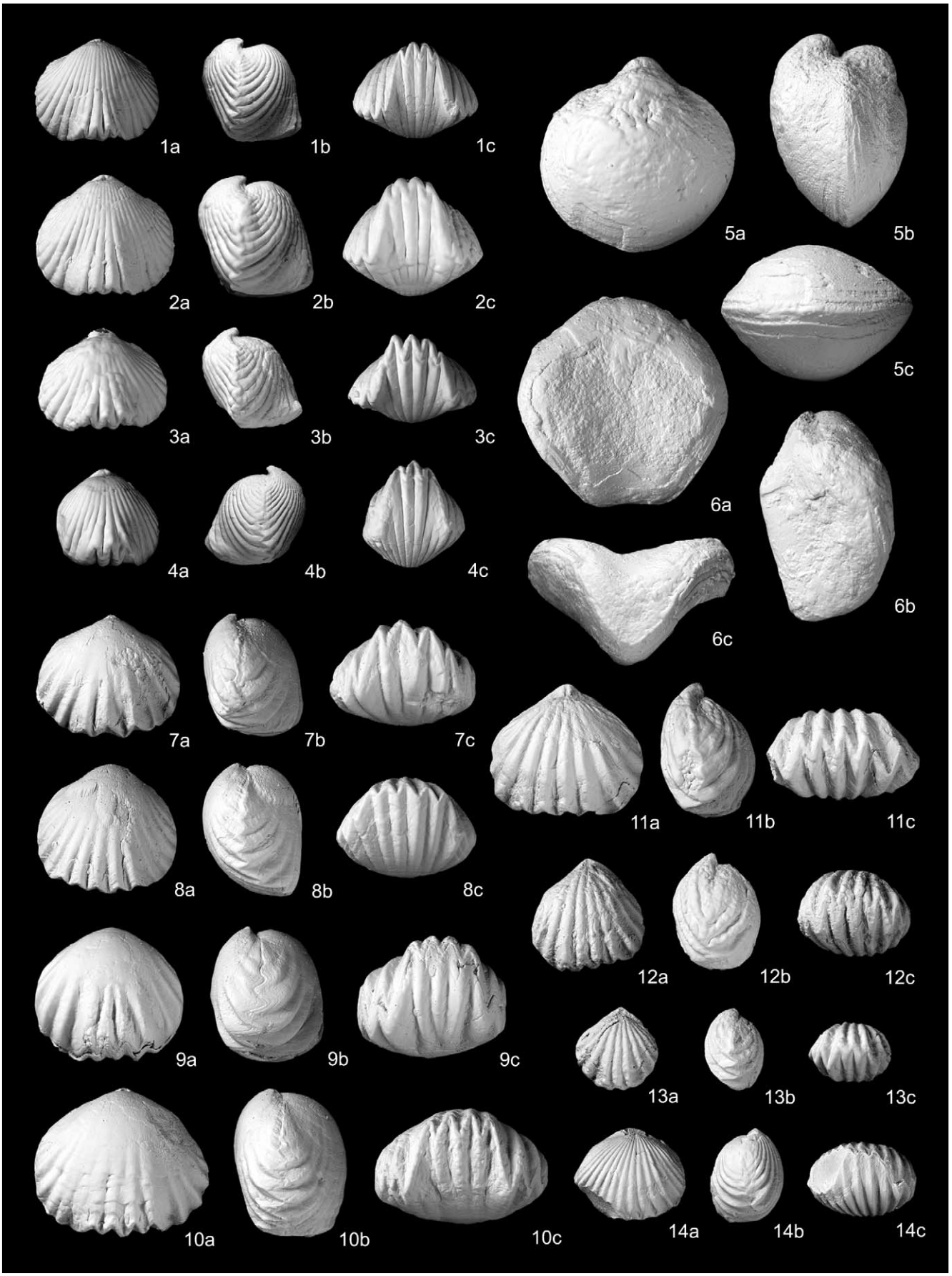


Fig. 2. Stratigraphic columns of the Toarcian of the Asturian coast and distribution of the recorded species of brachiopods. AAL: Aalensis; BIN: Bingmani; FAL: Fallaciosum; FAS: Fascigerum; GRU: Gruneri; LEV: Levesquei; MAC: Mactra; OPA: Opalinum; PAL: Paltum; PSE: Pseudoradiosa; SEM: Semicelatum; TEN: Tenuicostatum; THO: Thouarsense; VIT: Vitiosa.
Colonnes stratigraphiques du Toarcien de la côte Asturienne et répartition des espèces de brachiopodes.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the Serpentinum Zone. In the rocks of this last zone and in those of the Bifrons Zone, brachiopods have not been found.

