SABELLID AND SERPULID WORMS (POLYCHAETA, CANALIPALPATA, SABELLIDA, SABELLLIDAE, SERPULIDAE) FROM THE ROCKY COAST FACIES (LATE CENOMANIAN) AT PŘEDBOJ NEAR PRAGUE

INTRODUCTION

Sabellid and serpulid worms are characteristic elements of the mesofauna of the rocky coast facies sites on the southwestern and southern border of the Bohemian Cretaceous Basin (BCB). During fieldwork between 1960 – 1968 at the classical rocky coast facies locality at Předboj, Dr. O. Nekvasilová collected 214 specimens of sabellid and serpulid worm tubes, some of them consisting of two or more tubes attached to each other. During recent relocation of some parts of the National Museum collections, the material collected by Nekvasilová attracted attention again. Some specimens from this locality had already been briefly mentioned by Ziegler (1984), included in a faunal list by Žítt et al. (1999), and in preliminary reports by Kočí (2012b, c). The fauna consists of 10 genera represented by 16 species, some of them are described in open nomenclature. Two of the species are new: Pyrgopolon (Septenaria) nekvasilovae sp. nov. and Pyrgopolon (Septenaria) zitti sp. nov. All species are described, and their systematics, taxonomy and palaeoecology are discussed.

Abstract. The relatively rich assemblage of tube dwelling polychaetes including sabellid (Sabelldae) and serpulid (Serpulidae) worms (Polychaeta, Canalipalpata) from the classical rocky coast facies locality Předboj (Late Cenomanian – Early Turonian, Vltava-Beroun area, Bohemian Cretaceous Basin) is described in detail for the first time in a single publication. Ten genera: Glomerula, Filogranula, Neovermilia, Cementula, Laqueoserpula, Dorsoserpula, Placostegus, Pyrgopolon, Neomicrorbis, and Bipygmaeus are represented by 16 species, some of them are described in open nomenclature. Two of the species are new: Pyrgopolon (Septenaria) nekvasilovae sp. nov. and Pyrgopolon (Septenaria) zitti sp. nov. All species are described, and their systematics, taxonomy and palaeoecology are discussed.

Annelida, Polychaeta, Sabelllidae, taxonomiy, palaeoecology, Late Cretaceous, Bohemian Cretaceous Basin.

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INTRODUCTION

Sabellid and serpulid worms are characteristic elements of the mesofauna of the rocky coast facies sites on the southwestern and southern border of the Bohemian Cretaceous Basin (BCB). During fieldwork between 1960 – 1968 at the classical rocky coast facies locality at Předboj, Dr. O. Nekvasilová collected 214 specimens of sabellid and serpulid worm tubes, some of them consisting of two or more tubes attached to each other. During recent relocation of some parts of the National Museum collections, the material collected by Nekvasilová attracted attention again. Some specimens from this locality had already been briefly mentioned by Ziegler (1984), included in a faunal list by Žítt et al. (1999), and in preliminary reports by Kočí (2012b, c). The fauna consists of 10 genera represented by 16 species, some of them are described in open nomenclature. Two of the species are new: Pyrgopolon (Septenaria) nekvasilovae sp. nov. and Pyrgopolon (Septenaria) zitti sp. nov. The sabellid and serpulid worm tubes from the rocky coast facies deposits of the BCB were studied recently by Jäger and Kočí (2007), Kočí (2007a, b, 2009a, b, 2010, 2011, 2012a, b, c), and those from hemipelagic facies deposits of the BCB were studied by Sklenář et al. (2013).

GEOLOGICAL AND GEOGRAPHICAL SETTINGS

In the Předboj area there were several outcrops (see Žítt et al. 1999) showing geological sections and yielding more
or less abundant macrofauna. Text-fig. 1 shows the (palaeo-) geographical situation of the Předboj area within the context of Europe. Text-fig. 2 shows the stratigraphical profile at Předboj (slightly modified after Žítt et al. 1999).

The classical locality at Předboj is named outcrop A. This former quarry had been filled in during the 1960s. It is situated north of Prague, just east of the road from Předboj to Horňátky, circa 300 m NNE from the triangulation point 213 m above sea level. The site forms part of Unhošť-Tursko High (Žítt et al. 1999). Here, boulders and smaller pieces of rock broken down from a massive cliff of Late Proterozoic High (Žítt et al. 1999). To Horňátky, circa 300 m NNE from the triangulation point situated north of Prague, just east of the road from Předboj to Horňátky, circa 300 m NNE from the triangulation point.

History of palaeontological research at Předboj


In his monograph on sabbellid and serpulid worm tubes from rocky coast facies localities of the BCB, Ziegler (1984) presented photographs of the following species from the Early Turonian of Předboj; here we include their names as published by Ziegler (1984) as well as their revised actual names after study of the original specimens in the NM: Martina parva Ziegler, 1984 (specimen NM-O5117) belongs to Dorsoserpula bipartita (Reuss, 1845). The original figured specimen of Pomatoceros triangularis (Münster in Goldfuss, 1831) was not found in the collection, but another specimen was present and belongs to Neovermilia cf.;ampullacea (J. de C. Sowerby, 1829). One of the two figured specimens of Eoaplatystegus dentatus (Brünich Nielsen, 1931), specimen NM-O5388 figured on Pl. 5, Fig. 7, is from Předboj, although this locality is not mentioned in the locality list of this species, the specimen belongs to Platystegus zbylavanus (Ziegler, 1984). All these revised species are also described in the present paper.

Moreover, Ziegler listed the following species as occurring in the Early Turonian at Předboj, but the figured specimens of these species were found at other localities, so the correctness of the determination of the non-figured specimens from Předboj can not be confirmed by study of the figured specimens only: Glomerula gordialis (von Schlotheim, 1820), Glomerula solitaria Regenhardt, 1961 and Serpula prolifera Goldfuss, 1831 belong to Glomerula serpentina (Goldfuss, 1831), Glomerula scitula Regenhardt, 1961 and Spiraserpula subinvoluta (Reuss, 1844) belong to Glomerula lombricus (DeFranza, 1827). Sarcinella plicus (J. de C. Sowerby, 1829) belongs to Filograna socialis (Goldfuss, 1831). Serpula antiquata [sic!] J. de C. Sowerby, 1829 and Proliserpula ampullacea (J. de C. Sowerby, 1829) belong to Neovermilia cf. ampullacea (J. de C. Sowerby, 1829). The two figured specimens of Spiraserpula spirographis (Goldfuss, 1831) belong to Glomerula serpentina (Goldfuss, 1831) and Laqueoserpula russii (Weinzelleti, 1910), respectively. The figured specimen (NM-O5382) of Pomatoceros biplicatus (Reuss, 1844) is not a serpulid at all, but an octocoral. Hamulus hexagonus (Roemer, 1841) is not figured and can not be judged without studying the original specimen. Spirorbis asper (van Hagenow, 1840) belongs to Dorsoserpula bipartita (Reuss, 1845). Spirorbis margarita Ziegler, 1984 and Spirorbis milada Ziegler, 1984 belong to Neomicrorbis crenatostriatus subrogusosus (Münster in Goldfuss, 1831). From these revised species, all except Glomerula lombricus, Filograna socialis and Pygropolon (Hamulus) hexagonus, which we did not see in the Nekvasilová collection from Předboj, are also described in the present paper.

A preliminary brief report of sabbellid and serpulid worms from Předboj was published recently by Kočí (2012b, c).

