Arenig (Lower Ordovician) orthide brachiopods from Prague Basin, Bohemia

Orthidi brachiopodi arenigského stáří (spodní ordovik) z pražské pánve, Čechy (Czech summary)

(4 text-figs., 6 plates)

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Nine genera and eleven species of orthide brachiopods are known from the Klabava Formation (Arenig, Ordovician) of Bohemia. In addition to previously described species (genera Ferrax, Nereidella, Nocturnellia, Prantiina and Ranorthis), Hesperorthis sp., Poramborthis sp., Protohesperonomia sp. and Styxorthis tuffogena gen. et sp. n. have been recognized for the first time in the Arenig of Bohemia.

Introduction

Orthide brachiopods of the Klabava Formation have been reported by Barrande (1879) and recently redescribed by Havlíček (1949, 1977). New collecting gathered one new genus, several new species, and new material of previously known species; this enables a better understanding of their morphology and their geographic distribution.

Material is deposited in the National Museum, Prague (NM-L), and in the District Museum of Dr. Horák in Rokycany (OMR, VH). The author is indebted to Dr. V. Havlíček (Prague), to Dr. J. Kraft (Rokycany), and Dr. R. J. Prokop (Prague) for loan of the material.

Abbreviations: L — length, W — width, KSFB — boundary between Klabava and Sárka Formations.
Orthide brachiopod associations

Orthide brachiopod fauna of the Klabava Formation is taxonomically poor in comparison with contemporaneous inarticulate brachiopod fauna (Havlíček 1982), nevertheless two orthide brachiopod associations (sensu Pickertill – Brenchley 1979) (Nocturnellia nocturna Community and assemblage with Prantlina, Ferrax and Nereidella) have been recognized by Havlíček (1982). In addition, Ranorthis lipoldi association is proposed here to specify the association lacking common Nocturnellia and large orthids; furthermore, the presence of further small orthide brachiopod association is not excluded in the shallowest parts of the basin.

The first association is characterized by a dominance of Nocturnellia nocturna Community (in Havlíček 1982); additional orthids are always less common (Nereidella pribyli, Nocturnellia bachori, Poramborthis sp., Prantlina bohemica, P. desiderata, and Ranorthis lipoldi). Another fauna consists of sponge spicules, inarticulate brachiopods (Ephippelasma), ostracods, rare gastropods (Mimospira, Modestospira), bryozoans and trilobites (Placoparia, Pricyclopyge). This association is restricted to rehashed tuffs in the upper part of the Klabava Formation, and is widespread along northwestern limb of the basin; rarely, this association was ascertained in the Komárov volcanic area (Křišťenice). Fine fragmentation of shells, sorting, and common presence of characteristic trace fossils (e.g. Bergaueria) are typical of this association.

The second association is dominated by Nereidella pribyli and Ferrax ooliticus, the species Prantlina bohemica, P. desiderata and Styxorthis tuffogena are less common. Abundant sponge spicules and rare inarticulate branchiopods, gastropods (Mimospira) and trilobites (Ectillaenus, Pliomerops) appear in this association. The Nereidella – Ferrax assemblage is restricted to coarse pyroclastic rocks (tuffs, tuffites) in upper part of the Klabava Formation in the small area near Komárov. Brachiopod valves are not usually damaged and closed shells are rather common (about 15% of Nereidella pribyli shells), although they occur in very coarse material.

The third association is dominated by Ranorthis lipoldi; other orthids are less common (Nocturnellia nocturna, Nereidella pribyli) or rare (Nocturnellia bachori, Poramborthis sp. and Protohesperonomia sp.), and their percentage varies in particular localities. This association in known from several localities in marginal parts of the Komárov volcanic area and from small area near Ejpovice, in both places at the top of the Klabava Formation. This association is accompanied locally by abundant and diversified fauna of inarticulate brachiopods, bryozoans, sponges, gastropods (Mimospira, Modestospira), ostracods and trilobites (Asaphellus, Ectillaenus, Pricyclopyge);

All these three brachiopod associations are of shallow water origin in intertidal to shallow subtidal environment (Havlíček 1982). The deeper Rafanoglossa Community (Havlíček 1982) bears only rare minute shells of Hesperorthis sp., although other benthic groups (inarticulate brachiopods, sponges, gastropods, trilobites) are common.
Orthacea Woodward, 1852
Hesperonomiidae Ulrich – Cooper, 1936
Protohesperonomia Williams – Curry, 1985
Protohesperonomia sp.