The Middle and Upper Toarcian rock records (Variabilis to Aalensis Zones) are found in the Section of El Puntal (located in the left margin of the Creek of Villaviciosa) and in the Section of Santa Mera (located in the coast, north of the town of the same name). In this last section, brachiopods corresponding to all biozones have been collected. The Section of El Puntal is complementary to the previous one and it has particularly rich assemblages in several beds of the Insigne Zone (Fig. 2).

4. Brachiopod assemblages

In the upper part of the Spinatum Zone of the Late Pliensbachian and in the Tenuicostatum Zone of the Early Toarcian, some of the species that correspond to Assemblage 1, recognized in the Iberian Range by Goy et al. (1997a) and García Joral and Goy (2000), have been recorded. This assemblage is characterized by taxa typical of the Upper Pliensbachian of NW Europe, accompanied by others of more restricted geographical distribution. The dominant species is *Gibbirhynchia cantabrica* nov. sp. (Appendix A; quoted as *Gibbirhynchia* nov. sp. in García Joral and Goy, 2000), which appears together with scarce individuals of *Quadratyrhynchia quadrata* Buckman, *Liospiriferina* sp., *Lobothyris subpunctata* (Davidson) and *Aulacothyris resupinata* (Sowerby).

It is worth noting that *G. cantabrica* nov. sp. represents 94% of the sampled specimens, and that it is the smallest species in the assemblage. Therefore, the individuals of the other species are also smaller than those recorded in other areas of Eastern Spain (Iberian Range, Coastal Catalan Ranges, Central and Oriental Pyrenees). The Asturian basin represents the minimum values of a South-North gradient of diversity and size, observed in the East and North margins of the Iberian Massif (cf. García Joral et al., 2000). Above the last level with *G. cantabrica* nov. sp. a small tract of black shales is appreciated, and the brachiopods disappear, not to be found again until the Variabilis Zone of the Middle Toarcian.

The disappearance of brachiopods in the Asturian basin can be related to the Early Toarcian Oceanic Anoxic Event (ETOAE) that has been considered by numerous authors to be the cause of the extinction that takes place in the Tenuicostatum – Serpentinum transition (Jenkyns, 1988; Little and Benton, 1995; Hallam, 1996; Jiménez et al., 1996; Hesselbo et al., 2000; Pálfy and Smith, 2000; Macchioni, 2002; Vörös, 2002; Tremolada et al., 2005; Wignall et al., 2005, among others). Recently, a rise in seawater temperature averaging 5.7 ‰C to 7.8 ‰C has been suggested for the Tenuicostatum–Serpentinum transition up to the Bifrons Biochron. This warming interval, which started rapidly and which seems to be synchronous at least in Western Europe, is considered one of the main factors responsible for the mass extinction (Gómez et al., 2008). The difference with other basins in the periphery of the Iberian Massif is that, in these basins, brachiopods recover after a brief interval in which the effects of the crisis are manifested – while in the Asturian basin (just like in the Basque Cantabrian basin, where a brief episode of "black shales" exists) the interval without brachiopods is much longer. This probably means that the adverse bottom conditions remain in these basins for a longer period of time or perhaps that the platform becomes much deeper, impeding the installation and the development of new brachiopod assemblages. In nearby areas of the periphery of the Iberian Massif, such as the Lusitanian and Iberian basins, brachiopods recover in the Serpentinum Zone, showing an evolutionary radiation to which ensue the rich assemblages of the so-called Spanish Bioprovince (Choffat, 1880; Dubar, 1931; García Joral and Goy, 1984, 2004).

In the Middle and Upper Toarcian two species occur in the basin: *Pseudogibbirhynchia bothenhamptonensis* (Walker), from the Variabilis Zone, Illustris Subzone, up to the Aalensis Zone; and *Soaresirhynchia renzi* (Choffat *in* Alméras), from the Variabilis Zone, Vitiosa Subzone up to the Dispansum Zone, Insigne Subzone. Both are more frequent during the transgressive interval of the second order cycle LJ-4 (Gómez and Goy, 2004, 2005) and in particular in levels of the Insigne Subzone. *P. bothenhamptonensis* has a very continuous presence in the Middle and Upper Toarcian, although few specimens have been picked up in each level. Perhaps it could be more than a species of the same phyletic lineage, but the low number of sampled individuals and their wide stratigraphic dispersion make them very difficult to classify. They represent 16% of the brachiopods in this interval. *S. renzi* has a shorter