Material and methods

The studied and described material was collected by Dr. Olga Nekvasilová during field work between 1960 – 1968. All this material is deposited in the collections of the National Museum in Prague. The specimens were studied under a binocular microscope (20x–40x, Bresser) and photographed with a Canon EOS 550D and some of them by use of the high-speed photography setting on an Olympus DP70. Plates were prepared using Corel Graphic Suite X4. The figured specimens are kept in the collection of the National Museum at Prague, numbered NM-O7544 – O7573.

Systematic palaeontology


Class Polychaeta GRUBE, 1850

Infraorder Canalipalpata ROUSE et FAUCHALD, 1997

Order Sabellida FAUCHALD, 1977

Family Sabellidae LATREILLE, 1825

Subfamily Sabellinae CHAMBERLIN, 1919

Glomerula BRÜNNICH NIelsen, 1931

Glomerula serpentina (Goldfuss, 1831)

Pl. 1, Fig. 1

1831 Serpula gordialis SCHLOTHEIM Variety serpentina – Goldfuss, p. 240, pl. 71, fig. 4.
1840 Serpula implicata nob. – von Hagenow, p. 668, pl. 9, fig. 17.
1846 Serpula serpentina Goldfuss – Reuss, p. 106, pl. 42, fig. 22.
1911a Serpula gordialis, var. serpentina – Frič: p. 72, fig. 304.
1911b Serpula gordialis, var. serpentina – Frič, p. 72, fig. 304.
1961 Glomerula solitaria n. sp. – Regenhardt: p. 28, pl. 9, fig. 11.
1961 Protula rasilis n. sp. – Regenhardt, p. 33, pl. 1, fig. 7.
1961 Omasaria omnivaga n. sp. – Regenhardt, p. 45–46, pl. 5, fig. 7.
1984 Glomerula gordialis (Schlotheim, 1820) – Ziegler, p. 215–216, pl. 1, fig. 3–5.
2005 Glomerula serpentina (Goldfuss, 1831) – Jäger, p. 130, pl. 1, fig. 1.
2012a Glomerula serpentina (Goldfuss) – Kočí, p. 8–9, pl. 1, fig. 1.
2012b Glomerula serpentina (Goldfuss) – Kočí, p. 120–122, fig. 1A.
2014 Glomerula serpentina Münster in Goldfuss [sic!] – Jäger, p. 60, fig. 1d.

Material: 40 planispiral specimens, 8 specimens forming glomerulate knots, 74 tube fragments.

Substrate: One small tube is attached to a valve of the oyster Amphidonte (Amphidonte) reticulatum (Reuss, 1846), another specimen to an Ostrea sp., and a third one to a pectinid valve.

Description. The tube is coiled to form either glomerulate knots or planispirals. The surface of the tube is smooth without any ornamentation. The tube diameter ranges from 1 to 2.7 mm, usually from 1.3 to 2.2 mm, and in most specimens it measures circa 2 mm. The cross-section of the tube as well as the cross-section of the lumen is circular.

Remarks and relationships. The genus Glomerula ranges from at least the Hettangian to the Recent, and it is common and geographically widespread from the Late Triassic to the Recent, ranging from at least the Hettangian to the Recent, Glomerula

and usually solitary G. serpentina is the most common. Clusters composed of dozens or even more than a hundred Glomerula tubes occurring mainly in the Santonian and Campanian of South Sweden, North Germany, and England (type area) may be separated taxonomically and determined as G. plexus (J. de C. Sowerby, 1829). Only in fine-grained offshore facies it has proven useful to separate specimens with a small tube diameter as Glomerula lombriacus (Defrance, 1827).

Family Serpulidae Rafinesque, 1815

Filogranula Langerhans, 1884

Filogranula cincta (Goldfuss, 1831)

Pl. 1, Fig. 6

1831 Filogranula cincta nobis – Goldfuss, p. 237, pl. 70, fig. 9a–c.
1893 Filogranula cincta (Goldfuss, 1831) – Jäger, p. 68–71, pl. 8, fig. 8–13.
1996 Filogranula cincta (Goldfuss, 1831) – Radwańska, p. 71, pl. 8, fig. 1–6.
2007b Filogranula cincta (Goldfuss, 1831) – Kočí, p. 112–113, fig. 1–2.
2011 Filogranula cincta (Goldfuss, 1831) – Jäger, p. 686, pl. 4, fig. 1.
2012b Filogranula cincta (Goldfuss) – Kočí, p. 122, fig. 1F.

Material: One specimen.

Substrate: No substrate is preserved.

Description. The tube is 7 mm long. The tube diameter is 1.8 mm at the posterior trapezoidal cross-section and 1.2 mm at the aperture. The upper side of the tube bears three cocks’ comb-like longitudinal ridges. The lumen is circular.

Remarks and relationships. Filogranula cincta resembles three Late Cretaceous species: Vermiliopsis fluctuata (J. de C. Sowerby, 1829), Metavermilia (Vepreculina) fimbriata Regenhardt, 1961 and Serpula? trilineata Roemer, 1841. Vermiliopsis fluctuata has an extra two longitudinal ridges and is heptangular in cross-section, its aperture does not show any strong tendency to grow upwards. The latter is also true for Serpula? trilineata which erroneously was affiliated to the genus Janita Saint-Joseph, 1894 by Jäger (1983). Moreover, Serpula? trilineata has weaker longitudinal ridges and delicate transverse ornamentation. Metavermilia (Vepreculina) fimbriata, of which only the free tube portion is known, has a smaller tube diameter of only 0.7–1.0 mm, and a variable number of often granulose longitudinal ridges which occur all around the tube.

Like Filogranula cincta, the Recent Crucigera websteri Benedict, 1887 has three irregularly undulating longitudinal keels that may reach 1.4 mm in height. Its tube differs in its circular cross-section, greater width which may reach 5.5 mm including the keels, and by the fact that in juvenile specimens the base of the keels may be perforated. Sometimes there is
a pair of faintly developed longitudinal ridges near the base of
the tube. Terminal flaring peristomes or collar-like rings
have not been observed (ten Hove and Jansen-Jacobs 1984).

According to Lommerzheim (1979) who considered
Filogranula cincta a synonym of Vermiliopsis fluctuata and
combined them under the name Filogranula fluctuata, the
present species lived in an ecologically wide range of marine
shelf environments from the littoral down to a water depth
of circa 200 m. Jäger (1983) confirmed the wide ecological
range of Filogranula cincta. This species was attached to
various kinds of hard substrate (pieces of rock, coral
skeletons, sponges, shells, filiform stems of algae). The
detailed palaeoecological relationships were mentioned by
Kočí (2007b). According to Zibrowius (1968), Recent
representatives of the genus Filogranula live in the
Mediterranean Sea and northeastern Atlantic at depths of
15–1780 metres, preferring deep, calm habitats, even though
some specimens also live in water currents. In the
Mediterranean Sea, Filogranula is also common in
submarine caves in relatively shallow water, even in the
darkest and most remote parts. Other species of Filogranula
live at Brazil and Japan.

Neovermilia Day, 1961

*Neovermilia* cf. *ampullacea* (J. de C. Sowerby, 1829)

Pl. 1, Fig. 2; Pl. 3, Fig. 3; Pl. 4, Fig. 1

2012b *Neovermilia* ex gr. *ampullacea* (Sowerby) –
Kočí, p. 122, fig. 1B.

2014 *Neovermilia* cf. *ampullacea* (Sowerby, 1829) –
Jäger, p. 66, fig. 2c.

**Material:** Three fragments of the anterior tube
portion.

**Substrate:** No substrate is preserved, but vice versa
one of the tubes (Pl. 3, Fig. 3) is encrusted by membranipore
bryozoa.

**Description.** The tube is circular in cross-section
and measures 3–9 mm in diameter. An annular peristome,
characteristic of *Neovermilia* sensu stricto, is present.