Material: 7 valves

Description: Shell minute, 5 mm wide in adults, semicircular. Pedicle valve nearly flat with weakly convex umbal region, brachial valve flat to nearly resupinate (material is deformed). Hinge line forms maximum width of the valve; cardinal extremities angular. Ornamentation of valves unequally parvicostellate, by ribs originating at umbo segregated into several (7 to 9) sectors; each sector bears 4–5 finer ribs. Ribs rounded, separated by flat, wide interspaces. Antero-medianly, there are 9–11 ribs 2 mm.

Remarks: The Czech species recalls by the gross morphology and ornamentation pattern genus Protohesperonomia Williams – Curry from the upper Arenig of Ireland (Williams-Curry 1985). Irish species P. resupinata differs from the Czech species by a larger number of secondary ribs, but lack of information about interiors makes comparison and generic assignment tentative.

Occurrence: Klabava Formation, the top of formation. Locality: Ejpovice, quarry, the lens of hematite iron ore 1.5 m below KSFB (rare).

Poramborthidae Havlíček, 1951
Poramborthis Havlíček, 1949
Poramborthis sp.

Material: Two valves, many fragments.

Remarks: There are two poorly preserved valves and many fragments of thin-shelled valves, maximally 10–15 mm wide adults. The ornamentation consists of wide capillae with flat crests of uniform size, new capillae originate by dichotomy. Capillae are separated by fine radial grooves. Bottom of radial grooves is crossed by fine concentric fila, but capillae are smooth. There are 17–19 capillae per 2 mm in the largest specimens. Ornamentation pattern is nearly identical with ornamentation of Poramborthis grimmi (Barrande) from the Bohemian lower Tremadoc (Havlíček 1977) but closer comparison is impossible. Poramborthis sp. is the youngest member of the genus known; the majority of Poramborthis-species are early-late Tremadoc in age (Havlíček 1977, Havlíček - Josopait 1972).

Occurrence: Klabava Formation, upper part of formation. Localities: Ejpovice, quarry (several places 5–1.5 m below KSFB) (rare); Rač, old dumps at N foot of the hill, rewashed tuffs (rare); Osek, old dump W of the village, rewashed tuffs (rare); Klabava, gallery Kristiánka, rewashed tuffs (rare); Strašice, section along road to Těně, rewashed tuffs (rare).
Ranorthidae Havlíček, 1949
Ranorthis Řípik, 1939
Ranorthis lipoldi Havlíček, 1949
Pl. I, figs. 1–5

1949 Ranorthis lipoldi n. sp.; Havlíček, p. 253, pl. 2, figs. 2, 4.
1977 Ranorthis lipoldi Havlíček, 1949; Havlíček, p. 55, pl. 9, figs. 5–8.

Description: Havlíček (1977).
Occurrence: Klabava Formation, upper part of formation. Localities: in addition to Havlíček (1977), Ejpovice, quarry (several places 5–1.5 mm below KSFB), rewashed tuffs (common to rare); Mýto, section near Štěpánský pond, tuffs with carbonate cement (abundant); Milina hill, old dumps of Josef mine, reddish tuffitic shale (abundant); Strašice, section along road to Těně (1.5 m below KSFB), rewashed tuffs (abundant); Neřežín, old dump of Zuzana mine (note of C. Klouček in his diary in 1921).

Orthidae Woodward, 1852
Productorthinae Schuchert - Cooper, 1931

Prantlina Havlíček, 1949

Remarks: Diagnostic features of Prantlina are subparallel ventral vascula media and orthoid type, ridge-like cardinal process (Havlíček, 1977). This type of vascula media is well developed in Prantlina desiderata (type species) but Prantlina bohemica has vascula media X-shaped, reminiscent of vascula media of Panderina. The shape of cardinal process and definition of ventral muscle field are the best features distinguishing the two genera.

