

## ***Bournonia excavata* (D'Orbigny) from the Campanian-Maastrichtian of Stranice (north-east of Slovenia)**

### ***Bournonia excavata* (D'Orbigny) iz kampanija in maastrichtija pri Stranicah (severovzhodna Slovenija)**

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*Ključne besede:* kampanij-maastrichtij, karbonatna platforma, rudisti, *Bournonia excavata*, Slovenija

#### **Abstract**

The rudist fauna of Stranice, in the north-east of Slovenia, has been studied for a long time thanks to the good preservation-state of the specimens found in the calcareous breccias from Campanian-Maastrichtian. The presence of *Bournonia excavata* (d'Orbigny) at Stranice is reported for the first time in this work. The specimen described in this paper is compared with other specimens from other carbonate platform deposits, previously described by different authors. In addition, a complete individual with both valves of *Radiolites angeiodes* (Lapeirouse) is described.

#### **Kratka vsebina**

Rudistno favno pri Stranicah v severovzhodni Sloveniji so raziskovali že dolgo časa zaradi dobre ohranjenosti primerkov, ki so bili najdeni v campanijsko-maastrichtijskih apnenčevih brečah. Prisotnost vrste *Bournonia excavata* (d'Orbigny) pri Stranicah je v tej razpravi prvič omenjena. Primerek, omenjen v tem članku, je primerjan z drugimi primerki z drugih nahajališč na karbonatni platformi, ki so jih že prej opisali različni avtorji. Razen tega je opisan popoln primerek z obema loputama vrste *Radiolites angeiodes* (Lapeirouse).

#### **Introduction**

The rudist fauna of Stranice, in the north-east of Slovenia (fig. 1) has been studied by different authors (Pleničar, 1971; Pleničar & Šribar, 1992; Pleničar, 1993, 1994 and Caffau, 2000). The rudist association includes the following species: *Hippurites conicus* (Kühn), *H. (Batolites) organisans* de Monfort, *Hippuritella castroi* (Vidal), *H. colliciatatus* (Woodward), *H. variabilis* (Munier-Chalmas), *H. lapeirousei* (Goldfuss), *H. he-*

*ritschi* (Kühn), *Vaccinites sulcatus* (Defrance), *Radiolites angeiodes* (Lapeirouse), *R. cf. aurigerensis* Munier-Chalmas, *Biradiolites ley-chertensis* Toucas, *B. radix* Astre, *Sauvagesia meneghiniana* (Pirona), *Praelapeirouseia bjelusensis* Slišković, *P. kossmati* Wiontzek, *P. wiontzeki* Slišković, *P. pajtleri* Pleničar, *Lapeirouseia jouanneti* (Des Moulins), *L. laskarevi* Milovanović, *L. plana* Milovanovic, *L. pervinquieri* (Toucas) and *L. zitteli* Douvillé.

This fauna is mostly composed of well-preserved individuals, which allowed to de-

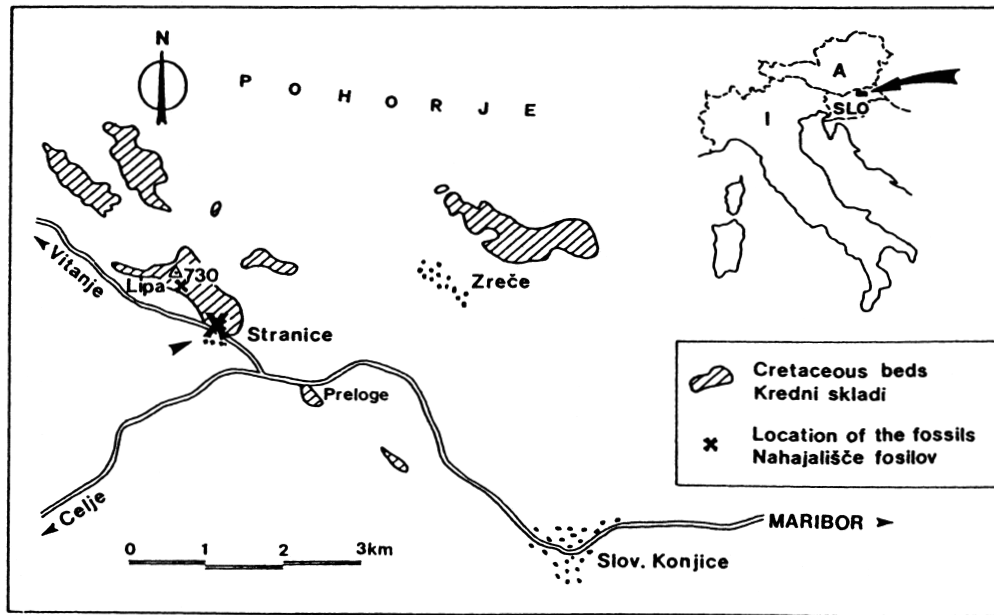


Fig.1. Location map of the rudist deposits of Stranice.

