

Morphology and taxonomy of *Neohuttonia reichardtii* (Grunow) O. Kuntze (Bacillariophyta) from southern Brazil

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ABSTRACT – The fine structure of the rarely recorded epipsammic marine diatom *Neohuttonia reichardtii* (Grunow) O. Kuntze was studied in detail using samples from Porto Belo sandy beaches (Santa Catarina State, Brazil). *Neohuttonia reichardtii* is characterized by its twisted frustule with one ocellus at each pole, two pseudosepta and one central rimoportula per valva. It is described and illustrated from LM and SEM pictures. Its taxonomic position is discussed taking into account the Triceratiaceae family.

Key words: epipsammic marine diatom, *Neohuttonia*, fine structure.

RESUMO – **Morfologia e taxonomia de *Neohuttonia reichardtii* (Grunow) O. Kuntze (Bacillariophyta) do Sul do Brasil.** A ultra-estrutura de uma rara diatomácea marinha epipsâmica, *Neohuttonia reichardtii* (Grunow) O. Kuntze, foi estudada em detalhe a partir de amostras coletadas nas praias arenosas de Porto Belo (Santa Catarina, Brasil). *Neohuttonia reichardtii* é caracterizada por sua frústula torcida com um ocelo em cada extremidade, dois pseudoseptos e uma rimoportula central por valva. Esta espécie é descrita e ilustrada com detalhes de microscopia óptica e eletrônica de varredura. Sua posição taxonômica é discutida considerando a família Triceratiaceae.

Palavras-chave: diatomácea epipsâmica marinha, *Neohuttonia*, ultra-estrutura.

INTRODUCTION

According to Fourtanier & Kociolek (1999) four species were mentioned by O. Kuntze in 1898 to *Neohuttonia*: *N. alternans* (Grunow & Sturt) O. Kuntze, *N. labuani* (Grunow) O. Kuntze, *N. reichardtii* (Grunow) O. Kuntze, and *N. virgata* (Grunow & Sturt) O. Kuntze.

Neohuttonia O. Kuntze is a genus with a complex nomenclature and the specific epithet *N. reichardtii*, as well. The taxon addressed in this paper was firstly described by Grunow (1863) as *Cerataulus* (?) *reichardtii* Grunow to the Adriatic Sea from a sand sample collected at S. Pietro beach of Nembi. Hendey (1964) presented this taxon as *Huttonia* described by Grove & Sturt (1887) but it is a homonym of *Huttonia* Sternberg published in 1837. According to Fourtanier & Kociolek (1999) this taxon was combined into *Neohuttonia* by O. Kuntze in 1898.

Hustedt (1955) found *Huttonia reichardtii* Grunow in mud samples from North Carolina and

he combined it latter into *Huttoniella* Karsten and named it *Huttoniella reichardtii* (Grunow) Hustedt after examining Grunow's original material from the type locality. He probably did not know O. Kuntze's paper, which was published in 1898. Besides, Van Landingham (1971) refers to this taxon in *Huttoniella* Karsten.

Neohuttonia reichardtii was found in Tanzania by Foged (1975) in samples collected from scraps of an old trunk in a lagoon, by Hendey (1964) at West Mersey, and in the U.S.A. by Hustedt (1955) in mud samples collected in North Carolina. Hustedt *op. cit.* also mentioned these species from the coasts of the Mediterranean, the Atlantic coast of Africa, the Virgin Islands and the Caribbean.

More recently it has been found in the continental shelf of North Carolina by Cahoon & Laws (1993) as an extremely rare species. According to Witkowski *et al.* (2000) *Huttoniella reichardtii* (Grunow) Hustedt is a common diatom from marine littoral tropical and subtropical that was found at Qurum Beach (Oman).

Fine structural details of this not very well known diatom are not available in the current literature. Therefore, the present paper describes the morphology of *Neohuttonia reichardtii* from the coast of Santa Catarina (southern Brazil) based on light microscopy (LM) and scanning electron microscopy (SEM) studies, and discusses its taxonomic position.

MATERIAL AND METHODS

The Porto Belo peninsula, located between 27°05'S-27°13'S and 48°27'W-48°37'W, in Santa Catarina State, Brazil has a wide range of beaches ranging from dissipative to reflective conditions, and each one of them is separated by a few kilometres only.

The 121 samples were collected in December 1995 and in January 1996 along beach transects from the base of the dune (called station 1) to the swash (called station 3) by using a 3.7 cm diameter PVC, which was pressed down vertically into the sediment. The first centimetre of sediment was kept in flasks with 20 ml of 3% lugol solution.

Fixed material was stored in the Herbarium (ICN) of the Department of Botany, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, from the numbers 91392 to 91513. Sand samples were cleaned by following the Simonsen (1974) technique. Aliquots were dried onto cover slips and mounted in Hyrax for permanent slides. Slides were examined with a Zeiss Axioplan light microscope with phase contrast and the specimens were photographed either on Ilford Pan F 50 or on T Max 100 film. For scanning electron microscopy (SEM), cleaned frustules were dried onto a stub, coated with gold at 1kV for 4 minutes, and examined with Phillips 501B at an accelerating voltage of 15kV. An Ilford SP 4 film was used for photography.

