An emendation of some Cretaceous species of *"Reophax"* (Foraminiferida) from northwest Europe and Poland

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ABSTRACT

The classification of some deep-water agglutinated foraminifera identified as *Reophax minuta* Tappan, 1940 is revised based upon examination of type material. Lower Cretaceous specimens formerly placed in *Reophax minuta* from northwest Europe and the Polish Carpathians in actuality belong in *Pseudonodosinella troyeri* (Tappan, 1960). Upper Cretaceous forms formerly referred to *R. minuta* are now placed in *Pseudonodosinella parvula* (Huss, 1966). A neotype for *Pseudonodosinella parvula* is designated herein.

INTRODUCTION

Some tapered specimens of *Reophax* referred to the species *R. minuta* Tappan, 1940 are commonly encountered in deep-water sediments of Cretaceous to Paleogene age. In the biostratigraphic schemes of the Polish Carpathians (Geroch & Nowak, 1984) and North Sea (King *et al.*, 1989), *"R. minuta"* is used as zonal index taxon for the upper Barremian to Aptian, and the upper Aptian to lower Albian, respectively. However, the type specimens of *Reophax minuta* housed at the US Natural History Museum in Washington DC are derived from comparatively shallow facies from the Coastal Plain of Texas. The "true" *Reophax minuta* possesses numerous, regularly enlarging chambers, horizontal sutures, lacks an apertural neck, and does not display the characteristic tapered morphology of specimens known from deep-water deposits. These specimens from the Cretaceous of Texas were designated the type species of the genus *Scherochorella* Loeblich & Tappan, 1984. Despite the fact that Loeblich & Tappan (1984, 1987) regarded these forms as distinct from typical deep-water *Reophax*, some confusion has persisted in the recent literature with regard to the systematics of deep-water and boreal specimens.

The primary purpose of this paper is to document the Cretaceous deep-water species of *Reophax* known from the North Sea area and the Polish Carpathian flysch and to revise their taxonomy based on direct comparison to type material in the collections of the US Natural History Museum.

MATERIAL

In this study we concentrated our efforts to determine the taxonomic affinity of specimens normally lumped in *Reophax minuta*, by examining specimens housed in the "primary types" collection at the US Natural History Museum as well as specimens from various localites in the Carpathians (Fig. 1). One species, *Reophax parvulus* Huss, 1966, previously

