

Some Early Jurassic brachiopod faunas from Slovenia

Nekaj spodnjeljurskih brahiopodnih favn iz Slovenije

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Abstract

The article brings a review of the Early Jurassic brachiopods from two neighbouring carbonate platforms, the Julian and the Dinaric. It is based on the previously published data supplemented by the author's study of some newly collected fossils. The new brachiopod specimens were serially sectioned, but the quality of their preservation was generally not good. For this reason, the presence of the Pliensbachian genus *Livarirhynchia* and the Toarcian genus *Soaresirhynchia* on the Dinaric Carbonate Platform margin still lacks a confirmation by the appropriate internal structures. The brachiopod diversity and distribution were mainly controlled by sedimentary and tectonic paleoenvironments. The morphology of many Mediterranean-type pre-Toarcian brachiopods was particularly suitable for the setting of the Hierlatz-type facies limited to the Julian Carbonate Platform.

Key words: brachiopods, Early Jurassic, Slovenia, Dinaric Carbonate Platform, Julian Carbonate Platform

Izvleček

Prispevek prinaša pregled spodnjeljurskih brahiopodov s sosednjih karbonatnih platform, Julijske in Dinarske. Temelji na predhodno objavljenih podatkih, ki jih dopolnjuje avtoričina raziskava novonabranih fosilov. Novi primerki brahiopodov so bili preiskani z metodo zaporednih odbrusov, a jih večina žal ni bila dobro ohranjena. To je tudi razlog, da prisotnost pliensbachijskega rodu *Livarirhynchia* in toarcijskega rodu *Soaresirhynchia* na robu Dinarske karbonatne platforme še ni podprta z dokazi ustreznih notranjih struktur. Brahiopodna diverziteteta in distribucija sta bili pogojeni predvsem s sedimentacijskimi in tektonskimi paleokolji. Morfologija mnogih predtoarcijskih brahiopodov mediteranskega tipa je bila posebej primerna za okolje facies hierlaškega tipa, ki je bilo omejeno na Julijsko karbonatno platformo.

Ključne besede: brahiopodi, spodnja jura, Slovenija, Dinarska karbonatna platforma, Julijska karbonatna platforma

Introduction

The Early Jurassic brachiopods in present-day Slovenia are neither abundant, nor exceptionally well-preserved. No important Lower Jurassic brachiopod macrolocalities were added after the pioneering era of Austro-Hungarian geologists, and few if any technical papers on these topics were published. Still, three types of brachiopod assemblages stand out (Fig. 1):

- the brachiopods of the Hierlatz-type facies; found in the vicinity of Bohinj^[1-3] and on Mt. Stol^[4, 5], both on the Julian Carbonate Platform, with the Bohinj localities belonging to its deepened part, the Bled Basin^[6];
- the brachiopods belonging to the informal *Hesperithyris-Lychnothyris* group *sensu* Vörös^[7] and associated with the Pliensbachian lithiotid facies^[3, 8-10]; several outcrops on the Dinaric Carbonate Platform;
- the Early and/or Middle Jurassic brachiopods from Trnovski gozd^[3, 11, 12]; during the Jurassic period, these brachiopods inhabited the northern margin of the Dinaric Carbonate Platform^[10].

In a small-scale way, these findings reflect the trends and events in brachiopod history, which often make sense only after considering a broader picture. This article aims to summarize local and regional perspectives on the Early Jurassic brachiopod faunas from Slovenia.

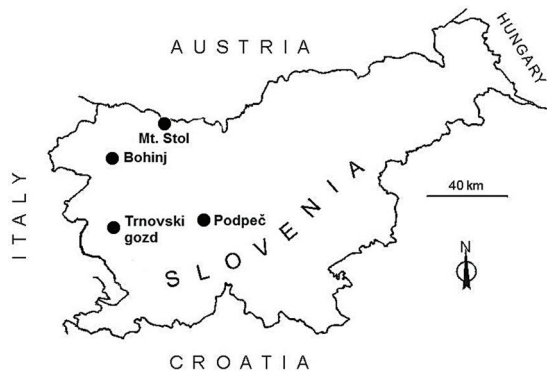


Figure 1: Position of the main Early Jurassic brachiopod areas in Slovenia

Results

Brachiopod fauna from the Bohinj area

In 1858, the following Early Jurassic brachiopods from the surroundings of Jereka were

