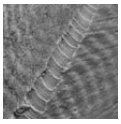
A new bivalve community from the lower Ludlow of the Prague Basin (Perunica, Bohemia)

JIŘÍ KŘÍŽ



The new shallow-water Bivalvia *Janicula potens* Community from the lower Gorstian carbonate platform influenced by the Svatý Jan Volcano activity in the Prague Basin, Bohemia is composed of 32 species [*Slava sathon* Kříž, 1985 (Slavidae); *Cardiola donigala* Kříž *in* Kříž & Serpagli, 1993, *Cardiola signata* Barrande, 1881, *Cardiola* aff. *geminans* Barrande, 1881 (Cardiolidae); *Dualina amina* sp. nov. (Antipleuridae); *Mila parvula* Kříž *in* Kříž & Serpagli, 1993 (Stolidotidae); *Algerina* aff. *algena* Kříž, 2008, *Tetinka costulifera* sp. nov. (Spanilidae); *Macrodesma enigma* sp. nov. (Cyrtodontidae); *Phthonia regularis* (Barrande, 1881) (Mytilidae); *Ambonychia volitans* (Barrande, 1881), *Amphicoelia pojetana* sp. nov., *Mytilarca parens* (Barrande, 1881), *Mytilarca* sp. (Ambonychiidae); *Molinicola bohemica* sp. nov. (Pterineidae); *Palaeopecten radvani* sp. nov., *Palaeopecten* sp. (Leiopectinidae); *Rhombopteria perunicola* sp. nov. (Rhombopteriidae); *Praeostrea bohemica* Barrande, 1881 (Praeostreidae); *Butovicella migrans* (Barrande, 1881) (Butovicellidae); *Mimerodonta phaseolus* sp. nov., *Janicula potens* (Barrande, 1881), *Goniophora tyri* Liljedahl, 1984, *Goniophora ascia* sp. nov., *Goniophora compta* sp. nov., *Goniophora solci* sp. nov., *Goniophora* sp. (Modiomorphidae); *Goniophorina nitidula* sp. nov. (Goniophorinidae); *Cymatonota prolata* sp. nov., *Cimitaria liscina* sp. nov., *Cimitaria* cf. *liscina* sp. nov., *Sanguinolites*? *drupa* sp. nov. (Grammysiidae)]. In the paper one new genus (*Janicula* gen. nov.), and 15 new species are described. The *Janicula potens* Community occupied the environment of protected well-ventilated shallow-water flats, locally overgrown by algae, with carbonate sedimentation influenced by direct ash falls and the subsequent sedimentation of volcaniclastics by currents around the volcanic archipelago. It is accompanied by a rich benthos, especially crinoids, corals, gastropods, and brachiopods together with abundant trilobites, rostroconchids, common cephalopods, stromatoporids, relatively rare ostracods, tergomyans, polyplacophorids, worms, bryozoans, sponges, and algae. It is classified as a part of the Coral-Crinoid Community Group which in the Prague Basin, Bohemia includes the homologous and analogous late Homerian, Wenlock Coral-Leptaenid Community, *Hircinisca-Ancillotoechia* Community, and *Septatrypa lissodermis-Cyrtia maior* Community, the early Gorstian, Ludlow *Atrypa fumosa* Community, and the *Coniproetus-Protocymostrophia* Community. The *Janicula potens* Community from the Liščí Quarry locality near the Amerika gamekeeper's lodge north of Karlštejn, Bohemia is the most diversified Bivalvia community in the Silurian of the Prague Basin. The lower Gorstian tuffaceous limestones, with more than 202 benthic and nektobenthic known species, represent the most fossiliferous Silurian level in the Prague Basin. The *Janicula potens* Community shows close palaeogeographic relationships with the upper Wenlock, Racine Formation reefs of Wisconsin and Illinois (North America), Silurian of Gotland and Dalarna (Sweden), Maine (North America), and Nova Scotia (Canada). • Key words: Bivalvia, Silurian, lower Ludlow, new taxa, palaeoecology, shallow water, volcaniclastics, Perunica, Prague Basin, Bohemia.

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In the Prague Basin (Bohemia, Barrandian), the earliest Silurian sediments were pelitic. During the Telychian (Llandovery) and especially in the early Sheinwoodian (Wenlock) the carbonate admixture increased continuously. Since the Aeronian (Llandovery) the sedimentation in the Prague Basin was influenced by volcanic activity, accompanied by the production of volcaniclastic sediments, magma intrusions and effusions. Several volcanic centres existed along the deep synsedimentary growth faults and their zones of intersection (Kříž 1991, 1998). In the Prague Basin the volcanic archipelago developed at these volcanic centres: Hýskov Volcano (Aeronian), Svatý Jan Volcano (late Sheinwoodian–Gorstian), Řeporyje Volcano (Sheinwoodian and early Homerian), Kosov Volcano and Nová Ves Volcano (latest Homerian–early Gorstian).

The sedimentation and redeposition of volcaniclastics by currents near the volcanic archipelago led to the origin of well-ventilated shallow-water flats with carbonate

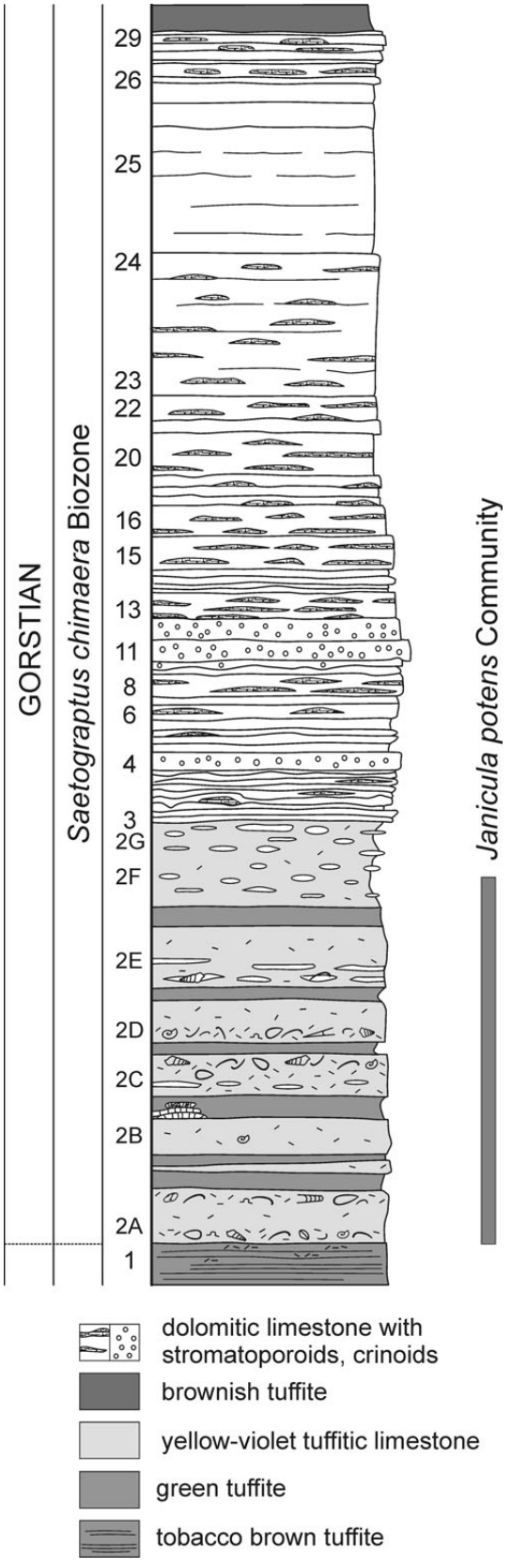


Figure 1. Liščí Quarry near Amerika gamekeeper's lodge, Karlštejn, Prague Basin, Bohemia, section No. 942 showing lithologies.

sedimentation, overgrown by algae, and occupied by a rich benthos, especially crinoids, corals, stromatoporoids, brachiopods, gastropods, and bivalves. Bioclasts formed a substantial proportion of the sediments. In the periods of volcanic activity and subsequent deposition of volcaniclastics, the tuffaceous admixture in the sediments increased. During the late Wenlock the Svatý Jan Volcano emerged. A rich assemblage of early land plants is documented by a rich occurrence of trilete miospores and cryptospores in the littoral sediments around the island. The assemblage of the sporomorphs is comparable with the assemblage of almost the same species described from Shropshire (Kříž 1992, Kříž *et al*. 1993, Dufka 1995).

In sediments of the carbonate platforms developed on slopes of the Svatý Jan Volcano in the lower Homerian, Wenlock, a crinoid, gastropod, bivalve, brachiopod and trilobite-rich fauna occurs at the localities in the Section Loděnice – Bubovice (Kříž 1992), Svatý Jan – Hliník (Horný 1955), Tachlovice – Section No. 713 (Kříž *et al.* 1993), Lištice (Herinky) and Kozel near Beroun – Section No. 960 (Kříž 1992), and was described already by Barrande in his *"Systême silurien du centre de la Bohême"* (1852–1881). From these localities Barrande described (1881) a rich assemblage of bivalves dominated by pterineids, pectinoids, ambonychiids, and modiomorphids. They usually occur together with the rich communities of gastropods described for the *Systême silurien du centre de la Bohême* by Perner (1903–1911).

A similar rich coral, stromatoporoid, gastropod, bivalve, brachiopod and crinoid fauna of the early Ludlow age was discovered in 1929 (Bouček 1931) in the new quarries near the Amerika gamekeeper's lodge north of Karlštejn in the southern vicinity of the Silurian Svatý Jan Volcano. In the Amerika Anticline the lower Gorstian tuffaceous partly unconsolidated carbonates were exposed. They originated on the shallow-water protected flats built by the Wenlock tuffites and overgrown by algae, important for development of the rich gastropod, brachiopod and bivalve communities. The general composition of these communities is very similar to that of the communities known from the older rocks of Wenlock age to Barrande.

The rich fauna from the quarries in the Amerika Anticline was carefully collected for many years and only slowly scientifically analysed. Prantl (1939a, b) described three new species of rugose corals from the locality. Přibyl (1943) correlated the levels with the early Ludlow (*Neodiversograptus nilssoni – Saetograptus chimaera* Biozone) and described from here the characteristic brachiopod *Kirkidium (Pinguaela) bohemicum* (Přibyl, 1943). Růžička & Bouška (1944) published on the activities and the collections from this locality in 1929–1944, and listed 125 species of crinoids (17), trilobites (11), cephalopods (6), gastropods (28), bivalves (6), brachiopods (21), bryozoans (3), corals (29), stromatoporoids (3) and algae (1).

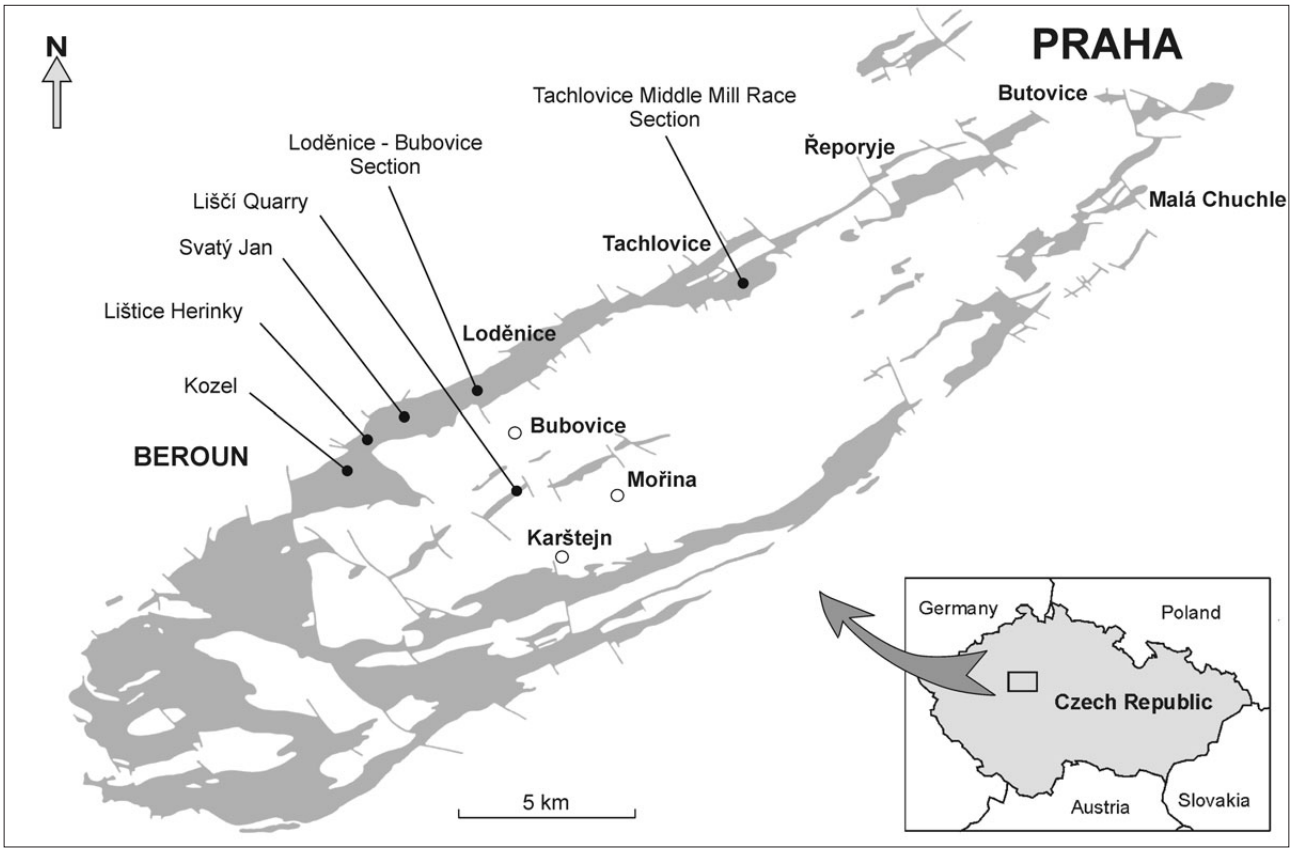


Figure 2. Distribution of the Silurian rocks in the Prague Basin and the location of the localities discussed in the text.

Horný (1952) published first detailed description of the gastropod-rich locality Liščí Quarry and in 1955 described the Wenlock–Ludlow section in the region of Amerika Anticline near Karlštejn and also a first detailed list of fauna (more than 127 species) of the gastropod-rich tuffaceous rocks. Svoboda & Prantl (1955) discussed the section and fauna in the Amerika quarries, and Prantl (1957) described from here *Helmintidium mirum bohemicum* Prantl, 1957 and the list of corals from the locality (more than 23 species). Kříž (1986) compiled the most recent list of fauna from the locality, and Havlíček & Štorch (1990) re-described the brachiopods and defined from here the Coral-Crinoid Community. Horný & Peel (1995) estimated more than 60 species of gastropods from the locality Liščí Quarry.

The locality represents the most fossiliferous Silurian locality in the Prague Basin. From the "gastropod levels" in Liščí Quarry are known more than 202 species, consisting of crinoids (12), ostracods (2), trilobites (11), cephalopods (13), gastropods (60), bivalves (32), rostroconchids (4), tergomyans (1), polyplacophorids (1), worms (1), bryozoans (3), brachiopods (26), corals (31), stomatoporids (3), algae (1) and sponges.

Radvan Horný from the National Museum, Prague collected at the Liščí Quarry locality near the Amerika gamekeeper's lodge in the period 1952–1998, and measured the gastropod rich levels of the tuffaceous limestones in detail in 1964, in 1995 (levels A–G), and in 1998 (level A). Jiří Kříž collected bivalves at the locality in the period 1961–1966 and measured exposed section No. 942 (Fig. 1) in the southern slope of the Liščí Quarry in 1977. The statistics of the bivalve community are based on the all bivalves collected from the layer No. 2 (section No. 942). The distribution of bivalves in the levels A–E of the bed No. 2 (Tables 1, 2) is based on the collections from the period 1965–1966.

The section No. 942 (coord. 49° 57´ 17.2˝ N; 14° 10´ 23.1˝ E) starts by the tobacco-brown tuffites with fragments of benthic fauna in upper part (bed No. 1).

They are overlain by 555 cm thick formation of the yellow, brown, violet and rusty, partly unconsolidated limestone with tuffaceous admixture and volcanic glass. Horný (1998) collected in the formation also common irregularly shaped volcanic bombs up to 15 cm in diameter. Beds, 15 to 30 cm thick, of light green tuffite contain lapilli (up to 10 millimetres in size), and divide the bed No. 2 into six levels (A–G). The tuffaceous limestones contains crinoid, coral, bivalve, brachiopod and gastropod fauna accompanied by cephalopods, trilobites and other benthic groups described above. Accumulations of gastropods are developed at the base and in the upper part of the level A, and at the base of the levels B and C occur large tabulate

(favositids, heliolitids, chaetetids) and rugose coral colonies (*Microplasma flexuosum* Prantl, 1939a). In the level C, and in the middle part of the level D abundant bivalves, gastropods and brachiopods occur. In the levels E, F, and G the tabulate coral colonies became locally abundant.

Higher up is 127 cm thick formation of 7–17 cm thick lenticular layers (beds No. 3–5) of the brown to pinkish lenticular limestones, alternating with grey-green to greenish grey tuffites with abundant stromatoporoid colonies and tuffaceous limestones.

The section continues with the 900 cm thick formation of 6–180 cm thick layers (beds No. 6–30) of mostly massive pinkish grey, greyish brown to rusty brown biodetrital dolomitic limestones with crinoid detritus and stromatoporoid colonies. This formation may be correlated with the biodetrital pinkish crinoidal dolomitic limestones with tabulates and stromatoporoid colonies between the two tuffitic levels exposed in western part of the Liščí Quarry, macroscopically and microscopically described by Kukal (1955, formation No. 3, 11 m thick, p. 248).

The sequence No. 942 is terminated by greenish tuffites (bed No. 31) and higher up it is covered by the quarry scree.

Systematic palaeontology

Abbreviations. – V = valve, L = length of the shell, H = height of the shell, W = width of the shell, W/2 = width of one valve (Kříž 1969); JK 95, JK 142, JK 3291, JK 8535, JK 11499–JK 11980 bivalves (1900 specimens) deposited in the collection of Jiří Kříž in the Czech Geological Survey, Prague; NM bivalves deposited in the National Museum, Prague. All measurements are in millimetres.

Class Bivalvia Linné, 1758
Subclass Autolamellibranchiata Grobben, 1894
Superorder Nepiomorphia Kříž, 2007
Order Praecardioida Newell, 1965
Superfamily Cardioloidea Hoernes, 1884
Family Slavidae Kříž, 1982

Genus *Slava* Barrande, 1881

Type species. – *Slava bohemica* Barrande, 1881, Bohemia, Prague Basin, Silurian, Ludlow, Gorstian.

Slava sathon Kříž, 1985
Figure 3A, B

1985 *Slava sathon* sp. n.; Kříž, p. 74–77, pl. 9, figs 1–9, pl. 11, figs 1, 2, 10, 11.
1993 *Slava sathon* Kříž. – Kříž *in* Kříž & Serpagli, p. 325, pl. 7, figs 1, 2, 23.
1996 *Slava sathon* Kříž. – Kříž, p. 50, pl. 5, figs 14, 18, 23.

Holotype. – Internal mould of a left valve with fragments of the shell, JK 3288, figured by Kříž (1985) on pl. 9, figs 7, 9.

Type locality. – Bohemia, Praha-Malá Chuchle Valley.

Type horizon. – Silurian, Wenlock, Homerian, *Testograptus testis* Biozone.

Material. – One incomplete right valve.

Dimensions. –

specimen	V	L	H	W/2
JK 3291	R	18.0	23.2	9.2

Discussion. – In its general shape, outer and inner surface sculpture, and ontogeny the specimen from the Liščí Quarry locality is conspecific with type material (Kříž 1985) from the lower Ludfordian of the Prague Basin.

Mode of life. – Endobyssate, infaunal (Kříž 1985).

Occurrence. – *Slava sathon* occurs in the Prague Basin, Bohemia from the upper Wenlock, Homerian up to the lowermost Ludfordian (Ludlow). It is a common species in the Bivalvia-dominated *Cardiola donigala-Slava sathon* Community described from the lower Gorstian of the Prague Basin (Manda & Kříž 2007). It was also described from the *Cardiola docens* Community, lower Ludfordian of Sardinia, Galemmu locality near Fluminimaggiore (Kříž *in* Kříž & Serpagli 1993) and from the upper Wenlock, Homerian of Montagne Noire, France, Roquemaillére locality near Gabian (Kříž 1996).

Family Cardiolidae Hoernes, 1884

Genus *Cardiola* Broderip *in* Murchison, 1839

Type species. – *Cardiola interrupta* Sowerby *in* Murchison, 1839, Great Britain, Wales, Radnor Forest, New Radnor, Silurian, Ludlow.

Cardiola donigala Kříž *in* Kříž & Serpagli, 1993
Figure 3C–F

1993 *Cardiola donigala* sp. n.; Kříž *in* Kříž & Serpagli, p. 316, pl. 5, figs 4–7, 10, 11.
1996 *Cardiola donigala* Kříž. – Kříž, p. 45, pl. 2, figs 19, 22–25, 28–30, pl. 3, figs 1–6.

Holotype. – Left valve, deposited in the Paleontological Institute, University of Modena under the number MO 23 050.

Type locality. – Italy, Sardinia, S'Antonio Donigala.

Type horizon. – Silurian, Ludlow, lower Gorstian, most probably the *Saetograptus chimaera* Biozone.

Material. – One right, and five left valves.

Dimensions.–

specimen	V	L	H	W/2
JK 11565	L	10.0	12.1	5.1

Discussion. – In their general shape, outer and inner surfaces sculpture, and ontogeny the specimens from the Liščí Quarry locality are conspecific with type material from the Gorstian (Ludlow) of Sardinia. They are also conspecific with the specimens from the Gorstian of Bohemia. *Cardiola* sp. described from the upper Wenlock, Racine Formation reef dolostone of Wisconsin and Illinois, North America (Watkins 1997) is a member of the *Cardiola agna – Cardiola gibbosa – Cardiola donigala – Cardiola docens* lineage (Kříž 1979) and it is closely related to *Cardiola donigala* by general shape and surface sculpture.

Mode of life. – *Cardiola donigala* was epibyssate, attached to the firm substrate, most probably to the empty cephalopod shells or to the biodetrite on the bottom (Kříž 1979) in the cephalopod limestone biofacies.