Sl.1. Lega nahajališč rudistov pri Stranicah.

scribe in detail their taxonomic characters (Caffau, 2000). The association of benthonic foraminifers allowed to assign the rudist-containing breccia to Campanian-Maastrichtian (Pleničar & Šribar, 1992).

Pleničar (pers. comm., 2001) and Caffau (2000) consider that the rudist association of Stranice has been subjected to a certain degree of reworking.

The presence of *Bournonia excavata* (d'Orbigny) at Stranice is reported for the first time in this work. Besides, a complete individual with both valves of *R. angeiodes* is described.

### Systematic palaeontology

The morphological characters of *B. excavata* are described on the basis of a right valve of a limestone-embedded specimen and therefore, the morphology of the outer ornamentations can only be partially described. For *R. angeiodes*, we are able to describe all the outer morphological characters of both valves. All specimens found at Stranice that were used for this study are deposited at the University of Ljubljana.

*Bournonia* Fischer, 1887

*Bournonia excavata* (d'Orbigny, 1847)

Fig. 2 in text.

1907 *Bournonia excavata* (d'Orbigny); Toucas, p. 26, pl. 2, figs. 11-13a.

1912 *Bournonia excavata* (d'Orbigny); Parona, p. 285, fig. 4 in text.

1968 *Bournonia excavata* (d'Orbigny); Pejović, pl. 5, fig. 2.

1987 *Bournonia excavata* (d'Orbigny); Cestari & Sirna, p. 145, fig. 3.

1989 *Bournonia excavata* (d'Orbigny); Cestari & Sirna, p. 717, fig. 11.

1995 *Bournonia excavata* (d'Orbigny); Caffau & Pleničar, p. 230; pl. 7, figs. 2, 2a; pl. 12, fig. 3.

1995 *Bournonia excavata* (d'Orbigny); Cestari & Sartori, p. 136.

### Diagnosis

The most evident morphological characters of the attached valve are the anterior band (**ab**) and posterior band (**pb**). Although the shell, 1 to 2 mm thick, is partially embedded in the limestone, two ribs (**a** and **b**) at the dorsal side can be seen. The recrystallization of the shell doesn't allow to dis-

tinguish the pseudo-polygonal structure that characterises the *Bournonia* genus.

### Biometrical parameters

Morphometrical parameters are indicated in fig.2: **Sa** (Shell area), **Ia** (Inner area) and **ab<sup>^</sup>pb** (angle formed between the anterior and the posterior radial bands). These parameters were previously used in other studies of radiolitids, for example: Cestari (1992), Caffau & Pleničar (1996), Caffau & Protopsalti (1999) and Caffau (2000). Measures were done on a transversal section of the specimen of Stranice and on the photographs of the other specimens, published by the authors listed in table 1.

*Ventral side.* **ab** and **pb** are separated by an interband, a concave region with smooth shell surface. The angle **ab<sup>^</sup>pb** is 56° (tab. 1). **ab** and **pb** are 2.5 and 3.5 mm wide respectively at the proximal part of the shell, being **pb** wider and longer than **ab**. Both radial bands present sharp ends **ab** is perfectly straight, whereas **pb** is slightly twisted.

*Dorsal side.* The thickness of the shell varies from 0.3 to 1.5 mm in this side. Two longitudinal ribs **a** and **b** (fig. 2) encompass

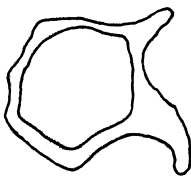
this area giving a pseudo-polygonal shape to the transverse section of the shell. The shell is 1.5mm thick at the ribs, being the mayor thickness of the shell.

### Comparative analysis of *B. excavata* specimens from different origins.

Some morphometric parameters such as the angle **ab<sup>^</sup>pb**, the area of the inner cavity **Ia** and the area of the shell **Sa** (fig. 3) were measured on the specimen of *B. excavata* described in this work.

Other rudist associations that include *B. excavata*, similar to that of Stranice, from the western Peritethyan Upper Cretaceous carbonate platform deposits were described or mentioned, for example, by Polšak (1979), Polšak et al. (1982), Caffau & Pleničar (1995), Cestari & Sirna (1987), Pejović (1968), Sirna & Cestari (1989). The same morphometrical parameters were measured on specimens of the same species described by the mentioned authors.

