SABELLIDAE AND SERPULIDAE (POLYCHAETA, CANALIPALPATA) FROM THE LOCALITY KAŇK – NA VRŠÍCH IN KUTNÁ HORA (UPPER CENOMANIAN – LOWER TURONIAN, BOHEMIAN CRETACEOUS BASIN – THE CZECH REPUBLIC)

TOMÁŠ KOČÍ
Ivančická 581, 199 00 Praha 9 – Letňany, Czech Republic; e-mail: protula@seznam.cz

Abstract. The relatively rich assemblage of tube dwelling polychaetes: sabellid (Sabellidae) and serpulid (Serpulidae) worms (Polychaeta, Canalipalpata) from the nearshore locality Kaňk – Na Vrších (Upper Cenomanian – Lower Turonian, Kolín area, Bohemian Cretaceous Basin) is described in detail for the first time. Eight taxa are described belonging to six genera: Glomerula Brünnich Nielsen, 1931; Filograna Oken, 1815; Neovermilia Day, 1961; Dorsoserpula Parsch, 1956; Placostegus Philippi, 1844; and Pyrgopolon de Montfort, 1808. Their taxonomy and palaeoecology are discussed.

Nearshore facies, Upper Cenomanian, Lower Turonian, Bohemian Cretaceous Basin, Serpulidae, Filograna, Neovermilia, Dorsoserpula, Placostegus, Pyrgopolon

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Introduction

Serpulid worm tubes are a common component of the mesofaunal remains of Upper Cretaceous nearshore sediments in the Czech Republic and elsewhere. The locality Kaňk – Na Vrších is one of the most important classic localities for the high diversity fossil-rich nearshore facies around the Cenomanian / Turonian boundary in the Bohemian Cretaceous Basin. The most detailed information on serpulid tubes from the BCB was presented in a monograph by V. Ziegler (1984). In this monograph and other papers by the same author (Ziegler 1966a, 1966b, 1967, 1969, 1973, 1974, 1978, 2006) many species of serpulid tube worms from Kaňk and other nearshore localities (Velim, Turkaňk, Kamajka, Předboj near Prague, Kněžívka) are described. Recent papers were published by Kočí (2007a, 2007b, 2008, 2009a, 2009b, 2010).

Geological and geographical setting

The State nature reserve known as “Na Vrších” is an abandoned quarry composed of crystalline (gneiss) rocks. The geographical detail is shown in Text-fig. 1. Depressions in the gneiss surface are filled with Upper Cretaceous sediments of nearshore facies. This locality has two parts. The base of the Upper Cretaceous sediments consists of a coarse grained gneiss conglomerate with a bioclastic limestone matrix (1 m thick), the bioclastic limestone passing gradually into the overlying thin-bedded white organodetritic limestones. The white limestones are 1.8 m thick, and they are separated from the overlying calcareous claystones (1 m...
thick) by an erosional surface (Žítt, 1992). The matrix of the conglomerate and the lower part of the organodetritic limestones were dated as Late Cenomanian (Bílá Hora Formation) – base of the Early Turonian (Bílá Hora Formation) by the presence of the foraminifer Pseudotextulariella cretosa and the nanoplankton species Predicosphaera cretacea (Hradecká and Švabenická, 2007). The overlying calcareous claystones belong to the Early Turonian (Bílá Hora Formation). For details of lithology see Žítt (1992), and for more details of the stratigraphical section see Text-fig. 2.

Material and methods

During eight years (2002–2010) of fieldwork at the locality Kaňk – Na Vrších about 100 specimens of serpulid worm tubes were collected, of which 13 specimens are complete. This material was obtained by washing and sieving (mesh diameter 1 mm) more than 50 kg of loose rubble which had accumulated below and between the two parts of this locality. Some specimens (e.g. Pyrgopolon ziegleri and Pyrgopolon (Septenaria) cf. tricostata) were collected at the top of both parts of this locality which belong to the Lower Turonian. Original material described by Weinzel (1910) and Ziegler (1984) was studied in the National Museum collection in Prague. Below are described only species which were found during the present fieldwork.