Occurrence. – *Cardiola donigala* is a dominant species of the *Cardiola donigala* Community described from the lower Gorstian (Ludlow) of Sardinia (Kříž *in* Kříž & Serpagli (1993). It is also dominant species of the *Cardiola donigala-Slava cubicula* Community described by Kříž (1999b) from the cephalopod limestone biofacies on the northern slopes of the Svatý Jan Volcano, the upper *Saetograptus chimaera* Biozone, upper Gorstian and of the *Cardiola donigala – Slava sathon* Community described from the cephalopod limestone biofacies on the slope of volcanic accumulation near Prague, the lower *Saetograptus chimaera* Biozone, lower Gorstian (Manda & Kříž 2007).

Cardiola signata Barrande, 1881

Figure 3G–J

1881 *Cardiola signata* Barr.; Barrande, pl. 167, figs V/9–23, 32–34, 37–42.
1979 *Cardiola signata* Barrande. – Kříž, pp. 86, 87, pl. 19, figs 2, 3, pl. 39, fig. 4 (for a complete previous synonymy see this paper).
1993 *Cardiola signata* Barrande. – Kříž *in* Kříž & Serpagli, pp. 318, 319, pl. 6, fig. 21.
1995 *Cardiola signata* Barrande. – Kříž & Bogolepova, pp. 577, 578, pl. 70, figs 6, 8, 10, 13, 16.
1996 *Cardiola signata* Barrande. – Kříž, p. 46, pl. 3, figs 9, 12, 13, 17.
1999c *Cardiola signata* Barrande. – Kříž, p. 283, pl. 5, figs 21, 27, 28, pl. 6, figs 1–3.

Lectotype. – Designated by Kříž (1979). Left valve, deposited in the National Museum, Prague under the number L 7249, and re-figured by Kříž (1979) on pl. 19, figs 2, 3.

Type locality. – Bohemia, Koněprusy near Beroun.

Type horizon. – Silurian, Ludlow, lower Ludfordian.

Material. – Two right valves.

Dimensions.–

specimen	V	L	H	W/2
JK 11569	R	5.1	7.9	2.7
JK 11570	R	7.5	8.4	3.5

Discussion. – From their general shape, outer and inner surfaces sculpture, and ontogeny the specimens from the Liščí Quarry locality are conspecific with Barrande's type material from the Gorstian and the Ludfordian (Ludlow) of Bohemia.

Mode of life. – *Cardiola signata* was epibyssate, attached to the firm substrate, most probably to the empty cephalopod shells or to the biodetritus on the bottom in the cephalopod limestone biofacies.

Occurrence. – *Cardiola signata* represents a cosmopolitan cardiolid. It is a dominant species of the *Cardiola signata* Community described from the uppermost Gorstian cephalopod limestone biofacies (*Saetograptus chimaera* Biozone) of Tajmyr (Kříž & Bogolepova 1995). The *Cardiola signata* Community was also described from the locality Mušlovka, Bohemia, from the cephalopod limestone biofacies, lower Ludfordian, lower part of the *Saetograptus fritschi* Biozone by Manda & Budil (2007). In Bohemia *Cardiola signata* occurs in the *Cardiola donigala-Slava cubicula* Community described from the cephalopod limestone biofacies on the northern slopes of the Svatý Jan Volcano, upper *Saetograptus chimaera* Biozone, the upper Gorstian (Kříž 1999b), from the *Cardiola donigala-Slava sathon* Community described from the cephalopod limestone biofacies on the slope of volcanic accumulation near Prague, lower *Saetograptus chimaera* Biozone, the lower Gorstian (Manda & Kříž 2007) and from the *Cardiola docens* Community, *Saetograptus fritschi* Biozone, the lower Ludfordian.

Besides Bohemia and Tajmyr, it occurs in Poland (Wenlock); Germany (Lindener Mark, lower Ludlow), Austria

(Carnic Alps, Wenlock – Ludlow boundary); Sweden, Gotland (Wenlock – Ludlow boundary), Skåne (Wenlock – Ludlow boundary); France (Massif Armoricain, Wenlock – Ludlow boundary); Massif de Mouthoumet and Montagne Noire, Wenlock – lower Ludlow); Portugal; Great Britain Welsh Borderland (Wenlock – Ludlow boundary); and Italy (Sardinia, Wenlock – Ludlow boundary).

***Cardiola* aff. *geminans* Barrande, 1881**
Figure 3K

Material. – One right valve.

Dimensions. –

specimen	V	L	H	W/2
JK 11614	R	14.3	17.7	8.0

Discussion. – Based on their general shape, outer and inner surface sculpture, and ontogeny the specimens from the Liščí Quarry locality are closely related to Barrande's holotype of *Cardiola geminans* Barrande, 1881 and other specimens, which are very rare in the lower part of the Ludfordian (Ludlow) of the Prague Basin, Bohemia.

Mode of life. – *Cardiola* aff. *geminans* was byssate, probably semi-infaunal.

Occurrence. – *Cardiola geminans* is known from the lower Ludfordian, Ludlow cephalopod limestone biofacies from the Prague Basin, Bohemia, locality Dlouhá Hora Hill near Beroun and from the Mušlovka Quarry near Praha-Řeporyje.

Order Antipleuroida Kříž, 2007
Superfamily Antipleuroidea Kříž, 2007
Family Antipleuridae Neumayr, 1891

Genus *Dualina* Barrande, 1881

Type species. – *Dualina comitans* Barrande, 1881, Bohemia, Prague Basin, Silurian, Ludlow, Ludfordian.

***Dualina amina* sp. nov.**
Figure 3L–N, Q–T

Holotype. – The left upper valve from the shell inclined to the right, JK 11817, figured on Fig. 3Q–T.

Paratype. – The compressed shell with conjoined valves inclined to the right, JK 11573, figured of Fig. 3L–N.

Derivation of name. – Name derived from the Czech name *Amina* from the tale; indeclinable noun.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

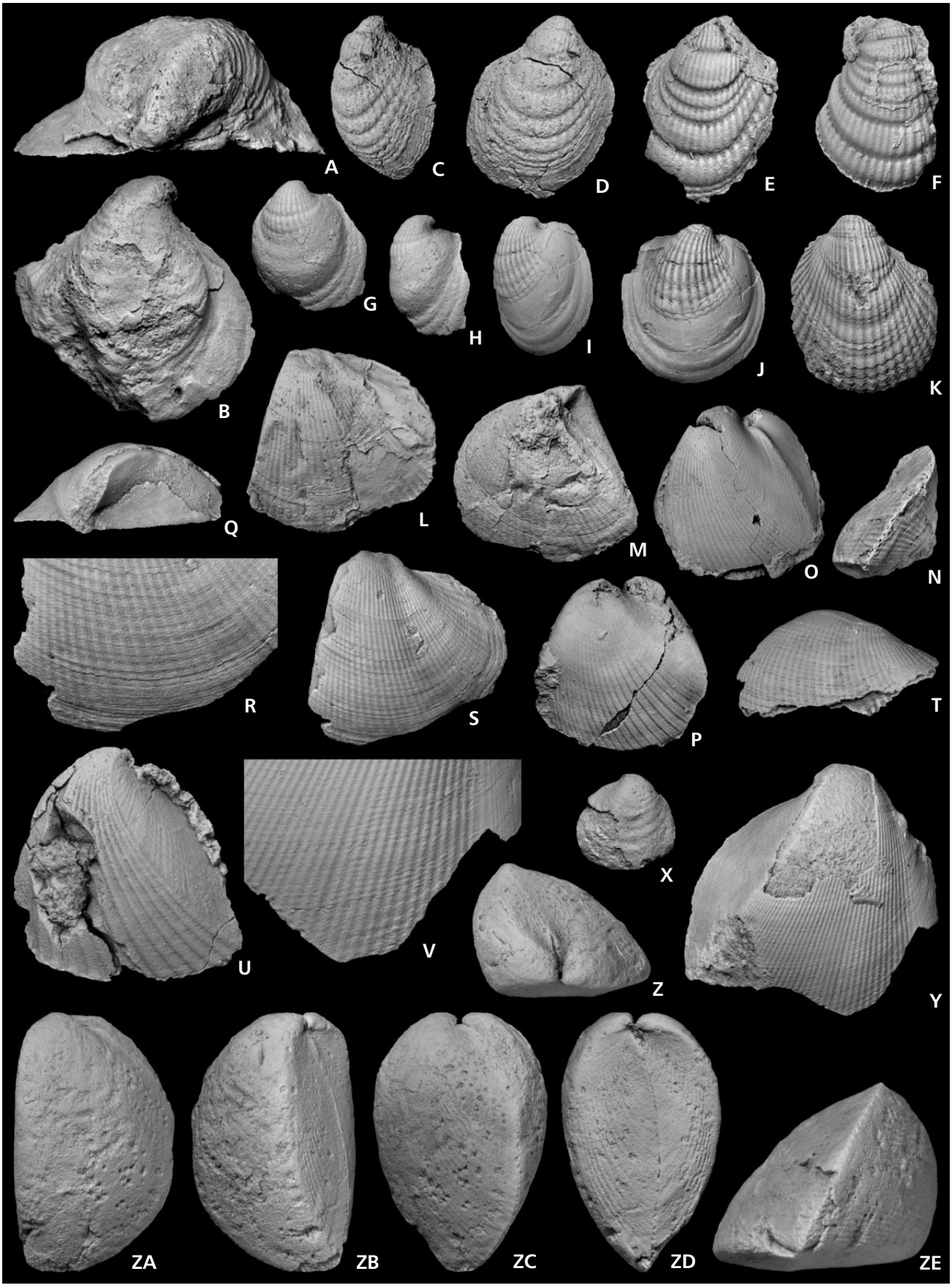
Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Types only.

Diagnosis. – *Dualina* of the *Dualina longiuscula* Barrande, 1881 group with small subtrigonal shells, shell length and width almost equal, inequivalve, compressed, and strongly enantiomorphous, distinctly inclined to the right, with flat, lanceolate frontal face. Anterior margin of the upper valve is almost straight, and in dorsoventral direction. On the anterior face of the shell are developed 18 radial ribs and 28 radial ribs developed in posterior part of the shell. Posterior wing is separated from the rest of the shell by shallow radial sinus.

Description. – Shell is small (L = 12.6, H = 12.3, W/2 = 4.0), subtrigonal, inequilateral, inequivalve, strongly enantiomorphous, inclined to the left and to the right, and inflated but laterally compressed (H/W = 1.53). Umbones are in anterior position, coiled, beaks prosogyrate. In the opisthocline upper valve (left valve) of the shell inclined to the right is developed a distinct, overhanging anterior face separated from the valve by a rounded umbonal ridge. Posterior of upper valve is twisted laterally up along wide, shallow radial sinus. Hinge line is very short, convex. Anterior margin of the upper valve formed by umbonal ridge

Figure 3. A, B – *Slava sathon* Kříž, 1985, right valve, JK 3291; A – dorsal view, × 2; B – lateral view, × 1.6. • C–F – *Cardiola donigala* Kříž, 1993; C, D – left valve, JK 11565; C – postero-lateral view, × 2.2; D – lateral view, × 2.4; E – left lateral view, JK 11567, × 3.5; F – left lateral view, JK 11568, × 3.1. • G–J – *Cardiola signata* Barrande, 1881; G, H – right valve, JK 11569; G – lateral view, × 2.6; H – antero-lateral view, × 2.5; I, J – right valve, JK 11570; I – antero-lateral view, × 2.2; J – lateral view, × 2.8. • K – *Cardiola* aff. *geminans* Barrande, 1881, right valve, lateral view, JK 11614, × 1.7. • L–N – *Dualina amina* sp. nov., articulated specimen, JK 11573, paratype; L – left lateral view, × 2.7; M – right lateral view, × 2.5; N – ventral view, × 2.2. • O, P – *Dualina tenuissima* Barrande, 1881, articulated specimen, NM L 14685, lectotype; O – right lateral view, × 1.7; P – left lateral view, × 1.6. • Q–T – *Dualina amina* sp. nov., left valve, JK 11817, holotype; Q – dorsal view, × 2.8; R – detail of the outer surface sculpture in ventral part, × 4; S – lateral view, × 2.3; T – ventro-lateral view, × 2.6. • U – *Mila parvula* Kříž, 1993, JK 11572, right lateral view, × 3.7. • V–Y – *Algerina* aff. *algena* Kříž, 2008, left valve, JK 11818; V – detail of the outer surface sculpture in ventral part, × 6.4; X – detail of nepioconch, left lateral view, × 5.8; Y – lateral view, × 3.4. • Z–ZE – *Tetinka costulifera* sp. nov., articulated specimen, JK 11571, holotype; Z – dorsal view, × 4.6; ZA – left view, × 4.4; ZB – right view, × 4.4; ZC – posterior view, × 4.4; ZD – anterior view, × 4.4; ZE – ventral view, × 6.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ZE

is almost straight in dorsoventral direction. Ventral end of anterior margin is angular. Ventral margin is evenly rounded and together with the posterior margin it forms the posterior rounded, wing-like part of shell. Outer surface sculpture consists of irregular growth wrinkles forming narrow growth bands and furrows in combination with 18 flat radial ribs on the anterior face, and about 28 on the rest of the valve. Radial ribs are less prominent on the anterior face of the upper valve and on the corresponding anterior part of the lower valve. Radial ribs are curved posteriorly in upper valve (left) and anteriorly in lower valve (right). Hinge is unknown, ligament opisthodetic.

Dimensions. –

specimen	V	L	H	W/2
JK 11817	L	12.3	12.4	5.1
JK 11573	L	12.6	12.3	4.1

Discussion. – Lectotype (SD, herein) of *Dualina tenuissima* Barrande, 1881 [shell with conjoined valves inclined to the right deposited in the National Museum, Prague under the number L 14 685, figured by Barrande (1881) on pl. 34, figs I/20–26, and herein on Fig. 3O, P] differs from *Dualina amina* by a little dorsoventrally elongated shell, convex anterior margin, less numerous radial ribs in posterior part of the left (upper valve) and by generally higher number of convex radial ribs on the shell (about 39 in number). *Dualina amina* was one of the earliest representatives of the genus *Dualina* and was probably an ancestral form of *Dualina tenuissima.*

Mode of life. – Reclining, byssate, with posterior part close to the water-sediment interface.

Occurrence. – The descendant of *Dualina amina - Dualina tenuissima* represents a common species of the Bivalvia dominated communities in the Ludfordian (Ludlow) cephalopod limestone biofacies.

Family Stolidotidae Starobogatov, 1977

Mila Barrande, 1881

Type species. – *Mila complexa* Barrande, 1881, Bohemia, Prague Basin, Silurian, Ludlow, Ludfordian.

***Mila parvula* Kříž *in* Kříž & Serpagli, 1993**
Figure 3U

1993 *Mila parvula* Kříž; Kříž *in* Kříž & Serpagli, pp. 329, 330, pl. 8, figs 13,15–18, 20.

Holotype. – Left (lower) valve figured by Kříž *in* Kříž & Serpagli (1993) on pl. 8, figs 15, 16, and deposited in the Paleontological Institute, University of Modena under No. MO 22 970.

Type locality. – Italy, Sardinia, Fluminimaggiore, Galemmu locality.

Type horizon. – Silurian, Ludlow, lower Ludfordian, *Cardiola docens* Community.

Material. – One right (lower) valve.

Dimensions. –

specimen	V	L	H	W/2
JK 11572	L	10.3	10.3	1.8

Discussion. – Enantiomorphous (Kříž 2001), right, lower valve of *Mila parvula* from the lower Gorstian, Liščí Quarry locality, represents probably the oldest known representative of the species. The shell is inclined to the right while the shells from Sardinia are all inclined to the left. The right lower valve is opisthodetic, umbo in posterior position and prosogyrate with coiled beak. A little inflated anterior face is separated from the rest of the shell by a distinct bend curved anteriorly, formed by the anterior-most wide radial rib. Posterior wing well developed, separated from the central part of the valve by shallow radial sinus. Outer surface sculpture is composed of growth wrinkles and irregular narrow growth bands in combination with radial ribs, convex in cross-section and wide radial gutters. Both, the radial ribs and radial gutters broaden ventrally and are anteriorly curved. The radial ribs are narrower and less prominent in frontal face of the valve. 12 radial ribs are developed between anterior bend and posterior sinus separating the wing. Number of radial ribs in Sardinian specimens is similar (13–17).

Mode of life. – *Mila parvula* was probably reclining, with posterior part close to the water-sediment interface.

Occurrence. – The cephalopod limestone biofacies of the lower Ludfordian (Ludlow) of the South-Western Sardinia, Fluminimaggiore, Galemmu locality.

Family Spanilidae Kříž, 2007

Genus *Algerina* Kříž, 2008

Type species. – *Algerina algena* Kříž, 2008, Algeria, Hoggar Mountains, Ahnet Massif, Foum Belrem Section, Silurian, Ludlow, lower Gorstian.

***Algerina* aff. *algena* Kříž, 2008**
Figure 3V–Y

Material. – One incomplete left valve (lower) of the shell inclined to the left.

Discussion. – In its general size and shape, outer and inner surfaces sculpture, and ontogeny the specimen from the Liščí Quarry locality is most probably the early descendant form of *Algerina algena* from the lower Gorstian, Ludlow of Algeria. Stage II, preserved in umbonal part of adult shell, is subcircular in outline, moderately inflated, inequilateral, and slightly opisthocline. Beaks prosogyrate. Outer surface formed by regularly spaced convex growth bands and furrows. Stage III developed as swollen band, which is separated from the adult valve by a distinct bend. Outer surface sculpture smooth, shell becomes more opisthocline. Adult shell (Stage IV) is broadly elliptical, obese (H/W = 1.35), inequilateral, opisthocline, enantiomorphous, inclined to the left. Bulky, prosogyrate and coiled umbo is slightly shifted to posterior. Anterior slope of the valve with frontal face is steeper than posterior slope. Widely lanceolate, slightly inflated frontal face is separated from the central part of the shell by a distinct bend, slightly curved anteriorly. Posterior part with wing-like shape, separated from the central part of the shell by a shallow radial sulcus. Outer surface sculpture is formed by the combination of growth wrinkles and anteriorly curved, prominent, narrow, radial ribs (in adult specimen more than 23 on frontal face, 40 in central part of the valve, and 8 on the wing). The ribs are not so distinct on the frontal face. Radial ribs and radial gutters equal in width, and are broadening ventrally. Inner surface sculpture is generally smoother. Shell thickness is 0.14 mm. Other features are unknown.

Algerina aff. *algena* differs from *Algerina algena* by its longer shell, by the absence of radial ribs in the Stages II and III, and by the frontal face separated by distinct bend in adult stage. Number of radial ribs is practically the same except the higher number of radial ribs (8) on the wing (in *Algerina algena* 2–4 ribs). *Algerina cocco* (Kříž, 1999) from the lower Ludlow of the Carnic Alps, Italy is close to *Algerina* aff. *algena* in the development of the frontal face, but it differs by the more numerous radial ribs in adult shell.

Dimensions. –

specimen	V	L	H	W/2
JK 11818	L	13.4	13.8	5.1

Mode of life. – Most probably reclining, byssate.

Occurrence. – *Algerina algena* Kříž, 2008 is known from the cephalopod limestone biofacies of Algeria, northern margin of the western Hoggar Mountains, Ahnet Massif, Foum Belrem Section, and Ougarta Range, Saoura area, Oued Ali Section.

Genus *Tetinka* Barrande, 1881

Type species. – *Tetinka sagitta* Barrande, 1881, Bohemia, Prague Basin, Ludlow, late Ludfordian.

***Tetinka costulifera* sp. nov.**
Figure 3Z–ZE

Holotype. – The shell with conjoined valves, JK 11571, figured on Fig. 3Z–ZE.

Derivation of name. – Derived from Latin *costula*, rib, feminine diminutive, and from Latin suffix *-fera*, meaning carry, bear, have.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Holotype only.

Diagnosis. – Spanilidae with small dorso-ventrally elongated shell, inequivalve, narowly obovate, inflated, and enantiomorphous, distinctly inclined to the right, with flat, and lanceolate frontal face. 31 radial ribs developed in posterior part of the shell. On the anterior face of the shell are developed more than 26 radial ribs. Posterior wing is separated from the rest of the shell by shallow radial sinus. During ontogeny the shell becomes dorsoventrally elongated with length and width almost equal.

Description. – Small, inequivalve, inequilateral, dorsoventrally elongated (H /L= 1.5), narrowly obovate, and inflated shells (L/W = 1.2). The left valve is prosocline and the right valve is opisthocline. Enantiomorphous, distinctly inclined to the right. In the left valve overhanging, almost flat, lanceolate frontal face is separated from the posterior part of the shell by blunt edge, slightly curved anteriorly. The frontal face in the right valve is flat and wider than in the left valve; posterior slope in the right valve is steeper than frontal face. Prominent blunt umbones are in anterior terminal position, prosogyrate. Posterior wing is relatively narrow and separated by shallow radial sulcus from the rest of the valve. Outer surface is with numerous radial ribs (> 26 on the frontal

face, 31 in posterior part of the shell) in combination with irregular growth wrinkles and inexpressive growth bands. On the posterior wing up to 6 radial ribs are visible. Both, the radial ribs and radial gutters broaden ventrally. External opisthodetic ligament is developed in short longitudinal groove.

Dimensions. –

specimen	L	H	W
JK 11571	6.1	9.3	4.9

Remarks. – *Tetinka costulifera* sp. nov. from the lower Gorstian of the Prague Basin is the oldest known representative of the genus. It is most probably ancestral form of *Tetinka caesarea* (Barrande, 1881) from the middle Ludfordian cephalopod limestone biofacies. Shells of *Tetinka caesarea* are much larger (H ≥ 20), dorso-ventrally elongated, inflated, enantiomorphous, inclined to the right. Frontal face is moderately inflated, lanceolate, separated from the posterior part of the shell by blunt edge slightly curved anteriorly. Prominent blunt umbones in anterior terminal position, prosogyrate. Posterior wing is dorsoventrally more elongated, protruding slightly posteriorly, well separated from the rest of the shell by wide radial sinus. Outer surface sculpture consits of numerous, not so distinct radial ribs and radial gutters in combination with irregular growth wrinkles. and narrow regularly spaced indistinct growth bands. The radial ribs are more developed on inner surface of the shell. The ratio of the width of radial ribs to that of radial gutters is 1 : 1. Both, the radial ribs and radial gutters broaden ventrally.

Mode of life. – Infaunal, byssate.

Superorder Pteriomorphia Beurlen, 1944
Order Cyrtodontida Cope, 1996
Superfamily Cyrtodontoidea Ulrich, 1894
Family Cyrtodontidae Ulrich, 1894

Genus *Macrodesma* Isberg, 1934

Type species. – *Macrodesma striata* Isberg, 1934, Sweden, Dalarna, Upper Ordovician.