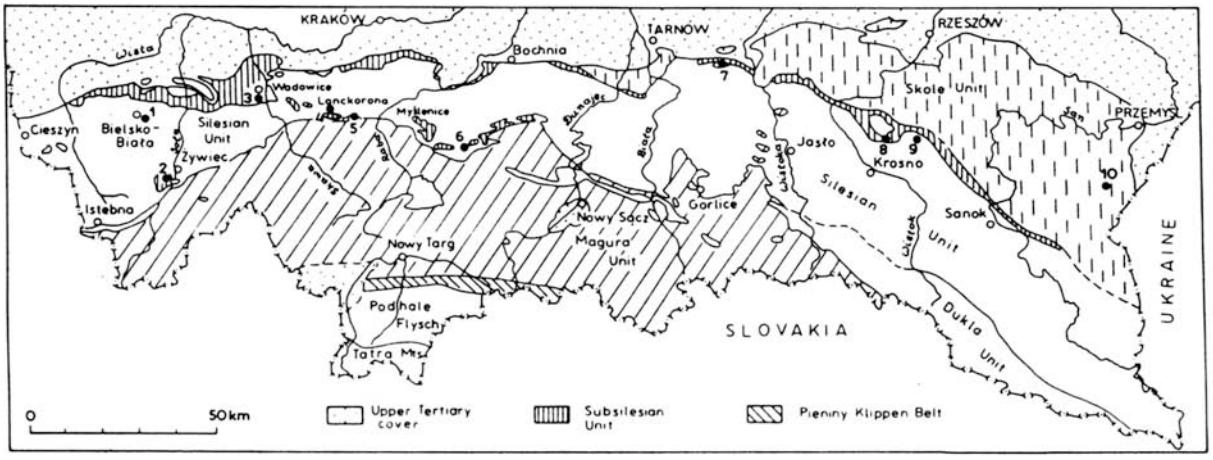

Figure 1. Tectonic units of the Polish Outer Carpathians (modified after Ksiazkiewicz, 1968), with localities indicated. 1- Straconka, Lipnik, 2- Zywiec, 3- Zawadka, 4- Lanckorona, 5- Sulkowice, 6- Wilkowisko, 7- Wiernik, 8- Weglówka, 9- Domaradz, 10- Rybotycze.

In: Kaminski, M.A. Geroch, S., & Gasiƒski, M.A. (eds.), 1995. Proceedings of the Fourth International Workshop on Agglutinated Foraminifera, Kraków Poland, September 12-19, 1993. *Grzybowski Foundation Special Publication* no. **3**, pp. 117-122.

named *R. minuta* Tappan (Huss, 1957), was originally described from the Carpathians. Unfortunately, Huss never deposited type specimens in any museum, and her collection no longer exists. However, Huss did provide an adequate description and illustrations (Textfig. 2). Luckily, some foraminiferal assemblages picked from boreholes from the type area Weglówka near Krosno described in her papers (Huss, 1957; 1966) were at our disposal.

SYSTEMATIC DESCRIPTIONS

Family HORMOSINIDAE Haeckel, 1894
Subfamily Hormosininae Haeckel, 1894
Genus ***Pseudonodosinella*** Saidova, 1970

The genus *Pseudonodosinella* (type species *Reophax nodulosa* Brady, 1879) is characterised by its smooth, finely finished wall comprised of a multiple layer of grains, ovate to subpyriform chambers with horizontal sutures, and a terminal aperture "at the centre of a thickened wall and produced face".

Pseudonodosinella troyeri (Tappan, 1960)
Plate 1, Figs. 1, 2, 4-16

Reophax troyeri Tappan, 1960, p. 291, pl. 1, figs. 10-12. - Tappan, 1962, p. 153, pl. 30, figs. 11-13.
Haplostiche D1 Hecht, 1938, pl. 3a, figs. 24-26; pl. 4a, figs. 4-8; pl. 6a, fig. 29.
Reophax cf. *minuta* Tappan. - Geroch, 1960, p. 123, pl. 6, figs. 2, 3.
Reophax minutus Tappan. - Bartenstein & Bettenstaedt, 1962, p. 282, pl. 39, fig. 1. - Geroch, 1966, p. 439, fig. 7 (7-17). - Grün *et al.*, 1972, pl. 5, fig. 6. - Geroch & Nowak, 1984, pl. 1, fig. 9.
Reophax minuta Tappan. - Bach, 1965, p. 7, pl. 1, fig. 1. -- Hanzliková, 1966, p. 103, pl. 1, figs. 15-16. - Bleachu *et al.* 1968, p. 148, pl. 2, fig. 12. - King *et al.*, 1989. pl. 8.1, fig. 19.
Reophax liassicus Franke. - Geroch, 1966, p. 440, fig. 7 (1, 4-6).

Holotype. Deposited in the "Primary Types" collection at the US Natural History Museum.
Description. Test straight or arched very slightly, tapered at both ends, consisting of 3-6 rapidly enlarging chambers, with horizontal sutures. Microsphaeric forms have as many as six chambers, megalosphaeric forms usually have only three chambers. Aperture single, terminal, on a low, broad neck. The wall is thickened around the aperture. Wall finely agglutinated, comprised of a multiple layer of grains, finely finished.
Remarks. This species was originally illustrated as *"Haplostiche* D1" by Hecht (1938) from outcrops in northwest Germany. In his revision of Hecht's classic fauna, Bartenstein (1952, 1962, 1965) assigned Hecht's specimens to *Reophax minuta* Tappan, 1940. Most subsequent workers (including ourselves) have adopted the name *R. minuta* for Cretaceous specimens of *Reophax* that possess an aperture on a produced neck.