Systematic palaeontology

Classification of sabellid and serpulid worms follows that of Goldfuss (1826-1833), Reuss (1845-1846), Geinitz (1871–1875, 1872–1875), Regenhardt (1961), Ware (1975), Lommerzheim (1979), Jäger (1983, 1993, 2005), Jäger, M. and Breton, G. (2002), Ziegler (1966a, 1967, 1969, 1973, 1974, 1984, 2006), Radwańska (1996) and ten Hove, H. A. ten and Kupriyanova, E. K. (2009). In the monograph by V. Ziegler (1984) 13 species were mentioned from the locality Kaňk – Na Vrších. After revision of Václav Ziegler’s collection, which is deposited in the National Museum in Prague, and after determination of new finds, Ziegler’s determinations are redetermined as follows: Glomerula gordialis (only pl. 1, fig. 1) and Serpula prolifera belong to Glomerula serpentina; Glomerula scitula belongs to Glomerula lombricus; Sarcinella plexus and Sarcinella minor (only specimen NM-O5373 which is not the specimen figured by Ziegler) belong to Filograna socialis; Serpula antiquata and Proliserpula ampullacea belong to Neovermilia ampullacea; Eoplacostegus dentatus belongs to Placostegus sp.; Pomatoeceros areni belongs to Pyrgopolon (Septenaria) sp.; Spirobius asper and S. subrugosus belong to Doroserpula ex. gr. Wegneri; S. milada belongs to Neomicrobis crenatosstriatus subrugosus; Neomicrobis knobi belongs to N. crenatosstriatus crenatosstriatus.

Below are described only species which were found during the present fieldwork.

Class: Polychaeta Grube, 1850

Ordo: Sabellida FAUCHALD, 1977

Family: Sabellidae JOHNSTON, 1846

Glomerula BRÜNNICH NIelsen, 1931

Glomerula serpentina (GOLDFUSS)

Pl. 1, fig. 1

1831 Serpula gordialis SCHLOTHEIM var. Serpentina. – Goldfuss: p. 240, pl. 71, fig. 4.
1840 Serpula implicata – von Hagenow: p. 668, pl. 9, fig. 17.
1846 Serpula serpentina GOLDFUSS. – Reuss: pl. 42, fig. 22.
1904 Serpula eximiplicata – Rovereto: p. 12, pl. 3, fig. 8a-e.
1911 Serpula gordialis, var. serpentina. – Fréch: p. 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.
1964 Omasaria omnivaga n. sp. – Regenhardt: pp. 45-46, pl. 5, fig. 7.
1964 Glomerula jerseyensis – Clough: p. 999, fig. 1.

Material: One specimen attached to an oyster. 15 tube fragments.

Description: Tube circular. Surface smooth. The tube is coiled to form a ball or knots. Lumen circular, a trilobite lumen was not observed in these specimens. Tube diameter ranges from 1.6 to 2.6 mm, in most specimens the diameter is 2 mm.

Discussion: Glomerula serpentina belongs among the typical species of nearshore facies of the BCB. Glomerula serpentina (GOLDFUSS) was considered to
belong to *G. gordialis* SCHLOTHEIM by some authors (for example, Regenhardt 1961, Jäger 1983, Ziegler, 1984). Later Jäger (2005) restricted *Glomerula gordialis* SCHLOTHEIM to Jurassic material and determined Cretaceous specimens as a separate species, *G. serpen-tina*. A similar species, *Glomerula lombricus* (DEFRANCE), is distinguished by its small tube diameter which is normally less than circa 1 mm. The systematic position of the genus *Glomerula* is very problematic. The genus *Glomerula* has survived from the Hettangian to the Recent, and it is most common and geographically widespread from the Upper Toarcian until the Eocene. Jäger (personal communication) gave the example that the genus *Glomerula* existed as a large number of species, but that it is nearly impossible to separate them because the construction of the tube is so simple and the morphologic variation between specimens even in one sample is extremely wide.