Fig. 3. 1–4. *Gibbirhynchia cantabrica* nov. sp. 1, holotype WR.30.1, Tenuicostatum Zone, Paltum Subzone of the West Rodiles Section; 2, specimen LA.15.1, Spinatum Zone, Hawskerense Subzone of the Lastres Section; 3, specimen LA.30.1, Tenuicostatum Zone, Paltum Subzone of the Lastres Section; 4, specimen WR.40.1, Tenuicostatum Zone, Semicelatum Subzone of the West Rodiles Section. 5. *Liospiriferina* sp., specimen WR.31.1, Tenuicostatum Zone, Paltum Subzone of the West Rodiles Section. 6. *Aulacothyris resupinata* (Sowerby, 1818), specimen WR.31.2, same locality and horizon. 7–10. *Soaresirhynchia renzi* Choffat in Alméras, 1994, Dispansum Zone, Insigne Subzone of the El Puntal Section; 7, specimen PU.106.1; 8, specimen PU.106.2; 9, specimen PU.105.2; 10, specimen PU.116.1. 11–13. *Pseudogibbirhynchia bothenhamptonensis* (Walker, 1892); 11, specimen ME.55.1, Variabilis Zone, Illustris Subzone of the Santa Mera Section; 12, specimen ME.173.1, Aalensis Zone, Mactra Subzone of the same locality; 13, specimen ME.82.1, Thouarsense Zone, Fascigerum Subzone of the same locality. 14. *Praemonticlarella* sp., specimen ME.144.1, Pseudoradiosa Zone, Levesquei Subzone of the Santa Mera Section. In all cases: a: dorsal view; b: lateral view; c: frontal view; all photographs x 2.

1–4. Gibbirhynchia cantabrica *nov. sp. 1, holotype WR.30.1, provenant de la Zone à Tenuicostatum, Sous-zone à Paltum de la Section de Rodiles Ouest ; 2, exemplaire LA.15.1, Zone à Spinatum, Sous-zone à Hawskerense de la Section de Lastres ; 3, exemplaire LA.30.1, Zone à Tenuicostatum, Sous-zone à Paltum de la Section de Lastres ; 4, exemplaire WR.40.1, Zone à Tenuicostatum, Sous-zone à Semicelatum de la Section de Rodiles Ouest. 5.* Liospiriferina *sp., exemplaire WR.31.1, Zone à Tenuicostatum, Sous-zone à Paltum de la Section de Rodiles Ouest. 6.* Aulacothyris resupinata *(Sowerby, 1818), exemplaire WR.31.2, même localité et âge. 7–10.* Soaresirhynchia renzi *Choffat in* Alméras, 1994*, Zone à Dispansum, Sous-zone à Insigne de la Section de El Puntal ; 7, exemplaire PU.106.1 ; 8, exemplaire PU.106.2 ; 9, exemplaire PU.105.2 ; 10, exemplaire PU.116.1. 11–13.* Pseudogibbirhynchia bothenhamptonensis *(Walker, 1892) ; 11, exemplaire ME.55.1, Zone à Variabilis, Sous-zone à Illustris de la Section de Santa Mera ; 12, exemplaire ME.173.1, Zone à Aalensis, Sous-zone à Mactra, même localité ; 13, exemplaire ME.82.1, Zone à Thouarsense, Sous-zone à Fascigerum, même localité. 14.* Praemonticlarella *sp., exemplaire ME.144.1, Zone à Pseudoradiosa, Sous-zone à Levesquei, de la Section de Santa Mera. Dans toutes les cas : a : vue dorsale ; b : vue latérale ; c : vue frontale ; toutes les photographies* x *2.*

stratigraphic distribution, but numerous individuals at each level have been obtained. It represents 80% of the brachiopods of the Middle and Upper Toarcian, and it is particularly abundant in the Insigne Subzone, where it surpasses 93% of recorded brachiopods.

Scarce individuals of *Neozeilleria* sp. have also been collected in the Insigne Subzone. They probably belong to *N. lycetti* (Davidson), although the fragmentation of the individuals does not allow for a precise determination. Something similar happens with *Praemonticlarella* sp., with few individuals recorded from the Insigne Subzone up to the Levesquei Subzone.

5. Relationships with other basins

The assemblage recognized in the Early Toarcian of Asturias shows a clear paleobiogeographic relationship with those in other platforms of the North European and Mediterranean provinces. It includes taxa that are known in many regions of Europe and North Africa, although the dominant species (*G. cantabrica* nov. sp.) has a distribution more restricted to the north of the Iberian subplate and nearby areas (Cantabrian Range, Pyrenees, Southeast of Armorican Massif and Northern Sector of the Iberian Range).

On the contrary, Middle and Upper Toarcian assemblages are different to the ones developed in Eastern Spain, but are very similar to those described in the distal areas of the Lusitanian Basin (cf. Alméras, 1994, 1996; Andrade, 2006). This similarity could be due to a good communication between the Asturian platform and those in the Lusitanian Basin, but it could also be related to depth, meaning that assemblages with *S. renzi* and *P. bothenhamptonensis* could be characteristic of the deepest (or more open to the ocean) environments in the platform, conditions that neither occurred in the Iberian and Coastal-Catalan Ranges nor in the Eastern Pyrenees.