Remarks. – Upper Ordovician *Macrodesma* from Dalarna, Sweden was considered by Newell (1969) to be younger synonym of the Upper Devonian *Ptychodesma* Hall & Whitfield, 1872. For the type species of *Ptychodesma* – *Ptychodesma knappianum* Hall & Whitfield, 1872 very short anterior part curving downward into the ventral margin is very characteristic. In the type species of *Macrodesma* – *Macrodesma striata* Isberg, 1934 a lobate, evenly rounded, anterior margin is developed.

***Macrodesma enigma* sp. nov.**
Figure 4A–N

Holotype. – The left valve with most of the outer surface sculpture and posterior part of the ligament area preserved, JK 11761, figured on Fig. 4G–J.

Paratypes. – JK 11755–JK 11760, JK 11819, JK 11820, JK 11858, JK 11861–JK 11866 measured for dimensions, included into community analysis and figured on Fig. 4A–F, K–N.

Derivation of name. – From Latin *aenigma*, something mystery, obscure, riddle.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Three shells with conjoined valves, eight left valves and five right valves.

Diagnosis. – Ludlovian *Macrodesma* with dorsal line more than half of shell length, with anterior part evenly rounded. Umbones are in a little than one half of the shell length from anterior.

Description. – Shell medium-sized (L = 29.6, H = 24.5, W = 7.0), equivalve, longitudinally widely ovoidal, elongate, inequilateral (L/H = 1.11–1.31), inflated (H/W = 1.75–2.99). Umbones are in a little than one half of the shell length from anterior, beaks prosogyrate. Dorsal margin almost straight, more than half of the shell length long. Anterior part of the shell is shorter and smaller than posterior part, and evenly rounded. Ventral margin is long, convex, posterior margin is also evenly rounded. Posterior end of the dorsal margin is angular. Outer surface sculpture formed by regularly spaced flat, narrow growth bands and furrows. In the furrows are rarely preserved fine radial costae, interrupted by growth bands. Commissure lies within a single plane, no discernible byssal gape. Ligament is duplivincular, almost opisthodetic, low, long, with several chevron type grooves. On inner surface low triangular area is developed between the umbones and posteriorly. Shell thickness is 0.19–0.76 mm.

Dimensions. –

specimen	V	L	H	W/2
JK 11756	R	7.7	6.2	1.3
JK 11761	L	8.8	7.5	1.7
JK 11865	R	9.2	7.0	1.7
JK 11866	L	9.2	7.6	2.0

JK 11863	R	9.4	8.2	1.4
JK 11862	L	9.7	7.8	1.3
JK 11820	A	12.1	10.6	2.8
JK 11861	A	15.4	13.9	3.3
JK 11862	L	16.0	12.5	2.7
JK 11865	R	16.0	13.2	3.0
JK 11756	R	17.1	14.4	3.3
JK 11761	L	17.8	14.3	3.5
JK 11755	A	23.6	21.1	6.0
JK 11756	R	> 27.7	–	6.4
JK 11761	L	29.6	24.5	7.0

Discussion. – The Gorstian *Macrodesma enigma* sp. nov. differs from *Macrodesma striata* Isberg, 1934 from the Upper Ordovician of Dalarna, Sweden by generally larger shells, by evenly rounded anterior part of the shell, by outer surface sculpture formed by regularly spaced flat, narrow growth bands and furrows and by the fine radial costae preserved in the furrows, and interrupted by growth bands.

Mode of life. – Most probably infaunal, byssate.

Order Pterioida Newell, 1965
Superfamily Mytiloidea Rafinesque, 1815
Family Mytilidae Rafinesque, 1815
Subfamily Modiolinae Keen, 1958

Phthonia Hall & Whitfield, 1869

Type species. – *Cypricardites sectifrons* Conrad, 1842, U.S.A., New York, Middle Devonian.

Phthonia regularis (Barrande, 1881)

Figure 4O–Y

1881 *Modiolopsis regularis* Barr.; Barrande, pl. 285, figs I/6–9.

Lectotype. – (SD – herein); Internal mould of the shell with conjoined valves, NM L 22 768, figured by Barrande (1881) on pl. 285 as fig. I/9.

Paralectotype. – Internal mould of the shell with conjoined valves, with partly preserved outer surface sculpture, from the Ludlow, upper Ludfordian, Praha-Lochkov, Bohemia, NM L 22 767, figured by Barrande (1881) on pl. 285 as figs I/6–8.

Type locality. – Bohemia, Dlouhá hora Hill near Beroun.

Type horizon. – Silurian, lower Ludfordian.

Material. – Four shells with conjoined valves from the locality Liščí Quarry and the Barrande's types.

Diagnosis. – Ludlovian *Phthonia* with well developed fine radial costellae dorsally of umbonal ridge and in the posterior part of the shell.

Description. – Shell small to medium size (L = 15.9–21.7; H = 9.3–12.3), elongate elliptical, equivalved, inequilateral, and obese (H/W = 1.20–1.26). Lunule developed. Umbones sub-anterior, relatively large, beaks are prosogyrate. Umbonal ridge well defined, becoming obsolete before reaching post-inferior extremity. Dorsal margin long, about 55–64% the shell length. Anterior end is short, lobate, posterior end is subangular. Posterior margin is evenly round, ventral margin is long and almost parallel with dorsal margin, slightly convex. Anterior margin evenly rounded. Outer surface sculpture of ventral part of the shell is smooth, with irregular growth wrinkles or very little convex narrow growth bands. Radial costellae are developed in dorsal part of the shell, dorsally of umbonal ridge, and may be seen also in the posterior part of the shell in a very low angle strong light. Inner surface is smooth. Ligament is opisthodetic, in wide and deep groove bordered by narrow ligamental nymphs. Interior unknown. Shell very thin.

Dimensions. –

specimen	L	H	W
NM L 22767	11.7	7.4	4.6
NM L 22768	13.9	9.1	5.8
JK 11765	15.9	9.3	7.4
JK 11813	16.8	10.4	9.0
JK 11763	21.7	12.3	10.2

Discussion. – *Phthonia regularis* (Barrande, 1881) from the Gorstian and Ludfordian (Ludlow), Prague Basin, Bohemia is surprisingly closely related to *Phthonia cylindrica* Hall, 1883 from the Middle Devonian (Hamilton Group) of New York, U.S.A., which differs in having more elongated shells with outer surface sculpture consisting of extremely fine radial striae, more conspicuous ventrally of the umbonal ridge. Type species *Phthonia sectifrons* (Conrad, 1842) is also more elongated than *Phthonia regularis* but radial costellae are developed on all parts of the shell; they are stronger on the umbonal ridge, and on the anterior end. *Phthonia semiradiata* (Hall, 1860) from the upper Ludlow, Arisaig, Nova Scotia, Canada has also elongate elliptical shells but with flattened dichotomized radiating striae developed only in the posterior slope.

Mode of life. – Infaunal, burrowing.

Occurrence. – Bohemia, type locality and Praha-Lochkov, upper Ludfordian, Ludlow.

Superfamily Ambonychioidea Miller, 1877
Family Ambonychiidae Miller, 1877

Genus *Ambonychia* Hall, 1847

Type species. – *Ambonychia radiata* Hall, 1847, U.S.A., New York, Kentucky, Ohio, Upper Ordovician (Pojeta 1962).

***Ambonychia volitans* (Barrande, 1881)**
Figures 4Z, 5A

1881 *Mytilus volitans* Barr.; Barrande, pl. 211, figs V/1–3.

Lectotype. – (SD, herein), the right valve with outer surface sculpture preserved, NM L 21 396, figured by Barrande (1881) on pl. 211, figs V/2, 3, re-figured here on Fig. 4Z.

Paralectotype. – The left valve with outer surface sculpture preserved, NM L 21 395, figured by Barrande (1881) on pl. 211, fig. V/1.

Type locality. – Bohemia, Dlouhá hora Hill near Beroun.

Type horizon. – Silurian, lower Ludfordian.

Material. – One right valve from the locality Liščí Quarry and the Barrande's types.

Diagnosis. – The upper Wenlock and Ludlow alate *Ambonychia* with numerous fine radial ribs and gutters.

Description. – Medium size (L = 11.6–17.7; H = 16.1–23.8), mytiliform, equivalved, inequilateral, alate and obese shells (L/W = 1.32–1.5), lacking an anterior lobe. Umbones are in extreme terminal position, beaks prosogyrate. Anterior margin is convex, posterior part is with prominent posterior wing. Outer surface sculpture consists of growth wrinkles and numerous convex radial ribs. No byssal gape is developed. Ligament and hinge unknown. Shell wall is very thin, 0.05–0.1 mm.

Dimensions. –

specimen	V	L	H	W/2
JK 11737	R	11.6	16.1	4.4
NM L 21396	R	15.8	22.0	6.0
NM L 21395	L	17.7	23.8	5.9

Discussion. – Closely related is *Ambonychia rara* (Barrande, 1881) from the upper Wenlock Barrande's localities Loděnice-Lužce and Tachlovice-Middle Mill Race with concave anterior margin and outer surface sculpture consisting of numerous but flat ribs in combination with irregular growth rugae or growth bands and furrows. *Ambonychia carens* (Barrande, 1881) from the upper Wenlock Loděnice-Bubovice locality and from the lower Ludfordian (Ludlow) Dlouhá hora Hill near Beroun is more dorsoventrally elongated and without distinct posterior wing.

Mode of life. – Epibyssate.

Occurrence. – Bohemia, type locality; Tachlovice, Middle Mill Race Section No. 713/4, 6, 10, upper Wenlock, lower Homerian.

Genus *Amphicoelia* Hall, 1865

Type species. – *Amphicoelia leidyi* Hall, 1865, U.S.A., Illinois, mid and late Silurian, Niagaran and Cayugan.

***Amphicoelia pojetana* sp. nov.**
Figure 5B–K

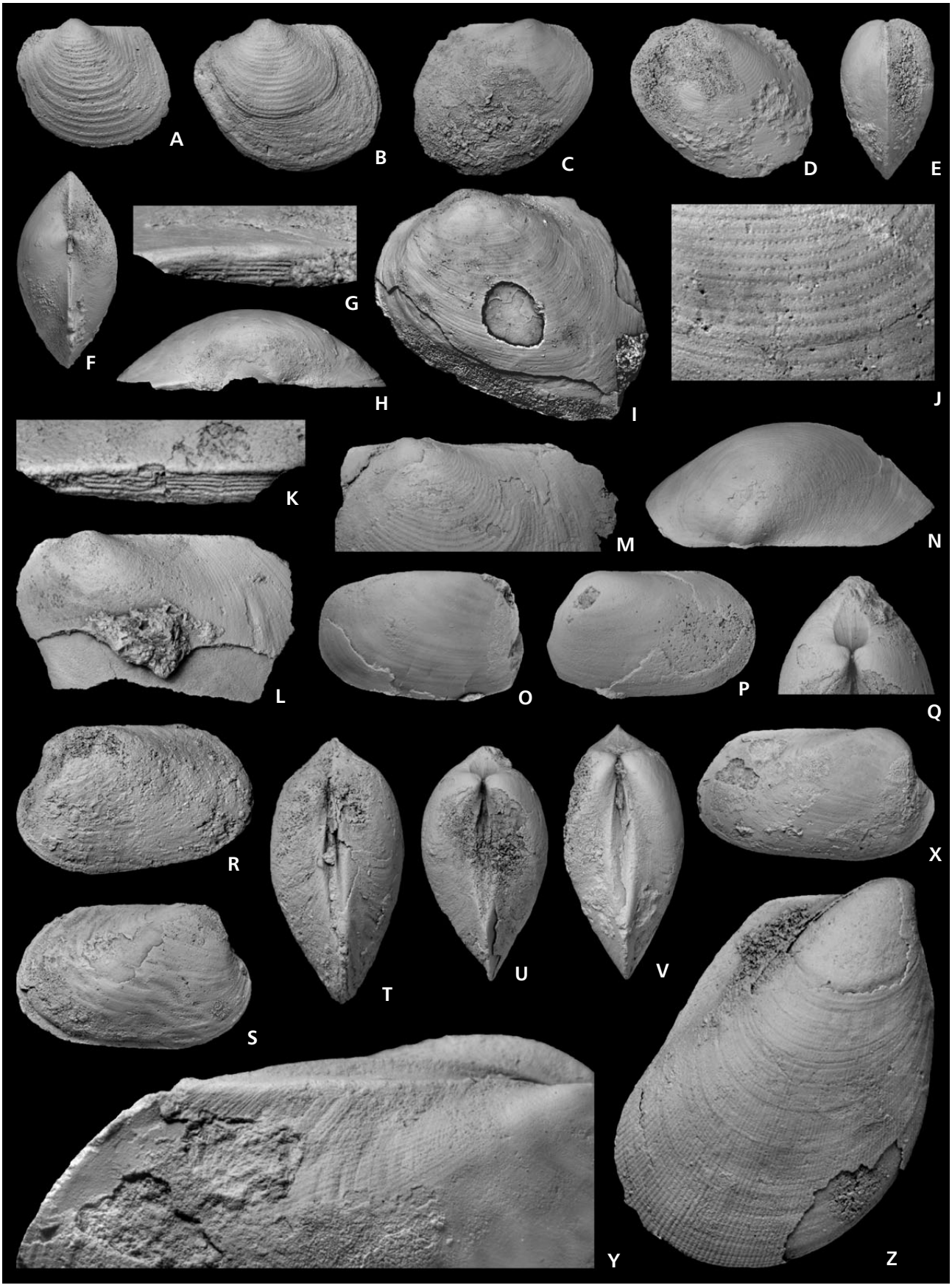
Holotype. – The right valve with ligament area and byssal sinus preserved, JK 11669, figured on Fig. 5B, C.

Paratypes. – JK 11670–JK 11697, measured for dimensions, included into community analysis and figured on Fig. 5D–K.

Derivation of name. – In honour of John Pojeta Jr. palaeontologist, expert in the Lower Paleozoic Bivalvia, from the U.S. Geological Survey, Washington, D.C., U.S.A.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Figure 4. A–N – *Macrodesma enigma* sp. nov.; A – left lateral view, JK 11759, paratype, × 3; B – left lateral view, JK 11820, paratype, × 2.7; C–F – articulated specimen, JK 11755, paratype; C – right view, × 1.4; D – left view, × 1.4; E – anterior view, × 1.4; F – dorsal view, × 1.4; G–J – left valve, JK 11761, holotype; G – detail of duplivincular ligament, × 6.25; H – dorsal view, × 1.6; I – lateral view, × 1.4; J – detail of the outer surface sculpture, × 6.8; K, L – left valve, JK 11819, paratype; K – detail of duplivincular ligament, × 10.5; L – left lateral view, × 2.3; M – detail of left lateral view, JK 11862, paratype, × 3.2; N – dorso-lateral right view, JK 11756, paratype, × 2. • O–Y – *Phthonia regularis* (Barrande, 1881); O, P – articulated specimen, NM L 22768, lectotype; O – right view, × 2.4; P – left view, × 2.4; Q, U – articulated specimen, JK 11813; Q – detail of lunula, × 3.5; U – dorsal view, × 2.4; R–T – articulated specimen, JK 11765; R – left view, × 2.8; S – right view, × 2.8; T – dorsal view, × 3.2; V–Y – articulated specimen, JK 11763; V – dorsal view, × 2; X – right view, × 1.85; Y – detail of the outer surface sculpture in dorsal part of the right valve, × 6. • Z – *Ambonychia volitans* (Barrande, 1881), right lateral view, JK 11737, × 4.5.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Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – 14 left and 12 right valves.

Diagnosis. – *Amphicoelia* with numerous flat ribs and narrow radial gutters.

Description. – Medium (L ≥ 70.0; H ≥ 70.0), equivalved, inequilateral, obese and prosocline shells (L/W = 1.77–2.18, H/W = 1.33–2.25). Umbones are terminal, prosogyrate. Cardinal margin is long and straight. Anterior part relatively short, anterior margin convex, evenly rounded ventral and posterior margins. Posterior wing well developed. Outer surface sculpture formed by prominent numerous ribs convex in cross-section in combination with narrow radial gutters. Both the radial ribs and radial gutters broaden ventrally. Growth sculptures consists of growth wrinkles, irregularly distributed growth furrows and very low, weak growth bands. Commissure lies within a single plane, no discernible byssal gape. Shell relatively thin (0.48–0.76 mm). Byssal sinus prominent, developed right between umbones. Ligamental area with duplivincular grooves and ridges, transversally obliquely several times folded. No dentition.

Dimensions. –

specimen	V	L	H	W/2
JK 11680	L	–	28.7	10.8
JK 11676	L	42.3	> 39.2	–
JK 11674	L	62.0	64.0	14.2
JK 11678	R	63.6	55.5	18.0
JK 11670	L	> 70.0	> 70.0	21.5

Discussion. – The ancestral species *Amphicoelia fausta* (Barrande, 1881) from the lower Homerian, Wenlock of the Prague Basin differs from *Amphicoelia pojetana* sp. nov. by the outer surface sculpture which consist of less numerous flat ribs with narrow radial gutters. *Amphicoelia faustula* (Barrande, 1881) is conspecific with *A. fausta. Amphicoelia leidyi* Hall, 1867 from the upper Wenlock, Racine Formation reef dolostone of Wisconsin and Illinois, North America (Watkins 1997) is closely related to *Amphicoelia pojetana* in its general shape but differs in its rounded anterior margin and less developed posterior wing.

Mode of life. – Most probably epibyssate.

Genus *Mytilarca* Hall & Whitfield, 1869

Type species. – *Inoceramus chemungensis* Conrad, 1842, U.S.A., New York, Upper Devonian, Chemung Stage.

Remarks. – In the past, numerous Lower Paleozoic species classified under *Mytilus* Linné, 1758 and *Mytilarca* Hall & Whitfield, 1869 (*e.g.*, Barrande 1881, Isberg 1934, Pojeta 1966). The genus *Mytilarca* is known from the Upper Ordovician, Silurian and Devonian. In general, the specific classification is very difficult when only general mytiliform shape, outer and inner surface sculpture is known (Růžička & Prantl 1961, Pojeta 1966). Since it is out of the scope of this paper to revise all the representatives of *Mytilarca* described in the past I compare my specimens found in lower Gorstian only with the upper Wenlockian and Ludlovian species described in the past from Bohemia (Barrande, 1881).

Mytilarca parens (Barrande, 1881)

Figure 5L–R

1881 *Mytilus parens* Barr.; Barrande, pl. 210, fig. II/1 (non pl. 210, figs II/2–13, and pl. 284, figs 22, 23).

Lectotype. – (SD, herein), the left valve with fragments of the shell preserved, NM L 21 385, figured by Barrande (1881) on pl. 210, figs II/1, re-figured here on Fig. 5M, R.

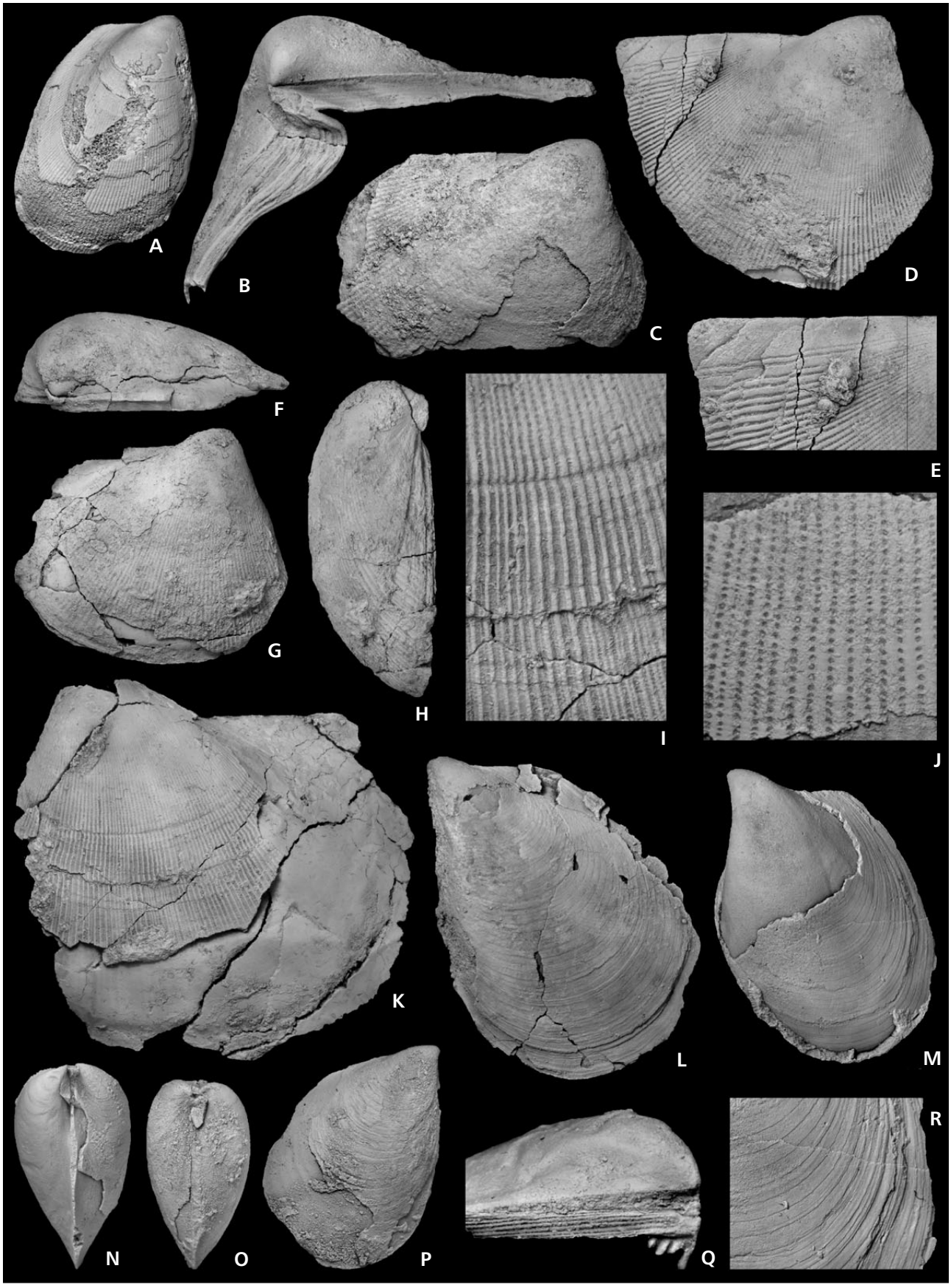
Paratypes. – Other Wenlockian specimens figured by Barrande under "*Mytilus*" *parens* are not from the type locality and have different or no outer surface preserved.

Type locality. – Bohemia, hills between Loděnice and Bubovice (Barrande 1881), Loděnice, Na Černidlech Hill.