However, the type specimens of *R. minuta* from the Albian Grayston Formation of the Texas Coastal Plain possess numerous rounded chambers and no sign of a neck. Loeblich & Tappan (1984) placed these specimens in their new genus *Scherochorella*, which differs from *Reophax* in possessing broad, low chambers, horizontal sutures, and in lacking a neck. Although the genus is characterised by the absence of a neck, Loeblich & Tappan (1987) retained *Scherochorella* in the subfamily Reophacinae Cushman, 1910, which is described as possessing a rounded, terminal aperture on a distinct neck.

Specimens formerly assigned to *R. minuta* from Lower Cretaceous deposits of northwest Europe and the Carpathian Flysch, however, are tapered at both ends and have a produced aperture. These most closely correspond to the type specimens of *Reophax troyeri* Tappan, 1960, described from the Lower Cretaceous of the Arctic slope of Alaska. We transfer this species to the genus *Pseudonodosinella* because of its general similarities to the type species *P. nodulosa* (Brady). Specimens of *P. troyeri* clearly have a finely agglutinated, multilayered wall, and the typical thickening of the wall around the aperture.

Pseudonodosinella parvula (Huss, 1966)
Plate 2, Figs. 1-19; Textfig. 2

Reophax parvulus Huss, 1966, p. 21, pl. 1, figs. 26-30.
Reophax sp. cf. *R. minutus* Tappan. - Geroch & Gradzinski, 1955, pl. 5, fig. 4.
Reophax minuta Tappan. - Neagu, 1970, p. 35, pl. 2, fig. 4.
Reophax sp. 2. Kaminski *et al.*, 1988, p. 187, pl. 3, figs 2, 3. - Kuhnt, 1990, p. 324, pl. 3, figs. 7-9.

Type material. The specimens illustrated by Huss (1966) were originally deposited at the GEONAFTA offices in Krakow, but the collection is now presumed lost. A neotype, designated herein, is illustrated in Plate 2, fig. 1. This specimen is housed in the Micropaleontology collections of the Jagiellonian University. It was selected from Borehole 7 at Weglówka, which was the same material studied by Huss. The material is derived from upper Cenomanian to Turonian green variegated shales and marly shales of the Subsilesian Unit of the Polish Carpathians. Additional specimens were selected from lower Senonian variegated and red marly shales from the Subsilesian Unit at Zawadka, near Wadowice.

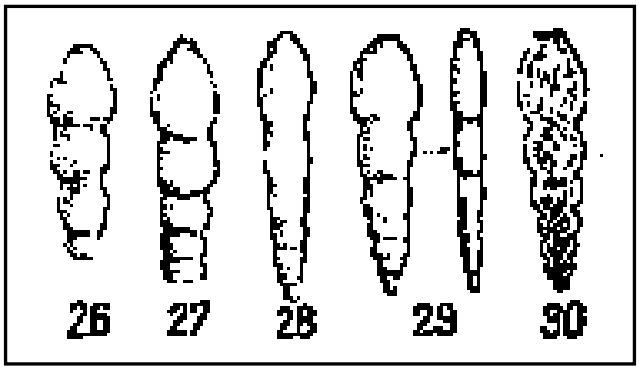

Figure 2. Type specimens of *"R. parvulus"* reproduced from Huss (1966).

Description. Test straight or arched very slightly, with oval to pyriform chambers, with horizontal sutures. Microsphaeric forms have as many as eight chambers, whereas megalosphaeric forms typically have four. Aperture single, terminal, on a low, broad

neck. The wall is thickened around the aperture. Wall finely agglutinated, comprised of a multiple layer of grains, finely finished.