6. Conclusions

The Toarcian brachiopods recorded in the Asturian coast remarkably reflect the environmental changes that take place at this time. Assemblages in the Late Pliensbachian and in the Tenuicostatum Zone are similar to the ones recorded in near basins. Coinciding with the extinction event that takes place in the transition between the Tenuicostatum and Serpentinum Zones, the brachiopods disappear in the region, and they are not recorded again until the Illustris Subzone of the Variabilis Zone. The assemblages of the Middle and Upper Toarcian, exclusively

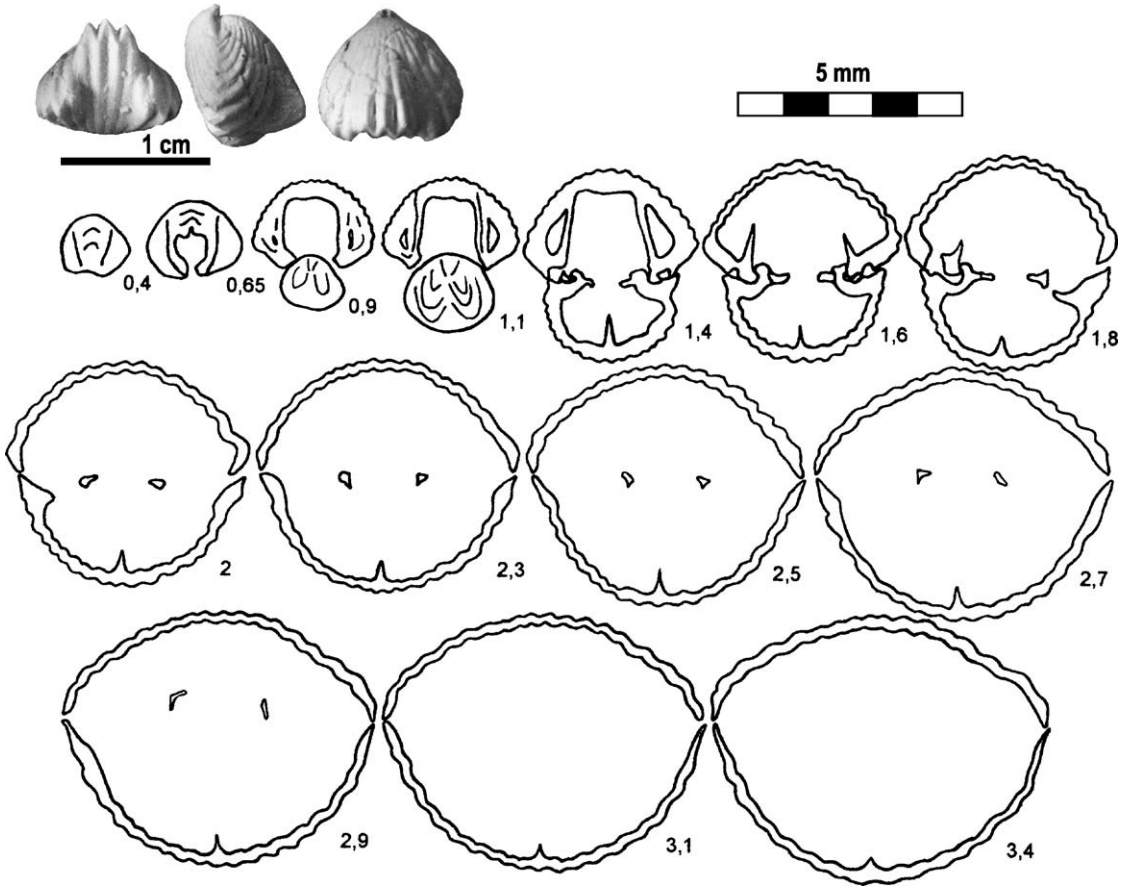

Fig. 4. *Gibbirhynchia cantabrica* nov. sp. Photographs (x 1) and serial sections of the paratype 1AR.45.1, coming from the Tenuicostatum Zone, Paltum Subzone of the Ariño Section (Teruel, Iberian Range). The numbers next to the drawings represent the distance in mm to the apex of the shell. Acetate peels from which the drawings were obtained are conserved in the collections of the Department of Paleontology UCM.