Morphometrical values, chronological distribution, localities of origin and bibliographic information are summarised on table 1.

|  | n ribs | Sa/Ia | ab <sup>^</sup> pb (degrees) | locality                            | age                     |
|---|--------|-------|------------------------------|-------------------------------------|-------------------------|
| this study  | 2      | 0,61  | 56                           | Stranice<br>north-east Slovenia     | Campanian-Maastrichtian |
| CAFFAU & PLENICAR (1995)<br>pl. 7; fig. 2a  | 2      | 1,8   | 50                           | Trieste Karst<br>north-east Italy   | Santonian-Campanian     |
| CESTARI & SIRNA (1987)<br>pl. 145; fig. 3   | 2      | 0,96  | 55                           | Southern Salento<br>southern Italy  | Campanian-Maastrichtian |
| CESTARI & SARTORI (1995)<br>p. 136  | 2      | 1,45  | 53                           | Esperia, Latium<br>Central Italy    | Coniacian-Santonian     |
| PARONA (1912)<br>p. 285, fig. 4   | 2      | 1,9   | 56                           | Central Apennines<br>Italy          | Santonian               |
| PEJOVIC (1968)<br>pl. 5; fig. 2   | 2      | 1,7   | 55                           | Jugoslavia                          | Maastrichtian           |
| SIRNA & CESTARI (1989)<br>p. 717, fig 11  | 2      | 1,1   | 58                           | Latium-Abruzzi<br>Central Apennines | Santonian-Campanian     |
| TOUCAS (1907)<br>p.26, fig. 11a   | 2      | 0,97  | 60                           | France                              | early Santonian         |

Tab.1. **Sa/Ia** and **ab<sup>^</sup>pb** values of the specimen of Stranice and of other specimens reported in the literature, coming from different carbonate platform deposits.

Tab.1. Vrednosti **Sa/Ia** in **ab<sup>^</sup>pb** primerka iz Stranice in drugih primerkov z različnih nahajališč na karbonatni platformi, o katerih poročajo v literaturi.



Fig.2, *Bournonia excavata*. The thin shell of the specimen is well visible in this figure. The small shell area **Sa** leads to the low rate **Sa/Ia** for this specimen. x3.

Sl.2. *Bournonia excavata*. Tenka lupina primerka je na tej sliki dobro vidna. Mala površina **Sa** na lupini povzroča za ta primerek nizko razmerje **Sa/Ia**. x3.

The morphometrical values **Sa/Ia** show a considerable difference between the specimen of Stranice (**Sa/Ia** = 0.61) and those from other origins (**Sa/Ia** = 0.96-1.9). These

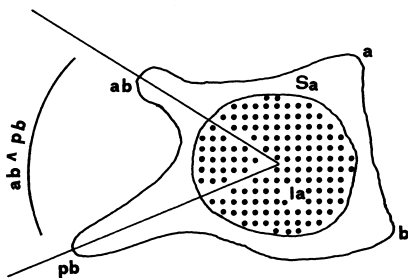


Fig.3 Transverse section of a right valve of *Bournonia excavata* where the measured parameters are indicated.

Sl.3. Prečni presek desne lopute vrste *Bournonia excavata*, na katerem so prikazani merjeni parametri.

data strongly suggest that the shell of the specimen under study was subjected to erosion due to transportation, giving a lower rate **Sa/Ia** than the other specimens of the same species. The values of the angle **ab ^ pb**, that do not depend on erosion due to transportation, are in the same range for all the specimens, between 50 and 60 degrees.

**Stratigraphic distribution.** This species is found in France, Italy (Central Apennins, Karst of Trieste, Puglia), Croatia and Spain.

*Radiolites* Lamark, 1801  
*Radiolites angeiodes* (Lapeirouse, 1781)  
 Figs. 4,5,6 in text.

1908 *Radiolites angeiodes* (Lapeirouse);  
 Toucas, p.77, pl.15, figs. 10-15.

1912 *Radiolites angeiodes* (Lapeirouse);  
 Parona, p. 13, fig.9.

1984 *Radiolites angeiodes* (Lapeirouse); Pejović, p.106, fig. 1 in text; pl.2, figs. 1-5; pl. 3, figs. 1,4; pl. 1,3; pl. 5, figs. 1-3.

1993 *Radiolites angeiodes* (Lapeirouse); Pleničar, p. 50, pl.1, figs. 1-5; pl. 2, figs. 1-3.

**Diagnosis.** The attached right valve of *R. angeiodes* is cone-shaped and has longitudinal robust ribs. Radial bands are well-marked in the shell. The inner structure is constituted by polygonal cells. At the radial bands, a lamellar structure encompass a mesh of small polygonal cells. The free left valve is slightly convex, with radial tiny ribs and two larger ribs at the radial bands **ab** and **pb**. The ligamental ridge is present.