**Remarks and relationships.** The genus
*Neovermilia* first occurred in the Late Oxfordian (Radači-
ska, 1996). *Neovermilia* is common in the coarse-grained
rocky coast facies sites in the BCB, e.g. Velim, Kamajka near
Chotusice, Kaňk – Na Vrších, etc. Tube morphology is quite
variable, making a useful discrimination between species
nearly impossible. Some specimens bear a sharp longitudinal
keel, whereas other specimens have no keel but a tube with
a circular cross-section. Many specimens of the genus
*Neovermilia* possess hollow “tubulae” (two small
longitudinal canals near the borders of the tube’s base;
compare e.g. Thomas 1940, Hedley 1958, fig. 9, Jäger 1983,
fig. 2, Vinn and Wilson 2010, fig. 4, Sklenář et al. 2013,
Ippolitov et al. 2014). In the genus *Neovermilia*, the tubulae
are cellular and composed of shorter cells than in the genera
*Spirobranchus Blainville*, 1818 and *Pyrgopolom de
Montfort*, 1808.

Formerly, *Neovermilia* *ampullacea* had been attributed to
the genus *Proliserpula Regenhart*, 1961, but according to
Jäger (2005) *Proliserpula* is a subjective synonym for

*Neovermilia*. The shape and structure of the tube in the
Plio-Pleistocene to Recent species *Neovermilia falcigeria*
(Roule, 1898) (see Zibrowius and ten Hove 1987, fig. 2) is
typically similar to that of the Cretaceous specimens except that
*N. falcigeria* has no keel, weaker transverse ornamentation
and a thick tube wall. However, a strong keel and delicate
transverse ornamentation are present in another Recent

The fossil genus *Propomatoceros Ware*, 1975 is usually
triangular or rounded triangular in cross-section. Although
some specimens of *Neovermilia* are also triangular in
cross-section, this genus is usually more rounded with
tunnel-shaped or circular cross-sections.

Ziegler (1974, 1984) described the present species from
many nearshore localities of the Late Cenomanian to the
Middle Turonian of the BCB, whereas specimens of
*N. ampullacea* sensu stricto from the offshore locality
Úpohlavy were described and discussed by Sklenář et al.
(2013).

Cementula Regenhart, 1961

*Cementula* sp.

Pl. 1, Fig. 11

2012b *Cementula* sp. – Kočí, p. 123, fig. 1L–M.
non 2012b *Cementula* sp. – Kočí, p. 120, fig. 1J–K.

**Material:** Twenty-two complete specimens and 12
fragments.

**Substrate:** This species shows a tendency to form
small clusters composed of several *Cementula* tubes attached
to each other.

**Description.** The tube is slightly depressed, has
a wide basal seam, and forms somewhat irregular, more or
less compact loops and coils, although rarely regular spirals,
using its own anterior tube portions as a substrate. Except for a small and low but distinct median keel and a few alae-shaped peristomes present in some specimens, the surface of the tube is smooth and tends to obscure the boundary lines between the separate whorls by calcareous tube material laid over them. The umbilicus is narrow and often obscured by a filling of sediment. Internal tube structures (“ITS”; Pillai 1993) are absent.

Remarks and relationships. Loops and coils are less regular compared to the regular spirals common in other Late Cretaceous Cementula species, e.g. C. spirographis (Goldfuss, 1831) and C. depressa (Goldfuss, 1831), both from the Middle Cenomanian of Saxony (Jäger 2014); the two last mentioned forming large systems of planar spirals attached to large oyster valves. The spirals of Cementula sphaerica Brünnic Nielsen, 1931 from Middle Santonian to Late Maastrichtian are also more regular, planar or more or less hemispherical in shape, and most of them lack an umbilicus. The Late Campanian and Maastrichtian species of the closely related genus Spiraserpula Regenhardt, 1961 differ by the presence of “ITS” (Pillai 1993).

Fossil representatives of Spiraserpula and Cementula (e.g. Goldfuss 1831, Brünnic Nielsen 1931, Regenhardt 1961, Lommerzheim 1979, Jäger 1983, 2005, Pillai 1993) occur mainly in shallow-water facies including Late Cretaceous sites from rocky coast and coral reefs down to relatively shallow portions of chalk facies circa 200 m deep (Lommerzheim 1979), Danian bryozone limestone facies, and Danian non-zooxanthellate coral facies (Brünnic Nielsen 1931). The 19 Recent species (including one in open nomenclature) of the genus Spiraserpula were described in detail by Pillai and ten Hove (1994) who are also the authors of all Spiraserpula species mentioned below except S. massiliensis (Zibrowius, 1968). Here we provide a compilation of their ecological data: Spiraserpula occurs at various depths and inhabits various substrates, but only a few species can be called deep water species, e.g. S. ypsilon, which lives around the Cape Verde Islands (e.g. Goldfuss 1831, Brünnich Nielsen 1931, Regenhardt 1984, 1986, Lommerzheim 1979). Among tropical coral reef sites inhabited by one or more Spiraserpula species, those situated in the Caribbean and in the Gulf of Mexico are mentioned most frequently, e.g. Bonaire, Curaçao, Florida, and others, but also Indonesia (e.g. Flores Sea) and Australia (New South Wales, Queensland). S. caribensis is widely distributed in the Caribbean and Gulf of Mexico from Florida to Barbuda and Panama; it lives intertidally down to 10 m in the Caribbean and to 18 m in the Eastern Gulf of Mexico. It occurs in a variety of habitats, from rockpools to the undersides of boulders in mangrove glades; it survives well in somewhat muddy, but always cryptic environments between boulders, coral debris, shells or other solid substrates. S. snelli is a reef dweller, often attached to corals, it occurs at depths of 2–30 m, and appears to be the most widely distributed species of the genus: northern Red Sea, Indonesia (Flores Sea), Australia (Great Barrier Reef), and Western Pacific (South Japan to New Caledonia).

**Laqueoserpula Lommerzheim, 1979**

**Laqueoserpula reussi (Weinzettl, 1910)**

Pl. 1, Fig. 7

non 1831 Serpula depressa nobis – Goldfuss, p. 236–237, pl. 70, fig. 6.
1875 Serpula depressa Goldfuss – Geinitz, p. 286, pl. 63, fig. 22.
1910 Burtinella(?) Reussi m. – Weinzettl, p. 23–24, pl. 3, fig. 46, 47, and 51. (NM-O3537, O3538, and O3539)
1979 Laqueoserpula cf. plana n. sp. – Lommerzheim, p. 150.
1984 Spiraserpula spirographis (Goldfuss, 1831) and Mucroserpula arcuata (Münster, 1831) – Ziegler, p. 225, pl. 3, fig. 7. (NM-O3577)
1984 Mucroserpula arcuata (Münster, 1831) – Ziegler, p. 228–229, pl. 4, fig. 3–4. (NM-O3579, O3580)
1984 Mucroserpula mucroserpula Regenhardt, 1961 – Ziegler, p. 229, pl. 4, fig. 5. (NM-O3581)
1984 Eoplagostegus sulcatus (Sowerby, 1829) – Ziegler, p. 235–236, pl. 5, fig. 8. (NM-O5167, not O5389, as erroneously stated by Ziegler (1984, p. 253))
1984 Hepterus septemspinulata (Roemer, 1841) – Ziegler, p. 240–241, pl. 7, fig. 3–4. (NM-O5397)
1984 Hamulus sexsulcatus (Münster, 1831) – Ziegler, p. 240, pl. 7, fig. 5. (NM-O5398)
2006 Serpula cf. rauca Ziegler – Žítt et al., p. 66, fig. 12M.
2012b Laqueoserpula sp. – Kočí, p. 122, fig. 1G.
2014 Laqueoserpula reussi (Weinzettl, 1910) – Jäger, p. 67, fig. 2d1–3.
non 1910 Burtinella (?) Reussi m. – Weinzettl, p. 23–24, pl. 3, fig. 48, 49, and 50.