Prantlina desiderata (Barrande, 1848)
Pl. III, figs. 1–9; text-fig. 1a

1848 Orthis desiderata Barr.; Barrande, p. 59, pl. 18, fig. 6.
1879 Orthis desiderata Barr.; Barrande, pl. 61, case VIII, figs. 1–3, 6, 7.
1949 Prantlina desiderata (Barrande, 1848); Havlíček, p. 251, pl. 1, figs. 1–6.

1. Shapes of vascula media in pedicle valve interiors of Prantlina desiderata (Barrande, 1848) (a) and Prantlina bohemica (Barrande, 1879) (b)
1951 *Prantlina desiderata* (Barrande, 1848); Havlíček, p. 58, pl. 3, figs. 2, 3, 5.
1977 *Prantlina desiderata* (Barrande, 1848); Havlíček, p. 63, pl. 8, figs. 1–5, 9, 10, pl. 9, fig. 4.

**Description:** Havlíček (1977).

**Occurrence:** Klabava Formation, upper part of formation. Localities: in addition to Havlíček (1977), Rač, old dumps at N foot of the hill, rewasher tuffs (abundant).

*Prantlina bohemica* (Barrande, 1879)
Pl. IV, figs. 1–8; text-fig. 1b
1879 *Orthis bohemica* Barrande; pl. 61, case IV.
1949 *Prantlina bohemica* (Barrande, 1879); Havlíček, p. 252.
1977 *Prantlina bohemica* (Barrande, 1879); Havlíček, p. 65, pl. 8, figs. 6–8.

**Material:** 4 pedicle and 4 brachial valves.

**Description:** Shell large, plano-convex, in adults 22–23 mm wide. Pedicle valve moderately convex, subcarinate, 86 % as long as wide, widest at hinge line; front margin evenly rounded. Cardinal extremities flattened, nearly rectangular in adults but angular in small specimens. Ventral interarea narrowly triangular, almost orthocline, with coarse growth lines. Delthyrium open, with edges subtending 80° angle.

Brachial valve flat, without fold or sulcus, about 80 % as long as wide. Dorsal interarea anacrine, forming short strip along posterior margin of valve. Notothyrium open.

Ornamentation of coarse costae, angular, separated by wide U-shaped interspaces. New costae originate by lateral branching and are always finer than primary costae. Small specimens up to 9 mm of length bear only primary costae, 12–14 in number. There are 5–6 costae per 5 mm anteromedianly in large specimens (both primary and secondary costae). Growth lamellae coarse, one or two in large valves, the first lamella appears in 8–10 mm long specimens. Growth lines form fine rugellae, better discernible at bottoms of interspaces and slopes of costae.

Pedicle valve interior with short, stout dental plates, limiting sides of deeply impressed, transversely concave muscle field. Muscle field subrhomboidal in outline, with rounded front margin. Posterior part of muscle field defined by thick, striated pedicle callist. Diductor impression narrower than weakly widening large adductor scars. Teeth large, ponderous. Vascula media convergent to midline in their posterior part, near midline curved and widely diverging anteriorly. Interior bears coarse, subangular ribs.

Brachial valve interior with simple, ridge-like cardinal process, which rests on a short, transverse, raised notothyrial platform. Brachiophores short, ridge-like, diverging anteriorly at 90° angle. Notothyrial platform anteriorly extends into low, short median ridge. Muscle impression weak, consisting of two pairs of adductor scars; anterior pair is about twice as large as posterior pair. Pallial markings unknown.
Comparison: *Prantlina desiderata* differs from *P. bohemica* by subparallel ventral vascular media, by wider ventral muscle field, finer internal ribbing and more numerous growth lamellae. Coarse external ribbing of *P. bohemica* is similar to the most extreme coarse-ornamented specimens of *P. desiderata*, for this reason the ornamentation is not a good feature for distinguishing these two species.

Occurrence: Klabava Formation, upper part of formation. Localities: in addition to Havlíček (1977), Rač, old dumps at N foot of the hill, re-washed tuffs (rare).