Gibbirhynchia cantabrica *nov. sp. Photographies (x 1) et coupes sériées du paratype 1AR.45.1, provenant de la Zone à Tenuicostatum, Sous-zone à Paltum de la Section d'Ariño (Teruel, Chaîne Ibérique). Les numéros près des dessins indiquent la distance en mm depuis l'apex de la coquille. Dessins réalisés à partir des répliques d'acétate qui sont conservées dans les collections du Département de Paléontologie de l'UCM.*

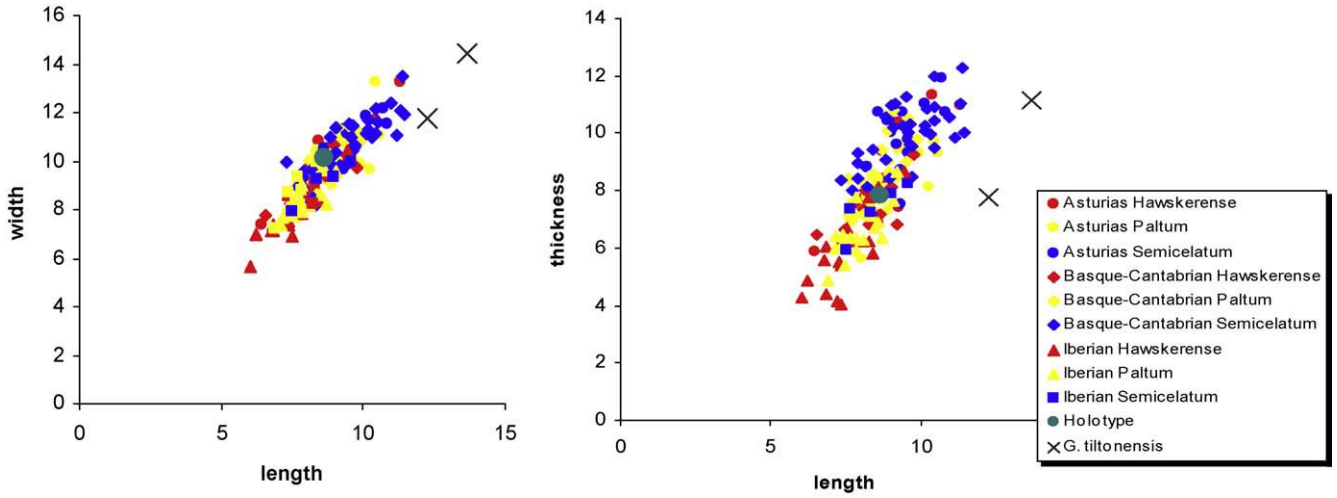

Fig. 5. Scatter plot of width/length and thickness/length of the measured specimens of *Gibbirhynchia cantabrica* nov. sp. Six groups of individuals are differentiated in the graphic, considering their origin (Asturias, which includes the West Rodiles and the Lastres Sections; Basque-Cantabrian, which includes only San Andrés Section; and Iberian, which includes specimens coming from the Ariño, La Almunia and Castrovido Sections) and their age (Subzones Hawskerense, Paltum and Semicelatum). The holotype and the paratype of *G. tiltonensis* figured by Ager (1962: Pl. 9, Figs 11 and 12) are represented in the graphic for comparison.
Diagramme de dispersion de largeur/longueur et épaisseur/longueur des exemplaires mesurés de Gibbirhynchia cantabrica *nov. sp. Six groupes de coquilles sont différenciés, selon leur provenance (Asturies, sections de Rodiles Ouest et de Lastres ; Basque-Cantabrique, section de San Andrés ; et Ibérique, sections d'Ariño, La Almunia et Castrovido) et leur âge (Sous-zones à Hawskerense, Paltum et Semicelatum). L'holotype et le paratype de* G. tiltonensis *figurés par Ager (1962: Pl.9, Fig. 11 et 12) sont aussi représentés dans le diagramme pour comparaison.*

formed by rhynchonellids and zeillerids, are very similar to those of the Atlantic coast of Portugal (North of the Tagus) and less to those in other areas surrounding the Iberian Massif.

Acknowledgements

This work has been financed by projects: CGL2005-01765/BTE and CGL2008-03112/BTE (AG), CGL2008-01273/BTE (FGJ) and CGL2005-04574 / BTE (FGJ & AG) of the Spanish *Ministerio de Educación y Ciencia*. We gratefully acknowledge professors Y. Alméras and M.J. Comas-Rengifo for their valuable comments and constructive reviews. We also thank the professor L.C. Suárez-Vega for sharing his valuable points of view on the stratigraphy of the Toarcian of Asturias.

Appendix A

A.1. Systematic

Order RHYNCHONELLIDA Khun, 1949.
Superfamily HEMITHIRIDOIDEA Rzhonsnitskaia, 1956.
Family TETRARHYNCHIIDAE Ager, 1965.
Subfamily GIBBIRHYNCHIINAE Manceñido and Owen, 2002.
Genus *Gibbirhynchia* Buckman, 1918.
Gibbirhynchia cantabrica nov. sp.
Figs. 3 and 4.
2000. *Gibbirhynchia* nov. sp. – García Joral and Goy, Fig. 2.
pars 2000. *Gibbirhynchia tiltonensis* Ager – Alméras and Fauré, p. 157, Pl. 16, Figs. 8, 9.
2002. *Gibbirhynchia tiltonensis* Ager – Alméras and Becaud, p. 22, Pl. 1, Fig. 8.