Material: Three complete specimens, one damaged coil and four fragments.

Substrate: In the figured specimen, a small tube is attached to a larger tube of the same species.
Description. The attached posterior tube portion forms a coil, whereas the free anterior tube portion is elevated and slightly spindle-shaped. In a well preserved specimen which has a spine over the aperture, the attached coil measures 6.4 mm in diameter, and the free anterior portion reaches a tube diameter of 3.9 mm. Longitudinal ornamentation consists of distinct lines on the upper side resembling tiny grooves. Transverse ornamentation consists of strong annular peristomes and distinct V-shaped wrinkles forming a spine over the aperture in one specimen, whereas in two other specimens such a spine is not present. Quadrangular cross-section.

Remarks and relationships. It may be speculated if the one specimen with a spine over the aperture and the two specimens lacking such a spine may belong to two different species, *L. reussi* and *L. plana* LOMMERZHEIM, 1979, respectively. However, the more likely explanation is that the spines may have simply broken off. This alternative explanation is supported by the fact that in a detailed revision of this species from other rocky coast facies localities of the BCB which will be published by Jäger et al. (in prep.), all well preserved apertures usually bear spines. The angular tube morphology bearing spines at the aperture somewhat resembles that of the genus *Placostegus* PHILIPPI, 1844, however, typical representatives of *Placostegus* are smaller and have a translucent tube.

**Dorsoserpula PARSCH, 1956**

*Dorsoserpula bipartita* (REUSS, 1845)

Pl. 1, Fig. 3, 4, 5, 9, 10; Pl. 3, Fig. 2

1845  *Serula bipartita* REUSS – Reuss, p. 19, pl. 13, fig. 95a–b.
1984  *Sarcinella minor* nov. spec. – Ziegler, p. 220–221, pl. 2, fig. 4.
non 1984  *Sarcinella minor* nov. spec. – Ziegler, p. 220–221, pl. 2, fig. 5.
1984  *Martina parva* nov. spec. – Ziegler, p. 227–228, pl. 3, fig. 9.
1984  *Spirorbis asper* (VON HAGENOW), 1840 – Ziegler, p. 242, pl. 7, fig. 6. (NM-O5400)
1984  *Spirorbis subrugosus* (MÜNSTER), 1831 – Ziegler, p. 244, pl. 8, fig. 2. (NM-O5401)
1984  *Spirorbis superminor* nov. sp. – Ziegler, p. 244–245, pl. 8, fig. 3. (NM-O5159)
2007a  *Dorsoserpula gamingensis* (GEINITZ, 1875) – Kočí, p. 109–110, fig. 5.
non 2009a  *Dorsoserpula gamingensis* (GEINITZ, 1875) – Kočí, p. 98, fig. 7.
2009b  *Dorsoserpula gamingensis* (GEINITZ) – Kočí, p. 209, 214, 218–220, fig. 3.
non 2012a  *Dorsoserpula gamingensis* (GEINITZ) – Kočí, p. 10, pl. 1, fig. 6.
2012b  *Dorsoserpula gamingensis* (GEINITZ, 1875) – Kočí, p. 122, fig. 1C, D.
2012b  *Dorsoserpula wegneri* (JÄGER, 1983) – Kočí, p. 122, fig. 1E, I, O.
2012b  *Cementula* sp. – Kočí, p. 120, fig. 1J–K.
non 2012b  *Cementula* sp. – Kočí, p. 123, fig. 1L–M.
2014  *Dorsoserpula bipartita* (REUSS, 1845) – Jäger, p. 70, fig. 2g1–5.

Material: Six complete or nearly complete tubes, one damaged coil, two juvenile tubes and two fragments.

Substrate: Two tubes are attached to oyster valves. Two other tubes are attached to dorsal valves of the brachiopod *Phaseolina phaseolina* (VALENCIENNES in LAMARCK, 1819). Three tubes are attached to, and one of these is coiled around, separate tubes of *Placostegus rigidus*. Another specimen had originally been attached to an unknown substrate which is no longer present, maybe a crinoid stem or a stem of an alga. A small circular tube, maybe the additional tube characteristic for the genus *Dorsoserpula* (“Nebenröhrle”; see Jäger 1983, p. 39), a juvenile serpulid tube or an overgrown stem of an alga, is laterally attached to the anterior portion of this specimen.

Description. Usually the tube is almost planispirally coiled and consists of two to three whorls. However, a few tubes, especially in the posterior tube portion, are nearly straight or curved or low trochospiral. Tube diameter ranges from 0.9 to 2.5 mm, and coil diameter ranges from 2.7 to 5.5 mm. There is a delicate but sharp and distinct keel which may be slightly undulating on top of the tube, respectively at the periphery of the coil, and some of the larger tubes possess two additional but less distinct lateral keels which start only in the posterior part of the coil, but don’t extend to the aperture of the tube. A smaller specimen has only one lateral keel. Apart from the keels, the surfaces of most tubes appear to be relatively smooth, but under the microscope very delicate, almost indistinct transverse wrinkles are visible. In one specimen, transverse ornamentation is curved forward, similar to the letter “V” turned upside down. The cross-section of the tube and the lumen are circular.

Remarks and relationships. Jäger (2005) previously considered *D. gamingensis* (GEINITZ, 1875) a junior subjective synonym of *D. bipartita*, but, however, did not decide if these Late Cenomanian to Early Turonian forms should be synonymized or not with *D. wegneri* (JÄGER, 1983) which is wide-spread mainly in the younger portion of the Late Cretaceous. After studying specimens from the BCB, Jäger (2014) concluded that *D. bipartita* and *D. wegneri* were two closely related but separate species, differing by size (*D. bipartita* remains smaller), by the rarity (but not total absence!) of a keel in subspecies *D. wegneri*wegneri, whereas *D. bipartita* usually (but not in every specimen!) has a keel, and by geological age (*D. wegneri*wegneri is now considered to exist only from the Middle Turonian onwards). Some specimens from Předboj earlier (Kočí 2012b) determined as *Dorsoserpula wegneri* are affiliated to *D. bipartita* here due to their small size, presence of a keel and relatively old geological age.

After a long gap in geological time, keeled forms became common again in the Maastrichtian and were considered by Jäger (2005) to be a separate subspecies, *D. wegneri*...
maastrichtensis JÄGER, 2005, differing from *D. bipartita* mainly by possession of cellular tubulae.

**Placostegus Philippi, 1844**

**Placostegus zbynslavus** (ZIEGLER, 1984)

Pl. 1, Fig. 8

1984  
*Eoplacostegus dentatus* (NIELSEN), 1931 –  
Ziegler, p. 235, pl. 5, figs. 6–7. (NM-O5387 and O5388)

1984  
*Eoplacostegus zbynslavus* nov. spec. – Ziegler, p. 236, pl. 6, fig. 1–2. (NM-O5390)

2009a  
*Placostegus zbynslavus* (Ziegler, 1984) – Kočí, p. 98, fig. 2.

2012a  
*Placostegus zbynslavus* (Ziegler) – Kočí, p. 10, pl. 1, fig. 3.

2012b  
*Placostegus zbynslavus* (Ziegler) – Kočí, p. 122–123, fig. 1H.

**Material:** Two complete specimens with the anterior tube portion preserved and two other specimens with the anterior portion damaged.