**Ferrax Havlíček, 1975**

Remarks: In the diagnosis of *Ferrax*, Havlíček (1975) suggested the notothyrium to be open and nearly infilled by posterior face of cardinal process. However, the new material shows large, highly convex triangular chilidium completely covering notothyrium (pl. 2, figs. 11, 12). In addition, the presumed trilobate cardinal process (Havliček 1975, 1977) is an artifact of poor preservation; cardinal process is simple, with posteroventrally sloping striated myophore. Outer surface of chilidium bears coarse growth lines laterally passing into growth lines in interarea.

**Ferrax ooliticus** (Havliček, 1949)

Pl. II, figs. 1–12; text-figs. 2, 3.

1879 *Orthis desiderata* Barr.; Barrande (partim); pl. 61, case VIII, figs. 4, 5.
1949 *Prantlina oolitica* n. sp.; Havlíček, p. 251, pl. 1, fig. 3.
1975 *Ferrax ooliticus* (Havl.); Havlíček, pl. 1, figs. 11–13.
1977 *Ferrax ooliticus* (Havliček, 1949); Havlíček, p. 88, pl. 8, figs. 11–14.

![Brachial valve interior of Ferrax ooliticus (Havliček, 1949)](image)

Description: Havlíček (1977).

Remarks: Growth changes are well marked in adult valves 13–15 mm wide. Young and medium sized valves are flat, but the large ones become gently convex owing to a set of imbricatated growth lamellae along valve periphery. The total number of growth lamellae is nearly constant in adults. There are 8 to 10 lamellae, of which 6 to 7 are crowded anteriorly. The number of growth lines on interarea is consistent with the number of growth lamellae.

Occurrence: Klabava Formation, upper part of formation. Localities: in
addition to Havlíček (1977), Komárov, section along Jalový creek, tuffs with carbonate cement (rare).

**Stylothyris** gen. n.

**Type species**: *Stylothyris tuffogena* sp. n.


**Comparison**: Externally similar *Ferrax* differs from *Stylothyris* by rectimarginate commissure, flat brachial valve, large chilidium and simple cardinal process. In addition, *Ferrax* lacks short ears in cardinal extremities, which are developed in *Stylothyris*. *Panderina* differs from *Stylothyris* by ponderous cardinal process and by X-shaped ventral vascula media.

*Stylothyris tuffogena* sp. n.

Pl. I, figs. 7–16, text-figs. 3, 4

**Holotype**: Brachial valve figured on pl. 1, fig. 14, deposited in collections of District Museum of Dr. B. Horák in Rokycany (OMR 23414).

**Type horizon**: Arenig, Klába Formation, upper part.

**Type locality**: Komárov, old dumps of abandoned mine "Hlava", diabase tuff.

**Material**: One complete shell, 8 pedicle and 4 brachial valves.

**Description**: Shell large, 13–14 mm wide in adults, plano-convex with sulcate anterior commissure.

Pedicle valve subcircular in outline, 83–88% as long as wide, widest at midlength, with evenly rounded lateral and anterior margins. Valve subcarinate, with hinge line 80–90% as wide as valve. Cardinal extremities nearly rectangular with minute ears. Ventral interarea short, well-developed, apsacline to almost orthocl ine, with coarse transverse strati ng, in lateral profile weakly concave. Delthyrium open, widely triangular, with edges forming 90° angle.

Brachial valve subquadrat e in outline, 79–82% as long as wide, with evenly rounded anterior margin, slightly shorter than pedicle valve. Shallow sulcus origi-
mates near umbo, widening and deepening anteriorly. Dorsal interarea very short, anacline, transversely striated; notothyrium open.

Ornamentation of coarse, high, angular costae separated by deep, wide, V-shaped interspaces. Secondary costae finer than primaries, branching both from inner and outer sides if primaries. Growth concentric lamellae coarse, crowded anteriorly, 6–8 in number. There are 6–7 costae per 5 mm anteromedianly in adult shells.

Pedicle valve interior with large teeth, supported by short dental plates continuing anteriorly as low ridges converging anteriorly to midline. Ventral muscle field roundedly triangular, about 25% as long and 20% as wide as valve. Diductor scars widely triangular, flanked by narrower and longer adductor scars. Sides of delthyrial chamber bear short, subtriangular scars probably corresponding to adjustor muscles. Vascula media widely divergent, extending from anterior points of adductor scars.