Studied material and types: 316 specimens have been studied, originating from several localities in Asturias, the Basque-Cantabrian Basin and the Iberian Range. The specimen labelled WR.30.1 is designated as holotype, coming from the Tenuicostatum Zone, Paltum Subzone, of the Section of West Rodiles, represented in Fig. 3(1). In Fig. 4, a sectioned paratype has also been represented, labelled 1AR.45.1, coming from the Tenuicostatum Zone, Paltum Subzone, of the Section of Ariño (Teruel Province, Iberian Range). Both the Holotype and the acetate peel of the sectioned paratype are deposited in the collections of the "Departamento de Paleontología de la Universidad Complutense de Madrid". Two figures illustrating the variability of the species have been elaborated with the 168 measurable recorded specimens (Figs. 5 and 6). Table 1 shows the measurements of the specimens represented in these figures.

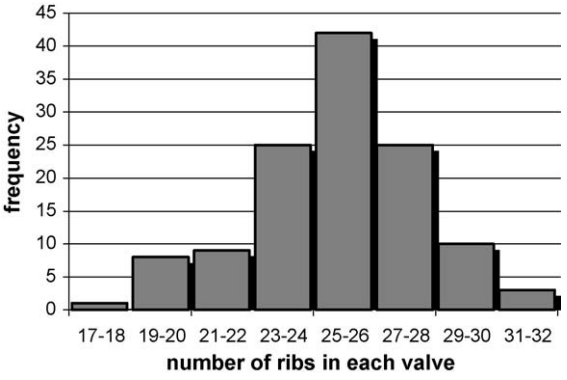

Fig. 6. Histogram of the rib number in the studied specimens of *Gibbirhynchia cantabrica* nov. sp.
Histogramme du nombre de côtes pour les exemplaires étudiés de Gibbirhynchia cantabrica *nov. sp.*

Table 1
Measurements (in mm)of the specimens of *Gibbirhynchia cantabrica* nov. sp. referred in this paper.
Mesures (en mm)des exemplaires de Gibbirhynchia cantabrica *nov. sp. étudiés dans ce travail.*