listed: *Rhynchonella hoernesii*, *Rhynchonella rigida*, *Rhynchonella serrata?*, *Spiriferina pyramidalis?*, *Spiriferina rostrata*, *Terebratula columbella* and *Waldheimia partschii*^[13]. In 1920, another determination of the brachiopods from the Bohinj area (Bitnje, Bohinjska Češnjica, Jereka) was published, inferring at least two separate samplings^[1], so the resulting cumulative faunal list should be regarded as a general information only (Table 1).

The locally prevalent Lower Jurassic strata are massive crinoidal limestones that can laterally and vertically pass into ooidal limestones^[2, 3]; historically, the crinoid-rich part was the one compared to the Austrian Hierlatz limestone^[2], while recently the bedded, often cherty limestones with echinoderms were described as the local Hierlatz facies^[6]. The thickness of individual beds can exceed 2 m^[14].

As an addendum, the brachiopods from the Early Jurassic crinoidal limestones of Mt. Stol (Karavanke Mts.)^[4, 5] should be mentioned (Table 2).

The costate rhynchonellids existed alongside the terebratulids and the terebratellids. The members of the order Terebratulida numerically prevail^[4].

Brachiopod fauna associated with the Pliensbachian lithiotid facies

The Slovenian part of the Early Jurassic Dinaric Carbonate Platform was covered mostly by shallow seas where brachiopods were not abundant^[35]. But in the proximity of the Domesian lithiotid facies, two characteristic terebratulids, the costate *Hesperithyris renierii* (Catullo, 1827) and the smooth *Lychnothyris rotzoana* (Schauroth, 1865)^[9, 11], locally form mass accumulations. Among numerous localities of the two species, the Podpeč quarry near Ljubljana is the most renowned one.

Brachiopod fauna from Trnovski gozd

The richest Mesozoic brachiopod levels in Slovenia are found on Trnovski gozd. The briefly mentioned Early Toarcian species *Stolmorhynchia bouchardi* (Davidson, 1852) from "the Dinarides of Slovenia"^[36] probably came from this area. The now-untraceable collection of Prof. Stanko Buser contained the following species (with the number of specimens in brackets): *Kallirhynchia waehneri* (Di Stefano) (16), *Rhyn-*

chyonella adunca Oppel (3), *Rhynchonella clesiana* Lepsius (58), *Rhynchonella erycina* Di Stefano (7), *Rhynchonella explanata* Di Stefano (3), *Rhynchonella pentagonensis* n. sp. (10), *Rhynchonella ucinensis* Di Stefano (4), *Rhynchonella vigili* Lepsius (46), *Rhynchonella ximenesi* Di Stefano (16), *Terebratula cernagonensis* Martelli (>200) and *Terebratula lossii* Lepsius (6)^[11].

Table 1: The determined^[1] brachiopod taxa from the vicinity of Bohinj

(N - number of specimens, H - Hettangian, S - Sinemurian, P - Pliensbachian, T - Toarcian)