Type horizon. – Silurian, Wenlock, lower Homerian, Motol Formation, grey-greenish tuffaceous limestone.

Material. – One shell with conjoined valves, 18 left, and four right valves.

Figure 5. A – *Ambonychia volitans* (Barrande, 1881), right lateral view, NM L 21396, lectotype, × 2.2. • B–K – *Amphicoelia pojetana* sp. nov.; B, C – right valve, JK 11669, holotype; B – detail of dorsal part, left lateral view of interior, × 2.3; C – lateral view, × 2.7; D, E – right valve, JK 11679, paratype; D – lateral view, × 1.1; E – detail of posterior wing, × 1.9; F–H – right valve, JK 11678, paratype; F – dorsal view, × 0.9; G – lateral view, × 0.8; H – anterior view, × 1.1; I, K – left valve, JK 11670, paratype; I – detail of the outer surface sculpture, × 2.85; K – lateral view, × 1.1; J – left valve, JK 11680, paratype, detail of the outer surface sculpture, × 6.5. • L–R – *Mytilarca parens* (Barrande, 1881); L – left lateral view, JK 11650, × 1.3; M, R – left valve, NM L 21385, lectotype; M – lateral view, × 1.65; R – detail of the outer surface sculpture, × 2.6. • N–P – articulated specimen, JK 11657; N – dorsal view, × 2.5; O – anterior view, × 1.9; P – right view, × 2.4; Q – left valve, detail of dorsal part with duplivincular ligament and hinge, JK 11666, × 6.2.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Diagnosis. – Upper Wenlock and lower Ludlow *Mytilarca* with regular flat and wide growth bands and narrow furrows.

Description. – Medium size (L = 13.8–36.7; H = 15.6–45.5), mytiliform, equivalved, inequilateral, and obese shells lacking an anterior lobe. Umbones are in extreme terminal position, beaks prosogyrate. Outer surface sculpture consists of growth wrinkles and of regular flat and wide growth bands and narrow furrows. Byssal sinus weak, no byssal gape developed. Ligament external, ligament area with numerous fine duplivincular grooves and ridges. Hinge in the left valve is composed of at least three oblique cardinal teeth just behind umbo. Shell thickness is 0.13–0.5 mm.

Dimensions. –

specimen	V	L	H	W/2
JK 11657	L	13.8	15.6	3.9
JK 11652	L	20.1	24.2	6.2
JK 11648	R	21.3	27.9	6.6
NM L 21385	L	22.5	33.7	5.6
JK 11650	L	36.7	45.5	8.6

Discussion. – The Wenlockian and Ludlovian species, described by Barrande (1881) as *Mytilus faustulus, M. carens, M. rarus,* and *M. volitans* have the mytiliform shells but their outer surface consists of radial ribs. They belong to *Ambonychia* Hall, 1847. In other Wenlockian mytiliform species described by Barrande (1881) such as *Mytilus buridani*, *M. excisus* and *M. spatula* the outer surface is not preserved.

Mode of life. – Epibyssate.

Occurrence. – Bohemia, type locality; Tachlovice, Middle Mill Race Section No. 713/4, 6, 10, upper Wenlock, lower Homerian.

***Mytilarca* sp.**

Material. – 17 left, 26 right, mostly incomplete valves.

Discussion. – The Ludlow specimens assigned as *Mytilarca* sp. differ from *Mytilarca parens* (Barrande, 1881) by their outer surface sculpture consisting of irregular growth wrinkles only. Until there a modern revision of the genus *Mytilarca*, and the study of its evolution, and specific classification is impossible.

Mode of life. – Epibyssate.

Superfamily Pterioidea, Gray, 1847
Family Pterineidae, Miller, 1877

Genus *Molinicola* Liljedahl, 1984

Type species. – *Molinicola gotlandica* Liljedahl, 1984, Sweden, Gotland, Mölbos 1, Silurian, late Wenlock, Halla Beds.

***Molinicola bohemica* sp. nov.**
Figure 6A–H

Holotype. – The right valve with fragments of the shell preserved, JK 11560, figured on Fig. 6D, G.

Paratypes. – JK 11523–JK 11527, JK 11561–JK 11563, JK 11868, JK 11980, measured for dimensions, included into community analysis, and figured on Fig. 6A–C, E, F.

Derivation of name. – Name derived from *Bohemia.*

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

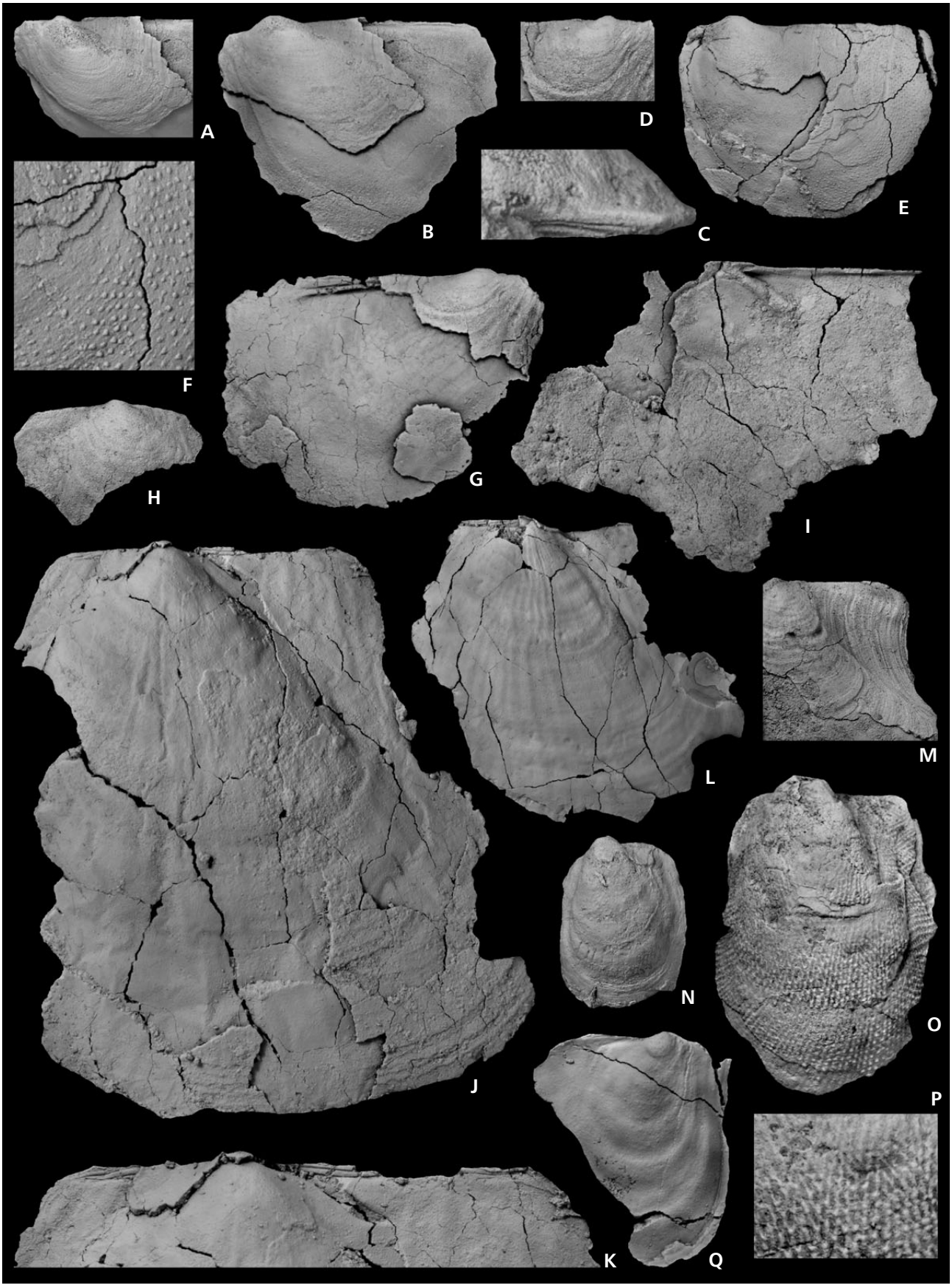
Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – 26 left and 15 right valves.

Diagnosis. – *Molinicola* with moderately inflated shells, left valve slightly more obese than the right valve, with outer surface sculpture composed only by growth wrinkles. Angle between the dorsal margin and the oblique anterior margin 71–80°.

Description. – Small to medium (L = 13.4–29.3; H = 9.4–21.9), antero-ventrally elongated, almost equivalved,

Figure 6. A–H – *Molinicola bohemica* sp. nov.; A–C – left valve, JK 11557, paratype; A – lateral view, detail of umbonal part, × 2.3; B – lateral view, × 2.5; C – detail of duplivincular ligament, × 11; D, G – right valve, JK 11560, holotype; D – lateral view, detail of umbonal part, × 4.2; G – lateral view, × 3.3; E, F – left valve, JK 11554, paratype; E – lateral view, × 2.3; F – detail of the outer surface sculpture, × 7. • H–M – *Palaeopecten radvani* sp. nov.; H – left valve, detail of umbonal part, JK 11705, paratype, × 1.85; I – right valve interior, lateral view, JK 11710, paratype, × 2.4; J, K – left valve, JK 11703, holotype; J – lateral view, × 1.5; K – dorso-lateral view, detail of duplivincular ligament, × 2.7; L – left lateral view, JK 11724, paratype, × 1.2; M – left valve, detail of posterior ear, JK 11735, paratype, × 1.4. • N–Q – *Rhombopteria perunicola* sp. nov.; N – left lateral view, JK 11518, paratype, × 1.25; O, P – left valve, JK 11517, holotype; O – lateral view, × 4.2; P – detail of outer surface sculpture, × 7.75; Q – right lateral view, JK 11522, paratype, × 4.4.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inequilateral, moderately inflated alate shell. The left valve is slightly more obese. Dorsal margin straight, forming maximum length of shell. Anterior extremity is with a small rounded ear or lobe, separated by very shallow sinus from evenly rounded ventral and posterior margins. Angle between the dorsal margin and the oblique anterior margin is 71–80°. Ventrally of anterior ear is a very small byssal opening. Posterior margin is slightly alate or almost perpendicular to the dorsal margin, terminates by blunt, rounded posterior extremity. Beaks prosogyrate, situated about 1/5th length from anterior margin. Commissure lies within a single plane. Outer surface sculpture of both vales consists of irregularly spaced growth wrinkles. In exceptionally preserved outer surface numerous small granulae developed on growth wrinkles are developed in adult parts of both valves (Fig. 6F). Large posterior adductor muscle scar is developed in the centre of the shell, and is connected with small anterior adductor muscle scar by narrow simple pallial line. Ligament duplivincular with ligament grooves preserved. Close to the posterior part of the hinge line, 2 lateral, parallel teeth are developed on the right valve. 1 lateral tooth is developed on the left valve and corresponds to a place between the lateral teeth on the right valve. Shell wall is 0.3–0.4 mm thick.

Dimensions. –

specimen	V	L	H
JK 11546	R	13.4	> 9.7
JK 11527	L	13.6	10.0
JK 11549	L	13.6	9.4
JK 11544	R	14.2	> 8.2
JK 11560	R	17.2	11.8
JK 11558	L	17.2	12.9
JK 11524	L	17.7	12.7
JK 11557	L	> 18.2	14.9
JK 11555	R	20.2	> 11.8
JK 11554	L	> 20.7	17.1
JK 11562	L	21.0	14.5
JK 11561	R	21.9	14.6
JK 11525	L	22.1	16.1
JK 11556	L	22.5	16.6
JK 11563	L	22.7	14.8
JK 11542	L	23.0	16.9
JK 11543	R	25.8	17.0
JK 11537	R	26.4	17.7
JK 11529	L	26.8	> 16.8
JK 11541	L	29.3	21.9

Discussion. – Walmsley (1962) published a detailed study on *Pteronitella retroflexa* (Wahlenberg, 1821) from the upper Ludfordian of Gotland and compared it with the specimens of *Pteronitella* from the upper Ludfordian of the Welsh Borderland. He also compared *Pteronitella retroflexa* with the species described by Billings (1874) and McLearn (1924) from the upper Wenlock, Ludlow and lower Přídolí of Nova Scotia, Canada, which were later classified by Liljedahl (1984) as the new genus *Molinicola*. Liljedahl (1984) described from the upper Wenlock of Gotland new genus and new species *Molinicola gotlandica* Liljedahl, 1984 and compared it with *Molinicola venusta* (Billings, 1874), *Molinicola oblonga* (Billings, 1874), and *Molinicola curta* (Billings, 1874) from the upper Silurian of Nova Scotia. *Molinicola bohemica* sp. nov. differs from all these species by the angle between the dorsal margin and the anterior margin 71–80° which is larger than in *Molinicola gotlandica* (50–60°) and smaller than in *Molinicola oblonga* (85–90°), and *Molinicola curta* (85°). *Molinicola venusta* differs by more distinct, longer anterior ear. *Molinicola cometula* (Barrande, 1881) from the upper Wenlock of the Prague Basin, Bohemia is most probably one of the ancestral forms of *Molinicola bohemica* sp. nov., and differs by its larger and longer anterior ear, generally larger shells, by the outer surface growth sculpture which consists of regular wide and flat growth furrows and narrow growth bands, and by the smaller angle between the dorsal margin and the oblique anterior margin (60°). *Molinicola reniformis* (Barrande, 1881), also from the upper Wenlock of the Prague Basin, Bohemia differs from *Molinicola bohemica* sp. nov. by higher shells and rounded posterior extremity.

Mode of life. – Most probably semi-infaunal, byssate.

Superfamily Pectinoidae Rafinesque, 1815
Family Leiopectinidae Krasilova, 1959

***Palaeopecten* Williams, 1913**

Type species. – *Palaeopecten cobscooki* Williams, 1913, U.S.A., Maine, Edmunds Formation, upper Silurian.

***Palaeopecten radvani* sp. nov.**
Figure 6I–M

Holotype. – The left valve with fragments of shell preserved, JK 11703 figured on Fig. 6J, K.

Paratypes. – JK 11704–JK 11717, JK 11719–JK 11722, JK 11724–JK 11732, measured for dimensions, included into community analysis, and figured on Fig. 6I, L, M.

Derivation of name. – In honour of Radvan Horný, palaeontologist, expert in the Lower Paleozoic gastropods, from the National Museum, Prague. We excavated together the "gastropod beds" in the lower Ludlow at the locality Liščí Quarry near Amerika gamekeeper's lodge before 1966.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – 24 left and six right valves from the type locality.

Diagnosis. – Dorso-ventrally elongated *Palaeopecten* with relatively large shells and irregular growth bands and furrows in combination with slightly more prominent, irregular wide radial ribs or folds and short auricular buttresses in the more convex left valve. Right valve flat or a little inflated, only with growth sculpture, and with short auricular buttresses.

Description. – Relatively large shell (L = 59–72 mm, H = 51.2–64 mm), upright, prosocline, inequilateral, dorso-ventrally elongated. Left valve gently convex (L/W = 2.9–3.0), right valve flat or only a little inflated. Commissure lies within a single plane. Umbones are low, indistinct, beaks prosogyrate, in anterior third of the dorsal margin length. Umbonal angle is 90–100°. Dorsal margin straight, shorter than the length of the valve. Shallow auricular sulci, anterior auricle and larger posterior auricle or wing are merging into body of shell without interruption, byssal notch absent. Anterior end of the dorsal line is blunt. Anterior margin, ventral margin and posterior margin evenly rounded. Posterior end of dorsal margin is obliquely truncated. Early shell preserved in the umbonal part is antero-posteriorly elongated, with posterior wing and outer surface sculpture consisting of regular growth bands and furrows. Outer surface sculpture of adult shell consists of growth wrinkles. In the left valve wide, irregular flat growth bands and irregular relatively wide, obtuse radial ribs or folds and gutters, more prominent in anterior part are developed. Inner surface sculpture of the left valve is similar. In the right valve only growth wrinkles are developed, inner surface is smooth. Ligament duplivincular, area is low, triangular, with a few grooves and ridges parallel with hinge line. In both valves prominent short auricular buttresses are developed on the inner surface of the sides of umbo with angle of divergence about 120°. Shell wall is very thin (0.5–0.9 mm).

Dimensions. –

specimen	V	L	H	width/2
JK 11704	L	59.0	51.2	10.2
JK 11717	L	62.4	61.8	> 8.2
JK 11716	L	71.2	> 63.0	> 7.4
JK 11703	L	> 72.0	64.0	12.5

Discussion. – *Palaeopecten obsequens* (Barrande, 1881) from the upper Wenlock of the Prague Basin, Bohemia differs from *Palaeopecten radvani* sp. nov. by very small rounded anterior ear and larger, acute posterior wing. *Palaeopecten correctus* (Barrande, 1881) from the upper Wenlock of the Prague Basin differs by distinctly transversally elongated shells. *Palaeopecten danbyi* (McCoy, 1851) from the upper Ludlow of Westmoreland, Great Britain, and the Ludlow and Přídolí of Arisaig, Nova Scotia, Canada and Eastport Area, Maine, U.S.A. has transversely elongated, generally smaller shells with more prominent radial ribs. *Palaeopecten cobscooki* Williams, 1913 from the Ludlow, Edmunds Formation of the Eastport Area, Maine, U.S.A. differs especially by generally smaller shells (L = 53.5 mm, H = 52 mm), angular anterior auricle and posterior wing. In general the anterior auricle is larger and umbonal angle (< 90°) is smaller.

Mode of life. – *Palaeopecten radvani* sp. nov. was most probably semi-infaunal, byssate, with probably more convex left valve down. Weak, flat and wide radial ribs, more prominent in the anterior part of the shell, could have increase friction when bivalve was partly buried in the sediment. Right valve was flat or only a little inflated, but may have have been even concave like in *Palaeopecten obsequens* (Barrande, 1881) from Bohemia and in *Palaeopecten transversalis* Williams, 1913 from Maine, U.S.A.

***Palaeopecten* sp.**

Material. – Four left valves.

Discussion. – Mostly incomplete specimens without the outer surface sculpture preserved are designated here as *Palaeopecten* sp. Since they cannot be classified specifically they were used only for statistical purposes.

Mode of life. – Semi-infaunal.

Family Rhombopteriidae Korobkov, 1960

Genus *Rhombopteria* Jackson, 1890

Type species. – *Avicula mira* Barrande, 1881, Bohemia, Prague Basin, Silurian, upper Ludlow.

***Rhombopteria perunicola* sp. nov.**
Figures 6N–Q, 7A–G

Holotype. – The left valve with most of shell preserved, JK 11517 figured on Fig. 6O, P.

Paratypes. – JK 8535, JK 11499–JK 11516, JK 11518–JK

11519, JK 11521–JK 11522, JK 11816 measured for dimensions, included into community analysis, and figured on Figs 6N, Q and 7A–G.

Derivation of name. – Derived from *Perunica* – peri-Gondwanan terrane and Latin *cola*, inhabitant.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – One shell with conjoined valves, 21 left and two right valves.

Diagnosis. – Dorso-ventrally elongated *Rhombopteria.*

Description. – Shell subrhombic to subovoid in outline, dorsoventrally elongated, inequivalved. Right valve is almost flat, inequilateral, moderately prosocline, umbo small with prosogyrate beak, auricular buttresses slightly developed anteriorly and posteriorly of umbo. Left valve is inequilateral, moderately prosocline to opisthocline, variably inflated (L/W = 1.79–2.83, H/W = 2.20–3.7), with dorsal margin straight, auricular sulci absent, anterior and posterior auricles merging into body of shell without interruption. Umbo large, prosogyrate. Anterior auricle is relatively small, lobate. Posterior auricle larger, wing like. Antero-ventral, ventral and postero-ventral margins evenly rounded. Commissure lies within a single plane except in anterior margin where it is concave on the left valve and convex on the right valve. Anterior slope of the left valve is steeper than posterior slope. Outer surface sculpture consists of wide, flat growth bands in combination with two sets of fine radial costellae or papillae arranged in quincunx. Inner surface smooth with weak, wide growth band and furrows. Large posterior adductor muscle scar (Fig. 7D) connected by pallial line with smaller anterior adductor muscle scar developed close to the umbo (Fig. 7G), pedal retractor muscle scars developed on right valve close to dorsal margin (Fig. 7G). Ligament area low, ligament duplivincular, with ligament grooves inclined to hinge axis with bent beneath the umbo. Teeth in central part of the hinge most probably absent as in the representative of Rhombopteriidae mentioned and figured by Johnston (1991, p. 305, fig. 7C, D). Shell wall thickness is 0.3 mm.

Dimensions. –

specimen	V	L	H	width/2
JK 11517	L	9.1	13.3	3.7
JK 11499	L	10.8	15.2	4.9
JK 11504	L	13.6	> 18.7	6.0
JK 11520	L	> 16.0	20.9	5.0
JK 11518	L	16.4	21.5	6.9
JK 11505	L	17.0	20.7	5.6
JK 11519	L	> 17.1	25.7	8.1
JK 11515	L	17.2	22.4	7.5
JK 11513	L	18.3	> 22.2	> 6.0
JK 11501	L	18.3	> 22.4	10.2
JK 11512	L	20.2	24.1	7.5

Discussion. – *Rhombopteria mira* (Barrande, 1881) differs from *Rhombopteria perunicola* sp. nov. by generally antero-postero-ventrally elongated and smaller shells, by distinctly longer dorsal margin, by the slightly inflated right valve, and by the less inflated left valve. *Rhombopteria* sp. nov., described from the upper Wenlock, Racine Formation reef dolostone of Wisconsin and Illinois, North America (Watkins 1997) is closely related to *Rhomboptetria perunicola* by general shape and especially by dorsoventrally elongated shells.

Mode of life. – Reclining. *Rhombopteria perunicola* sp. nov. most probably rested on the left convex valve with the flat upper valve as a lid on the lower valve. The commissure was most probably above substratum and was kept free of clogging by sediment.

Superfamily Modiomorphoidea Miller, 1877
Family Praeostreidae Kříž, 1966

Genus *Praeostrea* Barrande, 1881

Type species. – *Praeostrea bohemica* Barrande, 1881, Bohemia, Prague Basin, Dlouhá Hora Hill near Beroun, Ludlow, Ludlordian.

***Praeostrea bohemica* Barrande, 1881**
Figure 7J

1881 *Praeostrea bohemica* Barr.; Barrande, p. 147, pl. 111, fig. 2.
1881 *Praeostrea bohemica* var. *simplex* Barr.; Barrande, p. 147, pl. 111, figs 3, 4.
1966 *Praeostrea bohemica* Barrande. – Kříž, pp. 30, 31, pl. 1, figs 1–8 (for complete previous synonymy see this paper).
2006 *Praeostrea bohemica* Barrande. – Kříž, pp. 148, 149, fig. 1E–G.