Remarks. The species *"R. parvulus"* has until now have only been reported from Poland. In her original description of the species, Huss (1966) remarked that it differs from *R. minuta* in having fewer, less rounded chambers. Our specimens from the Polish Carpathians are derived from the Turonian and lower Senonian of the Subsilesian Unit, but this type of slender *Pseudonodosinella* with a tapered last chamber is also known from Paleocene deposits in Trinidad (Kaminski *et al.*, 1988) and from the Campanian to Paleocene at Gubbio, Italy (Kuhnt, 1990).

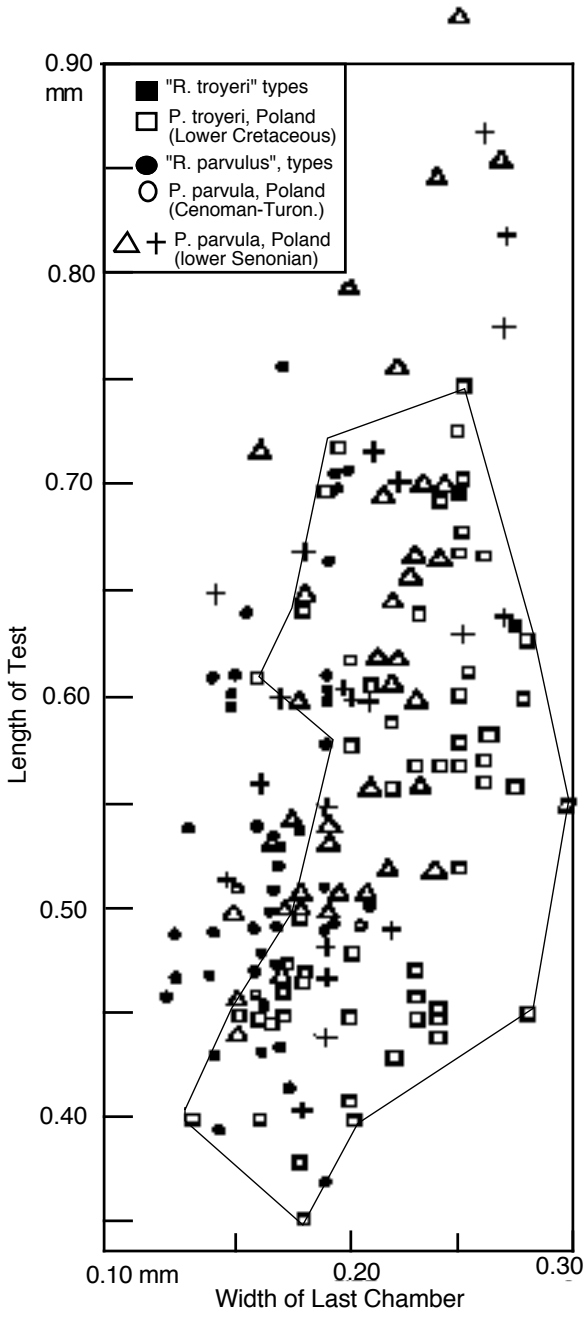

Figure 3. Dimensions of *P. parvula* and *P. troyeri* from various localities in the Polish Carpathians, compared with the type specimens. Field delineates the aspect ratios of *P. troyeri.*

This Upper Cretaceous to Paleocene species is no doubt closely related to *P. troyeri*, and there is some overlap between the two forms. However, microsphaeric specimens of *P. parvula* are generally more slender and have more elongated chambers than the Lower Cretaceous forms assigned to *P. troyeri* (Fig. 3). Megalosphaeric forms tend to have more slowly enlarging chambers than those of *P. troyeri,* and as a result have nearly parallel sides.

Subfamily Reophacinae Cushman, 1910
Genus ***Scherochorella*** Loeblich & Tappan, 1984

Scherochorella minuta (Tappan, 1940)
Pl. 1, Fig. 3; Textfig. 4

Reophax minuta Tappan, 1940, p. 94, pl. 14, figs. 4a-b. - Tappan, 1943, p. 480, pl. 77, fig. 4.

