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Horstia renatae gen. et sp. nov., a new diatom from the Przeworno Proterozoic marbles

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ABSTRACT. *Horstia renatae* as a remnant of *Navicula* s.l. found in the Przeworno Proterozoic marble was earlier preliminarly exhibited, and now it is formally described on the basis of the specimen photographed in the transmission electron microscope. The specimen was detached from a freshly broken piece of marble with the triafol replica film.

KEY WORDS: fossil diatoms, *Horstia*, Bacillariophyceae, Proterozoic, Lower Silesia

INTRODUCTION

Reports on the diatom remains found in two graphitic marble layers in the Przeworno white marble quarry (Lower Silesia in Poland) have been published earlier (Kwiecińska & Siemińska 1973, Siemińska 1980, 1981, Siemińska & Kwiecińska 1976, 2000). The Proterozoic age of the marble was recognized by Oberc (1966, 1975) on the basis of geology and tectonics. According to Oberc-Dziedzic (1999), Szczepański and Józefiak (1999), and Szczepański (2000) the age is probably Neoproterozoic. The details of geology and characteristics of the marble from Przeworno, together with the description of the methods used to found the diatom remnants, are also published (Kwiecińska 2000). From among the specimens found, three new diatom taxa heve been already described (Kwiecińska & Siemińska 2000); the formal description of the next one follows here.

MATERIAL AND METHODS

The specimen was detached from the freshly broken piece of rock using the triafol matrix technique. The replica was then evaporated with carbon and shadowed with platinum. The electron micrograph was taken with C. Zeiss ETH transmission electron microscope with an accelerating voltage of 65 kV.

The details of the structure of the specimen were studied on high and low contrast prints of the same negative. Separate drawings of the remaining parts of both the valves of the diatom frustule were made on the basis of these prints. The hypothetical reconstruction of the diatom valve was rebuilt with the help of a computer using the program Microsoft Photo Editor.

SYSTEMATIC DESCRIPTION

The remnant of the frustule is 5 μm long, and ca. 3 μm wide; it is severly damaged. When comparing the contrasty and low contrasty prints one can distinguish the details of the two valves of one frustule slightly displaced in relation to their apical axes (Figs 1, 2).

One valve only maintained the flatly rounded apex. On the illustration (Fig. 2:a), the right part of it reaches somewhat beyond its central area. The edge of the left part of this valve disappeared; this damage widens towards the central area. The second half of this part of the valve vanished almost entirely: only a narrow, irregular strip adhering to a part of the slightly thicker sternum remained.

The second valve is more seriously damaged (Fig. 2:b). The apical part is lacking, the