Lectotype. – Right valve, deposited in the National Museum, Prague, under No. L 6788.

Type locality. – Bohemia, Prague Basin, Dlouhá Hora Hill near Beroun.

Type horizon. – Silurian, Ludlow, Ludfordian.

Material. – One left valve.

Dimensions. –

specimen	length	height	width/2
JK 95	> 18.5	> 15.5	–

Discussion. – By the general shape, inner surfaces sculpture, and ontogeny the left valve (interior) from the Liščí Quarry locality is conspecific with type material from the Ludfrodian (Ludlow) of Bohemia.

Mode of life. – *Praeostrea bohemica* was most probably reclining on the right inflated valve and byssally attached to the substrate particles.

Occurrence. – *Praeostrea bohemica* occurs from the Wenlock, Homerian, *Testograptus testis* Biozone up to early Lochkovian (Devonian), *Monograptus uniformis* Biozone in Bohemia, Prague Basin. It is quite common in the *Cardiola gibbosa* Community of the lowermost Gorstian and from the uppermost Přídolí and lowermost Lochkovian (Lower Devonian). It is also known from the Ludfordian of Steinhorn in Kellervald and Alfredschacht near Giessen, Germany and from the lowermost Lochkovian, Austria, Carnic Alps, Cellon Section.

Family Butovicellidae Kříž, 1965

Genus *Butovicella* Kříž, 1965

Type species. – *Cardiola migrans* Barrande, 1881. Bohemia, Prague Basin, upper Wenlock and Ludlow.

***Butovicella migrans* (Barrande, 1881)**
Figure 7H, I

1881 *Cardiola migrans* Barr.; Barrande (partim), p. 268, pl. 183, figs I/12–15; pl. 184, figs I/1–12, figs II/1–4, figs III–V. Non: pl. 184, figs I/13–16 (= *Butovicella mima* Kříž, 1969) and pl. 184, figs II/5–16 (= *Butovicella medea* Kříž, 1969).

1999b *Butovicella migrans* Barrande. – Kříž, p. 303, 304, pl. 10, figs 24, 27 (for complete previous synonymy see this paper).

Lectotype. – (designated by Kříž 1965) Internal mould of a left valve, deposited in the National Museum, Prague under the number L 6116, and figured by Barrande (1881), pl. 184, figs V/1–4.

Type locality. – Bohemia, Prague Basin, Praha-Butovice, Na Břekvici Section.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, *Colonograptus colonus* Biozone (*Neodiversograptus nilssoni* Biozone).

Material. – One left valve and two right valves.

Dimensions. –

specimen	V	L	H	W/2
JK 11564	R	6.8	2.9	1.7
JK 142a	R	9.2	6.5	2.1

Discussion. – In its general shape, outer and inner surfaces sculpture, and ontogeny the specimen from the Liščí Quarry locality is conspecific with Barrande's type material from the Homerian (Wenlock) and the Gorstian (Ludlow), Bohemia.

Mode of life. – Epibyssate, attached to the firm substrate, most probably algae or to the clasts at the bottom.

Occurrence. – *Butovicella migrans* is a common cosmopolitan representative of the Butovicellidae. The species occurs in the Homerian (Wenlock) up to the Ludfordian (Ludlow) of Bohemia, Prague Basin. For the occurrences apart from Bohemia see Kříž (1969, 1996, 1999c) and Kříž & Serpagli (1993).

Superfamily Modiolopsoidea Fischer, 1887
Family Modiomorphidae Miller, 1877

***Mimerodonta* Liljedahl, 1994**

Type species. – *Mimerodonta atlei* Liljedahl, 1994, Sweden, Gotland, Ludfordian, Ludlow, Silurian.

***Mimerodonta phaseolus* sp. nov.**
Figure 7K–P

Holotype. – Right valve with the hinge tooth and the part of the outer surface preserved, JK 11739, figured on Fig. 7M, N.

Paratypes. – JK 11740–JK 11753, JK 11815 measured for dimensions, included into community analysis, and figured on Figs 7K, L, O, P.

Derivation of name. – From Latin *phaseolus*, kidney-bean, masculine diminutive; indeclinable noun.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – One shell with conjoined valves, six left and nine right valves.

Diagnosis. – Elongated *Mimerodonta* with distinctly larger posterior part than anterior part.

Description. – Shell medium in size (maximum L = 25.5), diagonally modioliform, equivalve, inflated (H/W = 1.73–2.2; L/W = 2.45–2.67), inequilateral, posterior part of the shell distinctly larger than anterior part, which is separated by radial, shallow sinus. Maximum width of the shell is in about one third of the shell length from anterior. Umbones are prominent, in anterior position, beaks small, apart, above the hinge line, prosogyrate. Dorsal margin line long, about one half of the shell length, slightly convex. Anterior margin is short, evenly rounded. Ventral margin is long, slightly concave. Posterior margin evenly rounded, long. Outer surface sculpture is composed of irregularly spaced growth wrinkles. Inner surface is smooth. Ligament is opisthodetic, in the ligament groove. Hinge line slightly convex; hinge in right valve with a single, blunt, elongated cardinal tooth arranged just bellow and posterior to beak. Well developed smaller, deeply impressed anterior and larger, less impressed posterior adductor muscle scars connected by the simple pallial line, running at some distance from the shell margin. Dorsally of the anterior adductor muscle scar is developed small, deeply impressed circular pedal retractor muscle scar. Shell thickness is 0.23–0.56.

Dimensions. –

specimen	V	L	H	W/2
JK 11815	L	17.7	17.7	3.7
JK 11739	R	> 19.7	15.3	4.0
JK 11740	R	21.1	17.8	4.2
JK 11742	L	23.0	16.3	4.7
JK 11741	R	24.6	18.3	4.6
JK 11752	R	25.5	19.1	4.8

Discussion. – Most closely related to Bohemian species is *Mimerodonta njordi* Liljedahl, 1994 from the Gorstian Hemse Beds of Gotland. *Mimerodonta phaseolus* sp. nov. differs in its more elongated shells and by distinctly larger posterior part than anterior part. *Mimerodonta atlei* Liljedahl, 1994 from the Ludfordian Burgswik Beds of Gotland has shorter shells and relatively longer dorsal margin.

Mode of life. – Most probably semi-infaunal.

Genus *Janicula* gen. nov.

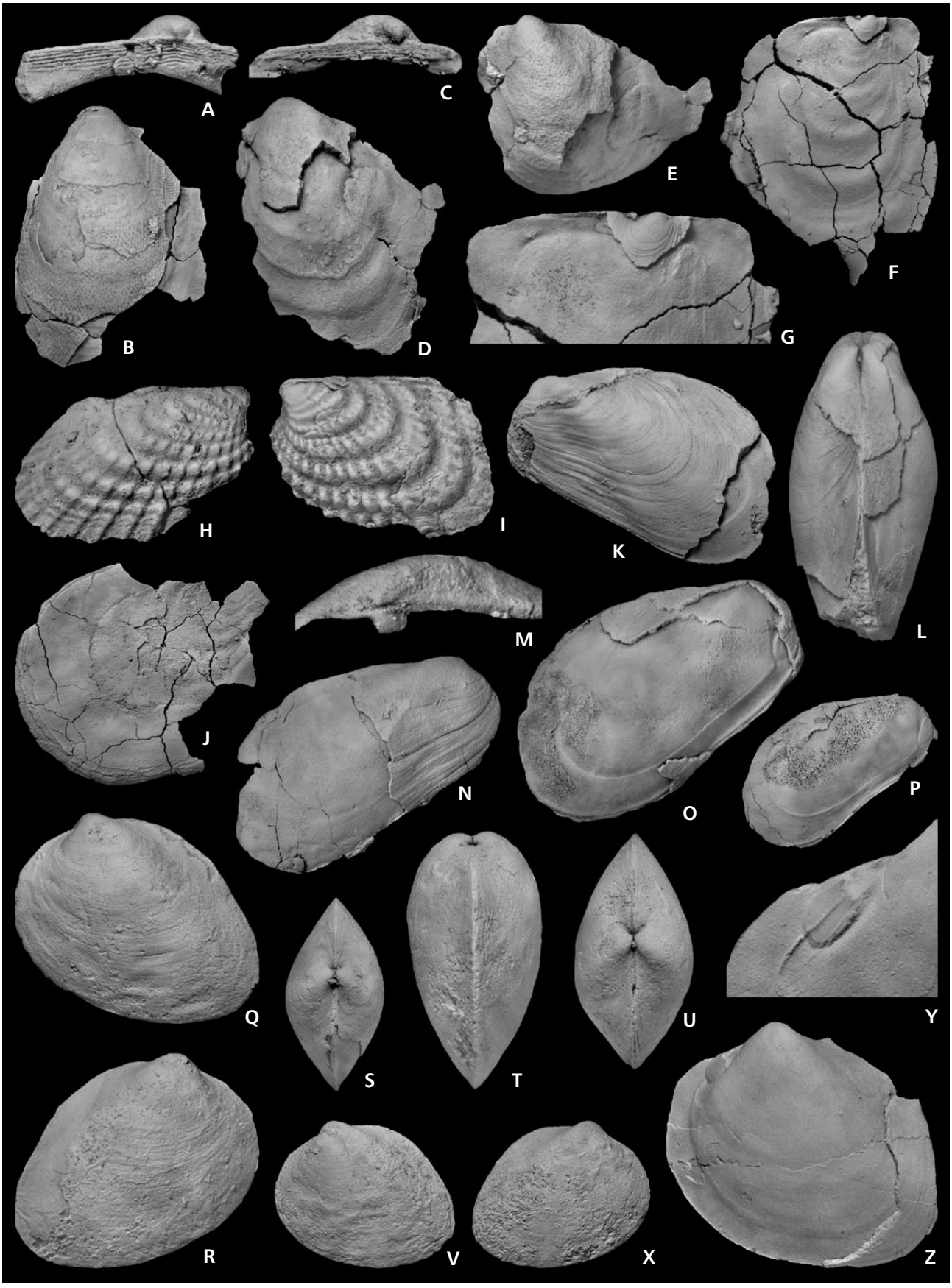
Type species. – *Nucula*? *potens* Barrande, 1881, upper Wenlock, lower Homerian, Loděnice, Na Černidlech Hill, Bohemia.

Derivation of name. – Derived from Jana, first name of my best friend, my wife and from the former Barrande's preliminary identification of the type species as the genus *Nucula*? Gender feminine.

Diagnosis. – Modiomorphid with the hinge composed in the left valve by single cardinal, prominent blunt tooth, elongated longitudinally, bellow and immediately posterior to the beak; in the right valve by smaller cardinal tooth, elongated longitudinally, developed immediately anterior to the beak, and of corresponding sockets in opposite valves. No hinge plate developed.

Description. – Shell quadrangular-subovate, equivalve, inequilateral, postero-ventrally elongated, and inflated. Umbones prominent, beaks small, prosogyrate, close together, slightly raised above the dorsal margin, situated in the anterior 1/5 of the shell length. Antero-dorsal and anterior margins evenly rounded and continuing in the convex ventral margin terminating in the rounded obtuse postero-ventral angle. Posterior margin obliquely truncated, postero-dorsal end rounded. Dorsal margin is convex. Outer shell surface is with growth wrinkles and less prominent irregular narrow growth bands and furrows. Inner shell surface is smooth. Well developed smaller anterior and larger posterior adductor muscle scars connected by the simple pallial line, running at some distance from the shell margin. Dorsally close to the anterior and posterior adductor muscle scars are small pedal retractor muscle scars. External opisthodetic ligament is developed in

Figure 7. A–G – *Rhombopteria perunicola* sp. nov.; A, B – left valve, JK 11519, paratype; A – detail of duplivincular ligament, × 5.8; B – lateral view, × 1.85; C–E – left valve, JK 11816, paratype; C – detail of duplivincular ligament, × 7.75; D – lateral view, × 3.1; E – dorso-lateral view, × 3.2; F, G – right valve, JK 11521, paratype; F – lateral view, × 3.3; G – dorso-lateral view, detail of umbonal part, anterior adductor muscle scar and posterior pedal retractor, × 6.25. • H, I – *Butovicella migrans* (Barrande, 1881); H – right lateral view, JK 142a, × 4.6; I – left lateral view, JK 11564, × 6. • J – *Praeostrea bohemica* Barrande, 1881, left valve interior, JK 95, × 2.3. • K–P – *Mimerodonta phaseolus* sp. nov.; K, L, O – articulated specimen, JK 11740, paratype; K – left view, × 2.2; L – dorsal view, × 2.4; O – right view, × 2.4; M, N – right valve, JK 11739, holotype; M – detail of the hinge, dorsal view, × 9; N – lateral view, × 2.6; P – right lateral view, JK 11741, paratype, × 1.45. • Q–Z – *Janicula potens* (Barrande, 1881); Q–S – articulated specimen, JK 11581; Q – left view, × 3; R – righ view, × 3; S – dorsal view, × 2.6; T–X – articulated specimen, JK 11583; T – anterior view, × 3.4; U – dorsal view, × 3; V – left view, × 2.15; X – right view, × 2.15; Y, Z – left valve, NM L 27215, holotype; Y – lateral view, detail of the anterior adductor muscle scar. × 4.25; Z – lateral view, × 2.05.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longitudinal groove. Hinge line slightly convex, hinge composed in the left valve of a single cardinal, robust blunt tooth bellow and immediately posterior to the beak, elongated in antero-posterior direction; a corresponding socket is developed in the right valve immediately posterior to the beak. A similar but smaller cardinal tooth is developed in the right valve, immediately anterior to the beak; a corresponding socket is developed immediately anterior to the beak in the left valve. No hinge plate.

Remarks. – Liljedahl (1994) erected the subfamily Modiomorphinae for 10 modiomorphid genera characterized by the presence of hinge teeth. *Aleodonta* Liljedahl, 1994, is characterized by hinge with no lateral teeth, one cardinal tooth in the right valve and corresponding socket in the left valve, *Modiodonta* Liljedahl, 1989 has hinge plate with one cardinal tooth in the right valve and corresponding socket in the left valve, no lateral teeth. The hinge of *Modiomorpha* Hall & Whitfield, 1869 consists of a robust tooth in the left valve and no lateral hinge teeth. In *Eurymyella* Williams, 1912 a straight hinge line is without distinct teeth. Obscure thickening of the hinge is in some specimens developed under the beak of the right valve, with a broader thickening in the same position in the left valve. Linear thickening is developed near the posterior end of the hinge margin. In *Colpomya* Ulrich, 1895 the hinge of right valve consists of a cardinal tooth fitting into the depression of the left valve. Posteriorly and anteriorly of this depression is developed conspicuous strong process which is partly received in a shallow socket at the anterior side of the in the right valve (Liljedahl, 1994). *Mimerodonta* Liljedahl, 1994 lacks hinge plate and has one cardinal tooth and two shallow sockets in the right valve and one deep socket flanked by two tooth-like reinforcements in the left valve. *Modiolodon* Ulrich, 1895 has 1 to 3 oblique cardinal teeth in each valve. *Callodonta* Isberg, 1934 has hinge with 6 cardinal teeth, anterior one pointed and others blunt. *Radiatodonta* Dahmer, 1921 differs from other modiomorphids by several dorsally convergent hinge teeth.

In *Goniophora* Phillips, 1848 postero-ventrally elongated shells, diagonal carina or keel from umbo to the posteroventral extremity are characteristic, together with simple or multi-teeth complex hinge (Růžička & Prantl 1959, Liljedahl 1984). On the other hand the presence of the keel or carina and simple or more complex hinge may be the result of the convergent evolution and different species now assigned to *Goniophora* may belong to several genera (Liljedahl 1984, p. 66). For all modiomorphids the dimyarian shells with simple pallial line are characteristic. All of them were infaunal or semi-infaunal byssate forms.

Janicula gen. nov. lacks the hinge plate and the hinge of the left valve is characterized by single, robust, cardinal blunt tooth, elongated longitudinally, bellow and immediately posterior to the beak (Fig. 8G–I). In the right valve the hinge is composed of smaller cardinal tooth, elongated longitudinally, immediately anterior to the beak (Fig. 8F). On both valves are developed corresponding sockets to the cardinal teeth; no lateral hinge teeth are developed.

Janicula gen. nov. is in general shape similar to the Permian genus *Schizodus* Murchison & de Verneuil, 1844, which differs by schizodian hinge with short teeth and one pivotal tooth in the left valve, mostly not extended posteriorly and well developed hinge plate. According to Newell & Boyd (1975) the main tooth of the right valve is the anterior of the principal teeth of the two valves and is reinforced by an arcuate ridge reaching from the distal end of the tooth backward along the rim of the hiatus, terminating in a short bladelike posterior tooth. The left valve in most species possesses only two teeth.

The upper Silurian *Schizodus*? sp. from the Elwy Group, lower Ludlow, *Saetograptus chimaera* Biozone, of Wales described by Newell & Boyd (1975) has probably also schizodian hinge with two cardinals in each valve at least and resembles *Janicula* gen. nov. by general shape. Somewhat similar is also *Silurozodus* Liljedahl, 1992, represented by the type species *Silurozodus gotlandicus* Liljedahl, 1992 from the upper Wenlock and upper Ludlow of Gotland, and classified as Schizodidae Newell & Boyd, 1975. It differs from *Janicula* gen. nov. by small opisthogyre umbones, prominent umbonal ridge, complex pedal muscles pattern, and hinge, which consists in left valve of a weakly developed, small, narrow anterior marginal tooth, and a large triangular cardinal tooth; in right valve is developed narrow, shallow anterior socket, than medium sized, narrow cardinal tooth, large unfloored triangular socket and in posterior the lamellar tooth separated from the nymph by a shallow furrow. *Schizodus* sp. nov. (Watkins 1997) from the upper Wenlock, Racine Formation reef dolostone of Wisconsin and Illinois, North America has also a similar general shape to *Janicula* gen. nov.

There is a possibility that the family Schizodidae is ancestral to most of the trigoniacean families that have been morphologically and phyletically isolated from the modiomorphid genus *Janicula* gen. nov. in the early Silurian.

Species and distribution. – *Janicula potens* occurs in the lower Homerian, Wenlock and the lower Gorstian, Ludlow of the Prague Basin, Bohemia.

Janicula potens (Barrande, 1881)

Figures 7Q–Z, 8A–K

1881 *Nucula*? *potens* Barr.; Barrande, pl. 274, figs 13–15.

Holotype (by monotypy). – Internal mould of a left valve, NM L 27215, figured by Barrande, 1881 on pl. 274, figs 13–15, and on Fig. 7Y, Z.

Type locality. – Bohemia, hills between Loděnice and Bubovice (Barrande 1881), Loděnice, Na Černidlech Hill.

Type horizon. – Silurian, Wenlock, lower Homerian, Motol Formation, most probably *Ischadites* limestones.

Material. – 179 shells with conjoined valves, 422 left and 473 right valves.

Diagnosis. – See diagnosis of the genus.

Description. – Relatively small shell (maximal L = 28.9, H = 22.1, W = 12.2), quadrangular-subovate (H/L = 0.71–0.92), equivalve, inequilateral, postero-ventrally elongated, and inflated (L/W = 1.96–2.58, H/W = 1.61–2.0). Umbones prominent, beaks small, prosogyrate, close together, slightly raised above the dorsal margin, situated in the anterior 1/5 of the shell length. Antero-dorsal and anterior margins evenly rounded and continuing in the convex ventral margin terminating in the rounded obtuse postero-ventral angle. Posterior margin obliquely truncated, postero-dorsal angle rounded. Dorsal margin is convex. Outer shell surface is with growth wrinkles and less prominent irregular narrow growth bands and furrows. Inner shell surface is smooth. Elliptical smaller anterior and larger posterior adductor muscle scars connected by a simple pallial line, running at some distance from the shell margin. Dorsally close to the anterior and posterior adductor muscle scars are developed small elliptical pedal muscle scars. Longer longitudinal groove for external opisthodetic ligament is developed posteriorly of umbones. Hinge line is slightly convex, hinge lacks hinge plate and is composed in the left valve of a single cardinal, robust blunt tooth bellow and immediately posterior to the beak, elongated in antero-posterior direction; a corresponding socket is developed in the right valve immediately posterior to the beak. A similar but smaller cardinal tooth is developed in the right valve, immediately anterior to the beak; a corresponding socket is developed immediately anterior to the beak in the left valve. In some shells interior diagonal gill attachment ridge is developed (Fig. 8J). Shell thickness is 0.17–0.51 mm.

Dimensions. –

specimen	L	H	width
JK 11609	5.2	4.4	2.6
JK 11608	5.2	5.2	3.2
JK 11606	6.2	5.1	3.1
JK 11607	6.3	5.0	3.1
JK 11605	7.9	6.4	3.7
JK 11613	8.5	6.9	3.9
JK 11612	9.8	7.0	3.8
JK 11594	10.3	8.8	5.0
JK 11610	10.4	9.5	5.1
JK 11604	10.7	8.7	4.8
JK 11580	11.0	10.2	5.3
JK 11602	11.2	9.4	5.1
JK 11601	11.4	9.8	5.4
JK 11593	12.8	11.3	6.3
JK 11611	13.2	11.2	6.1
JK 11584	13.4	11.0	5.5
JK 11582	13.9	11.6	6.3
JK 11581	14.2	13.2	7.1
JK 11587	14.5	11.2	7.4
JK 11583	15.0	12.5	7.0
JK 11585	16.0	13.3	7.2
JK 11592	16.6	12.6	7.0
JK 11597	18.2	15.3	–
JK 11599	18.8	15.7	–
JK 11589	22.0	17.6	9.6
JK 11600	22.1	18.3	–
JK 11586	23.2	18.3	10.5
NM L 27215	25.9	20.2	–
JK 11588	27.7	20.5	12.2
JK 11578	28.9	22.1	–

Discussion. – The same as for the genus.

Mode of life. – Infaunal, burrowing.

Occurrence. – Bohemia, type locality, lower Homerian, Wenlock, Liščí Quarry, Karlštejn, lower Gorstian, Ludlow.

Genus *Goniophora* Phillips, 1848

Type species. – *Cypricardia cymbaeformis* Sowerby *in* Murchison, 1839, England, upper Ludlow.

Goniophora tyri Liljedahl, 1994

Figures 8L–T, 9A–D

1994 *Goniophora tyri* n. sp.; Liljedahl, pp. 78, 79, figs 24, 53J, O.

Holotype. – Internal mould of a right valve, RMMo 21682, deposited in the Swedish Museum of Natural History, and figured by Liljedahl (1994) on fig. 53J.

Type locality. – Sweden, Gotland, Linde Klint.