Jäger (1983, 1993, 2005 and personal communication) mentioned that the genus *Glomerula* did not possess a trilobate lumen even in the Jurassic. From the uppermost Valanginian onwards, trilobate lumina are present, but they are still rare in most samples from the Lower Cretaceous and even in some samples from the Upper Cretaceous. The ability of the animal to produce a tube which in some sections has a trilobate lumen seems to be true phylogenetic progress. Jäger (2005 and personal communication) gave different names to species from the Jurassic and those from the Cretaceous to Eocene. Trilobate lumina may be present in *Glomerula plexus* (SOWERBY), in *Glomerula serpen-tina* (GOLDFUSS), and in *Glomerula lombricus* (DEFRANCE), but trilobate lumina are more frequent in *G. serpen-tina* than in *G. lombricus*. *Glomerula plexus* (SOWERBY) is gregarious, consisting of smooth uniform tubes, each measuring 1-2 mm in diameter, many of these together forming large irregular masses of a bulbous or elongated shape, reaching dimensions of up to 5 cm in the BCB and even larger in some localities, predominantly in the Santonian and Campanian of northern Germany, England, and southern Sweden. Apart from these typical large clusters consisting of dozens or even hundreds of tubes, in many localities it is possible to find two, three or four tubes fixed upon each other. Formally, these small clusters should be named „plexus“, but in reality they probably represent only dense populations of the „normal“ *serpen-tina* and *lombricus* (Jäger, personal communication).

**Family: Serpulidae Rafinesque, 1815**

**Filograna Berkeley, 1835**

**Filograna socialis** (GOLDFUSS)

Pl. 1, fig. 5

1831 *Serpula socialis* tobis. – GOLDFUSS: p. 235, pl. 69, fig. 12 a-c.
1845 *Serpula filiformis* SOWERBY. – REUS: p. 20, pl. 5, fig. 26.
1846 *Serpula filiformis* SOWERBY. – GEINITZ: p. 253, pl. 16, fig. 25.
1875 *Serpula socialis* GOLDFUSS. – GEINITZ: p. 200, pl. 37, fig. 2.
1883 *Serpula socialis* GOLDFUSS. – FRÍC: fig. 113.
1961 *Sarcinella socialis* (GOLDFUSS 1831). – Regenhardt: pp. 29-30, pl. 1, fig. 5.
1961 *Filograna sollistima* n. sp. – Regenhardt: p. 24, pl. 2, fig. 4.
1973 *Sarcinella socialis* (GOLDFUSS). – Ziegler: pp. 36-37, pl. 5, figs 4, 5, 6; pl. 6, fig. 1.
1978 *Sarcinella socialis* (GOLDFUSS). – Ziegler: pp. 219-221, pl. 50, fig. 4.

**Material:** Four free bundles found as loose specimens, 2 specimens in limestone.

**Description:** Many tubes attached more or less parallel to each other forming bundles. Tube circular. Surface smooth. Diameter of the tube 1.8 mm (sample in limestone), 1.2 mm in a bundle consisting of ca. 20 tubes collected in January 2006.

**Discussion:** In the BCB, this species is not typical for the nearshore facies, but it is typical for deeper environments in the Middle Turonian e.g. at the localities Dolánky near Turnov, Klokocské Loučky, Mladá Boleslav, Jizerní Vtělno, and Sychrov (see Ziegler 1973, 1978). These finds could probably indicate a deeper sea at this locality. *Filograna filosa* (DUJARDIN) has a similar habit, but can be distinguished by its smaller tube diameter (0.2-0.4 mm).

**Neoevermilia Day, 1961**

**Neoevermilia ex gr. ampullacea** (SOWERBY)

Pl. 1, fig. 8

**Material:** One complete specimen attached to an oyster. Three poorly preserved specimens also attached to an oyster. Six fragments of tube.

**Description:** The tube cross-section is subcircular. There is an indistinct very fine keel. The transversal ornamentation is very distinct and shows fine corrugations. The tube increases in diameter towards the anterior. Near the base of the tube a very distinct strong cellular layer is developed. The posterior portion of the tube forms a loop. Tube diameter 2.6 mm. Width of the tube’s base is 5 mm in the anterior portion. Lumen circular, 1.9 mm in diameter.