**Substrate:** Not preserved.

**Description.** Tube triangular in cross-section. Attached posterior tube portion planispiral, diameter of spiral at base 3.4–3.7 mm. Free anterior tube portion rises steeply above substrate, total height 4–5 mm, tube diameter of anterior portion 1.2–1.7 mm. Attached portion has one keel, free portion has three strong but rounded keels. Transverse ornamentation of attached tube portion consists of fine but distinct wrinkles, free tube portion lacks transverse ornamentation. Lumen circular.

**Remarks and relationships.** Ziegler (1984) described and in part figured several specimens of the present species from different localities. The specimens described as *Eoplacostegus dentatus* (BRÜNICH NIELSEN, 1931) by Ziegler (1984) from Předboj (NM-O5388) and from Kaňk (NM-O5387) belong to *Placostegus zbynslavus*. They correspond with *P. zbynslavus* in the triangular cross-section of the planispiral attached tube portion, and they differ from the specimen from the Danian of Denmark described as "*Eoplacostegus (Caesicius) dentatus* (Nielsen, 1931)" by Regenhardt (1961) which has denticulated longitudinal keels. Specimen number NM-O5388 has many borings produced by unknown marine organisms. Its attached portion is triangular in cross-section, and the free portion is circular. The specimen of *P. zbynslavus* NM-O5390 from Zbyslav no. 51 bears transverse ornamentation and has a triangular cross-section.

In addition to these specimens figured by Ziegler (1984), there are some other specimens belonging to *P. zbynslavus* which were not figured in Ziegler (1984) but, nevertheless, are kept in the collection of his original specimens in the NM Prague. A tube of the present species from Velim-Skalka bears inventory number NM-O5172, the same number had erroneously been mentioned by Ziegler (1984, p. 236) as the number of the holotype of this species, although the figure number 1 is correct (in spite of the wrong plate number, 5 instead of 6) and the correct type locality Zbyslav no. 51 indicate specimen no. NM-O5390 figured on pl. 6, fig. 1 to be the correct holotype. Another unfigured specimen of the present species from Velim has inventory number NM-O5389 which is presumably the correct number, even though Ziegler (1984, p. 253) had erroneously mentioned this number in the figure caption of his so-called "*Eoplacostegus sulcatus* (Sowerby, 1829)" from Velim which represents, however, a fine specimen of *Laqueoserpula reussi* with a rounded quadrangular cross-section and whose correct number, according to the label, is NM-O5167.

**Placostegus rigidus** (Regenhardt, 1961) is rather similar in its triangular tube, but has somewhat sharper longitudinal keels. *Cycloplacostegus pusillus* (J. DE C. Sowerby, 1844) has a circular cross-section, and its surface bears fine granulation.

**Placostegus rigidus** (Regenhardt, 1961)

Pl. 1, Fig. 9, 10; Pl. 3, Fig. 4

1961  
*Eoplacostegus* (*Eoplacostegus*) rigidus n. sp. – Regenhardt, p. 61, pl. 5, fig. 4.

1983  
*Eoplacostegus rigidus* Regenhardt, 1961 –  
Jäger, p. 98–99, pl. 12, fig. 1–3.

2005  

2012b  
*Placostegus* sp. – Kočí, p. 123, fig. 11–K.

**Material:** Six specimens in which at least parts of the attached posterior tube portion as well as the free rising anterior tube portion are preserved, one coil, and 21 specimens of which only the free anterior tube portion is preserved.

**Substrate:** One specimen is attached to an oyster valve *Ostrea* sp., another specimen is attached to a bryozoan stem. Vice versa, three *Placostegus* tubes are used as substrates, each of them by a *Dorosserpula bipartita* tube.

**Description.** The posterior tube portion attached to the substrate is straight or coiled to form a loop, the anterior free tube portion is long and rises steeply. One sharp, sometimes undulating keel is present in the posterior tube portion, three sharp keels in the free tube portion, forming three spines surrounding the aperture of the free tube portion. Between the keels a narrow longitudinal furrow may be present. Apart from the keels and furrows, the surface of the tube appears to be smooth at first sight, but under the microscope very fine distinct transverse corrugations are visible. Cross-section of the tube triangular, subtriangular or, less typical, square.

**Remarks and relationships.** The tube of *Placostegus velimensis* JÄGER et Kočí, 2007 is similar in shape, but the present species has a narrower tube diameter, less developed transverse ornamentation, and most tubes are triangular to subtriangular instead of square in cross-section. The tube of *Placostegus aduncus* (Regenhardt, 1961) is similar, too, but it differs by its often very well developed transverse ribs. Also *Placostegus zbynslavus* differs from the present species by its transverse ornamentation and its possibly more often planispirally coiled attached posterior tube portion.
Placostegus sp.
Pl. 2, Fig. 10

2012c Placostegus sp. – Kočí, p. 126, fig. 1M–N.

Material: Two small specimens of the attached posterior tube portion; neither the posterioriormost part nor aperture are preserved.

Substrate: Both tubes together are attached to one tube of Pyrgopolon (Septenaria) sp.

Description. The tubes are slightly curved or meandering. The diameter increases slowly up to 1 mm. A low narrow but sharp and distinct median keel is present. One of the two tubes has a longitudinal furrow in the lower part of the latera. The transverse ornamentation consists of delicate striae which on the latera are curved forward towards the keel. The tube is subtriangular in cross-section with convex latera especially in the posterior portion. Tubulce can be detected near the damaged area anteriorly though not posteriorly.

Remarks and relationships. Although the small posterior tube portions do not show many special features, comparison with similar posterior and middle portions of more completely preserved unequivocal specimens of the genus Placostegus from Velim and Kaňk makes affiliation also of the present specimens from Předboj to this genus probable. Moreover, it is possible that these specimens are juveniles of one of the other Placostegus species described in the present paper.

Pyrgopolon de Montfort, 1808

Pyrgopolon (Septenaria) cf. tricostata (GOLDFUSS, 1841)

Pl. 2, Fig. 8–9; Pl. 4, Fig. 2

1910 Burtinella (?) Reussi m. – Weinzettl, p. 23–24, pl. 3, fig. 48, 50. (NM-O3536)

1910 Burtinella (?) Reussi m. – Weinzettl, p. 23–24, pl. 3, fig. 46–47, 49, and 51.

1984 Ditrupa tricostata (GOLDFUSS), 1841 – Ziegler, p. 239, pl. 6, fig. 8–9. (NM-O5394–5395)

2009a Pyrgopolon cf. tricostata (GOLDFUSS) – Kočí, p. 98–100, fig. 5–6.

2010 Pyrgopolon (Septenaria) cf. tricostata (GOLDFUSS) – Kočí, p. 124–125, fig. 5–6.

2012a Pyrgopolon (Septenaria) cf. tricostata (GOLDFUSS) – Kočí, p. 10–11, pl. 1, fig. 4a–b.

2012c Pyrgopolon (Septenaria) cf. tricostata (GOLDFUSS, 1831) – Kočí, p. 126, fig. 11–L.

Material: At least four specimens. Two incomplete specimens representing the anterior tube portion with the aperture preserved, one of them with remains of the transitional area between the attached and the free portion.

Substrate: Not preserved. One of the tubes is infested by the symbiont Protulophila gestroi ROVERETO, 1901.

Description. A medium-sized Pyrgopolon. The free tube portion is straight and measures 2.9 mm, respectively 3.4 mm in diameter which stays nearly constant throughout the whole free tube portion. The upper side of the tube bears three strong straight keels of which the median keel is the strongest and highest. In the lower left and right there are two more keels but these are wide and very rounded, in cross-section appearing like lobes. Faint incremental lines protrude slightly on the median keel and cause this keel to protrude a little over the aperture. Apart from the keels and the faint incremental lines, the tube’s surface appears to be relatively smooth. The lumen is circular. The colour is usually brownish.