Terminology follows Round *et al.* (1990) and Barber & Haworth (1981).

RESULTS

Observation of this diatom in SEM has revealed several unknown details about the wall structure, ocellus, rimoportula and cingulum organization which will be described as follows:

Description

The cells have several (8-12) discoid plastids (Figs. 1, 2). In girdle view, frustules are heavily silicified, quadrangular, clearly twisted (Fig. 4).

Valves are elliptical in valve face view with bluntly rounded apices (Fig. 3), 21-47 µm long and 7-8 µm wide. The valve face is flat turning to a deep vertical mantle (Fig. 7). Spines are absent. There are two conspicuous incompletely developed pseudosepta crossing the valve (Figs. 3-5) never reaching the mantle edge (Figs. 4, 8). At opposite sides of the valve, one ocellus is present (Figs. 3-5). Mucilage secreted through the ocelli probably helps the frustule to attach itself to sand grains. One rimoportula is always present on the mantle at the centre of the valve (never prolonged outside of the valve by a tube). Striae on valve face are arranged irregularly (Fig. 3), while on the mantle, they can be observed on transverse and longitudinal rows in number of 7.8-10 in 10 µm (Figs. 5, 6) interrupted by cross-bars. The wall is loculated, with fine external pores and round internal foramina (Figs. 8, 9). The mantle edge is plain, free of ornamentation and not recurved (Figs. 6, 9). The cingulum has several open and equal copulae ornamented by vertical rows of fine pores (Figs. 6, 9).

Neohuttonia reichardtii was found attached to sand grains by its ocellus and living in mucilage bubbles also attached to sand grains, in six samples where it was a rare species.

On the epipsammon it was also observed *Eunotogramma* sp., *Achnanthes* spp. and *Catenula adherens* Mereschkowsky, *Diplomenora* sp. and small *Navicula* spp. and *Amphora* spp., among the free-moving diatoms.

Studied material: BRAZIL, SANTA CATARINA, Bombinhas, Bombas, 15. XII.1995 (ICN 91403); Mariscal, 22. I. 1996 (ICN 91481); Quatro Ilhas, 15. XII.1995 (ICN 91405); Quatro Ilhas, 15. XII.1995 (ICN 91407); Quatro Ilhas, 22. I. 1996 (ICN 91466) and Quatro Ilhas, 22. I. 1996 (ICN 91467).

DISCUSSION

Neohuttonia reichardtii was described from a sandy habitat and it has been frequently found in sediment samples. The length and breadth measured to this species from the coast of Santa Catarina are similar to those mentioned in the literature (Table 1).

TABLE 1 – *Neohuttonia reichardtii* data dimension registered in the literature.

Author	apical axis	transapical axis
Grunow (1863)	16-21 µm	8-13 µm
Foged (1975)	28-36 µm	–
Hustedt (1955)	70 µm	15 µm
Witkowski <i>et al.</i> (2000)	28-55 µm	8-15µm

Neohuttonia has been considered a genus close to *Cerataulus* as several authors such as Hendey (1964) and Hustedt (1955) have included the latter genus in their comments on *Neohuttonia*. In fact, Hustedt (1955) had doubts whether *N. reichardtii* should be retained as a separate genus or united with *Cerataulus*. According to Simonsen (1979), *Cerataulus* Ehrenberg, *Triceratium* Ehrenberg and *Eupodiscus* Bailey and *Huttoniella* are in the family Eupodiscaceae. For Round *et al.* (1990) the genera mentioned above are in the family Triceratiaceae but the taxonomic position of *Neohuttonia* is not analysed.

Neohuttonia shares some features with Anaulaceae, Biddulphiaceae and Triceratiaceae (Table 2). In Anaulaceae two genera are included by Round *et al.* (1990) *Anaulus* Ehrenberg and *Eunotogramma* Weisse. In the first genus, the ocelli have no obvious porellar plate and the well known *Anaulus astralis* Drebes & Schulz have no ocelli. The resembling characteristics between the genera of Anaulaceae and *N. reichardtii* are the two pseudoseptum and one rimoportula per valva, although areolae organization is distinct and external tube from the rimoportula is absent. On the other hand, the presence of pseudoseptum, ocellus and similar wall structure in genera as *Odontella* and *Sheshukovia* Glezer demonstrate its relationship with two latter families (Anaulaceae and Triceratiaceae). And, in conclusion, *N. reichardtii* should be assigned in Triceratiaceae.