Brachial valve interior with trilobate high cardinal process; median lobe ridgelike, lateral lobes fine. Notothyrial platform short, high, laterally passing into short and stout brachiophores. Dental sockets narrow, deep, diverging anteriorly at 110–120° angle. Notothyrial platform anteriorly expands into low, coarse median ridge, at midlength of valve decreasing in size and continuing as a low elevation to the front margin. Adductor muscle scars large, subrectangular in outline, adjacent to
posterior part of median ridge; anterior pair is larger than posterior one. Pallial markings obscure, composed of two radially arranged vascula media. Interiors of both valves bear fine crenulation along lateral and anterior margins; internal ribbing obscure.

**Occurrence**: Klabava Formation, upper part of formation. Localities: type locality only (rare).

*Dolerorthidae* Öpik, 1934

*Hesperorthinae* Schuchert - Cooper, 1931

*Hesperorthis* Schuchert - Cooper, 1931

*? Hesperorthis* sp.

Pl. IV, figs. 9, 10

**Material**: 20 valves, mostly deformed.

**Remarks**: There are valves which in general aspect recall *Hesperorthis*. They are of minute size, 4 mm wide, with obtuse cardinal angle and semicircular outline. Pedicle valve with very high, apsacline to almost orthocline interarea, brachial valve nearly flat, with narrow anacrine interarea. Ornamentation of coarse, simple rounded ribs, originating at umbo in pedicle valve, axial rib of brachial valve does not originate at umbo. There are 20 ribs on pedicle valve and 21 on brachial valve.

**Occurrence**: Klabava Formation, Tetragraptus cf. bigsbyi Zone, Locality: Klabava, “Starý hrad” locality, clayey shale (rare).

*Dalmanellacea* Schuchert, 1913

*Paurorthidae* Öpik, 1933

*Nereidella* Wang, 1955

*Nereidella pribyli* (Havlíček, 1949)

Pl. V, figs. 6–18

1949 *Archaeorthis pribyli* n. sp.; Havlíček, p. 258, pl. 2, fig. 1.

1977 *Archaeorthis pribyli* Havlíček, 1949; Havlíček, p. 60, pl. 9, figs. 1–3.

1977 *Nereidella* sp.; Havlíček, p. 111, pl. 9, fig. 9.

**Material**: 50 pedicle and 40 brachial valves.

**Description**: Shell subequally biconvex, 10–11 mm wide in adults.

Pedicle valve subcircular in outline, 89–95% as long as wide, with more transverse outline in small specimens. Valve strongly and evenly convex in both profiles, widest at midlength or slightly posteriorly to it; hinge line about 81–88% of the width. Cardinal extremities nearly rectangular. Ventral interarea high, apsacline, weakly concave in lateral profile, with large, wide, open delthyrium. Surface of interarea bears coarse transverse striating.

Brachial valve nearly circular, slightly less convex than pedicle valve, 87–92% as long as wide, without fold or sulcus. Dorsal interarea low, anacline, transversely striated, with large open notothyrium.
Ornamentation of fine, narrow and high subangular costellae, new costellae originate by lateral branching, less common by dichotomy. Costellae slightly increase in size anteriorly. There are 6–7 costellae per 2 mm anteromedianly at adult valves. Growth lamellae coarse, of uniform size, more crowded anteriorly than posteriorly, 8–10 in number in adult shells. Crests of costellae are in regular intervals penetrated by large exopunctae (pl. 5, fig. 18).

Pedicle valve interior: Ventral muscle field restricted to the delthyrial cavity. Shape of muscle field varies with size of shell; small valves have short, widely triangular muscle field, large valves have long, narrow muscle field, about twice as long as wide, with weakly diverging flanks. Surface and sides of muscle field bear coarse transverse striating, in median sector incurved anteriorly. Adductor impression narrow, as wide as each diductor scar. Teeth large, thick, supported by short and stout dental plates. Median ridge low, disappearing at anterior third of valve, laterally flanked by wide, anteriorly weakly divergent vascula media.