Remarks and relationships. The tubes from Předboj differ considerably from Pyrgopolon (P. or Triditrupa) tricostata sensu stricto from the Middle Cenomanian of Essen in which the tube diameter increases rapidly in size, it has three wide rounded keels situated at almost equal distances from each other all around the tube, and its circular inner tube wall is visible from the posterior tube fracture. This latter factor is typical for nearly all subgenera of the genus Pyrgopolon except for the subgenus Pyrgopolon (Septenaria) RENGENHARDT, 1961, see Jäger (2005). Thus, the tubes from Předboj may even belong to a different subgenus than tricostata sensu stricto.

Moreover, the tubes from Předboj also differ from tubes from Saxony described by Jäger (2014) as “Pyrgopolon (Septenaria) sp. aff. tricostata” in which the keels, in spite of considerable variation, are more similar to those of tricostata sensu stricto.

Within the BCB, except for its Saxon portion, the tubes from Předboj represent a similar fauna as the tubes described by Kočí (2009a, b, 2010, 2012a) from other rocky coast facies localities (Kaňk, Velim, Nová Ves near Kolin, Chrtníky, Kamajka) which display a wider range of tube diameters. For a more detailed discussion see Kočí (2012a).

The two specimens described and figured by Ziegler (1984) as “Ditrupa tricostata (GOLDFUSS), 1841” may, in spite of some morphological differences, represent the same species as the Předboj tubes. One of these specimens (NM-O5394) possesses a “Favositex structure” at the transition from the attached to the free tube portion; as a consequence at least this specimen belongs to the subgenus Pyrgopolon (Septenaria). Moreover, in the collection of Ziegler’s original specimens kept in the National Museum in Prague, there is another but unfigured specimen of P. cf. tricostata labelled with inventory number NM-O5363 instead of the missing “Ditrupa subtorquata” specimen with the same registration number figured by Ziegler (1984, pl. 6, fig. 7).

Pyrgopolon (Septenaria) nekvasilovae sp. nov.

Pl. 2, Fig. 5–7

2012c Pyrgopolon (Septenaria) sp. 1 – Kočí, p. 126, fig. 1E–H.

Diagnosis: A medium-sized species of the subgenus Pyrgopolon (Septenaria). Attached tube portion bears five distinct keels of which the median keel is very strong and undulating, whereas the other four keels are weaker and straight. Free tube portion bears seven moderately to weakly developed keels giving the tube a near-circular subheptagonal cross-section.
Etymology: In honour of Dr. Olga Nekvasilová, CSc. (the famous Czech specialist in Mesozoic brachiopods) who studied the geology and paleontology of the Předboj site and other rocky coast localities in the BCB.

Holotype: The specimen is deposited in the collections of the National Museum in Prague, inventory number NM-O7561, and figured on Pl. 2, Fig. 7.

Type locality: Předboj near Prague.

Type horizon: Upper Cenomanian.

Material: Three well preserved tubes.

Substrate: One of the tubes is attached to an oyster valve.

Description. The attached tube portion is slightly to strongly curved posteriorly and straight anteriorly, the short straight free anterior tube portion rises moderately above the substrate. For keels and cross-section see diagnosis. Anterior tube portion bears transverse ornamentation consisting of indistinct weak corrugations.

Remarks and relationships. Pyrgopolon (Septenaria) zitti (see below) is similar, but differs by possessing only three keels situated closer together in the attached tube portion.

Pyrgopolon (Septenaria) septenaria Regenhardt, 1961 and P. (S.) macropus (J. de C. Sowerby, 1829) possess respectively five and seven keels in the free tube portion, but differ by possessing only one strong keel in the attached portion.

Pyrgopolon (Septenaria) zitti sp. nov.

Pl. 2, Fig. 1–4; Pl. 3, Fig. 5.

2012c Pyrgopolon sp. 3 – Kočí, p. 126, fig. 1A–C.

2012c Propomatoceros? sp. – Kočí, p. 124–126, fig. 1D.

Diagnosis: A moderately large-sized species of the subgenus Pyrgopolon (Septenaria). Attached tube portion has three keels close to each other; the median keel appears as a high and sometimes undulating comb, the other two keels are straight and much smaller. One or two additional rounded longitudinal ridges may or may not be present on the latera. No transverse ornamentation. Cross-section triangular.

Etymology: In honour of Dr. Jiří Žítt, CSc. (the famous Czech specialist in Mesozoic echinoids, asteroids and crinoids) who studied the geology and paleontology of the Předboj site and other rocky coast localities in the BCB.

Holotype: The specimen is deposited in the collections of the National Museum in Prague, inventory number NM-O7555, and figured on Pl. 2, Fig. 1, as the holotype. The specimens with inventory numbers NM-O7556, O7557, O7558 and O7571 and figured on Pl. 2, Fig. 2, 3, 4 and Pl. 3, Fig. 5 are paratypes.

Type locality: Předboj near Prague.

Type horizon: Upper Cenomanian.

Material: At least four specimens representing at least 16 tubes, maybe more.

Substrate: Four tubes are attached to an oyster valve, eight tubes are attached to a Spondylus valve and in part to each other (Pl. 3, Fig. 5), two specimens (Pl. 2, Fig. 3–4) each consist of two tubes of which the upper one is attached to the lower one.

Description. Tube moderately large in size. The attached tube portion has three keels situated close to each other; the median keel is developed as a high and, in some tubes, undulating comb, whereas the other two keels are straight and much smaller, but nevertheless distinct. In a few tubes, one or two additional rounded longitudinal ridges may be present on the latera. Otherwise the surface is rather smooth; no transverse ornamentation. Tube triangular in cross-section; lumen circular. One or two specimens, including one of the two tubes shown in Pl. 2, Fig. 4, possess a distinct “Favosites structure”. However, the other tube shown in Pl. 2, Fig. 4 shows in cross-section depressions at the lateral areas of the base which may be interpreted as tubulae. Tube colour is bright yellow, slightly brighter than in Pyrgopolon gen. et sp. indet.

Remarks and relationships. The well-developed keels and the lack of peristomes point to the genus Pyrgopolon, and the presence of a distinct “Favosites structure” (Jäger 1983, Jäger and Breton 2002) characteristic for Pyrgopolon (Septenaria) clearly proves affiliation to this subgenus. However the triangular cross-section resembles that of the genera Propomatoceros, Spirobranchus and some fossil specimens of Neovermilia, all of these lacking a “Favosites structure”. One of the two tubes in Pl. 2, Fig. 4 shows structures which may be tubulae which are known in the above mentioned genera Propomatoceros, Spirobranchus, Neovermilia and others and in the subgenus Pyrgopolon (Pyrgopolon), but not in the subgenus Pyrgopolon (Septenaria), making determination of this specimen doubtful, even though its well-developed keels clearly match those of Pyrgopolon (Septenaria) zitti.

Pyrgopolon (Septenaria) sp. A1 (Kočí 2010) from the rocky coast facies locality Velim differs in its lower, less prominent median keel, a more rounded cross-section and a thinner tube wall. In Pyrgopolon (Septenaria) sp. A2 (Kočí 2010), also from Velim, the two lateral keels are weakly developed.

Pyrgopolon (Septenaria) sp.

Pl. 2, Fig. 10.

2012c Pyrgopolon (Septenaria) sp. 2 – Kočí, p. 126, fig. 1M–N.

Material: One fragment of the posterior tube portion.