ACKNOWLEDGEMENTS

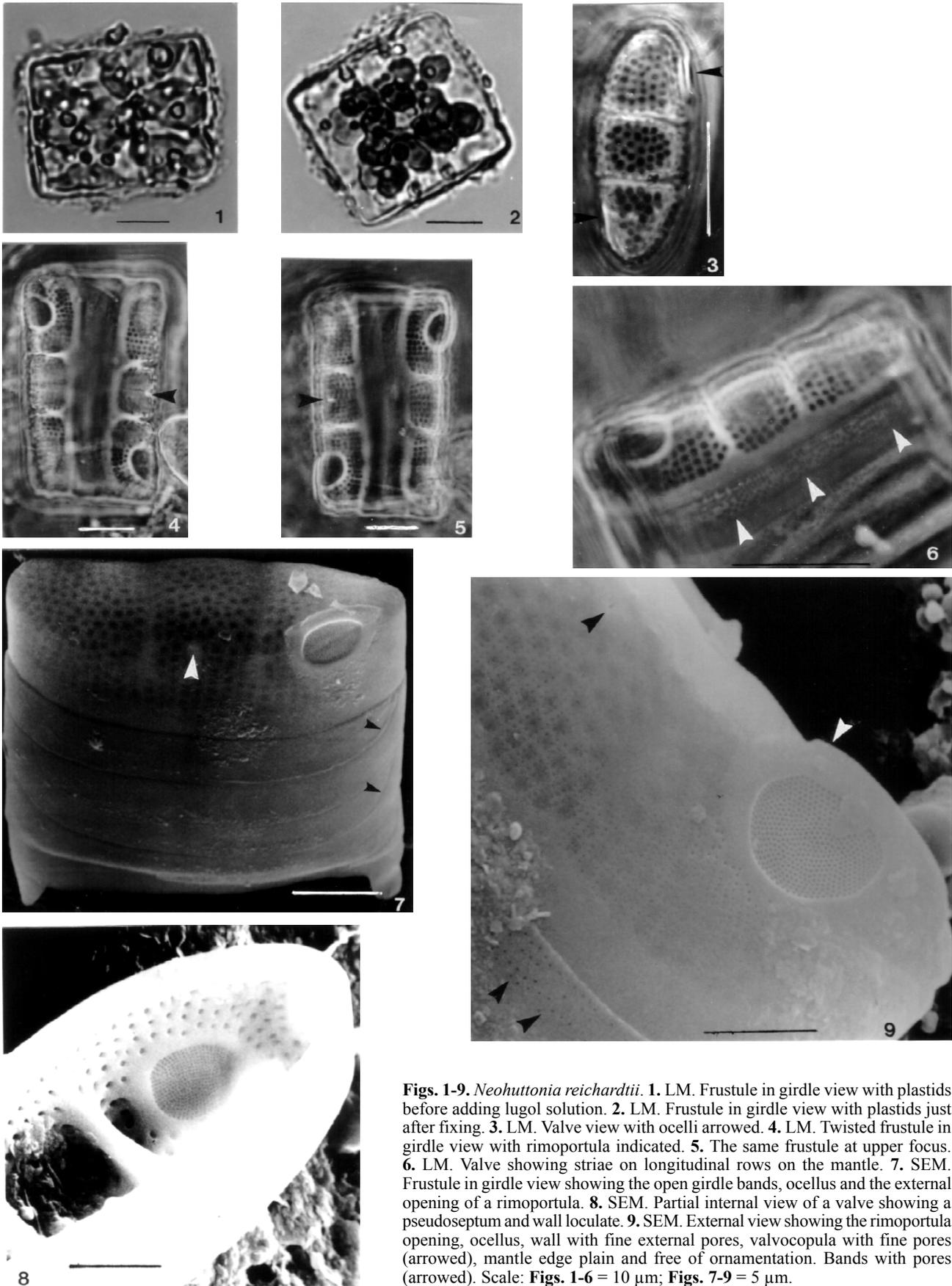
I am indebted to Dr. Eugenia Sar from Argentina for the helpful comments and manuscript improvement, the anonymous referee for constructive comments, and also to Dr. Lezilda Carvalho Torgan for the literature and technical facilities at Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul. Partial financial support was provided by CAPES.

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TABLE 2 – Comparison between the most important taxonomic features of *Neohuttonia* and allied families by Round *et al.* (1990) (+ = present, – = absent).

Characteristics	Anaulaceae	Biddulphiaceae	Triceratiaceae	<i>Neohuttonia</i>
Cribrum/Foramen	–	+	+	+
Pseudosepto	+	+	+	+
Rimoportula	+	+	+	+
Pseudocellus	–	+	–	–
Ocellus	–	–	+	+



Figs. 1-9. *Neohuttonia reichardtii*. **1.** LM. Frustule in girdle view with plastids before adding lugol solution. **2.** LM. Frustule in girdle view with plastids just after fixing. **3.** LM. Valve view with ocelli arrowed. **4.** LM. Twisted frustule in girdle view with rimoportula indicated. **5.** The same frustule at upper focus. **6.** LM. Valve showing striae on longitudinal rows on the mantle. **7.** SEM. Frustule in girdle view showing the open girdle bands, ocellus and the external opening of a rimoportula. **8.** SEM. Partial internal view of a valve showing a pseudoseptum and wall loculate. **9.** SEM. External view showing the rimoportula opening, ocellus, wall with fine external pores, valvocopula with fine pores (arrowed), mantle edge plain and free of ornamentation. Bands with pores (arrowed). Scale: **Figs. 1-6** = 10 μ m; **Figs. 7-9** = 5 μ m.