Type horizon. – Silurian, Ludlow, upper Gorstian, Hemse Beds.

Material. – Four shells with conjoined valves, 20 right and 23 left valves.

Diagnosis. – *Goniophora* with transverse "finger print" sculpture.

Description. – Original description of *Goniophora tyri* Liljedahl, 1994 may be completed by description of the outer surface sculpture and the shell interior. Outer surface sculpture consists of transversely undulating finger-print-like ribs (Liljedahl 1994), which are almost perpendicular to the dorsal and ventral margins. On the anterior lobe separated from the rest of shell by radial sulcus, only rough growth wrinkles are developed. In the posterior part of the left and right valve is developed large, radially elongated posterior adductor muscle scar with short part of pallial line in ventral direction. Anterior reinforcing ridge is developed ventrally of a smaller, but deep, subcircular anterior adductor muscle scar.

Dimensions. –

specimen	V	L	H	width/2
JK 11621	L	23.0	19.9	8.1
JK 11623	R	> 29.5	> 23.0	9.0
JK 11618	R	> 36.5	> 31.0	11.0
JK 11627	R	> 40.0	> 26.0	11.8
JK 11620	R	> 42.5	> 39.5	15.5
NM L 40 340	L	52.0	27.4	13.5

Discussion. – The Bohemian specimens are conspecific with the specimens described by Liljedahl (1994). They only differ in larger shells than specimens from Gotland.

Mode of life. – Most probably byssate, semi-infaunal with a carinas parallel to the sediment surface and anterior lobe dipped into the substrate (Liljedahl 1994).

Occurrence. – Sweden, Gotland, Hemse Beds, upper Gorstian, Ludlow.

***Goniophora ascia* sp. nov.**
Figure 9E–P

Holotype. – Shell with conjoined valves with large fragments of the outer surface preserved, JK 11814 figured on Fig. 9E–I.

Paratypes. – JK 11821–JK 11834, measured for dimensions and figured on Fig. 9J–P.

Derivation of name. – From Latin *ascia*, ax, carpenter's adze.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

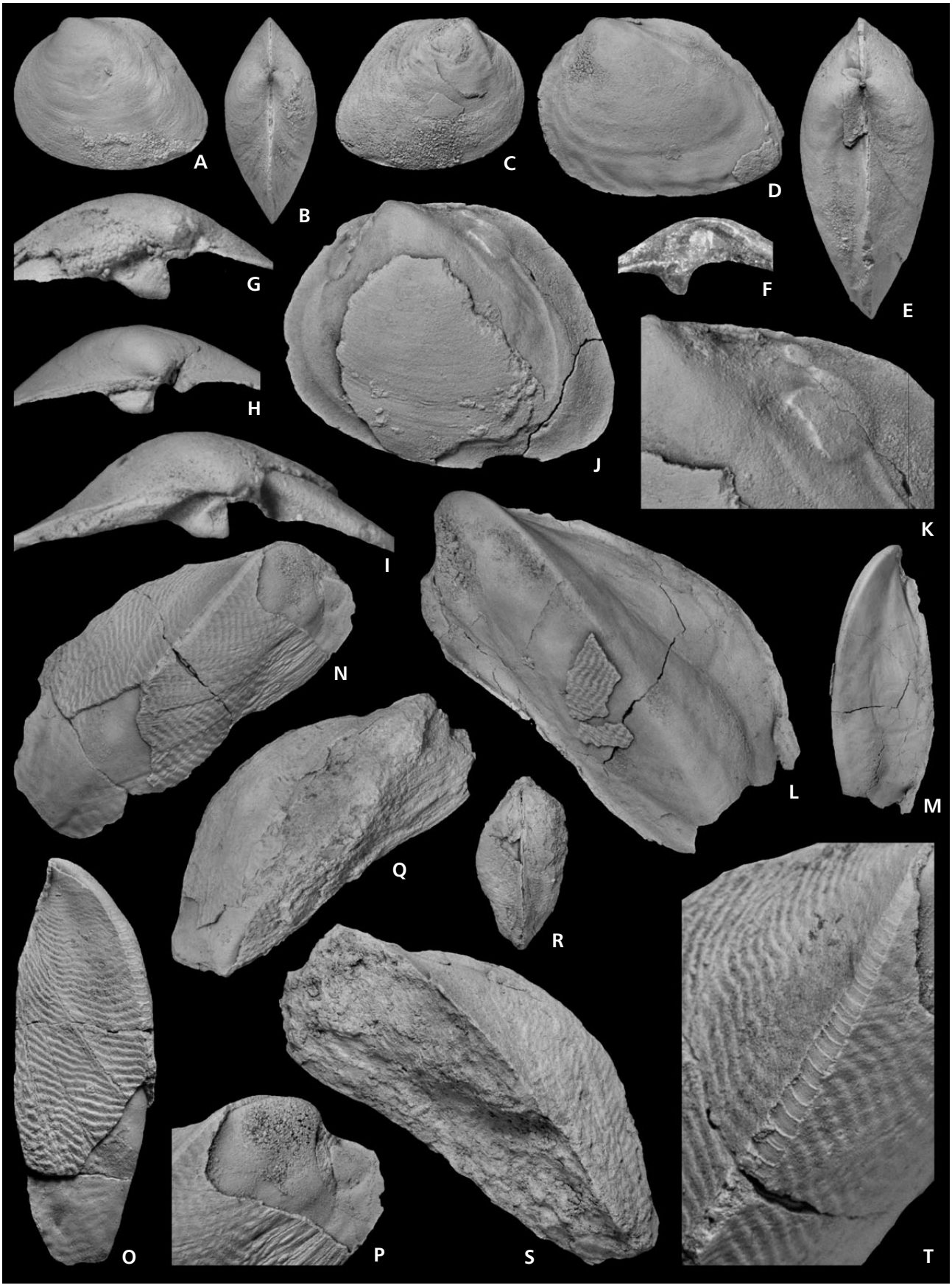
Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Eight shells with conjoined valves, five left and six right valves.

Diagnosis. – The Ludlow *Goniophora* with outer surface sculpture composed of numerous, regularly spaced growth bands and furrows and with dorsal and ventral parts separated by prominent slightly S-shaped carina between the umbo and ventral extremity. The claw-like appearance of the proximal end of this ridge laterally is not developed.

Description. – Shell medium size (L = 19.2, H = 30.9, W = 20.5), lanceolate, equivalve, strongly inequilateral, postero-ventrally elongated, and inflated (H/W = 1.40–1.51). No byssal gape. Umbones prominent, in anterior third of the dorsal margin line, closely incurved, beaks prosogyrate. Each valve subdivided by slightly sinuous, prominent high and diagonal carina between umbo and postero-ventral extremity, with rounded crest. The carina represents an interesting structure. It is composed of interior transversal segments, corresponding by width approximately to the width of the growth band (Fig. 9N, O; JK 11830). Each segment has wide base, which sits probably on the very thin inner layer of the shell. Laterally the width decreases and in highest part of the umbonal ridge again increases. The top of the carina is rounded. When only the inner surface of the shell is preserved, in the place of carina only the flat ridge with growth bands corresponding to the carina interior segments is preserved. Hinge line relatively short, slightly curved, with external opisthodetic ligament groove where fragmentary remains of ligament may be seen (Fig. 9M, JK 11826). Anterior margin is lobate, ventral

Figure 8. A–K – *Janicula potens* (Barrande, 1881); A–C – articulated specimen, JK 11585; A – left view, × 2.2; B – dorsal view, × 2.2; C – right view, × 2.2; D, E – articulated specimen, JK 11588; D – left view, × 1.55; E – dorsal view, × 2; F – right valve, JK 11577, detail of the hinge, dorsal view, not whitened, × 7; G – left valve, JK 11576, detail of the hinge, dorsal view, × 10.5; H – left valve, JK 11575, detail of the hinge, dorsal view, × 6.75; I – left valve, JK 11574, detail of the hinge, dorsal view, × 9.5; J, K – left valve, JK 11597; J – lateral view, × 3.05; K – detail of the posterior adductor muscle scar and posterior pedal retractor, × 6. • L–T – *Goniophora tyri* Liljedahl, 1994; L, M – left valve, JK 11616; L – lateral view, × 2; M – dorsal view, posterior adductor muscle scar view, × 1.2; • N–P, T – right valve, JK 11623; N – lateral view, × 2.15; O – dorsal view, × 2.3; P – detail of the anterior adductor muscle scar, × 3; T – dorso-lateral view, detail of the broken off carina, × 5.4; Q–S – articulated specimen, JK 11618; Q – right view, × 1.5; R – dorsal view, × 0.8; S – left view × 1.9.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margin long, a little concave. Ventral extremity where diagonal ridge ends, is rounded. Posterior margin long, convex. Outer surface sculpture consists of numerous regularly spaced, rounded growth bands and furrows, crowded in ventral parts of adult shells. Inner surface sculpture consists also of numerous growth bands and furrows. Hinge unknown. Anterior and posterior reinforcement ridges well developed close to the hinge line, slightly curved (Fig. 9K). Anterior adductor muscle scar is elliptical, deeply impressed on the inner side of the anterior lobe. Other muscle scars and hinge not observed. Shell wall is 0.14–0.31 mm thick.

Dimensions. –

specimen	L	H	W
JK 11814	14.9	21.9	15.9
JK 11827	17.1	30.9	20.5
JK 11823	19.2	> 25.0	16.4

Discussion. – *Goniophora ascia* sp. nov. is closely related to *Goniophora onyx* Liljedahl, 1984 from the upper Homerian (Wenlock), Halla Beds and the Gorstian (Ludlow), Hemse Beds of Gotland. It differs from the Bohemian species by presence of a claw-like appearance of the proximal end of the ridge between the umbo and ventral extremity. *Goniopohora rara* Barrande, 1881 from the upper Wenlock, Homerian of the Prague Basin has irregularly spaced wider growth bands, commonly diverging, differs by posteriorly elongated shells and by the presence of radial sinus in dorsal part of the shell separating prominent wing. On the inner surface of the wing is developed elliptical posterior adductor muscle scar. *Goniophora compta* sp. nov. and *Goniophora solci* sp. nov. differ by the presence of radial sculpture in outer surface. *Goniophora secans* Barrande, 1881 (Barrande 1881, pl. 255, figs II/1–3), from the reef Koněprusy Limestones, Pragian, Lower Devonian of the Prague Basin has similar outer surface sculpture but it differs by the very steep posterior part of the shell and subparallel dorsal and ventral margins.

Mode of life. – Most probably byssate, semi-infaunal with the carinas parallel to the sediment surface and anterior lobe dipped into the substrate (Liljedahl 1994).

***Goniophora compta* sp. nov.**
Figures 9Q–X, 10A–E

Holotype. – Slightly deformed shell with conjoined valves with large fragments of the outer surface preserved, JK 11838, figured on Fig. 9R, U–X.

Paratypes. – JK 11839–JK 11850, measured for dimensions and figured on Figs 9Q, S, 10A–E.

Derivation of name. – From Latin *comptus*, ornamented, adorned.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

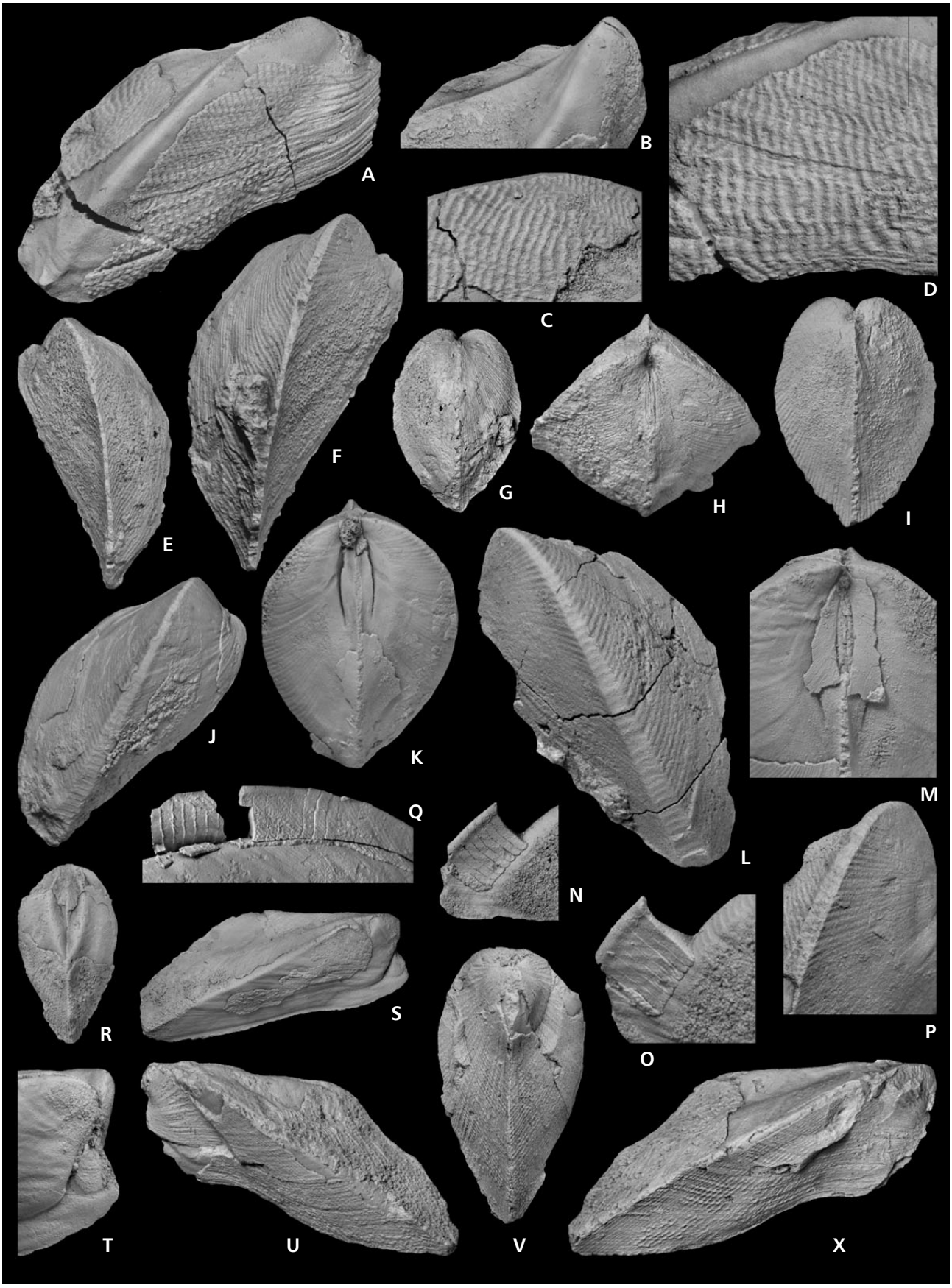
Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – 16 shells with conjoined valves, 17 left, and 14 right valves.

Diagnosis. – The Ludlow *Goniophora* with long dorsal margin, narrowly elongated, and with outer surface sculpture composed of prominent numerous radial riblets in combination with numerous narrow growth bands and furrows.

Description. – Shell medium in size (L ≥ 34.3, H = 15.9, W ≥ 22.5), lanceolate, equivalve, strongly inequilateral, postero-ventrally narrowly elongated, and inflated (H/W ≥ 0.70–0.84). No byssal gape. Umbones prominent, in almost terminal anterior position, closely incurved, prosogyrate. Each valve subdivided by sinuous, prominent diagonal carina between umbo and postero-ventral extremity, with rounded crest. Dorsal margin line long, slightly convexly curved. Anterior margin is lobate, ventral margin long, concave. Its anterior part is almost parallel with the dorsal margin. Ventral extremity, where umbonal ridge ends, is rounded. Posterior margin relatively short, convex. Ventrally of the dorsal margin radial sulcus widening ventrally separates wing like development of the posterior part of the shell. Interior of the carina is composed of interior transversal segments, corresponding by width approximately to the width of the growth band (Fig. 9Q, JK 11849). Each segment has

Figure 9. A–D – *Goniophora tyri* Liljedahl, 1994; A, D – right valve, JK 11626; A – lateral view, × 2.1; D – ventral view, detail of the outer surface sculpture, × 3.2; B, C – right valve, JK 11627; B – dorso-lateral view, detail of the posterior reinforcement ridge, × 2.6; C – ventral part of the shell, outer surface sculpture, × 2.4. • E–P – *Goniophora ascia* sp. nov.; E–I – articulated specimen, JK 11814, holotype; E – left view, × 2.1; F – right view, × 2.75; G – posterior view, × 1.4; H – dorsal view, × 2.4; I – anterior view, × 1.6; J, K – articulated specimen, JK 11823, paratype; J – right view, × 2; K – dorsal view, × 2.2; L – left lateral view, JK 11828, paratype, × 3.3; M – articulated specimen, dorsal view, JK 11826 paratype, × 2.2; N, O – right valve, JK 11830, paratype; N –ventral view of the carina, × 4; O – ventro-lateral view of the carina, × 5.5; P – right valve, lateral view, detail of the broken off carina, JK 11833, paratype, × 3. • Q–X – *Goniophora compta* sp. nov.; Q – right valve, ventral view, detail of the carina, JK 11849, paratype, × 4; R, U–X – articulated specimen, JK 11838, holotype; R – dorsal view, × 1.1; U – left view, × 2.1; V – ventral view, × 1.5; X – right view, × 2.1; S, T – right valve, JK 11839, paratype; S – lateral view, × 1.4; T – detail of anterior adductor muscle scar, × 2.8.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wide base, connected with the inner thin layer of the shell. Laterally the width decreases and in highest part of the umbonal ridge again increases. The top of the segment is rounded. The carina is covered by thin shell with radial riblets. Outer surface sculpture is composed of prominent numerous radial riblets in combination with growth wrinkles and numerous narrow growth bands and furrows. Inner surface sculpture almost smooth, sometime with faint radial ribs visible. Hinge unknown. Anterior and posterior reinforcement ridges well developed close to the dorsal margin. Anterior adductor muscle scar is elliptical, deeply impressed on the inner side of the anterior lobe. Other muscle scars and hinge not observed. Shell wall is 0.17–0.51 mm thick.

Dimensions. –

specimen	L	H	W
JK 11850	22.0	9.6	12.1
JK 11841	> 29.7	> 14.6	> 19.3
JK 11838	30.1	14.2	17.0
JK 11842	–	15.4	18.3
JK 11839	> 33.6	15.5	20.8
JK 11840	> 34.3	15.9	> 22.5

Discussion. – The only similar species is *Goniophora bellula* Billings, 1874 from the upper Ludlow and Přídolí of Arisaig, Nova Scotia, Canada, which has radial ribs in outer surface sculpture and was the reason why McLearn (1918) designated it as the type species (genotype) of the new subgenus *Goniophora* (*Cosmogoniophora*) McLearn, 1918. Liljedahl (1994) pointed out that the outer surface sculpture without distinct change of the general shape and morphology may have only specific significance and considered this subgenus to be the synonym of *Goniophora* Philips, 1848. General shape of *Goniophora compta* with elongated shells and with long dorsal margin is similar to *Goniophora acuta* Lindström, 1880 from the Wenlock and Ludlow of Gotland and Scania. *Goniophora compta* differs from *Goniophora acuta* by the outer surface sculpture composed of the distinct radial riblets dorsally and ventrally of umbonal ridge.

Mode of life. – Most probably byssate, semi-infaunal with the carinas parallel to the sediment surface and anterior lobe dipped into the substrate (Liljedahl 1994).

***Goniophora solci* sp. nov.**
Figure 10F–M

Holotype. – Incomplete left valve with the parts of shell wall with outer surface preserved, JK 11854, figured on Fig. 10I–L.

Paratypes. – JK 11851–JK 11853, measured for dimensions and figured on Fig. 10F–H, M.

Derivation of name. – In honour of Jiří Šolc and his father, amateur collectors from Praha-Nusle who introduced me to the localities in the vicinity of the Amerika gamekeeper's lodge and with whom I gained my first geological experiences in the Prague Basin in 1953–1957.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Four left and two right valves.

Diagnosis. – The Ludlow *Goniophora* with outer surface sculpture formed by narrow radial ribs and wide radial gutters on the ventral part of the shell and by the growth wrinkles and irregularly spaced narrow growth bands and furrows dorsally of the umbonal ridge.

Description. – Shell medium in size (H = 14.3, W = 16.6), lanceolate, equivalve, strongly inequilateral, elongated, and inflated (H/W = 0.80–0.86). No byssal gape. Umbones prominent, in almost terminal anterior position, closely incurved, prosogyrate. Each valve subdivided by sinuous, prominent carina between umbo and postero-ventral extremity, with carina broken off in all specimens, which I had at my disposal. Dorsal margin is relatively short, convex. Anterior part of the shell is lobate, separated from the shell by shallow radial sinus and by different outer surface sculpture formed by irregularly spaced growth bands and furrows. Ventral margin is slightly concave. Ventral extremity, where umbonal ridge ends, is rounded. Posterior margin relatively short, convex. Outer surface of the dorsal part of the shell is formed by growth wrinkles and irregularly spaced growth bands and furrows. Outer surface sculpture ventrally of the umbonal ridge is composed of the narrow radial ribs (10–11 in number) and wide radial gutters, broadening ventrally. Anterior lobe with growth sculptures is sharply separated by the last rib in the radial sinus. Inner surface sculpture of the dorsal part of the shell is almost smooth, on the ventral part radial ribs and gutters are developed. Anterior reinforcement ridge is not very deep, posterior reinforcement ridge is short and developed close to the dorsal margin. Anterior adductor muscle scar is widely ovoid, deeply impressed on the inner side of the anterior lobe. Other muscle scars and hinge not observed. Shell wall is 0.17–0.59 mm thick.

Dimensions. –

specimen	V	L	H	W/2
JK 11851	L	–	10.2	6.3
JK 11854	L	–	12.6	7.6
JK 11853	R	–	14.3	8.3

Discussion. – The Wenlockian and Ludlovian *Goniophora acuta* Lindström, 1880 from Gotland and Skåne has very similar outer surface sculpture but it differs from *Goniophora solci* sp. nov. by very antero-posteriorly elongated shells with almost subparallel dorsal and ventral margins and by distinctly larger ventral side of the shell (Liljedahl 1994). *Goniophora media* Barrande, 1881 from the upper Wenlock, Homerian of the Prague Basin has also similar but more elongated general shape, and different outer surface sculpture on the dorsal and ventral parts of the shell. Dorsally of the umbonal ridge the sculpture is composed of regularly spaced narrow growth bands and furrows and ventrally of the umbonal ridge are numerous narrow radial costellae. *Goniophora* aff. *media* from the Lochkovian, Lower Devonian of Podolia, Ukraine (Sinicyna 1964) differs from *Goniophora solci* especially by non lobate anterior part of the valve. Very similar in general shape and outer surface sculpture are *Goniophora kokbaitalica* Krasilova, 1963 from the upper Silurian and *Goniophora strialis* Krasilova, 1963 from the Lower Devonian of the north eastern Pribalchasie, Kazakhstan. They differ from probably ancestral *Goniophora solci* by distinct anterior lobate part of the shell separated by prominent ventral sinus and by narrow radial costellae in outer surface sculpture ventrally of umbonal ridge.