Substrate: The former substrate of this Pyrgopolon tube is unknown, but in turn the Pyrgopolon tube was used as a substrate for two juvenile serpulid tubes described above as Placostegus sp.

Description. The formerly attached tube portion is 6.4 mm wide (measured at the base) and 5 mm high. It bears five straight strong but rounded keels, of which the median one is the strongest and widest, two are in an upper/lateral position and two are in a lower lateral position, situated slightly above the tube’s base. Otherwise the tube’s surface is smooth.
Remarks and relationships. The wide and rounded median keel resembles that of Pyrgopolon subgen. et sp. indet., but the chevron pattern is not developed or not well developed, and the other keels are more distinctly developed.

Pyrgopolon subgen. et sp. indet.

Pl. 2, Fig. 11–12

2012c Pyrgopolon (Septenaria)? Pyrgopolon (Pyrgopolon) subsp. [sic!] indet. – Kočí, p. 126–127, fig. 10–Q.

Material: Two large tubes.

Substrate: The tubes had previously been attached to an unknown substrate.

Description. Tube large, 5.5–7.4 mm wide (measured at the base) and 5.8–6.0 mm high at the aperture respectively at the anterior cross-section; length reaching more than 25 mm in the longest preserved fragment. Attached posterior portion slightly twisted to strongly curved, free anterior portion unknown if at all existing. The attached portion in some specimens bears three keels or rounded edges, in other specimens five, most of them are inconspicuous except for the very broad flat median keel which shows a distinct chevron-like or V-like pattern of strongly protruding incremental lines. Cross-section rounded triangular posteriorly but tunnel-shaped or rounded trapezoid anteriorly. Lumen circular. Tube wall thick, with a thin innermost tube layer which is slightly separated from the main tube layer.

Remarks and relationships. In the Late Cretaceous of Europe the vast majority of Pyrgopolon specimens belong to one of two subgenera, P. (Pyrgopolon) and P. (Septenaria), which may look more or less similar in outer aspect but are usually well distinguishable by several features of the tube structure: usually P. (Pyrgopolon) has a moderate to thin tube wall and well-developed chambered tubulae in the lateral areas of the attached tube base, and often its inner tube layer is more or less separated from the outer tube layer during diagenesis. In contrast, P. (Septenaria) has a moderate to thick tube wall, which in the lower half of the attached portion may show “Favosites” structure which is a cellular structure resembling that of the Paleozoic coral genus, and some specimens may show a honeycomb-like ornamentation on the surface of the tube.

The problem with the present species is that it combines features of both previously mentioned subgenera, and plus the low number of available specimens mean it is therefore impossible to affiliate it to any subgenus at the present state of knowledge. Features pointing to P. (Pyrgopolon) are a thin innermost tube layer which is slightly separated from the main tube layer and the nondevelopment of a “Favosites” structure (Jäger 1983, Jäger and Breton 2002) and honeycomb-like ornamentation. Features pointing to P. (Septenaria) are the thick tube wall and the absence of tubulae.

In its relatively large size and thick tube wall, the present species resembles Pyrgopolon (Septenaria) sp. B (Kočí 2010) which, however, has a thicker external tube layer and developed cellular layers.

Subfamily Spirorbiniae Chamberlin, 1919

Neomicroorbis Rovereto, 1903

Affiliation of this genus to either Spirorbinae or non-spirorbin Serpulidae is still debated (see Ippolitov et al. 2014).

Neomicroorbis crenatostriatus subrugosus (Münster in Goldfuss, 1831)

Pl. 3, Fig. 1

1831 Serpula subrugosa Münster – Goldfuss, p. 239, pl. 71, fig. 1a–b.
2005 Neomicroorbis crenatostriatus subrugosus (Münster in Goldfuss, 1831) – Jäger, p. 197, pl. 9, fig. 11.
2012b Neomicroorbis crenatostriatus subrugosus (Münster in Goldfuss, 1831) – Kočí, p. 123, fig. 1N.

Material: Two tubes.

Substrate: Both tubes are attached to a dorsal valve of the brachiopod Cyclothyris aff. difformis (Valenciennes in Lamarck, 1819).

Description. The tube is circular, smooth, sinistrally coiled. Spiral diameter is 0.5–1.1 mm.

Remarks and relationships. Due to their small sizes, the present specimens are certainly juveniles. Detailed remarks and relationships of N. c. subrugosus are mentioned in Sklenář et al. (2013).

Bipygmaeus Regenhardt, 1961

Bipygmaeus pygmaeus (von Hagenow, 1840)

1840 Serpula pygmaea nob. – von Hagenow, p. 667.
1961 Spirobranchus (Bipygmaeus) pygmaeus (Hagenow, 1840) – Regenhardt, p. 89.

Material: Two damaged specimens of which at least one could belong to the present species.

Substrate: Both tubes are attached to a serpulid tube of the genus Pyrgopolon.

No description is given here due to insufficient preservation.

Palaeoecological remarks – worms and their substrates

The worm-substrate relationship has been at least a partial subject of many papers dealing with polychaetes (e.g. Taylor and Wilson 2003, Žít et al. 2003, Sørensen and Sørlýk 2010) among other benthic organisms since the 1960s. An exhaustive study of soft-bottom dwellers was published by Seilacher et al. (2008). The substrate preferences or the life strategies of taxa present at the locality Předboj are summarized below. Identified substrates inhabited by sabellids and serpulids at Předboj are also mentioned by us in the chapters on the individual species.
Larvae of the sabellid species *Glomerula serpentina* attached themselves not only to bivalve shells (see above), but frequently also to tiny substrates such as small shell fragments, large foraminifers or sand grains. During growth, a self-supporting knot-like reeflet (“glomerate knot”) adapted for living on soft bottom is produced (Seilacher et al. 2008).

In accordance with the vast majority of extant serpulid species, all serpulid species found at Předboj are obligate encrusters. Some of the Předboj serpulids, especially *Pyrgopolon (Septenaria) zitti*, but also *Cementula* sp. and *Laqueserpuella reussi*, built small clusters consisting of two tubes, rarely more, in which one tube was attached to another tube of the same species. Moreover, there are several specimens in which one serpulid tube is attached to the tube of a different serpulid species. For example, three specimens of *Dorsoserpula bipartita* are each attached to a separate tube of *Placostegus rigidus*, and two tubes of *Placostegus* sp. are attached to a single tube of *Pyrgopolon (Septenaria) sp.*

The Předboj serpulids are not specialized for any specific kind of hard substrate. Medium-sized to relatively large oyster valves and other bivalve shells are among the most common substrates onto which serpulids have settled. Dense spattfall had perhaps been the reason for the crowding of eight tubes of *Pyrgopolon (Septenaria) zitti* densely attached to a *Spondylus* valve and to each other (Pl. 3, Fig. 5).

Three brachiopod shells had been settled on by serpulid tubes. Two of these three specimens have a *D. bipartita* tube attached to the dorsal valve of *Phaseolina phaseolina*; one of these two tubes is oriented with its aperture towards the anterior commissure (Pl. 3, Fig. 2), the other towards the lateral commissure. The third specimen has two tubes of *Neomicrorbis crenatostriatus subrugosus* on the dorsal valve of *Cyclothyris aff. difformis*, between the ribs near the anterior commissure. These tubes attached close to the commissures of brachiopod shells could have fed upon microscopical food particles which were transported by currents produced by the activity of the brachiopods’ lophophorate apparatus (Pl. 3, Fig. 1) – provided that the brachiopods were still alive which is, however, unknown.