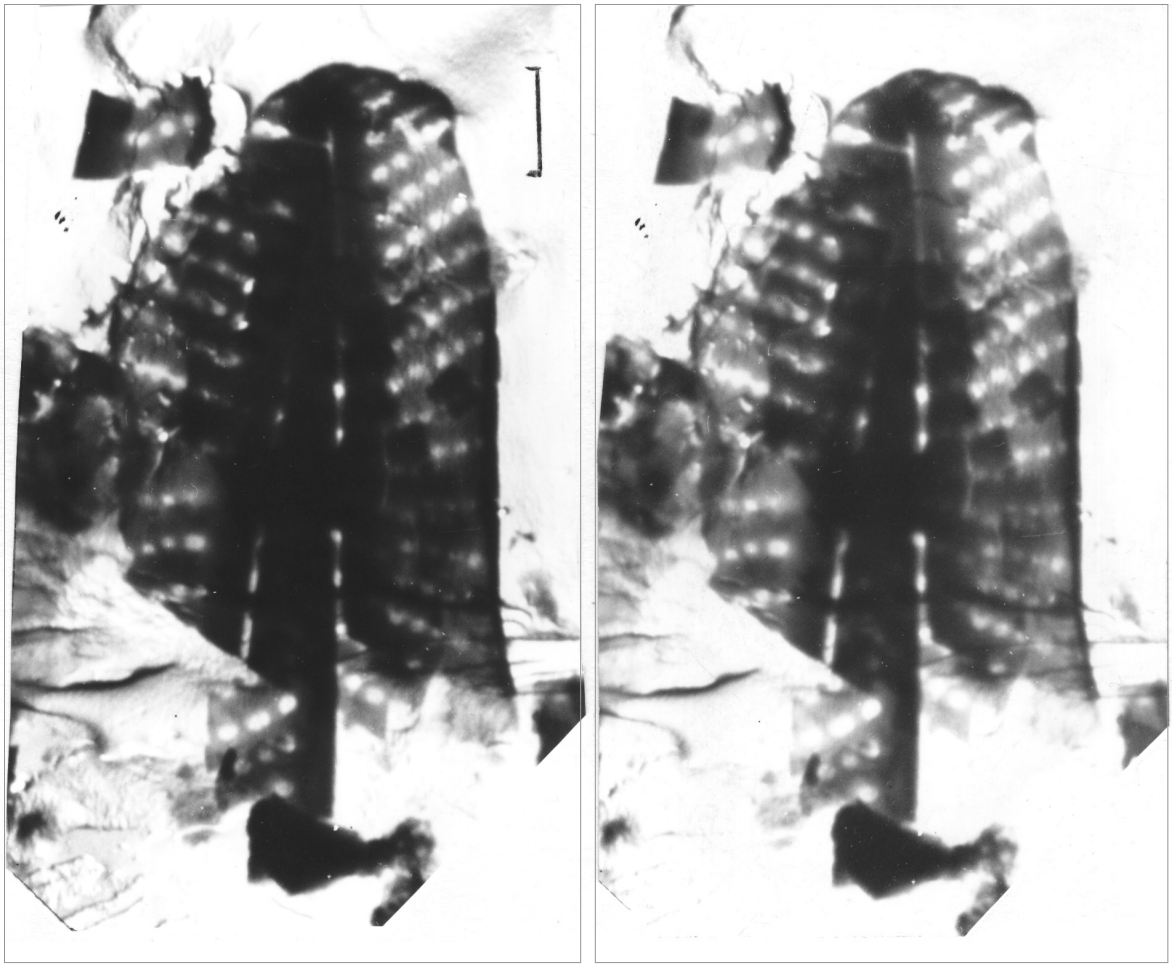

Fig. 1. *Horstia renatae*: **a** – contrasty, **b** – low contrasty -copies of the negative (TEM. Scale bar = 1 μm)

middle part of its left side has lost its edge but retained the clearly visible sternum; on its right side the upper section of the sternum partly covers the sternum of the other valve (Fig. 1:b); the rest of its surface is visible along the raphe slits of the other valve, and also as the very small particles scattered on the surface of the other valve.

Helicoglossae have been observed and there were no traces of the girdle bands in the remnant.

A fragment of the frustule has been detached and lies nearby (Fig. 1:a). It has the same character of areolae and part of the sternum.

The diagnosis of the species is partly based on the hypothetical reconstruction of a valve (Fig. 2:c).

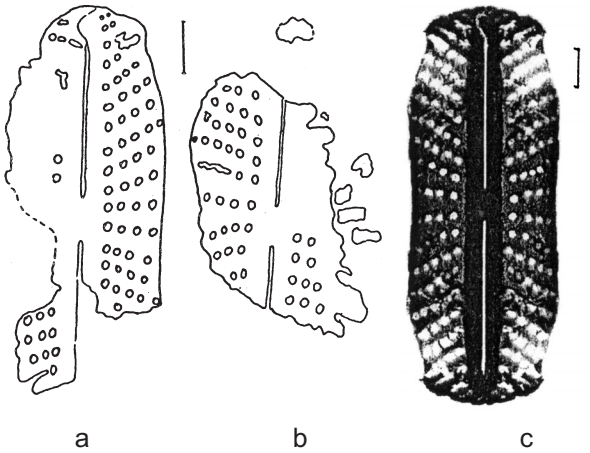

Fig. 2. *Horstia renatae:* **a, b** – outlines of the remains of both valves; **c** – the hypothetical reconstruction of the valve (scale bars = 1 μm)

Horstia Siem. & Kwiec. **gen. nov.**

Valvae minutissimae, elongatae, plane rotundae in extremitatibus, modice angustae ad apices et in medio. Ordines striarum radiales; areolae rotundatae. Sternum valde angustum, tantum paulatim crassius quam relictum valvae. Raphe rimae recta, cuius centrales terminationes angustae et rectae sunt.