Remarks: Our concept of this genus and species is in full agreement with the description given by Loeblich & Tappan (1987). Several slides of previously unfigured paratypes and metatypes from the U.S. Gulf Coast and the North Slope of Alaska are housed in the collections of the USNM. Specimens are from the Duck Creek Formation of Oklahoma, the Grayson Formation of Texas, and the Torok Formation of Alaska.

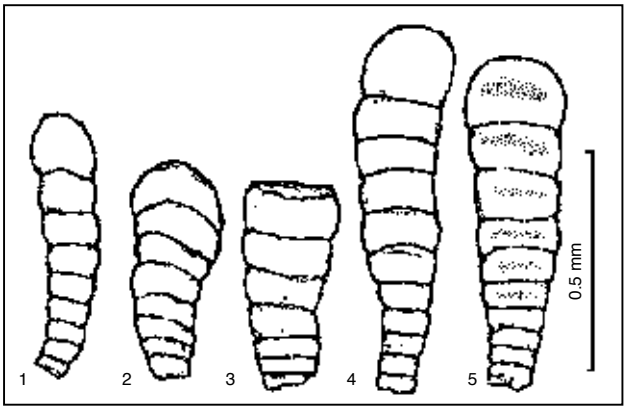

Figure 4. *Scherochorella minuta* (Tappan) from the Cushman Collection (camera lucida sketches). 1. paratype from the Grayson Formation, 3 1/2 mi NE of Koanoke, 2 mi E of Fort Worth - Denton road, Denton County Texas. 2-5. metatypes from the Duck Creek Formation, Red River, Horseshoe Bend, Love County Oklahoma.

CONCLUSIONS

The term *"Reophax minutus"* must be restricted to shallow water forms originally described from the Coastal Plain of the Gulf Coast. Deep-water and boreal forms display a more tapered morphology with a produced aperture. Specimens from the North Sea and the Polish Outer Carpathians are sufficiently different from the type specimens of *R. minuta* to warrent being placed in two different species based on the degree of expansion of the width of the test and the height of the final chamber. Lower Cretaceous deep-water forms formerly attributed to *"R. minutus"* are transferred to the species *Pseudonodosinella troyeri* (Tappan). The more slender Upper Cretaceous to Paleocene specimens are now placed in *Pseudonodosinella parvula* (Huss).

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Plate 1. *Pseudonodosinella troyeri* (Tappan). Specimens on left are photographed using reflected light or SEM; right - same specimen viewed in cross-polarised light. **1-2.** Holotype & Paratype of *Reophax troyeri,* Topagoruk Fm. of Alaska. **3.** Holotype of *Reophax minuta.* from Tappan (1940). **4a-16.** Specimens from the Verovice Beds (Barremian to Albian) of the Polish Carpathians. **4.** Wilkowisko MK 60, Silesian Unit; **5.** Zywiec JL38/91, Subsilesian Unit; **6.** Rybotycze 26/58; Skole Unit; **7-9, 15, 16.** Straconka BL8/89; Silesian Unit; **10.** Lanckorona, Silesian Unit; **11-12.** Straconka 20/91, 41/91; Silesian Unit; **13-14.** Lanckorona C9, A3; Silesian Unit;