**Discussion:** The present tube correspond well to the description given by Ziegler (1974), but these specimens from Kaňk have a cellular layer which is wider than the diameter of the tube at the base. There is pronounced variability within this species (Jäger, 2005). Specimens from the nearshore facies of the BCB (e.g. Kaňk – Na Vrších, Velim – eastern part, Předboj near Prague) differ in their tube morphology from specimens found in the deeper water facies of the BCB (e.g. in the Upper Turonian of the working quarry at Úpohlavy near Lovosice). The genus *Neoevermilia* bears shorter cells in the cellular layer than the genera *Pomatoceros* and *Pyrgopolon*. In the nearshore facies, a very fine but distinct longitudinal keel may be present (in the eastern part of the locality Velim and at Předboj near Prague) or may not (some specimens found at Kaňk – Na Vrších).
Dorsoserpula Parsch, 1956

Dorsoserpula gamigensis (Geinitz)

Material: Single specimen.

Description: Tube circular. A fine distinct undulated keel and two lateral keels are present. The posterior tube portion is coiled planispirally. The diameter of the planispiral is 3 mm, the diameter of the tube aperture is 1.6 mm. In the anterior tube portion, the transversal ornamentation consists of very fine incremental lines shaped like the letter V.

Discussion: A closely related species common in the Upper Cretaceous, especially in the Santonian and Campanian, was described by Jäger (1983) under the name Parsimonia wegleri nom. nov. This species usually lacks a true longitudinal keel. Later Jäger (2005) renamed that species Dorsoserpula wegleri and, moreover, erected a new sub-species, Dorsoserpula wegleri maastrichtensis, for specimens of Maastrichtian age differing from typical wegleri specimens by the presence of a longitudinal keel and by the presence of a cellular tube base.

Dorsoserpula cf. conjuncta (Geinitz)

Material: Single specimen.

Description: Tube diameter 9 to 11.4 mm. The tube wall is 2.3 mm thick. The present specimen resembles those described by Ziegler (1969), but it differs by the presence of a cellular layer which is very strongly developed and by dense transversal lines at the base of the middle portion of the tube.

Discussion: Because of the differences in morphology described above, a more precise determination than 'cf. conjuncta' is not possible. The cellular layer may have enabled the specimen to live on the surface of a soft substrate.

Placostegus Philipp, 1844

Placostegus zbyslavus (Ziegler)

Material: One well preserved specimen. Two fragments of the erect free tube portion.

Description: The free subtriangular tube portion is steeply erect and is twisted around its longitudinal axis. The tube diameter is 1.6 mm in the anterior tube portion and 1.5 and 1.9 mm in the middle part. Lumen circular. The posterior tube portion is coiled to form a planispiral 3.9 mm in diameter. The surface bears fine transversal furrows and three distinct longitudinal lines situated between three rounded longitudinal edges which give the tube a rounded triangular cross-section.

Discussion: Placostegus zbyslavus (Ziegler) belongs among the smaller species of the genus Placostegus. The specimens described by Ziegler (1984) do not bear transversal furrows in the posterior fixed tube portion. Placostegus dentatus (Regenhardt) has a triangular cross-section, but lacks transversal ornamentation. Placostegus velimensis (Jäger and Kočí, 2007) is larger and has a rounded rectangular cross-section.
Pyrgopolon (Septenaria) ziegleri Kočí
Pl. 1, figs 2a-b
2010 Pyrgopolon ziegleri sp. n. – Kočí: p. 125, figs 7-8.

Material: One complete specimen. Two fragments of tube.

Description: Fixed tube portion large, smooth, triangular in cross-section, bears a distinct median keel. There is no transversal ornamentation. Tube width at the anterior end of the base 13.2 mm, corresponding tube height 12.6 mm. Towards the posterior, the tube is considerably narrower, and the height is only 6.7 mm. Lumen circular, 3.96 mm in diameter. The lumen is situated in an excentric position, near to the keel. Immediately below the aperture, there is a smaller tall but narrow chamber measuring circa 2 mm, and between that chamber and the tube’s base there is a fine groove. Free tube portion is unknown.