Brachial valve interior: Notothyrial chamber deep, narrow, triangular, without cardinal process. Diductor scars transversely striated, separated from each other by fine myophragm. Brachiphores high, thick, projecting anteroventrally, with their ventral edges forming 90° angle. Sockets large, deep, widely divergent. Median ridge extends from the callosity in front of notothyrial chamber. Ridge is low and disappears at midlength of valve. Adductor scars large, deeply impressed; anterior scars larger than posterior ones, separated from each other by fine, posteriorly converging ridge. Anterior scars suboval in outline, with striated surface.

Marginal crenulations of both valves fine, restricted to the narrow perimarginal brim. Surface of internal moulds commonly bears radial rows of exopunctae infillings, which gently increase in size anteriorly.

Comparison: Nereidella resima (Rubel, 1961) from Estonia and Leningrad area, N. subcarinata (Laurie, 1980) from Tasmania and N. sinuata Wang, 1955, all of Arenig age, differ from N. pribyli by sulcate brachial valves. N. typa Wang, 1955 differs from N. pribyli by coarser ornamentation and maximum shell width anteriorly to midlength.

Occurrence: Klabava Formation, upper part of formation. Localities: in addition to Havlíček (1977), old dumps of abandoned mine "Hlava" near Komárov, diabase tuffs (abundant); Milina hill, old dumps of Josef mine (rare); Strašice, section along road to Těně (1.5 m below KSFB), rewashed tuffs (rare); Rač, old dumps at N foot of the hill, rewashed tuffs (rare); Ejpovice, quarry, the lens of hematite iron ore 1.5 m below KSFB (abundant).

Enteletacea Wagen, 1884
Draboviidae Havlíček, 1951
Nocturnellia Havlíček, 1951
Nocturnellia nocturna (Barrande, 1879)

Pl. VI, figs. 2–12

1879 Orthis nocturna Barr.; Barrande, pl. 152, case IV, fig. 4.
1951  *Nocturnella nocturna* (Barrande, 1879); Havliček, p. 54, pl. 11, figs. 14, 15.
1977  *Nocturnella nocturna* (Barrande, 1879); Havliček, p. 237, pl. 9, figs. 10–12, 16–18.

**Description:** Havliček (1977).

**Occurrence:** Klabava Formation, upper part of formation. Localities: in addition to Havliček (1977), Klešťenice, old dump above Jřový creek, reddish tuffitic shales (abundant).

*Nocturnella bachori* Havliček, 1977

Pl. I, fig. 6

1977  *Nocturnella bachori* sp. n.; Havliček, p. 239, pl. 9, figs. 13–15.

**Description:** Havliček (1977).

**Occurrence:** Klabava Formation, upper part of formation. Localities: in addition to Havliček (1977), Ejpovice, quarry, the lens of hematite iron ore 1.5 m below KSFB (rare).

*Translated by the author*

**References**


(1951): The Ordovician Brachiopoda from Bohemia. – Rozpr. Ústř. Úst. geol., 13, Praha.


Orthidni brachiopodi areníského stáří (spodní ordovik) z pražské páne, Čechy

Orthidní brachiopodová fauna klabavského souvrství (arenig) zahrnuje 9 rodů a 11 druhů, z nichž nejzajímavější je zjištění nových rodů pro Čechy (Protohesperonomia, ?Hesperorthis) a nového rodu Styxorthis s typickým druhem S. tufogena. V orthidní brachiopodové fauně je možno vyčlenit 3 asociace lišící se vzájemným zastoupením druhů. V první asociaci prevládá druh Nocturnella nocturna, ve druhé druhy Nereidella pribyli a Ferrax ooliticus, pro třetí asociaci je typická dominance druhu Ranorthis lipoldi, vzácněji se v jednotlivých asociacích vyskytují i další druhy. Všechny tři brachiopodové asociace osidlovaly mělkovodní prostředí a jsou výskytem vázány na vyšší polohy klabavského souvrství.

Explanation of plates

Plate I
1–5 – Ranorthis lipoldi Havlíček, 1949
1, 4 – pedicle valves, internal moulds, OMR 23402, OMR 23405, x8; 2 – pedicle valve, latex cast, OMR 23403, x8; 3 – brachial valve, latex cast, OMR 23404, x8; 5– brachial valve, internal mould, OMR 23406, x8.
6 – Nocturnella bachori Havlíček, 1977
6 – brachial valve, internal mould, OMR 23407, x7.
7–16 – Styxorthis tufogena sp. n.
7–9, 13 – pedicle valves, internal moulds, OMR 23408, OMR 23409, OMR 23410, OMR 23413, all x3; 10–12 – complete shell, latex cast, OMR 23411, x3; 14 – brachial valve, holotype, internal mould, OMR 23414, x3; 15, 16 – brachial valve, internal mould and latex cast, OMR 23412, x3.