Determined species ^[1]	N	References to the revised type specimens of the species	Age	Remarks
<i>Rhynchonella</i> cf. <i>Albertii</i> Opp.	2	<i>Salgirella albertii</i> (Oppel, 1861) ^[15-18] <i>Salgirella</i> cf. <i>albertii</i> (Oppel, 1861) ^[19-21]	H, S H, S	costate rhynchonellid
<i>Rhynchonella</i> <i>De Lottoi</i> Dal Piaz	3			costate ^[22] rhynchonellid
<i>Rhynchonella</i> cf. <i>Delmensis</i> H. Haas	2			
<i>Rhynchonella</i> <i>Fabianii</i> Dal Piaz	1			costate ^[22] rhynchonellid
<i>Rhynchonella fascicostata</i> Uhlig	3	<i>Calcirhynchia fascicostata</i> (Uhlig, 1879) ^[15, 16, 19, 21]	H, S, P	costate rhynchonellid
<i>Rhynchonella fascicostata</i> nov. var. <i>densicosta</i>	2			
<i>Rhynchonella</i> "cf. <i>fascicostata</i> Uhlig" O. Haas	2			
<i>Rhynchonella flabellum</i> Meneghini	2	<i>Prionorhynchia flabellum</i> (Meneghini in Gemmellaro, 1874) ^[17-19] <i>Prionorhynchia?</i> <i>flabellum</i> (Gemmellaro, 1874) ^[16, 23]	S, P S, P	costate rhynchonellid
<i>Rhynchonella</i> cf. <i>Fraasi</i> Opp.	5	<i>Cuneirhynchia fraasi</i> (Oppel, 1861) ^[15, 16, 19, 21] <i>Cuneirhynchia(?) fraasi</i> (Opp.) ^[18] <i>Prionorhynchia fraasi</i> (Oppel, 1861) ^[17, 18, 24, 25]	S, P S H, S, P	costate rhynchonellid
<i>Rhynchonella palmaeformis</i> O. Haas	29	<i>Lokutella palmaeformis</i> (Haas, 1912) ^[16, 23, 26]	P, T	costate rhynchonellid
<i>Rhynchonella</i> cf. <i>palmata</i> Opp.	1	<i>Cuneirhynchia palmata</i> (Oppel, 1861) ^[16, 19, 23] <i>Prionorhynchia palmata</i> (Oppel, 1861) ^[17, 18]	S, P S, P	costate rhynchonellid
<i>Rhynchonella peristera</i> Uhlig	1			
<i>Rhynchonella</i> cf. <i>peristera</i> Uhlig	3			
<i>Rhynchonella Scherina</i> Gemm.	1	<i>Prionorhynchia</i> cf. <i>Scherina</i> (Gemm.) ^[18]	P	costate rhynchonellid
<i>Rhynchonella</i> "sp. indet." Parona	1			
<i>Rhynchonella</i> cf. <i>subdecussata</i> Uhlig	1			
<i>Rhynchonella</i> cf. <i>tetraëdra</i> Parona (Sow.?)	1	" <i>Tetrarhynchia tetraëdra</i> " (Sowerby, 1812)		costate rhynchonellid
<i>Rhynchonella triquetra</i> Gemm. cf. var. <i>Boeseana</i> O. Haas	1	" <i>Rhynchonella</i> " <i>triquetra</i> Gemmellaro, 1874 ^[15, 21, 27] <i>Prionorhynchia?</i> <i>triquetra</i> (Gemmellaro, 1874) ^[16]	S, P S	costate rhynchonellid
<i>Rhynchonellina</i> <i>Telleri</i> n. sp.	2			costate? smooth? rhynchonellid
<i>Spiriferina alpina</i> Oppel	12	<i>Liospiriferina alpina</i> (Oppel, 1861) ^[15-17, 19, 21, 24, 28-30]	H, S, P	smooth spiriferinid
<i>Spiriferina angulata</i> Oppel	7	<i>Liospiriferina angulata</i> (Oppel, 1861) ^[17, 19, 21, 29]	S	smooth spiriferinid
<i>Spiriferina</i> cf. <i>decipiens</i> Schlosser	2			