As is common in the genus *Dorsoserpula*, some but not all tubes of *D. bipartita* coiled spirally around a longer present upright cylindrical object which may had been the stem of an alga, another serpulid tube, or a crinoid stem. Crinoid columnals have been found in the centre of *D. bipartita* coils at other rocky coast facies sites of the BCB, e.g. Velim, Kamajka, and Chrtníky, as well as in the centre of *D. wegeneri wegeneri* at Úpohlavy (Sklenář et al. 2013) and in northern Germany (Jäger 1983).

Vice versa, serpulid tubes had often been settled on by other organisms. Some tubes, especially some specimens belonging to different species of the genera *Pyrgopolon* (e.g. Pl. 2, Fig. 1, 10, 12; Pl. 4, Fig. 2) and *Neovermilia* (Pl. 4, Fig. 1), show variable numbers of small holes. While these small holes are true borings by some unknown organisms into a formerly intact serpulid tube wall, additional larger holes in one of these serpulid tubes (Pl. 4, Fig. 2), some of a more oval shape and surrounded by a small elevated rim, were produced by the serpulid itself when prolonging its tube and thereby surrounding stolons of the symbiotic hydroid *Protulophila gestroi ROVERETO*, 1901 living inside the serpulid tube wall (see e.g. Zágoršek et al. 2009).

The common and diverse occurrence of medium- to large-sized and relatively thick-walled tubes of the subgenus *Pyrgopolon (Septenaria)* points to adaptation to an environment of high water energy. Some of the relatively smaller-sized serpulids, e.g. the *Dorsoserpula* tubes coiling around vertical substrates and the *Dorsoserpula* and *Neomicrorbis* tubes settling on the valves of living(?) brachiopods, may also have been exposed to considerable water energy, whereas other smaller-sized serpulids, e.g. *Filograna, Cementula* and others, may alternatively have settled on bioclasts or rocks within small cryptic environments of lower water energy.

**Conclusions**

A diverse tube-dwelling polychaete fauna thrived in the rocky coast environments near Předboj, comprising 10 genera and 16 species, some of them described in open nomenclature.

Two new species, *Pyrgopolon (Septenaria) nekasyllovae* sp. nov. and *Pyrgopolon (Septenaria) zitti* sp. nov., are described.

The relatively high diversity of tube dwelling polychaetes – sabellids and serpulids including spirorbins – is not unusual, and similar assemblages are known especially from other Late Cenomanian and Early Turonian shallow marine rocky coast sites in the Bohemian Cretaceous Basin, e.g. Velim, Kaňk, Kamajka, Chrtníky, and Zbyslav (Ziegler 1984, Kočić 2009a, 2010, 2012a, Žitt and Nekasyllová 1996, Žitt et al. 2006). Moreover, the fauna resembles that of shallow marine sites in northwest Germany, northeast Belgium, southeast Netherlands, southeast France and southern Sweden (Jäger 1983, 2005, 2012, Sørensen and Suryl 2010).

The common and diverse occurrence of medium to large sized and relatively thick-walled tubes of the subgenus *Pyrgopolon (Septenaria)* points to adaptation to a high water energy environment. Also the *Dorsoserpula* tubes coiled around vertical substrates and the *Dorsoserpula* and *Neomicrorbis* tubes settled on the valves of living(?) brachiopods may also have been exposed to considerable water energy, whereas other smaller-sized serpulids may alternatively have settled on bioclasts or rocks within small cryptic environments of lower water energy.

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Explanation of plates

PLATE 1

1. *Glomerula serpentina* (Goldfuss, 1831), the specimen is attached to an oyster valve, (NM-O7544).
3. *Dorsoserpula bipartita* (Reuss, 1845), tube coiled around a no longer preserved substrate, possibly a crinoid stem or a stem of an alga, (NM-O7546).
4. *Dorsoserpula bipartita* (Reuss, 1845), underside of coil (= lateral view of tube), with the posterior tube portion forming a kind of “apex” in the centre, (NM-O7547).
5. *Dorsoserpula bipartita* (Reuss, 1845), coil, (NM-O7548).
6. Filogranula cincta (Goldfuss, 1831), upper side, (NM-O7549).
7. Two tubes of *Laqueoserpula reussi* (Weinzettel, 1910), upper side of the larger specimen showing anterior tube portion, encrusted by a small tube, (NM-O7550).
10. *Placostegus rigidus* (Regenhardt, 1961), small tube fragment, encrusted by a now damaged coiled tube of *Dorsoserpula bipartita* (Reuss, 1845), (NM-O7553).
11. Cimentula sp., anterior parts of the attached tube portions of two tubes attached to each other, (NM-O7554).

Scale bars are 2 mm in Fig. 1–2 and 1 mm in Fig. 3–8 and 10–11.

PLATE 2

1. *Pyrgopolon* (Septenaria) *zitti* sp. nov., holotype, attached to an oyster valve, upper side, (NM-O7555).
2. *Pyrgopolon* (Septenaria) *zitti* sp. nov., paratype, attached to an oyster valve, upper side, (NM-O7556).
3. *Pyrgopolon* (Septenaria) *zitti* sp. nov., paratype, two tubes attached to a Spondylus valve and to each other, upper sides, (NM-O7557).
4. *Pyrgopolon* (Septenaria) *zitti* sp. nov., paratype, two tubes attached to each other, cross-sections. The tube seen in the lower part of the photograph shows depressions which may be tubulac (inner basal-lateral channels), whereas the tube seen in the upper part of the photograph possesses “Favosites structure”, (NM-O7558).
5. *Pyrgopolon* (Septenaria) nekasilovae sp. nov., attached to an oyster valve, upper side, (NM-O7559).
6. *Pyrgopolon* (Septenaria) nekasilovae sp. nov., lateral view of attached posterior tube portion and elevated free anterior portion, (NM-O7560).
7. *Pyrgopolon* (Septenaria) nekasilovae sp. nov., holotype, a – cross-section of anterior tube portion showing the five keels, b – upper side, (NM-O7561).

Scale bars are 5 mm in Fig. 1–7 and 9–12 and 4 mm in Fig. 8.

PLATE 3

1. *Neomicrorbis crenatostriatus subrugosus* (Münster in Goldfuss, 1831), a small spiral tube attached to the dorsal valve of a brachiopod, *Cyclothyris aff. difformis* (Valenciennes in Lamarck, 1819), upper side, (NM-O7567).
2. *Dorsoserpula bipartita* (Reuss, 1845), a curved but not coiled tube attached to a valve of the brachiopod *Phaseolina phaseolina* (Valenciennes in Lamarck, 1819), upper side, (NM-O7568).
4. *Placostegus rigidus* (Regenhardt, 1961), anterior tube portion with very short elevated free portion, posterior tube portion damaged, attached to poorly preserved bryozoan stem, oblique view to upper side and aperture, (NM-O7570).
5. *Pyrgopolon* (Septenaria) *zitti* sp. nov., paratype, eight tubes attached to spondylid valve and to each other, upper sides and cross-sections, (NM-O7571).

Scale bars are 2 mm in Fig. 1 and 5 mm in Fig. 2–5.

PLATE 4

1. *Neovermilia* cf. *ampullacea* (J. de C. Sowerby, 1829), a – upper side, b – underside of formerly attached tube portion, A, B – arrows point to an area with many borings into the tube wall, (NM-O7572).
2. *Pyrgopolon* (Septenaria) cf. *tricostata* (Goldfuss, 1831), anterior tube portion with borings and holes, A – arrows point to small borings similar to those in Fig. 1, present in all surfaces of the tube wall, B, C – arrows point to large holes caused by the growing serpulid tube around stolons of the hydroid symbiont *Protulophila gestroi* Rovereto, 1901, (NM-O7573).

Scale bars are 5 mm in Fig. 1 and 1 mm in Fig. 2.