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A new Carboniferous species of *Isogramma* (Dyctionellida, Brachiopoda) from NW Serbia

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Abstract. Representatives of a new Early Moscovian, Carboniferous, species of the dictionelid brachiopod *Isogramma* Meek & Worthen, 1870 from northwestern Serbia are described. Small dimensions, weakly developed dorsal lateral ridges and the absence of dorsal anterior sulcus characterize this new taxon. A comparison with other representatives of genus *Isogramma* and some remarks of this genus are given.

Keywords: Brachiopods, Isogrammidae, Early Moscovian, Carboniferous, NW Serbia, new species.

Апстракт. Описана је нова врста рода *Isogramma* из раног московског ката, карбона, северозападне Србије. Главне карактеристике ове врсте су мале димензије, слабо развијени дорзални бочни гребени и одстуство дорзално предњег сулкуса. Дато је упоређење нове врсте са осталим представницима овог рода, као и неке његове особине.

Кључне речи: брахиоподи, Isogrammidae, рани московски кат, карбон, СЗ Србија, нова врста.

Introduction

Detailed geological mapping of NW Serbia during the 1960's and 70's resulted in the discovery of many new rich faunas of Devonian–Carboniferous boundary conodonts, Carboniferous conodonts, fusulinids and brachiopods. The discoveries established the detailed stratigraphy of the region and resulted in numerous publications (Stojanović-Kuzenko, 1966–1967; Stojanović-Kuzenko *et al*., 1995; Archbold & Stojanović-Kuzenko, 1996).

One of the most fossiliferous localitites is the Hamlet of Obradovići, situated 4.4 km N–NW of Krupanj at the edge of an unsealed road towards the village of Cerova, 150 m NW of the trigonometric point 572. All *Isogramma* specimens in this locality, as in the majority of other localities, are preserved as moulds and impressions. Among this material, a well preserved dorsal valve (the natural counterpart) was found, and this is proposed as a holotype of a new species. The name of this new species, *Isogramma serbica*, was earlier introduced by the author (1966–1967) but without formal description. This is now provided.

As far as the author is aware, this is the first find of complete impressions of the interior and exterior of both valves of this species. Although the descriptions of new representatives of this genus appear sporadically in the literature, many questions remain unanswered: the exact function of the internal structure of the ventral valve, the question of communication within the valves and with the marine environment in which they have been lived. The reason for this is the relatively poor preservation of the fossil materials, although every new discovery places a new piece in the jigsaw puzzle of this unusual group.

The other constituents of the fauna in the locality of Obradovići Hamlet consist of numerous brachiopods typical of Early Moscovian (Stojanović-Kuzenko, 1966–1967). The assemblage shares many genera with Early Moscovian faunas of Spain (Archbold & Stojanović-Kuzenko, 1995; Río García & Martínez Chacón, 1988; Martínez Chacón, 1990, 1991; Sánches de Posada *et al*., 1993); links are also to be found with European Russian faunas.

The author and her colleagues I. Filipović and V. Pajić revisited the locality several times and found new material which are presented here as paratypes. The number of *Isogramma* specimens is low in comparison with the majority of other localities reported elsewhere.

One poorly preserved specimen of *Isogramma* was also discovered by the author in the locality Eljdište in the region of Sana's Paleozoic of Bosnia (Stojanović-Ku-

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ZENKO, 1966–1967), which is not included in this paper. Superfaminiliar classification follows WILLIAMS *et al.* (1996).

Taxonomic description

Phylum Brachiopoda DUMÉRIL, 1806
Subphylum Rhynchonelliformea WILLIAMS *et al.*, 1996
Class Chileata WILLIAMS *et al.*, 1996
Order Dictyonellida COOPER, 1956
Superfamily Eichwaldioidea SCHUCHERT, 1893
Family *Isogrammidae* SCHUCHERT, 1929

Genus ***Isogramma*** MEEK & WORTHEN, 1870

Type species: *Chonetes? millipunctatus* MEEK & WORTHEN, 1870.

Isogramma serbica sp. nov.
Pl. 1, Figs. 1–13

1966–67 *Isogramma serbica* STOJANOVIĆ-KUZENKO n. sp. – STOJANOVIĆ-KUZENKO: 230, pl. 1, figs. 8, 9; pl. 2, fig. 1 (*nomen nudum*).
1995 *Isogramma serbica* STOJANOVIĆ-KUZENKO sp. nov. – STOJANOVIĆ-KUZENKO, PAJIĆ & ARCHBOLD: 61, 99, pl. 65, figs. 6–6b (*nomen nudum*).
1996 *Isogramma serbica* STOJANOVIĆ-KUZENKO – ARCHBOLD & STOJANOVIĆ-KUZENKO: 26-27, fig. 2/29 (*nomen nudum*).