<i>Spiriferina expansa</i> var. <i>plicata</i> Par.	3			
<i>Spiriferina gryphoidea</i> Uhlig	11	<i>Spiriferina gryphoidea</i> Uhlig, 1880 ^[23] <i>Liospiriferina gryphoidea</i> (Uhlig, 1879) ^[16, 21, 28]	P H, S, P	smooth spiriferinid
<i>Spiriferina pyriformis</i> Seg.	3			smooth ^[22] spiriferinid
<i>Spiriferina rostrata</i> Schloth.	17	<i>Liospiriferina rostrata</i> (Schlotheim, 1822) ^[19, 28]	S, P	smooth spiriferinid
<i>Spiriferina rostrata</i> Schl. nov. var. <i>sinuata</i>	6			
<i>Spiriferina</i> n. sp. indet.	1			
<i>Terebratula Aspasia</i> Mgh. typ. (= var. <i>major</i> Zitt.)	10	<i>Linguithyrus aspasia</i> (Zittel, 1869) ^[16, 17, 19, 21, 23, 24, 29-31]	S, P	sulcate terebratulid
<i>Terebratula Aspasia</i> Mgh. var. <i>carinata</i> O. Haas	6			
<i>Terebratula Aspasia</i> Mgh. var. <i>Myrto</i> Mgh.	3			
<i>Terebratula Aspasia</i> Mgh. (juvenile specimens)	30			
<i>Terebratula Cornicolana</i> Canavari	2	<i>Linguithyrus cornicolana</i> (Canavari, 1881) ^[16, 23]	P	
<i>Terebratula De Lorenzoi</i> Böse	8	<i>Rhapidothyris delorenzoi</i> (Böse in Böse & Schlosser, 1900) ^[32]		smooth terebratulid
<i>Terebratula Erbaensis</i> Suess	1	<i>Securithyrus adnethensis</i> (Suess, 1855) ^[7, 16, 19, 23, 24]	P	imperforate pygopid ^[7, 33]
<i>Terebratula nimbata</i> Oppel	3	<i>Linguithyrus aspasia</i> and " <i>Terebratula</i> " <i>nimbata</i> (Oppel, 1861), a continuous range of variation ^[29, 30]	S, P	
<i>Terebratula nimbata</i> Opp. nov. var. <i>Bohinica</i>	2			
<i>Terebratula punctata?</i> Sow.	2	<i>Lobothyris punctata</i> (Sowerby, 1812) ^[16, 17, 19, 21, 23, 28, 29]	S, P, T	smooth terebratulid
<i>Terebratula synophrys</i> Uhlig	3	" <i>Terebratula</i> " <i>synophrys</i> Uhlig, 1869 is a "multiplied terebratulid of uncertain affinities" ^[34]		costate ^[22]
<i>Waldheimia alpina</i> Geyer	4	<i>Zeilleria alpina</i> (Geyer, 1889) ^[16, 17, 19, 21, 23, 24, 29]	H, S, P	smooth terebratellid
<i>Waldheimia Meneghinii</i> Par.	3	<i>Bakonyithyrus meneghinii</i> (Parona, 1880) ^[7, 16, 23]	P	sulcate terebratellid ^[7]
<i>Waldheimia</i> cf. <i>oenana</i> Böse	3	<i>Zeilleria oenana</i> (Böse, 1898) ^[16, 19]	S, P	
<i>Waldheimia oxygonia</i> Uhlig	5	angular ^[16] , externally similar to <i>Securina</i> , but with strongly curved lateral commissure ^[7]		axiniform
<i>Waldheimia pseudoxygonia</i> O. Haas	4			
<i>Waldheimia Sarthacensis</i> d'Orb. sp.	3			
<i>Waldheimia stapia</i> Opp. var. <i>meridionalis</i> Dal Piaz	1	<i>Zeilleria stapia</i> (Oppel, 1861) ^[16, 17, 24, 30]	H, S	smooth terebratellid
<i>Waldheimia venusta</i> Uhlig	1	<i>Zeilleria venusta</i> (Uhlig, 1879 [1880?]) ^[15, 17, 19, 21]	S	smooth terebratellid