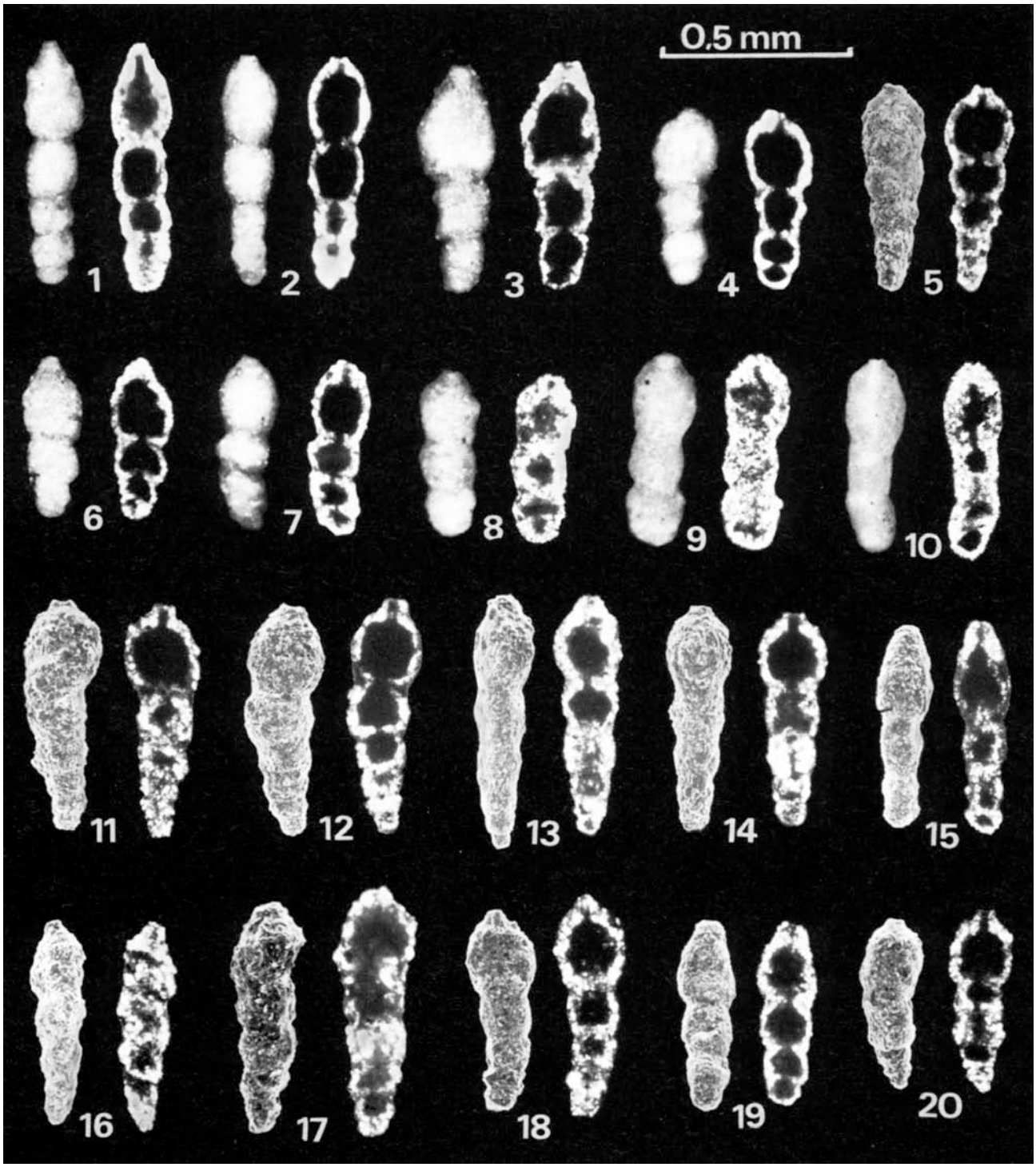

Plate 2. *Pseudonodosinella parvulus* (Huss), Subsilesian Unit of the Polish Carpathians. Specimens on left are photographed using reflected light or SEM; right - view in cross-polarised light. **1-9.** Green and variegated upper Cenomanian to Turonian shales, W´glówka boreholes. **1.** Neotype, W´glówka-7, 299-303 m. **2,4,6.** Weglówka-130, 230 m. **3,5.** W´glówka-6a, 241.6 - 247 m. **7-9.** Weglówka-6a, 251.6 - 257.4 m. **10-19.** Lower Senonian red variegated marly shales, Stream banks at Zawadka near Wadowice.