Diagnosis. Small species for the genus with weakly developed dorsal lateral ridges and no dorsal anterior sulcus.

Derivatio nominis. Name given from the land of Serbia.

Locus typicus. Obradovići Hamlet, village Cerova near Krupanj.

Stratum typicum. Yellow-tan alevrolites, Vereian Horizon, Early Moscovian stage, Carboniferous.

Holotype. Specimen OB100, dorsal valve, exterior and interior moulds, figured on Pl. 1, Figs. 1, 4, Collection of the Institute for Regional Geology and Paleontology, Belgrade University.

Paratypes. Specimens collected at a later date: two dorsal valves external moulds (OB101, OB103); ventral valve internal moulds (OB104) and natural counterparts of the exterior and interior of two ventral valves (OB102, OB105).

Description. Shell small, the largest specimen is a holotype with a length of 11.0 mm and a width of 22.0 mm, transversely sub-eliptical in outline, ventral valve convex, dorasal valve shallowly concave.

V*entral valve*. Posterior outline arched, the greatest convexity in the umbonal region. The beak does not extend beyond the hinge line. The notch (depressed triangular area) with well-defined lateral ridges, is positioned in the central part of the triangular depression and is divided medially by a narrow furrow extending anteriorly to its forked end. The length of the notch is two thirds of the valve (Pl. 1, Fig. 7) or slightly shorter (Pl. 1, Fig. 13). The platform extends from near the beak (Pl. 1, Figs. 7, 8). A notch divides the platform and forms two triangular symmetrical, posteriorly slightly depressed, anteriorly elevated areas with well developed lateral margins extending anteriorly and slightly longer than the notch. A very clear outline of the two triangular parts of the platform can be recognised (Pl. 1, Figs. 8, 13).

The platform is anteriorly curved with channels between radial grooves, which represent muscle scars and reach the lateral margins. The hinge line of the ventral interior valve is covered by a row of open punctae. The additional interior ridge with shallow furrows which is connected with the hinge line and it would appear that both parts of the platform are hanging from the hinge line (Pl. 1, Fig. 13).

The exterior surface of the ventral valve is covered with elevated lines with punctae in the interspaces and is interrupted with the posterior part of the notch (Pl. 1, Fig. 9). In some specimens, the notch is of different length or the whole valve is covered with ornaments.

Dorsal valve. Lateral margins rounded, extend from the cardinal process, greatest width just anterior to the hingeline. Exterior ornaments of fine concentric ridges, 2–4 per mm in the anterior half of the shell. The interspaces between the ridges contain a great number of small open punctae. The ventral ridges are sometimes irregular, with disruptions and with variation of ridge heights. In case of injury to the valves, the ridges intervene in the reparation (Pl. 1, Fig. 11). The interior of the dorsal valves is covered by a smaller number of randomly distributed rounded punctae. Weak lateral ridges extend from the cardinal process laterally, slightly shorter than the hinge line (Pl. 1, Fig. 4) The exterior of the dorsal valve shows a trace of the outline of muscle scars positioned on the inside of the valve. Muscle scar distinct, located on both sides of the prominent median septum which extends over two thirds of the valve length and is enclosed by the buttress plates.

The myophore is monolobate and distinct. The shaft, which is located anteriorly of the cardinal process, together with buttress plates, supports the myophore.

Comparison with other species of *Isogramma*

One of the closest species to *I. serbica* sp. nov. is *I. manchoukuensis* HATAI & OMURA (1940) from the Moscovian of Northern China. This latter lacks the dorsal sulcus but possesses coarser external ornaments. The shape of the shell is similar and so is the size. The ornamentation, however, consists of much broader and rounded commarginal ridges, from which the anterior margin posteriorly, are fewer and widely separated, almost disappearing at the lateral margins of the shell and the punctation is hardly visible. *I. salteri* BRAND (1970) from the

Early Carboniferous of Britain, is a less elongated species of greater cancavo-convexity. *I. carinthiaca* (AIGNER, 1931) from the Early Carboniferous of Germany is close to a new species in terms of the external ornamentation but possesses a distinct, narrow dorsal anterior sulcus. *I. millepunctata* (MEEK & WORTHEN, 1873), described by VOLGIN (1957) from southern Fergana, is also similar to *I. serbica*, but is a larger species. *I. pachti* (DITTMAR, 1972) from the Early Carboniferous of the Moscow basin, is of similar size and ornamentatation to *I. serbica* but is strongly concavo-convex, and possesses a sulcus. The stratigraphicaly younger forms *I. paotechowensis* (GRABAU & CHAO), 1927, and *I. millepunctata* (MEEK & WORTHEN), 1873, found in the Carnic Alps, are geographically the closest to NW Serbia.