The rhynchonellids were numerically prevailing over the terebratulids^[11]. While some of the listed^[11] species span the Early-Middle Jurassic boundary^[e. g. 17, 37], it was the traditional comparison with the Aalenian fauna from Capo San Vigilio (Italy) and the usage of literature on Middle Jurassic localities (notably by A. Martelli)^[11] that certainly contributed to the notion of a predominantly Middle Jurassic-type fauna.

Brachiopods were collected from Upper Pliensbachian peloidal limestones, Lower Toarcian brownish-reddish limestones and Middle Toarcian-Aalenian crinoidal-oidal limestones^[10]. Since the first brachiopod beds occur relatively close to the Pliensbachian lithiotid facies below, they could also be Lower Jurassic in age^[9, 12], but the absence of any other characteristic fossils makes it difficult to determine the boundary between the Lower and the Middle Jurassic strata. An exemplary studied Pliensbachian-Aalenian succession from Kovk (Trnovski gozd) further confirmed the presence of the Early Jurassic brachiopods^[10]. The several kilometres long main brachiopod horizon occurs in the ooidal limestones, its thickness varying from 0.5 m to 2 m^[11]. Large samples of variably preserved brachiopods (frequent decortication, unfavourable infilling and recrystallization, but extremely rare disarticulation) were collected on Trnovski gozd by the author. The sampling localities with the best preserved brachiopods were all discovered (some of them perhaps rediscovered) by Mr. Stanislav Bačar, who also donated a number of brachiopod specimens. They are situated outside the above mentioned Kovk section, so for now their stratigraphic relations to the Kovk section, to the main brachiopod horizon and among themselves are not entirely clear. The brachiopod content of these sampling localities included specimens that were

provisionally (the internal structures of the sectioned specimens were not preserved) assigned to the Pliensbachian genus *Livarirhynchia* Radulović, 2008 (Pl. 1, Figs. 1–4), to the Early Toarcian species *Soaresirhynchia* (formerly *Stolmorhynchia*) *bouchardi* (Davidson, 1852) (Pl. 1, Figs. 6–10) and to Aalenian-type fauna.

Discussion

The classic Hierlatz limestone is a Sinemurian-Pliensbachian facies, formed near submarine fault zones and deposited as neptunian dyke infills and submarine taluses, geographically limited to the Northern Calcareous Alps and the Transdanubian Central Range^[38]. Its macrofossil content consists of bivalves, brachiopods, cephalopods, crinoids, echinoderms and gastropods^[19], the groups also found in the Hierlatz-type strata from Bohinj^[1]. The topography was especially favourable for brachiopods. Comparable contemporaneous brachiopod communities of high taxonomic diversity flourished from present-day Caucasus^[e. g. 39] to present-day Iberian Peninsula^[e. g. 28]. These pre-Toarcian brachiopod communities often included taxa of "Mediterranean" provenance; the term itself stems from their morphological contrast to the more robust and costate brachiopods typical of the Northwestern European Province^[40]. Their distribution is thought to be controlled ecologically (e. g. bathymetrically), not merely geographically^[41]. The following characteristics define the "Mediterranean" brachiopod fauna: rhynchonellids and spiriferids are smooth^[40], terebratulids can be costate or perforate^[42], and axiniform, sulcate (dorsal sulcus, ventral fold)^[41] and uniplicate^[40] shapes are also present. Several of these elements can combine on a single brachiopod shell. After the

Table 2: The determined ^[4] brachiopod taxa from Mt. Stol (H - Hettangian, S - Sinemurian, P - Pliensbachian, T - Toarcian)

Determined species ^[4]	References to the revised type specimens of the species	Age
<i>Rhynchonella cartieri</i> Oppel	<i>Cuneirhynchia cartieri</i> (Oppel, 1861) ^[15-17, 19, 21]	H, S
<i>Rhynchonella</i> sp. sp.		
<i>Terebratula punctata</i> Sowerby	<i>Lobothyris punctata</i> (Sowerby, 1812) ^[16, 17, 19, 21, 23, 28, 29]	S, P, T
<i>Terebratula stapia</i> Oppel	<i>Zeilleria stapia</i> (Oppel, 1861) ^[16, 17, 24, 30]	H, S
<i>Terebratula</i> sp.		

Early Toarcian oceanic anoxic event, the survivors with such characteristics didn't recover until the Bajocian^[40].