Mode of life. – Semi-infaunal with the carinas parallel to the sediment surface and anterior lobe dipped into the substrate (Liljedahl 1994).

***Goniophora* sp.**

Material. – Two shells with conjoined valves, 35 left, and 22 right valves.

Discussion. – Mostly incomplete specimens without the outer surface sculpture preserved are designated here as *Goniophora* sp. Since they cannot be classified specifically they were used only for statistical purposes.

Mode of life. – Semi-infaunal.

Superordo Anomalodesmata Dall, 1889
Superfamily Pholadomyoidea Gray, 1847
Family Goniophorinidae Sánchez, 2006

Genus *Goniophorina* Isberg, 1934

Type species. – *Goniophorina volvens* Isberg, 1934, upper Ordovician, Boda Limestones, Dalarna, Sweden.

Remarks. – Isberg (1934) classified the toothless bivalves with distinct carina, and with the sub-parallel dorsal and ventral margins from the Upper Ordovician of Sweden as the genus *Goniophorina.* Liljedahl (1994) came to the opinion that "*Goniophora*-like" specimens with unknown hinge characters may belong to two or more different genera. He did not consider external sculpture and shell form to have generic significance and suggested that Isberg's genera *Cosmogoniophora, Goniophorina,* and *Goniophorina* (*Cosmogoniophorina*) to be synonyms of *Goniophora.* This opinion was not accepted by Cope (1996) who described *Goniophora* (*Cosmogoniophora*) *extensa* Cope, 1996 from the early Ordovician (Arenig) of South Wales, Great Britain. Subsequently Sánchez (2005) proposed for *Goniophorina* a new generic diagnosis including that dorsal and ventral margin may diverge posteriorly and that radial sculpture may be sometime presented. Sánchez (2006) discussed the systematic position and phylogenetic relationships of *Goniophorina* and included it in a new family Goniophorinidae, together with the genus *Lossella* Sánchez, 2006 from the late Tremadoc and early Arenig of Argentina. I agree with Sánchez (2006) that Goniophorinidae may be classified as the ancestral forms of the Anomalodesmata.

***Goniophorina nitidula* sp. nov.**
Figures 10N–Z, 11A, B

Holotype. – Shell with conjoined valves and with large fragments of the outer surface preserved, JK 11766, figured on Fig. 10N–Q.

Paratypes. – JK 11767–JK 11786, JK 11791 measured for dimensions, included into community analysis, and figured on Figs 10R–Z, 11A, B.

Derivation of name. – From Latin *nitidus*, shining, neat, elegant.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – 53 shells with conjoined valves, 131 left, 126 right valves from the type locality.

Diagnosis. – The Ludlow *Goniophorina* with fine radial costae.

Description. – Small lanceolate shells (L = 9.7–18.7, H = 5.0–8.1) are subequivalve, strongly inequilateral, longitudinally elongated, inflated (H/W = 1.06–1.67). Umbones are prominent, in almost terminal anterior position, closely

incurved, prosogyrate. Frequently the beaks are not exactly in opposition and one of them is slightly shifted anteriorly or posteriorly (Fig. 10P). Valves are subdivided by sinuous, prominent rounded diagonal umbonal ridge or almost carina between umbo and postero-ventral extremity. Dorsal margin is straight, less than the half and more than the third of the shell length. Dorsal and ventral margins are subparallel. Posterior end of the dorsal margin rounded. Posterior margin slightly convex; posterior extremity where the diagonal ridge meets the margin of the shell forms the sharp angle. Ventral margin is long, slightly convex. Anterior margin is evenly rounded. In front of the umbo small lunula is developed. Outer surface sculpture is formed of growth wrinkles and irregularly spaced narrow growth bands and furrows in combination with fine radial riblets and gutters. The radial sculpture is developed in uppermost shell layer of the shell only and it is preserved quite rarely since the uppermost shell layers were probably abraded away. Ligament is opisthodetic, in the distinct ligament groove. Rounded, relatively large posterior adductor muscle scar is developed between the posterior part of the dorsal margin and umbonal ridge. Posteriorly of the adductor muscle scar is visible short portion of the pallial line between the muscle scar and the umbonal ridge. The anterior adductor muscle scar is rarely deeply inserted on the anterior part of the shell. At the posterior end of narrow hinge area, at least one narrow lateral tooth is developed (Fig. 11B). Shell thickness is 0.1–0.17 mm.

Dimensions. –

specimen	L	H	W
JK 11782	9.7	5.0	3.0
JK 11771	11.6	5.5	5.2
JK 11772	14.7	6.5	5.7
JK 11769	> 15.2	7.5	6.4
JK 11774	15.5	7.2	6.8
JK 11776	16.2	7.6	6.8
JK 11766	> 16.4	7.9	6.8
JK 11767	> 16.9	9.0	7.2
JK 11775	17.0	8.0	6.4
JK 11777	> 17.0	7.8	6.9
JK 11773	18.7	8.1	7.3

Discussion. – The lectotype (SD herein) of *Goniophorina testis* (Barrande, 1881) from the Homerian, Wenlock, locality Tachlovice, Middle Mill Race, Prague Basin, Bohemia, figured by Barrande (1881) on pl. 261 as figs 1–5 differs from *Goniophorina nitidula* in its generally larger shell and outer surface sculpture without radial costellae ventrally of umbonal ridge while dorsally of the ridge fine radial striae are developed. *Goniophorina testis* from the Lochkovian, Lower Devonian of Podolia, Ukraine (Sinicyna 1964) is very similar to the Barrande's lectotype in its size and outer surface sculpture without the radial riblets.

Mode of life. – Burrowing, infaunal (Sánchez 2006).

Family Grammysiidae Miller, 1877

***Cymatonota* Ulrich, 1895**

Type species. – *Cymatonota typicalis* Ulrich, 1895, U.S.A., Ohio, Upper Ordovician.

***Cymatonota prolata* sp. nov.**
Figure 11C, D

Holotype. – Right valve with most of outer surface preserved, JK 11738, figured on Fig. 11C, D.

Derivation of name. – From Latin *prolatus*, extended, elongated.

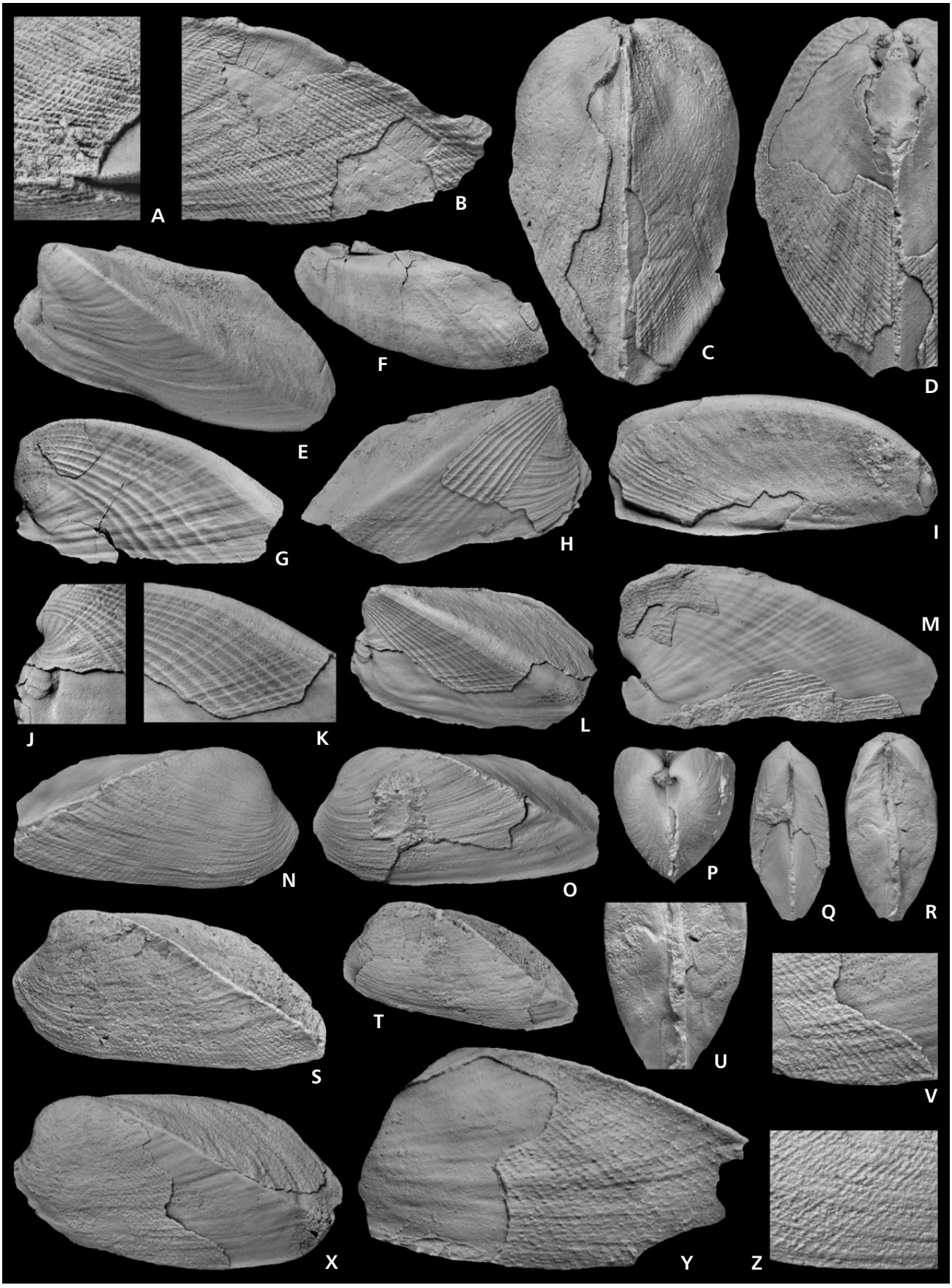
Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – One right valve.

Diagnosis. – The Ludlow *Cymatonota* with distinctly long shells.

Figure 10. A–E – *Goniophora compta* sp. nov.; A, C – articulated specimen, JK 11841, paratype; A – dorsal view of the outer surface sculpture, × 3.1; C – ventral view, × 2.1; B – left valve, ventral view, detail of the carina, JK 11846, paratype, × 4.4; D – articulated specimen, ventral view, JK 11845, paratype, × 4.5; E – left lateral view, JK 11844, paratype, × 2.3. • F–M – *Goniophora solci* sp. nov; F, G – left valve, JK 11851, paratype; F – dorsal view, posterior reinforcement ridge, × 2.8; G – ventro-lateral view, × 3; H – right lateral view, JK 11853, paratype, × 1.7; I–L –left valve, JK 11854, holotype; I – dorso-lateral view, × 2.8; J – detail of anterior adductor muscle scar, × 3.25; K – ventro-lateral view, detail of outer surface sculpture, × 3; L – lateral view, × 2.1; M – left valve, vento-lateral view, JK 11852, paratype, × 2. • N–Z – *Goniophorina nitidula* sp. nov.; N–Q – articulated specimen, JK 11766, holotype; N – right view, × 3.15; O – left view, 2.95; P – anterior view, × 3; Q – dorsal view, × 2.1; • R, U – articulated specimen, JK 11768, paratype; R – dorsal view, × 1.65; U – dorsal view, detail of the posterior adductor muscle scars with the pallial line, × 2.5; • S – articulated specimen, left view, JK 11767, paratype, × 3.3; T – articulated specimen, left view, JK 11777, paratype, × 2.6; V, X – articulated specimen, JK 11769, paratype; V – left lateral view, detail of the outer surface sculpture, × 5; X – left view, × 4.1; Y – left lateral view, detail of the carina, JK 11784, paratype, × 7; Z – articulated specimen, right ventro-lateral view, detail of the outer surface sculpture, JK 11772, paratype, × 6.5.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Description. – Shell longitudinally elongated (L ≥ 28.5, H ≥ 12.6), equivalve, strongly inequilateral, obese (H/W = 1.5). The shell has both anterior and posterior shell gapes. Umbones are prominent, beaks prosogyrate, in 1/4 of the length of shell from anterior. Dorsal margin is long, straight, almost parallel with the ventral margin, which is long, concave, and with ventral sinus. Posterior and anterior margins are rounded. Posterior part of the shell is higher than anterior and maximum width of the shell is about one fourth of the shell length from the posterior end. Outer surface sculpture is composed of the growth wrinkles and irregular narrow growth bands and furrows. Inner surface sculpture is similar. Muscle scars, hinge and ligament unknown. Shell thickness is 0.10–0.17 mm.

Dimensions. –

specimen	V	L	H	W/2
JK 11738	R	23.0	8.3	2.7
JK 11738	R	> 28.5	> 12.6	4.3

Discussion. – *Cymatonota prolata* sp. nov. differs from the Wenlockian and Gorstian *Cymatonota antiqua* (Barrande, 1881) by distinctly longer shells and by the position of beak in 1/4 of the length of shell from anterior. The Ludlow species is very similar to the type species of the genus, *Cymatonota typicalis* Ulrich, 1895 from the Upper Ordovician of U.S.A., which differs by subparallel dorsal and ventral margins.

Mode of life. – Infaunal, most probably burrowing (Pojeta 1971).

Cimitaria Hall & Whitfield, 1869

Type species. – *Cypricardites recurvus* Conrad, 1842, U.S.A., New York, Middle Devonian, Hamilton Group.

Cimitaria liscina sp. nov.

Figures 11E–P, 12A

Holotype. – Right valve with most of outer surface preserved, JK 11799, figured on Fig. 11M, N.

Paratypes. – JK 11800–JK 11809 measured for dimensions, included into community analysis, and figured on Figs 11E–L, 12A.

Derivation of name. – Derived from the Liščí Quarry near Amerika gamekeeper's lodge, Karlštejn, Bohemia.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

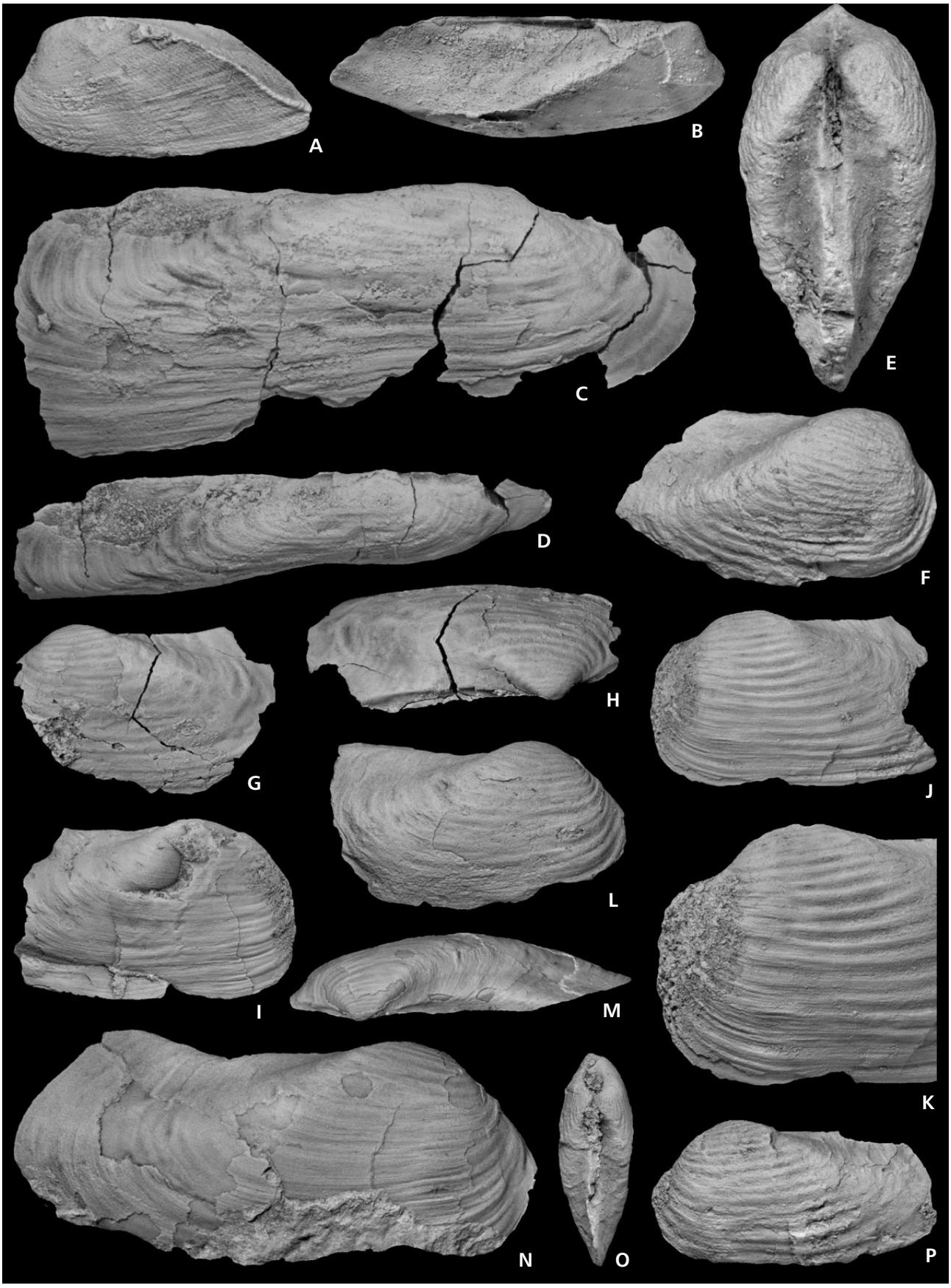
Material. – Six shells with conjoined valves, four left, and three right valves.

Description. – Medium sized (L = 44.0), elongated (L/H = 3.28), equivalve, and inflated shells (H/W = 1.22–1.44). Umbones are prominent, extended above the dorsal margin, gibbous, and incurved, less than 1/5 of the shell length from anterior. Umbonal ridge is indistinct, rounded, and became obsolete before reaching posterior extremity. Posterior part of concave dorsal margin is curved upward. Posterior extremity of dorsal margin is obliquely truncated. Anterior part is short and rounded. Ventral margin is slightly concave, with weak ventral sinus, subparallel with the most of the dorsal margin. Lunule and long escutcheon are well developed. Outer surface sculpture consists of irregular growth wrinkles; ventrally of umbonal ridge distinct, convex, regularly spaced growth bands and furrows are developed. Surface sculpture of the anterior part of the shell is composed of narrow irregularly spaced growth bands and furrows. Posteriorly, in the wide radial sinus the number of growth bands decreases and they became wider and regularly spaced. Ligament opisthodetic, internal features and hinge unknown. Shell wall is thin (0.14–0.31 mm).

Dimensions. –

specimen	V	L	H	W/2
JK 11701	L	12.5	7.1	3.1
JK 11804	R	17.1	9.1	–
JK 11802	L	19.6	10.1	3.5
JK 11805	L	> 21.2	11.0	4.5
JK 11799	R	44.0	13.4	5.5

Figure 11. A, B – *Goniophorina nitidula* sp. nov.; A – articulated specimen, left view, JK 11771, paratype, × 2; B – left valve, dorso-lateral view, JK 11785, × 3.6. • C, D – *Cymatonota prolata* sp. nov., right valve, JK 11738, holotype; C – lateral view, × 4.75; D – dorso-lateral view, × 3.7. • E–P – *Cimitaria liscina* sp. nov.; E, F – articulated specimen, JK 11701, paratype; E – dorsal view, × 5.5; F – right view, × 2.35; G, H – left valve, JK 11800, paratype; G – lateral view, × 2.5; H – dorso-lateral view, × 2.9; I–K – articulated specimen, JK 11801, paratype; I – right view, × 2; J – left view, × 2.3; K – left view, detail of anterior part, × 3.1; L – right valve, JK 11803, paratype, × 3.4; M, N – right valve, JK 11799, holotype; M – lateral view, × 1.95; N – dorso-lateral view, × 3; O, P – articulated specimen, JK 11802, paratype; O – dorsal view, × 1.7; P – left view, × 2.5.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Discussion. – *Cimitaria liscina* sp. nov. is the earliest known representative of the genus for which the most characteristic feature is the concave dorsal margin. Pojeta *et al*. (1986) described from the middle Emsian, Lower Devonian of Guangxi, China *Cimitaria sinensis* Pojeta, Zhang & Yang. From *Cimitaria recurva* (Conrad, 1842) from Givetian, Devonian of Michigan and New York, U.S.A., and from most of the other species of *Cimitaria* from the Middle and Upper Devonian New York, U.S.A. (Hall 1885). *Cimitaria liscina* differs by an indistinct umbonal ridge, by smaller shells and by the development of distinct regular convex growth bands and furrows in outer and inner surface sculpture of the shell ventrally of umbonal ridge and posteriorly of the weak radial sinus.

Mode of life. – Infaunal.

Sanguinolites McCoy, 1844

Type species. – *Sanguinolites discors* McCoy, 1844, Ireland, Lower Carboniferous.

Remarks. – Prominent growth bands and furrows are developed in the outer sculpture of the genera *Cymitaria* Hall and Whitfield, 1869 from the Middle and Upper Devonian of New York, U.S.A. and North American Upper Devonian genus *Sanguinolites* McCoy, 1844 with generally similar general shape. Also generally similar *Grammysioidea* Williams & Breger, 1916 from the lower Silurian to Upper Devonian of the North, South America and Europe is lacking regular growth bands and furrows in outer surface sculpture.

Sanguinolites? *drupa* sp. nov.
Figure 12B–G

Holotype. – Shell with conjoined valves with most of the outer surface preserved, JK 11698, figured on Fig. 12C–G.

Paratypes. – Three shells with conjoined valves, JK 11699–JK 11701, and one left valve, JK 11702, measured for dimensions, included into community analysis, and figured on Fig. 12B.

Derivation of name. – From Latin *drupa*, an overripe, wrinkled olive; indeclinable noun.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Type horizon. – Silurian, Ludlow, lower Gorstian, Kopanina Formation, section No. 942/2.

Material. – Four shells with conjoined valves and one left valve.

Diagnosis. – The Ludlow *Sanguinolites*? with outer surface sculpture composed of prominent numerous growth bands and furrows in combination with numerous fine radial costellae in the growth furrows.