ASTURIAS					BASQUE-CANTABRIAN					BASQUE-CANTABRIAN				
Specimen	W	L	T	R	Specimen	W	L	T	R	Specimen	W	L	T	R
LA.13.1	13.28	11.31	10.95	32	1SA.0.1	9.44	8.45	7.22	28	1SA.37.7	10.25	8.97	8.45	
LA.14.1	9.63	8.58	6.9	30	1SA.0.2	9.03	7.83	7.6	26	1SA.37.8	11.96	11.43	10	26
WR.15.1	11.7	10.42	11.35	26	1SA.0.3	8.2	7.46	6.64	28	1SA.37.9	10.95	10.31	9.99	26
LA.15.1[b]	11.32	9.28	10.41	30	1SA.2.1	9.71	9.79	9.28	30	1SA.37.10	11.46	9.64	10.32	26
WR.19.1	10.83	8.41	6.9	28	1SA.2.2	8.81	8.28	6.85		1SA.37.11	12.42	10.96	10.53	
WR.25.1	10.4	8.78	8.42	28	1SA.5.1	10.06	9.23	6.8	26	1SA.37.12	11.05	11.16	9.86	
WR.25.2	9.83	9.3	7.4	26	1SA.5.2	9.63	8.65	7.19	24	1SA.37.13	12.05	11.34	11.04	
WR.25.3	7.37	6.45	5.86	22	1SA.5.3	10.69	9	8.11		1SA.37.14	10.68	9.72	8.47	26
WR.26.1	10.49	8.74	9.37	26	1SA.5.4	9.79	8.13	7.99	24					
WR.27.1	9.39	8.17	7.8	28	1SA.5.5	7.79	6.53	6.46	26	IBERIAN				
WR.28.1	9	8.9	7.32	28	1SA.6.1	8.57	8.1	7.33	24	1AR.16.1	9.38	8.56	8.12	20
WR.28.2	9.96	8.22	7.8	28	1SA.16.1	11.45	9.53	9.01	26	1AR.20.1	10.42	9.46	8.66	24
WR.28.3	8.34	8.04	5.61	28	1SA.16.2	10.06	8.1	8.22	28	1AR.24.1	7.56	7.35	5.42	22
LA.28.1	9.22	8.57	8.44	28	1SA.16.3	10.04	8.52	8.39	28	1AR.32.1	8.38	8.42	5.82	20
WR.29.1	13.22	10.43	9.7	26	1SA.16.4	9.3	8.11	7.18	28	1AR.32.2	7.1	6.86	4.38	24
WR.29.2	10.88	9.63	9.95	24	1SA.17.1	9.66	8.51	8.27	26	1AR.32.3	6.97	6.21	4.86	22
WR.29.3	9.66	8.95	8.63	26	1SA.17.2	9.26	8.73	9.42	26	1AR.32.4	7.37	7.36	4.01	24
WR.29.4	9.62	8.41	7.32	24	1SA.18.1	8.63	8.35	7.36	26	1AR.32.5	7.34	7.25	4.18	
WR.29.5	9.93	8.47	8.55	28	1SA.22.1	10.07	8.91	9	26	1AR.32.6	7.41	6.84	6.06	24
WR.29.6	8.27	7.73	7.52	28	1SA.22.2	10.16	8.89	10.09	26	1AR.38.1	7.39	7.29	5.49	22
LA.29.1	11	9.22	8.44	26	1SA.22.3	8.97	7.62	7.11	26	1AR.38.2	7.1	6.78	5.58	26
LA.29.2	10.14	8.7	7.65	30	1SA.24.1	11.36	9.11	10.77	26	1AR.38.3	6.93	7.51	6.73	22
LA.29.3	10.77	9.28	9.44	30	1SA.24.2	10.8	9.91	9.76	26	1AR.38.4	7.86	7.84	6.25	22
LA.29.4	9.51	8.35	7.49	26	1SA.24.3	10.87	9.59	10.51		1AR.38.5	5.61	6.04	4.29	
LA.29.5	10.33	8.9	8.07	26	1SA.24.4	10.11	9.03	10.76		AL.1.1	9.12	8.3	7.77	
LA.29.6	9.9	9.89	9.36	26	1SA.24.5	7.72	7.7	6.97	26	AL.1.2	8.2	8.27	6.23	20
WR.30.1[a]	10.08	8.66	7.83	30	1SA.24.6	8.36	7.62	8.44		AL.5.1	8.52	7.36	6.36	24
WR.30.2	11.07	9.52	9.65	26	1SA.26.1	11.12	10.14	10.27		1AR.40.1	9.66	8.61	6.88	26
LA.30.1[b]	10.43	8.37	8.09	24	1SA.26.2	9.83	9.15	11.01	28	1AR.40.2	9.02	7.84	7.79	
WR.31.1	11.02	10.57	9.3	26	1SA.26.3	9.89	8.84	9.05	22	1AR.40.3	7.9	7.76	7.25	
WR.31.2	11.01	9.54	9.48	24	1SA.26.4	10.99	8.84	10.56		1AR.40.4	7.68	7.15	6.02	
WR.31.3	10.95	9.29	8.57	24	1SA.26.5	10.99	9.58	10.03	26	1AR.40.5	8.17	7.39	6.11	22
WR.31.4	10.11	9.67	10.44	24	1SA.26.6	9.86	9.42	10.28	24	1AR.40.6	7.34	7.13	6.43	
WR.31.5	10.33	8.36	7.97	24	1SA.26.7	8.19	8.31	7.2	26	1AR.40.7	7.79	7.47	5.39	20
WR.31.6	9.2	8.41	8.46	24	1SA.28.1	11.16	10.47	11.97		1AR.40.8	7.94	7.85	5.96	20
WR.32.1	11.1	9.94	9.34	28	1SA.28.2	13.52	11.36	12.27		1AR.45.1	9.31	8.35	7.14	18
WR.32.2	9.65	10.26	8.11	26	1SA.28.3	11.52	9.53	11.27	28	1AR.45.2	8.36	7.75	7.25	22
WR.34.1	8.85	8.22	7.99	26	1SA.28.4	12.17	10.43	10.92	26	1AR.45.3	8.16	8.07	6.28	22
WR.37.1	11.56	10.83	10.73	26	1SA.28.5	9.59	7.92	8.98	30	1AR.45.4	9.57	9.07	7.67	20
WR.37.2	10.99	9.57	9.31		1SA.28.6	10.04	8.38	9.42		1AR.45.5	8.2	8.72	6.33	
WR.37.3	11.12	9.41	10.74	30	1SA.28.7	11.26	10.17	10.1	24	1AR.49.1	8.62	8.48	6.71	24
LA.37.1	10.05	8.92	10.43	30	1SA.28.8	11.36	9.06	10.22	28	AL.9.1	7.24	6.91	4.84	26
WR.38.1	9.78	8.99	10.5	28	1SA.28.9	9.93	7.32	8.35		AL.11.1	9.94	8.34	7.15	26
WR.38.2	10.51	8.62	10.76	32	1SA.28.10	8.87	7.93	9.31	28	AL.13.1	9.33	7.73	7.11	
WR.38.3	10.46	9.6	9.78	26	1SA.30.1	8.93	7.7	7.99	26	AL.13.2	8.82	7.85	6.36	24
WR.38.4	11.83	10.14	11.04	24	1SA.30.2	9.33	7.93	8.44	30	AL.13.3	8.7	7.39	6.48	
LA.38.1	12.15	10.72	11.93	32	1SA.30.3	8.48	8.22	8.15	24	AL.13.4	8.35	7.66	6.35	
LA.38.2	9.86	9.35	8.74	24	1SA.32.1	9.61	8.17	8.82		AL.17.1	7.86	7.42	6.19	
LA.38.3	9.95	9	10.02	28	1SA.37.1	12.17	10.46	10.46		3CV.2.1	10.54	9.19	8.67	28
WR.39.1	9.94	9.23	9.59	24	1SA.37.2	11.61	10.48	9.47		AL.40.1	9.29	8.37	7.24	28
WR.40.1[**]	8.24	8.19	8.86	28	1SA.37.3	10.45	9.62	9.63		AL.40.2	9.33	9	7.87	26
WR.40.2	9.68	9.34	7.52	28	1SA.37.4	10.34	9.04	10.99		AL.40.3	7.94	7.5	5.94	24
					1SA.37.5	11.7	10.2	10.88		AL.52.1	9.93	9.58	8.26	
					1SA.37.6	10.57	9.73	9.56		3CV.17.1	8.32	7.63	7.38	26