Discussion: This species includes the largest specimens with triangular cross-section in the BCB and is characterized by its shape and size. Pyrgopolon (Septenaria) ares (Ziegler) differs by the position of its lumen and by its narrower longitudinal keel. Pyrgopolon sp. A1, Pyrgopolon sp. A2 and Pyrgopolon sp. B from the nearshore locality Velim (see Kočí, 2007a) differ also in the position of the lumen, and partly by their tube morphology. Pyrgopolon (Septenaria) marechali (Jäger et Bréton) from the Lower Cenomanian of Normandy, France, is even larger, and its tube is much more rounded. Pyrgopolon (Septenaria) polyforata (Jäger) differs by its specific ornamentation. Pyrgopolon (Septenaria) macropus (Sowerby) has a pentagonal to heptagonal cross-section and a more prominent keel (Jäger, 2005, pl. 9, fig. 5a). The tube of Pyrgopolon (Septenaria) macropus is attached to the substrate by its posterior tube portion and its anterior tube portion is erect above the substrate. The same is seen in Pyrgopolon (Septenaria) erecta (Goldfuss), which is distinguished by its larger tube diameter which may reach 14 mm. The subgenus Pyrgopolon (Septenaria) is most common in transgression facies (Jäger, personal communication).

Palaeoecological remarks – worms and their substrates

The worm-substrate relationship has been at least a partial theme of many papers dealing with polychaetes (e.g. Taylor and Wilson 2003, Zitt et al. 2003) and other benthic organisms since the 1960s. An exhaustive study of soft-bottom dwellers was published in 2008 by Seilacher et al. This research mainly concerned the substrate preference or life strategies of taxa present in the locality. The dominant and most diverse species are obligate encusters. Unfortunately only one small specimen of Glomerula serpentina fixed to fragment of an oyster valve was found. Moreover, larvae of Glomerula serpentina have frequently been found attached to tiny pieces of substrate such as small shell fragments or large foraminifers or very small pebbles and during growth created a self-supporting knot-like reeflet which was an adaptation for living above the soft bottom. The larvae of Filograna socialis preferred attachment to the tubes of their own species after a first tube had successfully begun colonization. Filograna socialis belongs among the mud-sticking species and was able to fasciculate colonies which grew upright like staghorn corals (see Seilacher et al. 2008, fig. 3 C-D). At Kaňk only smaller parts of the fasciculate colonies were found.

Neoevermilia ex. gr. ampullacea belongs to the obligate encusters. Four specimens were found fixed to an oyster valve. The next species described belong to the obligate epibionts with the exception of Dorosserpula cf. conjuncta. This specimen differs considerably from other conjuncta specimens found at other nearshore facies localities (e.g. Velim, Plaňany) by its very strong cellular layers which may be interpreted as an adaptation for living on soft muddy sediment.

The new finds from Kaňk described above, comparison of the species (e.g. Filograna socialis and Pyrgopolon cf. tricostata) with the fauna from other nearshore localities (e.g. Velim and Kamajka), and sedimentological arguments (Eliáš and Zelenka, 2002) point to the conclusion that the sea at Kaňk was probably deeper than at other typical nearshore localities. However, according to the presence of redepositional shallow water corals (e.g. Synhelia gibbosa, Dimorphastrea sp., Meandrastraea pseudomeandrina, Calamophylliopsis sp., Proaplophyllia? sp.) at these localities, the depth was 0-50 m, and according to comparison with recent corals, the depth reached 20-30 m (Eliášová, 1997).

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References


Explanation of the plate

PLATE 1

Fig. 1 Glomerula serpentina (GOLDFUSS); NM-O6975.

Fig. 2 Pyrgopolon ziegleri Kočí – 2a: view of anterior end, 2b: view from above; NM-O6832.

Fig. 3 Placostegus zbylalus (ZIEGLER) – basal coiled part and free triangular fusiform anterior part; NM-O6976.

Fig. 4 Pyrgopolon (Septentaria) cf. tricostata (GOLDFUSS) – 4a: lateral view, 4b: view from above including aperture; NM-O6977.

Fig. 5 Filograna socialis (GOLDFUSS) – fragment of a bundle of tubes; NM-O6978.

Fig. 6 Dorosserpula gamigensis (GEINITZ) – lateral view; NM-O6979.

Fig. 7 Dorosserpula cf. conjuncta (GOLDFUSS) – two tubes with a strong tube wall; NM-O6980.

Fig. 8 Neovermilia ex gr. ampullacea (SOWERBY) – specimen is attached to oyster valve; NM-O6981.

(photo: Jan Sklenář)