As the original determination of the brachiopods from Bohinj^[1] did not include any illustrations, the figured type specimens, on which it was based, served as an approximation for a preliminary assessment of the basic brachiopod morphology and faunal composition (Table 1). These type specimens, revised, now belong to nine superfamilies: the rhynchonellid Dimerelloidea (*Rhynchonellina*), Hemithiridoidea (*Tetrarhynchia*), Rhynchonelloidea (*Cuneirhynchia*), Rhynchotetradoidea (*Lokutella*, *Prionorhynchia*) and Wellerelloidea (*Calcirhynchia*, *Salgirella*), the spiriferinid Spiriferinoidea (*Liospiriferina*), the terebratulid Dyscolioidea (*Linguithyris*, *Securithyris*) and Loboidothyridoidea (*Lobothyris*, *Rhapidothyris*), and the terebratellid Zeillerioidea (*Bakonyithyris*, *Zeilleria*). The absence of any koninckinid athyridid brachiopods is conspicuous.

A sampling bias or not, from both Bohinj and Mt. Stol localities a preliminary picture emerges of exclusively costate rhynchonellids. In the Early Jurassic of the Mediterranean Province costate and smooth rhynchonellids usually coexisted in different proportions. Even the predominantly smooth Pliensbachian brachiopod fauna from the Bakony (Hungary) owes this status to its smooth specimens (e. g. of the rhynchonellid genera *Apringia*, *Nannirhynchia* and *Pisirhynchia*) vastly outnumbering (the equally diverse) costate specimens^[40]. The dimerellid rhynchonellid brachiopod *Rhynchonellina telleri* Härtel, as a notable exception, could be smooth. So far, no smooth (only costate) dimerellids are known from Slovenia^[43]. The costate dimerellids of the genus *Sulcirostra* (formerly also part of the genus *Rhynchonellina*) tend to form monospecific and highly endemic assemblages, while the dimerellids occasionally found in mixed pre-Toarcian brachiopod assemblages of the Mediterranean Province are mostly smooth^[27, 29] (genus *Rhynchonellina*). It is unclear if a smaller costate variety of *Rhynchonellina hoffmanni* from the Transdanubian Central Range (Hungary) is a juvenile stage of a larger smooth form^[21]. The spiriferinids are also smooth. The short-looped (terebratulids) and the long-looped (terebratellids) members of the order

Terebratulida can serve as bathymetric indicators; both *Linguithyris* and *Securithyris* (terebratulids) indicate deeper environments^[44], the latter being an axiniform genus. A further corroboration of such axiniform morphology is the species *Waldheimia Partschii*^[13]. While it cannot be automatically "revised" into *Securina partschii*^[17], it most probably was a triangularly-shaped terebratellid or its terebratulid homeomorph. All over the Mediterranean brachiopod province, the koninckinids only rarely form the bulk of specimens at any given locality. The bathyal rocky slopes were the koninckinids' main habitat from the Sinemurian to the Late Pliensbachian^[45].

Both brachiopod faunas imply deeper, but not very deep, environments. A study of the Early Jurassic brachiopods from the Tatra Mountains clearly linked calmer and deeper water conditions with the Mediterranean-type fauna, and more shallow, energetic regime with the Northwestern European-type fauna^[46]. Regardless of the environmental conditions, no strong Northwestern European affinities are expected for the brachiopods from Slovenia. (Dis)regarding the species' names from the lists above, both faunas could be Sinemurian, but a Pliensbachian age of the brachiopods from Bohinj is more probable. If the indicator species^[47] *Cuneirhynchia cartieri* is confirmed on Mt. Stol, the inferred Sinemurian age of that fauna will be proven. The closest analogues to this fauna are found in northern Italy, Austria and Hungary (see the references in Table 1).

The association of *Hesperithyris renierii* and *Lychnothyris rotzoana* with the lithiotid facies on the Dinaric Carbonate Platform in Slovenia is similar to some Croatian and Italian localities, though *Lychnothyris rotzoana* alone is often listed there^[47]. On Velebit (Croatia) lithiotids and brachiopods preserved in living position occur in lithiotid and brachiopod lithosomes and tempestite coquinas of shallow subtidal and lagoonal regions of the inner platform^[48]. The connection between the bivalves and the brachiopods is the low energy environment they both required. A joint occurrence of these two species is known from the Bakony (Hungary), where they were part of a very diverse Pliensbachian brachiopod assemblage^[23], while in the Northern Calcareous Alps they are con-

sidered a rare southern faunal element^[34]. It is not known which influence prevailed in assemblages from the Bohinj area (representing the whole Julian Carbonate Platform).