Description. – Medium size shell (L = 12.5–44.0; H = 7.1–23.4; W = 6.3–19.8), transverselly subovate, equivalve, inequilateral, elongated (L/H = 1.56–1.92), and distinctly obese (H/W = 1.13–1.37). Umbones are prominent, in anterior position, closely incurved, prosogyrate. Umbonal ridge is indistinct, rounded, and became obsolete before reaching posterior extremity. Lunule and escutcheon are well defined, escutcheon bordered by narrow ridge. Dorsal margin is long, straight. Anterior part is relatively long, lobate, separated from the rest of the shell by wide, ventrally widening shallow radial sulcus. Ventral margin is long, slightly convex. Posterior margin rounded. Outer surface sculpture is composed of the growth wrinkles and prominent convex growth bands and furrows in combination with numerous, irregularly spaced, short radial riblets. Growth bands increase in number posteriorly of anterior part by intercalation or bifurcation, usually starting in the radial sulcus or posteriorly of it. Growth bands and furrows disappear dorsally of umbonal ridge. Inner surface sculpture is composed of the growth bands and furrows only. Muscle scars and hinge unknown. Shell thickness is 0.14–0.37 mm.

Dimensions. –

specimen	L	H	W
JK 11698	34.1	21.8	15.9
JK 11699	45.0	> 23.4	> 19.8

Discussion. – The ancestral Wenlockian species from the Barrande's locality "hills between Loděnice and Bubovice", *Sanguinolites*? *bialata* (Barrande, 1881), figured by Barrande on pl. 261, figs I/1–7 as *Leda bialata* (NM L 27022–L 27023) and *Sanguinolites*? *solida* (Barrande, 1881) figured on pl. 261, figs IV/1–7 as *Modiolopsis solida* (NM L 27 019–L 27 020) are most probably conspecific and represent most probably oldest known species of *Sanguinolites*?. They differ from *Sanguinolites*? *drupa* by less robust shells with shallow radial sulcus separating posterior wing; outer and inner surface sculpture is composed of less convex numerous growth bands and furrows. The radial riblets developed on *Sanguinolites? drupa* are not preserved on Barrande's types from the Wenlock. *Sanguinolites nagaolingensis* Pojeta *et al.*, 1986 from the Lower Devonian Nagaoling Formation of Guangxi, China has very similar outer surface sculpture, formed by growth bands and furrows, increasing in number in anterior part of the shell by intercalation or bifurcation. *Sanguinolites*?

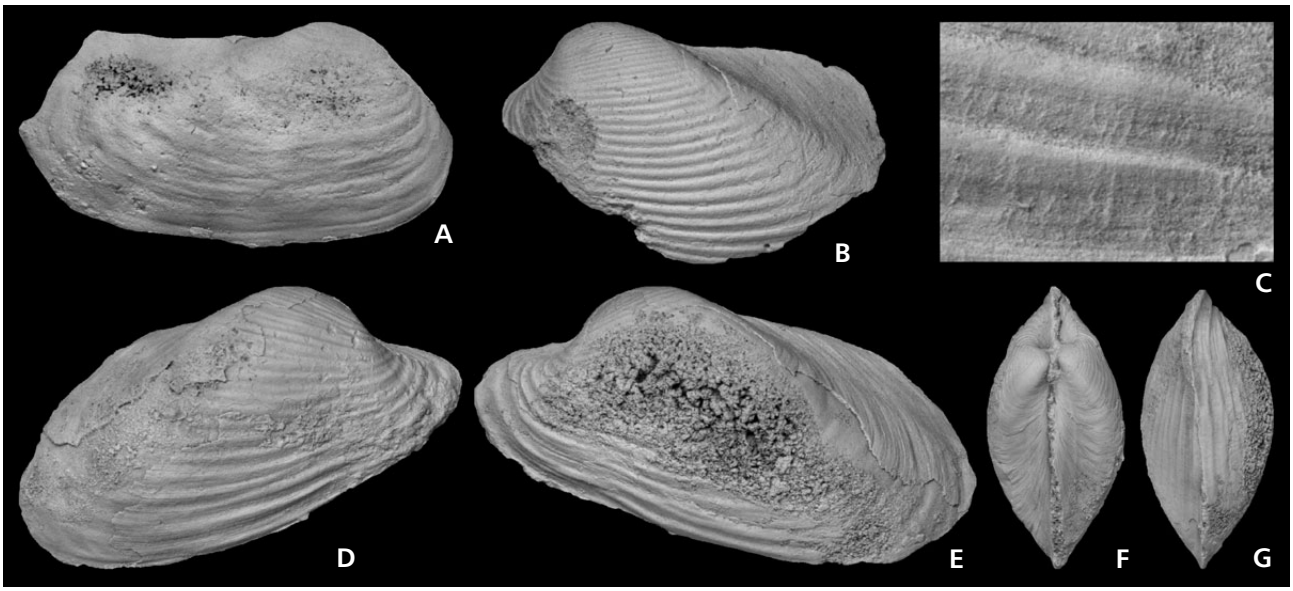

Figure 12. A– *Cimitaria liscina* sp. nov., right lateral view, JK 11804, × 4.9. • B–G – *Sanguinolites*? *drupa* sp. nov.; B – left valve, JK 11702, paratype, × 2.8; C–G – articulated specimen, JK 11698, holotype; C – right view, detail of the outer surface sculpture, × 6; D – right view, × 1.7; E – left view, × 1.7; F – dorsal view, × 1; G – ventral view, × 0.95.

drupa differs from Chinese species by distinctly obese shells, the longer anterior part, separated from the rest of the shell by radial sulcus, by not parallel dorsal and ventral margin, and by numerous, fine radial riblets presented in outer surface sculpture. Similar general shape, relatively long, lobate anterior part is developed only in the modiomorphid *Whiteavesia cincinnatensis* (Hall & Whitfield, 1875) from the Upper Ordovician of Kentucky, U.S.A., but it differs in lacking the coarse growth bands and ventral sinus (Pojeta 1971, pl. 17, figs 1–15). Similar features may be seen on internal mould of *Whiteavesia* sp. from the Upper Ordovician, lower Ashgill of Siberian Platform, Russia (Krasilova 1979). The type species *Sanguinolites discors* McCoy, 1844, from the Lower Carboniferous of Ireland differs from *Sanguinolites*? *drupa* by prominent umbonal carina, elongated, less inflated shells and by angular posterior part of the dorsal margin which is not parallel with ventral margin and by distinctly long anterior lobate part.

Mode of life. – Probably semi-infaunal.

Community analysis

The Bivalvia dominated communities from the Silurian and Lower Devonian carbonates of the Bohemian type bivalves were classified by Kříž (1999a) into the five natural community groups, each containing homologous and analogous communities (Boucot & Kříž 1999). These community groups are related to the cephalopod limestone biofacies (*Cardiola* Community Group), to the contemporary deeper water micritic limestone biofacies (*Cheiopteria* Community Group), to the Přídolí and Lower Devonian soft bottom micritic limestone biofacies (*Snoopyia* Community Group and *Patrocardia* Community Group) and to the soft bottom Lower Devonian biomicritic to biodetritic biofacies (*Antipleura-Hercynella* Community Group).

Coral-Crinoid Community Group

Havlíček & Štorch (1990, 1999) described shallow water Coral-Crinoid Community from the Liščí Quarry near Amerika gamekeeper's lodge near Karlštejn. They interpreted the community as a biostrome characterized by prevalence of crinoids, corals, stromatoporoids accompanied by bivalves, brachiopods, gastropods, and trilobites (Horný 1962).

The shallow water coral-crinoid biofacies is known in the Prague Basin, Bohemia in the upper Wenlock (Homerian), lower Ludlow (Gorstian) and in the Lower Devonian (Lochkovian and Pragian). The Bivalvia communities developed in this biofacies are not analogous and homologous with the other Bivalvia community groups described by Kříž (1999a). For that I propose for this type of the communities the term Coral-Crinoid Community Group. It includes for example the homologous and analogous late Homerian, Wenlock Coral-Leptaenid Community, *Hircinisca-Ancillotoechia* Community, and *Septatrypa lissodermis-Cyrtia maior* Community, the early Gorstian, Ludlow *Atrypa fumosa* Community, the Lochkovian *Warburgella* Community

Table 1. The *Janicula potens* Community highest rank abundance bivalves occurrence in the levels A–E of the layer 2, section No. 942, lower Gorstian, Ludlow, Silurian, Liščí Quarry near Amerika gamekeeper's lodge, Karlštejn, Prague Basin, Bohemia. L – left valves, R – right valves, A – valves with conjoined valves.

A			B			C			D			E			LEVEL
L	R	A	L	R	A	L	R	A	L	R	A	L	R	A	VALVES
1	1	9	34	57	29	176	193	68	63	66	31	3	3	6	*Janicula potens*
–	1	1	14	19	1	53	59	10	39	21	12	–	–	–	*Goniophorina nitidula*
1	–	1	8	4	8	–	3	–	3	7	1	–	–	–	*Goniophora compta*
–	–	1	8	6	–	7	5	–	6	2	1	–	–	–	*Goniophora* sp.
–	2	1	4	3	–	7	5	2	4	7	1	–	–	–	*Goniophora tyri*
2	2	–	7	8	–	3	2	–	5	3	–	–	–	–	*Mytilarca* sp.
–	–	–	–	–	–	16	13	–	6	1	–	–	–	–	*Molinicola bohemica*
2	–	–	2	–	–	8	5	–	1	1	–	–	–	–	*Palaeopecten radvani*
2	–	–	–	3	5	–	1	1	–	–	–	–	–	–	*Goniophora ascia*
1	–	–	7	6	–	2	–	–	2	2	–	–	–	–	*Amphicoelia pojetana*
–	–	–	5	–	–	4	3	–	4	–	–	1	–	1	*Mytilarca parens*
–	–	–	6	–	–	5	2	–	6	–	–	–	–	–	*Rhombopteria perunicola*
–	–	–	1	–	–	3	1	2	3	3	1	1	–	–	*Macrodesma enigma*
–	–	–	2	3	5	–	–	–	2	–	–	–	–	–	*Cimitaria liscina*
–	1	–	1	2	–	2	3	1	1	1	–	–	1	–	*Mimerodonta phaseolus*

and *Coniproetus-Protocymostrophia* Community (Havlíček & Štorch 1999). To this community group also correspond the new lower Gorstian *Janicula potens* Community from the coral-crinoid biofacies in the Liščí Quarry.

Janicula potens Community

Name. – Used here for the first time.

Community group assignment. – Coral-Crinoid Community Group.

Composition. – 32 species of bivalves: *Slava sathon*, *Cardiola donigala*, *Cardiola signata*, *Cardiola* aff. *geminans*, *Dualina amina*, *Mila parvula*, *Algerina* aff. *algena*, *Tetinka costulifera*, *Macrodesma enigma*, *Phthonia regularis*, *Ambonychia volitans*, *Amphicoelia pojetana*, *Mytilarca parens*, *Mytilarca* sp., *Molinicola bohemica*, *Palaeopecten radvani*, *Palaeopecten* sp., *Rhombopteria perunicola*, *Praeostrea bohemica*, *Butovicella migrans*, *Mimerodonta phaseolus, Janicula potens*, *Goniophora tyri*, *Goniophora ascia*, *Goniophora compta*, *Goniophora solci*, *Goniophora* sp., *Goniophorina nitidula*, *Cymatonota prolata*, *Cimitaria liscina*, *Cimitaria* cf. *liscina*, and *Sanguinolites*? *drupa*, together with abundant gastropods (60 species), brachiopods (26), corals (31), trilobites (11), rostroconchids (4), and crinoids (12), common cephalopods (13), and stomatoporoids (3), and relatively rare ostracods (2), tergomyans (1), polyplacophorids (1), worms (1), bryozoans (3), algae (1), and sponges.

Age. – The coral-crinoid biofacies is not favourable for graptolites and their preservation. The correlation should be based on the benthic and nektobenthic organisms. The bivalves *Slava sathon, Cardiola donigala*, *Butovicella migrans,* and *Cardiola signata* occur in the contemporaneous cephalopod limestone biofacies *Cardiola donigala – Slava sathon* Community described from the lower parts of the *Saetograptus chimaera* Biozone, lower Gorstian, Ludlow (Manda & Kříž 2007). *Algerina* aff. *algena* is very closely related to *Algerina algena* described from the lower Gorstian of Algeria (Kříž 2008) where it represents a dominant species of the *Algerina algena – Cardiola agna agna* Subcommunity in the cephalopod limestone biofacies of the *Colonograptus colonus* Biozone. All these species represent in the *Janicula potens* Community low rank species and marginal occurrences of the bivalves dominant or common in cephalopod limestone biofacies *Cardiola* dominated communities.

On the other side brachiopods with the dominant *Atrypa fumosa* Havlíček *in* Havlíček & Štorch, 1990 may be correlated with the nearby locality Kozolupy, Kouřící Quarry, where *Atrypa fumosa* occurs just above the lower Gorstian *Atrypoidea renitens* Community (Havlíček & Štorch 1990). Trilobite *Cromus storchi* (Šnajdr, 1983), one of the dominant species of the trilobite assemblage from the Liščí

Table 2. Numerical and ranked abundance of bivalves in the *Janicula potens* Community, lower Gorstian, Ludlow, Silurian, Liščí Quarry near Amerika gamekeeper's lodge, Karlštejn, Bohemia. R+L – right and left valves (disarticulated), A – shells with conjoined valves, RA – percentage relative abundance, AA – percentage relative abundance of shells with conjoined valves, R – rank abundance.

species	life habits	R+L	A	RA	AA	R
Janicula potens	infaunal	895	179	59.30	28.52	1
Goniophorina nitidula	infaunal	257	53	17.18	29.20	2
Goniophora compta	semi-infaunal	31	16	2.98	50.79	3
Goniophora sp.	semi-infaunal	57	2	2.89	13.11	4
Goniophora tyri	semi-infaunal	44	4	2.46	15.38	5
Mytilarca sp.	epifaunal	43	–	2.04	–	6
Molinicola bohemica	semi-infaunal	40	–	1.89	–	7
Palaeopecten radvani	semi-infaunal	30	–	1.42	–	8
Goniophora ascia	semi-infaunal	11	8	1.28	29.63	9
Amphicoelia pojetana	epifaunal	26	–	1.23	–	10
Rhombopteria perunicola	reclining	23	1	1.19	8.00	11
Mytilarca parens	epifaunal	22	1	1.14	8.33	12
Macrodesma enigma	infaunal	14	3	0.95	30.00	13
Cimitaria liscina	infaunal	7	6	0.90	63.16	14
Mimerodonta phaseolus	semi-infaunal	15	1	0.80	11.76	15
Phthonia regularis	infaunal	–	4	0.38	100.00	16
Sanguinolites? *drupa*	semi-infaunal	1	3	0.33	85.71	17
Goniophora solci	semi-infaunal	6	–	0.28	–	18
Cardiola donigala	epifaunal	6	–	0.28	–	18
Palaeopecten sp.	semi-infaunal	4	–	0.19	–	19
Dualina amina	reclining	1	1	0.14	66.67	20
Butovicella migrans	epifaunal	3	–	0.14	–	20
Cimitaria cf. *liscina*	infaunal	2	–	0.09	–	21
Tetinka costulifera	infaunal	–	1	0.09	100.0	21
Cardiola signata	semi-infaunal	2	–	0.09	–	21
Algerina aff. *algena*	reclining	1	–	0.05	–	22
Slava sathon	infaunal	1	–	0.05	–	22
Ambonychia volitans	epifaunal	1	–	0.05	–	22
Cymatonota prolata	infaunal	1	–	0.05	–	22
Cardiola aff. *geminans*	semi-infaunal	1	–	0.05	–	22
Praeostrea bohemica	reclining	1	–	0.05	–	22
Mila parvula	reclining	1	–	0.05	–	22
Totals		1547	283	100.01%	26.79%	

Quarry locality, occurs in the lower Gorstian, *Colonograptus colonus* Biozone in the section No. 687 between Arethusina Gorge and Mušlovka Quarry near Praha-Řeporyje (Kříž 1992). It may be concluded that the *Janicula potens* Community is the lower Gorstian, *Saetograptus chimaera* Biozone in age.

Type locality. – Bohemia, Karlštejn, Liščí Quarry near Amerika gamekeeper's lodge.

Geographic distribution. – The *Janicula potens* Community is analogous and homologous with the similar lower Homerian, upper Wenlock communities of bivalves of which species were described by Barrande (1881) from the vicinity of Loděnice, Tachlovice, Svatý Jan (Hliník), Kozel near Beroun and Lištice in the Prague Basin, Bohemia.

Very closely related are the Silurian reef bivalves described by Watkins (1997) from the upper Wenlock Racine Formation of Wisconsin and Illinois, North America. The reefs are located on open marine shelves. In total the Racine Formation Bivalvia community consists of 15 species, mostly epibyssate, semi-infaunal, reclining and also free burrowing, including *Amphicoelia, Mytilarca, Goniophora, Rhombopteria* and *Cardiola*. The community is analogous and homologous with the *Janicula potens* Community.

Environment interpretation. – The bivalves occur in presumably bioturbated environment of partly unconsolidated biodetrital limestone (Fig. 1, section No. 942, bed No. 2) with high tuffaceous admixture together with abundant crinoids, corals, gastropods, commonly articulated brachiopods and other benthic and nektobenthic fauna. The relatively thick layers (15–30 cm), of grey green tuffites containing rarely lapilli (up to a tens of milimeters large) represent the evidence of periodical disturbance of the environment by volcanic activity of the nearby (ca 2.5 km) Svatý Jan Volcano.

Polyplacophoran molluscs are preserved as isolated sclerites. Bivalves are mostly not fragmented, except the largest infaunal, semi-infaunal, and epibyssate bivalves (*Slava, Amphicoelia*, *Palaeopecten,* and *Mytilarca*). High-spired gastropods are mostly preserved as large fragments (Horný 1952), but in general the gastropods are not fragmented and were not transported postmortally (Horný & Peel 1995). Interesting is the observation of a large, adult specimen of the belleropohontoidean *Boiotrermus incipiens* (Barrande *in* Perner, 1903) with a large injury caused presumably by a small volcanic bomb (Horný 1998).

Cephalopod shells are commonly found with body chambers. Abundant crinoids are mostly disarticulated. Tabulate coral colonies are frequently overturned. Large branched rugose coral colonies (*Microplasma flexuosum* Prantl, 1939a) at the base of the green tuffite bed between the levels B and C are preserved in living position.

The *Janicula potens* Community is highly diversified (32 species of bivalves) and has quite high population densities. The bivalves are well preserved, mostly disarticulated but also abundant shells with conjoined valves (26.79%). In the soft-bottom environment the most abundant are infaunal bivalves (11 species – 78.99%). Dominant *Janicula potens* (59.30%), and *Goniophorina nitidula* (17.18%), were probably burrowing species and their shells with conjoined valves are very common (percentage relative abundance is quite high 28.52% and 29.20%). The community also contains relatively high number of the semi-infaunal (10 species –14.66%), epifaunal (7 species – 4.88%), and reclining (5 species – 1.48%) bivalves, some of them also with still common shells with conjoined valves (*Goniophora*). The idea about autochthonous community with minimal transport is supported by the common preservation of the infaunal bivalves as shells with conjoined valves together with a little fragmented large *Palaeopecten* and *Amphicoelia* shells.

Gastropods represent the most diversified group at the locality. Horný & Peel (1995) estimated more than 60 species. High-spired murchisonoideans, oriostomatids, and bellerophontoideans are most characteristic. Very abundant *Oriostoma* Munier-Chalmas, 1876 and *Tophicola* Horný & Peel, 1995 were most probably epifaunal sedentary ciliary feeders (Horný 1995, Horný & Peel 1995). They were well adapted against fine periodically dispersed volcanic ash by the heavy, massive operculum. The dominant *Euomphalopterus* cf. *aliger* Barrande *in* Perner, 1907 (thousands of specimens have been collected) was probably also deposit feeder characterized by a wide flange at the whorl periphery which may be an adaptation to prevent sinking into a soft substratum by increase in surface area (Peel & Wängberg-Eriksson 1979). Some of the gastropods were grazers that lived on algal foliage (Peel 1978). The community is most probably homologous and analogous with the "soft-bottom, shallow marine shallow platform fauna" described from the Silurian Arisaig Group, Nova Scotia, Canada (Peel 1978).

The co-occurring well diversified brachiopod community is dominated by *Atrypa fumosa* Havlíček *in* Havlíček & Štorch, 1990, *Isorthis (Arcualla) manon* Havlíček, 1977, *Sufetirhynchia radvani* (Havlíček, 1961), *Atrypinella fuxa* Havlíček *in* Havlíček & Štorch, 1990, *Meristina mora* Michalík, 1970, and *Kirkidium (Pinguaela) bohemicum* (Přibyl, 1943). Most of the brachiopods were found articulated in the tuffaceous limestones together with bivalves and gastropods. The relatively large brachiopod *Meristina mora* is mostly found articulated in life position, in groups, forming nests in a small channels and depressions filled with the green tuffite (Michalík 1970). According to Havlíček & Štorch (1999) the brachiopod community inhabited the top of a submarine elevation built up of volcaniclastic rocks of the Wenlock and the lowermost Ludlow age.

The trilobite *Sphaerexochus-Proetus* Assemblage (Chlupáč 1987) and benthic fauna from the Liščí Quarry was interpreted as autochtonous and typical of an extremely shallow water environment of active volcanic elevations and mostly above the wave base.

It may be concluded that the *Janicula potens* Community together with other benthic organism most probably inhabited well-ventilated shallow-water flats, overgrown locally by algae, with biodetrite carbonate sedimentation influenced and periodically interrupted by direct ash fall and by the subsequent sedimentation of volcaniclastics by currents around the volcanic archipelago. The environment was most probably protected against direct wave action by the local bars of crinoidal sands with the biolitic frame built by tabulate (mainly favositids, halysitids, and heliolitids) and rugose (microplasmid) coral colonies. The occurrence of quite abundant isolated sclerites of polyplacophoran molluscs indicates nearness of the high energy, tidal, reef-shoal environments (Cherns 1999). The *Janicula potens* Community, with its 32 bivalve species, is the most diversified Bivalvia community in the Silurian of the Prague Basin. It shows close palaeogeographic relationships with the upper Wenlock, Racine Formation reefs of Wisconsin and Illinois, North America (Watkins 1997) and Silurian of Gotland and Dalarna (Sweden), Maine (North America),

and Nova Scotia (Canada). The Liščí Quarry lower Gorstian tuffaceous limestones, with more than 202 species benthic and nektobenthic organisms known, represent the most fossiliferous Silurian locality in the Prague Basin.

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