Plate II
1–12 – Ferrax ooliticus (Havlíček, 1949)
1 – pedicle valve of young specimen, internal mould, OMR 23432, x3; 2, 3 – pedicle valve, internal mould and latex cast, OMR 23433, x3, x3; 4, 7 – pedicle valves, internal moulds, OMR 23434, OMR 23437, x3, x3; 5 – exterior of pedicle valve, OMR 23435, x3; 6 – exterior of brachial valve, OMR 23436, x3; 8, 9 – brachial valves, latex cast and internal mould, OMR 23438, OMR 23439, x3, x3; 10, 11 – brachial valve, internal mould, OMR 23440, x3, x7; 12 – posterior view to complete shell showing chilidium, latex cast, OMR 23441, x5.

Plate III
1–9 – Prantlina desiderata (Barrande, 1848)
1, 2 – external moulds of pedicle and brachial valves, VH 1028, VH 1029, x2.5, x2.5; 3 – latex cast of brachial valve, OMR 23460, x3; 5–8 – brachial valves, internal moulds, NM-L 28903, VH 1032a, VH 741b, VH 1030, all x2.5; 4 – pedicle valve exterior, NM-L 28902, x2.5; 9 – pedicle valve, internal mould, NM-L 36675, x2.5.

Plate IV
1–8 – Prantlina bohemia (Barrande, 1879)
1–3 – brachial valve, internal and external moulds, latex cast, OMR 23409, all x2.5; 4 – brachial valve, internal mould, VH 743b, x2.5; 5, 6 – pedicle valves, internal mould and latex cast of exterior, OMR 23453, OMR 23452, x2.5, x2.5; 7, 8 – pedicle valve, internal mould and latex cast, OMR 23454, x2.5, x2.5.
9, 10 – ?Hesperorthis sp.
9, 10 – deformed closed shells, latex casts, OMR 23451, all x8.

Plate V
1–4 – Protohesperonomia sp.
1 - 4 - external moulds of brachial valves, OMR 23415, OMR 23416, OMR 23417, OMR 23418, all \times 9.
5 - gen. and sp. indet.
6 - external mould of ? pedicle valve, OMR 23419, \times 9.
6 - 10 - pedicle valves, internal moulds, OMR 23420, OMR 23422, OMR 23421, OMR 23423, OMR 23424, all \times 4.2; 11 - 13 - brachial valves, internal moulds, OMR 23425, OMR 23426, OMR 23427, all \times 4.2; 14 - brachial valve, latex cast, OMR 23428, \times 4.2; 15 - pedicle valve, latex casts of exterior, OMR 23429, \times 4.2; 16, 17 - brachial valve, latex cast of exterior, OMR 23430, \times 4.2; 18 - external mould of brachial valve showing infillings of exopunctae, OMR 23431, \times 4.2.

Plate VI

1 - Poramborthis sp.
1 - exterior showing ornamentation, latex cast, OMR 23445, \times 8.
2 - 6 - pedicle valves, internal moulds, OMR 23442, OMR 23443, OMR 23444, OMR 23447, all \times 8; 7, 8, 10, 12 - brachial valves, internal moulds, OMR 23446, OMR 23449, OMR 23447, OMR 23449, all \times 8; 9 - pedicle valve, latex cast of exterior, OMR 23448, \times 8; 11 - brachial valve, latex cast of exterior, OMR 23450, \times 8.

All photos by the author

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Vydavatelství Ústředního ústavu geologického
Vám nabízí geologické mapy, jejichž rozšířování bylo v minulosti omezeno na služební potřebu

GEOLOGICKÉ MAPY měřítka 1 : 25 000

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For explanation see p. 12

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M. Mergl: Arenig (Lower Ordovician) orthide brachiopods... (Pl. II)
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