When a new genus and new species *Livarirhynchia rajkae* Radulović, 2008 was erected from a group of elongated, fully costate Pliensbachian brachiopods from Montenegro (the southern part of the Dinaric Carbonate Platform), the author incorporated some foreign specimens of *Rhynchonella serrata* into its synonymy and provided criteria for the separation of *Livarirhynchia* from the genus *Prionorhynchia*^[49]. *Rhynchonella serrata?* was also reported from Bohinj^[13]. On Trnovski gozd, *Livarirhynchia* sp. forms quite monospecific assemblages, but a single fragment of a large costate rhynchonellid (Pl. 1, Fig. 5) resembling the genus *Cuneirhynchia* (maybe *Prionorhynchia*) was also found. *Prionorhynchia fraasi* (Oppel, 1861) was documented in association with *L. rajkae* in Montenegro^[49] and nominally described in Bohinj^[1]. In Montenegro, the lateral equivalent of these brachiopods is a limestone facies with lithotids^[50]. The already confirmed Pliensbachian localities of *Livarirhynchia rajkae* are Livari (Montenegro), Sicily (zone of *Terebratula aspasia*) and South Tyrol (both Italy)^[49].

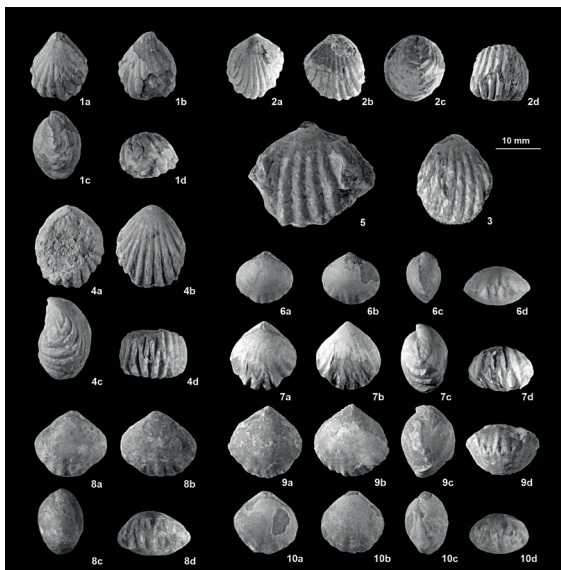


Plate 1: The Early Jurassic brachiopods from Trnovski gozd (dorsal, ventral, lateral and anterior view). 1–4 *Livarirhynchia* sp. (specimens K32, K82, K105, K31), 5 ?*Cuneirhynchia* sp. (specimen K89), 6–10 *Soaresirhynchia* cf. *bouchardi* (specimens ST1, Š4, MG12, Z4, ST5)

The widespread Toarcian flourishing of the the Early-Middle Jurassic^[51] genus *Soaresirhynchia* may have been caused by the Toarcian oceanic anoxic event^[52]. The type species, *S. bouchardi*, is an index taxon with a great intraspecific variability^[26, 28] that has been recorded in Algeria, Bosnia, France, Germany, Great Britain, Italy, Morocco, Portugal and Spain^[52], which makes its Slovenian population a peripheral one. The accepted generic definition summarizes its exterior as "subcircular to transversely oval, smooth stage extended at least to midvalve, costae few, simple, rounded anteriorly"^[53]. These characteristics distinguish the specimens from Trnovski gozd from the Aalenian-type brachiopods^[e. g. 54].

Conclusions

In the simplified tripartite division of the Early Jurassic geography of Slovenia, the Julian Carbonate Platform hosted a diverse Sinemurian-Pliensbachian Hierlatz-type brachiopod fauna, the elements of which sporadically appeared on the Dinaric Carbonate Platform also. The morphotypes characteristic of the Mediterranean brachiopod province were common until the Toarcian turnover, although the rhynchonellids were costate. In Toarcian, the biotic crisis affected the brachiopods on both platforms, but the generalist/disaster brachiopods that followed are known only from the Dinaric Carbonate Platform (more suitable environmental conditions).

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