Valves very small, elongated, flatly rounded at the ends, slightly narrowed toward the apices and in the middle. Rows of the striae radial, consisting of single, round areoles. Sternum slightly thicker than the rest of the valve. Raphe slits simple, their central endings strait and simple, without nods.

Genus extinct, Neoproterozoic, described from graphitic marble layers from Przeworno (Lower Silesia in Poland).

It is named in honour of Professor Horst Lange-Bertalot, the eminent German diatomist.

Type species. *Horstia renatae* Siem. & Kwiec.

The genus is similar to *Mayamaea* Lange-Bertalot 1997. The differences are: the shape of the valve at *Mayamaea* is always elliptical, never subcapitate or acuminate and in *Horstia* it is slightly narrowed toward the apices and in the middle (this is noticeable on the remnant and clearly visible on the reconstruction); the proximal raphe ends at *Mayamaea* terminate in simple nods and in *Horstia* there are no nods at all.

It is also similar to *Adlafia* Moser, Lange-Bertalot & Metzeltin 1998 which differs from *Horstia* by the elliptical outline of the valve, striae convergent towards the apices of the valve, and also by possesing the copulae.

Horstia renatae Siem. & Kwiec. **sp. nov.**

Valvae minutissimae, (versimile erant) 8 μm longae, circa 3 μm latae, elongatae, plane rotundae in extremitatibus, modice angustae ad apices et in medio. Ordines striarum radiales, circa 3–4 in 1 μm. Sternum valdae angustum, tantum paulatim crassius quam relictum valvae, ad aream centralem non dilatatum. Raphe rimae recta, probabiliter valde hamata ad subtilem (non clare visibilem) terminalem fissuram, cuius centrales terminationes angustae et rectae sunt.

Valves very small, (must have been) 8 μm long, ca. 3 μm wide, elongated, flatly rounded at the ends, slightly narrowed toward the apices and in the middle. Rows of the striae radial, ca. 3–4 in 1 μm, consisting of small and single, round areolae; there are 4 areolae in 1 μm. Sternum very narrow, only slightly thicker than the rest of the valve, not widened at the central area. Raphe slits simple, strongly hooked at the delicate (not clearly visible) terminal fissure; its central endings strait and simple, with no nods.

Iconotype. Fig. 1. Negative Nr 967 taken by B. Kwiecińska in TEM, stored at the Phycological Department of the W. Szafer Institute of Botany, Polish Academy of Sciences, Cracow, Poland.

Type locality. Black layers of the Neoproterozoic marbles in Przeworno (Lower Silesia in Poland).

The species is named to honour Professor Renate Lange-Bertalot.

The specimen appears similar to *Mayamaea atomus* (Kützing) Lange-Bertalot var. *permitis* (Hustedt) Lange-Bertalot 1997 (=*Navicula atomus* Kützing var. *permitis* Hustedt) and to *M. atomus* var. *atomus* (= *Navicula atomus* var. *atomus*, Lange-Bertalot 1997); from both of them it differs in the outline of the valve shape and in the lack of proximal raphe ends nods. The same features distingush the new species from *Sellaphora* Mereschkowsky (Mereschkowsky 1902).

DISCUSSION

Both taxa, the genus and the species, are described basing on a single fragment of the frustule; the situation is expected to be acceptable in case of such an old and rare material.

Horstia renatae is one of the 39 diatom remnants found on 16 grids with the replicas taken of the investigated marble surface (out of ca 150 grids studied). It was necessary to use its image as the type instead of the specimen itself, because the only one discovered specimen of the species was too small to be found again on the grid in TEM among abundant particles of the rock. The grid was later accidentaly destroied in the course of preparation for the scaning electron microscope study.

Molecular evidence for the origin of diatoms estimated lately by Medlin et al. (2000) indicates that it is unlikely that the diatoms existed before the Permian Triassic boundary. The unquestionable finds, however, of Cambrian diatoms by Vologdin (1962) and Gapeev (1992, 1995) are not in accordance with this opinion. Other discoveries of diatoms in the deposits older than the Cretaceous was recently discussed (Siemińska 2000). These facts are in accordance with Sedlak's opinion (Sedlak 1959, 1965, 1985) that abundantly occurring silica was primarily the basic component of protective structure of the first organisms living on the earth, and was only later replaced by carbonates.

It is then obvious that diatoms lived already 570 milion years ago, and that they are ones of the oldest organisms of the world.

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