**Attached right valve.** This valve is conic in shape (fig. 4, 6), 30mm long and its diameter is 25mm at the commissure. In the ventral area, the anterior radial band **ab** is well visible along all the shell and is 5mm wide at the commissure. The **ab** profile is concave and the surface is transversally crossed by tiny lamellae. **pb** is slightly concave, presents a smooth surface and is less marked than **ab**. This band is 3mm wide at the commissure. Radial bands are separated by pronounced ribs, the interband ribs **ib**. These interband ribs present a triangular profile and are usually more pronounced than the other ribs in the shell.

Ornamentations consists of robust, protruding and longitudinal ribs, with a triangular profile. The width of the ribs varies from 1 to 0.5mm at the bases, the larger ribs

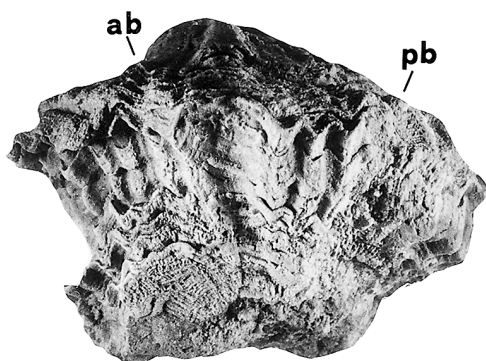


Fig.4. *Radiolites angeiodes*. Attached right valve. View of the anterior radial band **ab** and posterior radial band **pb**. x2.

Sl.4. *Radiolites angeiodes*. Pritrjena desna loputa. Pogled na prednjo radialno brazdo **ab** in zadnjo radialno brazdo **pb**. x2.



Fig.5. *Radiolites angeiodes*. View of the free left valve with both radial bands. x2.

Sl.5. *Radiolites angeiodes*. Pogled na prsto levo loputo z obema radialnima brazdama. x2.

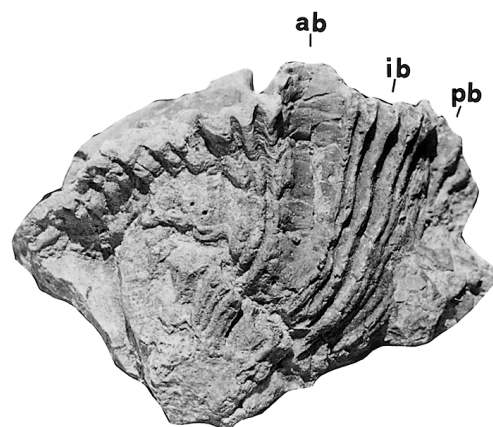


Fig.6. *Radiolites angeiodes*. Attached right valve. View of the morphology of the anterior radial band and the pronounced interband ribs **ib**, with triangular profile. x2.

Sl.6. *Radiolites angeiodes*. Pritrjena desna loputa. Pogled na morfologijo prednje radialne brazde **ab** in štrleča midsifonalna rebra **ib** s trikotnim profilom. x2.

are located at the dorsal area. The thickness of the shell at the commissure varies from 3-4mm at the dorsal area, 2-3mm at the postero-dorsal and postero-ventral side, to 1-2mm at the ventral side. The inner structure is characterised by the presence of pseudo-pillars at the radial bands **ab** and **pb**. The **ab** pillar is oval and the **pb** pillar, although similar in shape, is smaller than the former

one. The morphology of the ligamental ridge varies from the most ancient to the most recent part of the shell. It shows a triangular profile at the lower part of the shell and ends with a rectangular profile.

**Free left valve.** This valve (fig. 5) is slightly convex and is ornamented by thin concentric growth lines and tiny radial costulae originating from the cardinal area. The radial costulae present a triangular profile, except those at the radial bands that show a rectangular profile. The width of the radial bands increase from the centre of the shell towards the outer side, 2 to 5mm for **ab** and 1 to 3mm for **pb**. The angle between both radial bands **ab** and **pb** is 61°.

#### Geographic and stratigraphic distribution.

This species was found in Algeria, Austria, Bulgaria, France, Italy (Karst of Trieste, central Apennins, Puglia), Romania, Slovenia, Spain, Tunisia, Turkey and Yugoslavia.

#### Final considerations

The low frequency of *B. excavata* at Stranice, testified by the finding of only one specimen and rare small fragments of other individuals, together with the observations on the preservation state of the shell, allow to conclude that the described individual was subjected to reworking, more than other individuals of other species that constitute the rudist assemblage of Stranice. Moreover, the lower rate **Sa/Ia** confirms that this specimen was subjected to reworking when compared with other individuals of the same species from different origins.

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