Remarks on the genus *Isogamma*

Isogramma is a sporadic genus in terms of its geographical distribution and is known from the Early Carboniferous and Permian. Comprehensive reviews of the genus include those of AIGNER & HERITSCH (1931), COOPER (1952), BRAND (1970) and WARDLOW *et al*. (1987). Early species of the genus from the Early Carboniferous and Moscovian tend to be small in size, whereas Late Carboniferous and Permian forms often attain a larger size (LIKHAREV, 1936; GAURI, 1965; NAKAMURA, 1970). *Isogramma serbica* sp. nov. belongs to the earlier group of small species with fine concentric ornamentation and is proposed as a new species on the basis of the absence of a narrow dorsal sulcus to the anterior of the prominent dorsal median ridge.

The genus *Isogramma* does not have teeth or sockets, so a solution is needed for the opening and closing of valves. MUIR-WOOD & COOPER (1960) and BRAND (1970), stated the probability of the role of lateral ridges in the dorsal valve in articulation. WARDLAW *et al*. (1987), believe that articulation was accomplished by the additional ridge in the ventral valve.

Specimens of *I. serbica* sp. nov. contain puntae in the hinge line of the interior of the ventral valve, as well as the additional ridge. There is no foramen for the pedicle in the ventral valve and the only possible communication with the interior of the shell is through the bordering punctae along the margin of the umbonal plate, as WARDLAW *et al*. (1987) suggested.

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Резиме

Нова карбонска врста рода *Isogramma* (Dyctionellida, Brachiopoda) из СЗ Србије

Из локалности засеока Обрадовћи, у близини Крупња, СЗ Србија, из алевролита верејског хоризонта раног Московског ката Карбона описана је нова врста – *Isogramma serbica.* Ово је први налазак спољашњих и унутрашњих калупа и отисака оба капка представника овога рода у Србији.

Вентрални капак испупчен, најиспупченији у умбоналном делу. Кљун не прелази бравну ивицу. Унутрашња површина вентралног капка и отисак са јасно уочљивом платформом и умбоналним плочицама. Отисци мишића су смештени испод платформе.

Дорзални капак попречно субелиптичан, слабо удубљен, највећа ширина нешто унапред од бравне ивице. Слабо развијеним дорзалним латералним гребенима и без дорзалног сулкуса. Спољашњи орнамент се састоји од финих концентричних гребена између којих су смештене многобројне поре. Унутрашња површина дорзалног капка је покривена мањим бројем крупнијих округластих пора које су хаотично распоређене. Монолобатни миофор је јасан, средишња септа добро развијена, без предњих сулкуса, канал испред септуме, заједно са потпорним плочама, подупире миофор. Отисци мишића су јасни.

Вентрални капак нема отвор за пролаз дршке и једина комуникација са унутрашњошћу капка је кроз ивичне поре на маргинама умбоналне плоче.

Род *Isogramma* нема ни ни зубе ни зубне јамице, па се предпоставља да је артикулација остварена помоћу бочних гребена дорзалног капка и додатног гребена вентралног капка.

Род *Isogramma* познат је од доњег карбона и перма. Стратигтафски старије врсте су мањег раста док су пермске врсте, знатно веће. *I. serbica* има љуштуре мањих димензија.

Детаљно упоређење нове врсте са осталим представницима овога рода, исте или сличне старости, приказано је у енглеском тексту.

PLATE 1

Figs. 1–13. *Isogramma serbica* sp. nov.

All specimens come from the Obradovići Hamlet, village Cerova near Krupanj, NW Serbia; Vereian Horizon, Early Moscovian, Carboniferous.
Specimens are coated with ammonium chloride.