W: width; L: length; T: thickness; R: rib number per valve.
Mesures des exemplaires de Gibbirhynchia cantabrica *nov. sp. étudiés dans ce travail. Abréviations : W: largeur ; L : longueur ; T: épaisseur ; R : nombre de côtes par valve.*
[a] Holotype.
[b] Figured paratypes.

Origin of the name: from the Cantabrian region (Northern Spain, including Asturias, Cantabria and Basque country) where this species is particularly frequent.

Diagnosis: *Gibbirhynchia* of small size (up to 11.5 mm in length for the studied specimens, generally between 7 and 10 mm), biconvex, with the dorsal valve moderately gibbous. Width shows slightly higher values than length and thickness, which are approximately equidimensional. High uniplication that rises above the half bend of the dorsal valve, with 3 to 5 ribs in the fold. Constullation dense, with 18 to 32 ribs on each valve, most frequently 25–26. Beak curved, with rounded fairly large foramen and disjunct deltidial plates. Septalium shallow, hinge plates sub-parallels, crura raduliform, dorsal septum very long.

Discussion: this species has been described by Alméras and Fauré (2000: p. 157) as a part of the variability of *Gibbirhynchia tiltonensis* Ager, 1954. These authors figure four specimens (Pl. 16, Figs. 6–9) stating that the first two are similar to the holotype and paratype of the species described by Ager (1962: p. 106, Pl. 9, Figs. 11 and 12) and the other two are smaller and precociously uniplicate. In our opinion, this difference is enough to separate them in an independent species that is distinguished from *G. tiltonensis* by these two characteristics (smaller size and more developed uniplication) as well as by the more equidimensional form (in *G. tiltonensis* the width is clearly larger that the thickness) and the densest costulation, with a mean value of 25-26 ribs in each valve in *G. cantabrica* nov. sp., against 17–18 in *G. tiltonensis* (Figs. 5 and 6). In Asturias individuals with the morphology of *G. tiltonensis* are not recorded, although in the Spinatum Zone of the Pliensbachian some specimens attributed to other species of *Gibbirhynchia* have been picked up, such as *G. gibbosa* and *G. micra*. These two species seem to be the closest ones to *G. cantabrica* nov. sp., and probably one of them is its ancestor. They are distinguished, however, by a more globose morphology in *G. cantabrica* nov. sp. than in *G. micra* and a smaller size than in *G. gibbosa* and, above all, by a higher uniplication that surpass the bend of the dorsal valve.

G. cantabrica nov. sp. is a very frequent species in the Spinatum and Tenuicostatum Zones of Northern Spain (Asturias and Basque-Cantabrian Basin) and it is present, although with relative less abundance, in the Pyrenees and the Iberian Range, where it has been recorded only in some localities of the Northern Sector of the Aragonese Branch. Alméras and Becaud (2002: Pl. 1, Fig. 8) figure a specimen clearly attributable to this species coming from the Serpentinum Zone, Elegantulum Subzone, of Le Bernard (South of Armorican Massif). In the Spanish localities, *G. cantabrica* nov. sp. never extend beyond the Tenuicostatum Zone.

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