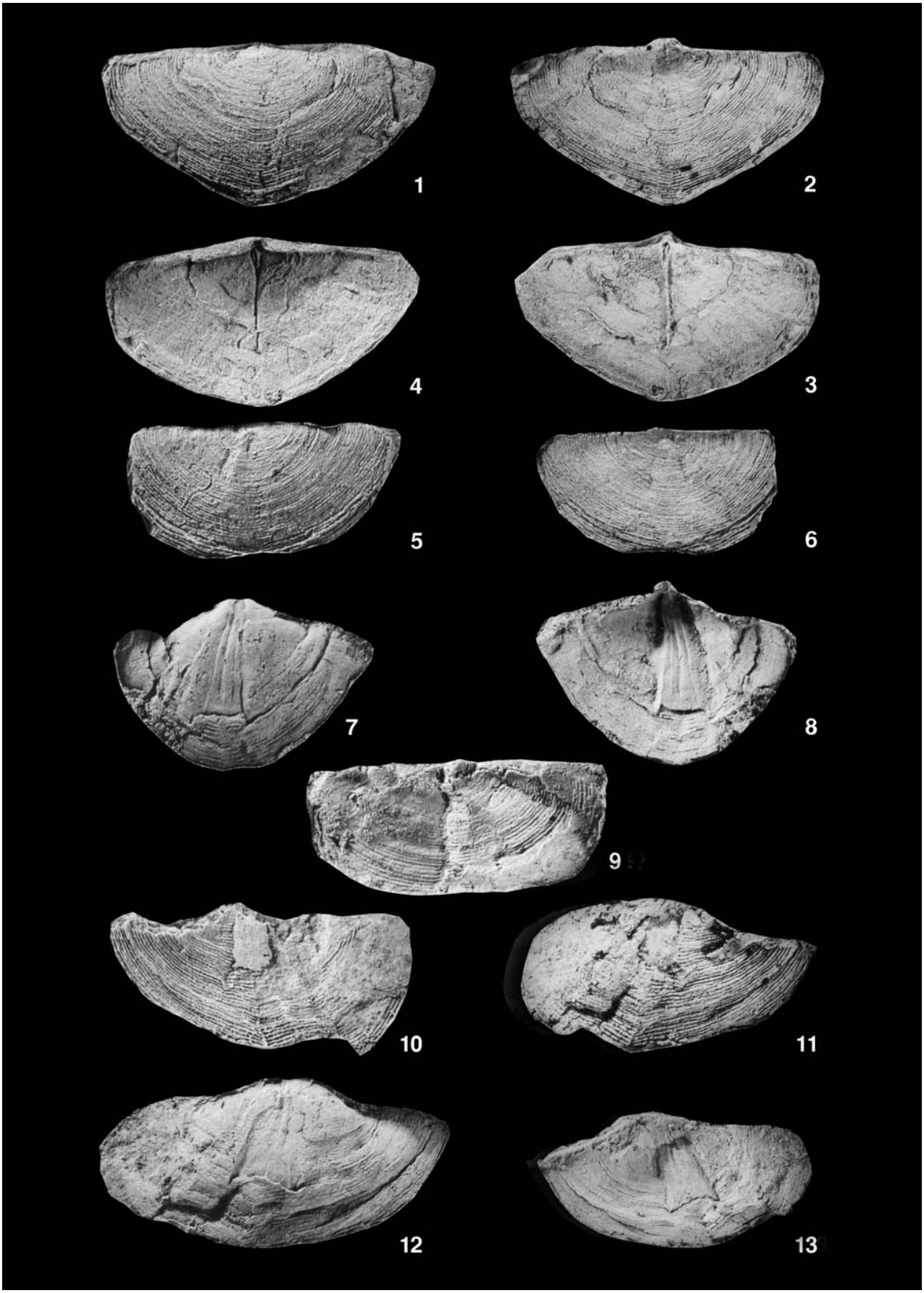
1–4. Holotype, specimen OB 100; × 3.
1. Dorsal valve exterior mould.
2. Dorsal valve exterior latex cast.
3. Dorsal valve interior latex cast.
4. Dorsal valve interior mould.

5, 6. Pareatype, specimen OB 101.
5. Dorsal valve exterior mould; × 2.5.
6. Dorsal valve exterior latex cast; × 2.3.

7, 8. Paratype, specimen OB 102; × 4.
7. Ventral valve interior mould.
8. Ventral valve interior latex cast.
9. Paratype, specimen OB 103; × 3. Dorsal valve exterior latex cast.

10, 11. Paratype, specimen 104; × 3.
10. Ventral valve exterior mould.
11. Ventral valve exterior latex cast.

12, 13. Paratype, specimen OB 105.
12. Ventral valve interior mould; × 3.
13. Ventral valve interior latex cast; × 2.5.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