

## Examination of Type Material of *Melosira nivalis* W.Sm. (Bacillariophyceae) and its Synonymy with *Aulacoseira pfaffiana* (Reinsch) Krammer

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**Abstract** Syntype material of *Melosira nivalis* W.Sm. was examined using scanning electron microscopy. There is no clear morphological difference between *M. nivalis* and *Melosira pfaffiana* Reinsch. Since *M. nivalis* differs from *Melosira distans* in many morphological characters, and *M. nivalis* has a priority for *M. pfaffiana* at species rank, the name *Aulacoseira nivalis* (W.Sm.) English & Potapova should be used for this taxon. When this taxon is used in the variety rank, *M. distans* var. *pfaffiana* has a priority over *M. distans* var. *nivalis*.

**Key words:** *Aulacoseira nivalis*, *Aulacoseira pfaffiana*, *Melosira distans*, *Melosira nivalis*, *Melosira pfaffiana*, syntype.

### Introduction

*Melosira nivalis* W.Sm. was described by W. Smith in his famous British monograph (Smith, 1856). He used three localities for this taxon. Kirchner (1878) made a new combination of this taxon as a variety of *Melosira distans* (Ehrenb.) Kützing. English and Potapova (2009) transferred this taxon to the species rank of genus *Aulacoseira*.

The relationship between this taxon and *Aulacoseira pfaffiana* (Reinsch) Krammer, is very confusing. Krammer and Lange-Bertalot (1991), European monographs widely used for the identification of diatoms, presented the light microscopy (LM) images of type materials for *A. nivalis* and *A. pfaffiana*. The difference of these two taxa is number of areolae on perivalvar striae, and the arrangement of valve face areolae (Potapova *et al.*, 2008).

Tuji and Williams (2006) examined the ultrastructure of *A. pfaffiana* by scanning electron microscopy (SEM) using the type material and

Japanese materials from Yaku-shima Island. Later, Tanaka and Nagumo (2007) presented the SEM photographs of *A. distans* var. *nivalis* using Japanese material. However, their SEM images of *A. distans* var. *nivalis* were very close to those of *A. pfaffiana* presented by Tuji and Williams (2006). They discussed morphological differences of both taxa in Krammer and Lange-Bertalot (1991), and noted the need for a further study of type materials. Potapova *et al.* (2008) discussed morphological differences of both taxa as illustrated in Krammer and Lange-Bertalot (1991) and concluded the synonymy of *A. pfaffiana* with *M. distans* var. *nivalis*, and the priority of *M. distans* var. *nivalis* from *A. pfaffiana*.

In this paper, the type material of *M. nivalis* is examined, and the synonymy of this taxon with *M. pfaffiana* is discussed.

### Materials and Methods

A material in the packet Pg. 307, Snow mud Den McDhui, 2800 ft. Dr. Dickie, 4. August 45

housed in the Hustedt's Colelctiojn, Bremerhaven (AWH) was examined. The locality and sampling date agree with one of the original localities in Smith (1856), and this packet should be a syntype for *M. nivalis*. Hoover (1976) also described this packet as the 'SYNTYPE' of *M. nivalis*. This is the only one raw material found in AWH for this taxon. The LM photographs in Krammer and Lange-Bertalot (1991), are taken from the slides from other two localities. Because AWH is the place where the original W. Smith collection is housed, the raw materials from two other localities may not exist.

A very small amount of raw material on a mica from this packet was examined. The material was boiled in concentrated nitric acid about five minutes and rinsed with distilled water 5 times. This cleaned material is kept in 70% ethanol.

About 0.1 ml of cleaned material was put on two SEM stubs and dried up in room temperature in one night. The stubs were sputter-coated with platinum and examined with a scanning electron microscope (JEOL-6390LV, JEOL, Japan) equipped with lanthanum hexaboride cathode.

### Results and Discussion

*Aulacoseira nivalis* (W.Sm.) English & Potapova.

Proc. Acad. Nat. Sci. Philadelphia **158**: 39. 2009.

≡ *Melosira nivalis* W.Sm. Synopsis Brit. Diat.: 58, pl. 53. f. 336. 1856.

≡ *Aulacoseira distans* var. *nivalis* (W.Sm.) Haworth Diat. Res. **5**: 195. 1990.

≡ *Melosira distans* var. *nivalis* (W.Sm.) Kirchner Algen. In: Kryptog.-Fl. Schl.: 216. 1878.

≡ *Melosira pfaffiana* Reinsch in Rabenh. Die Algen Europa's Exsiccatae. No. 1912. 1866.

≡ *Melosira pfaffiana* Reinsch Abh. Senckenberg. Naturg. Ges. 6: 137, pl. XX: C: III; Algenfl. Franken: 11, pl. I. f. II. 1867 (1866).

≡ *Melosira distans* var. *pfaffiana* (Reinsch) Grunow in Cleve & Moller, Diatoms Esats Edquists Boktryckeri No. 56. 1878.

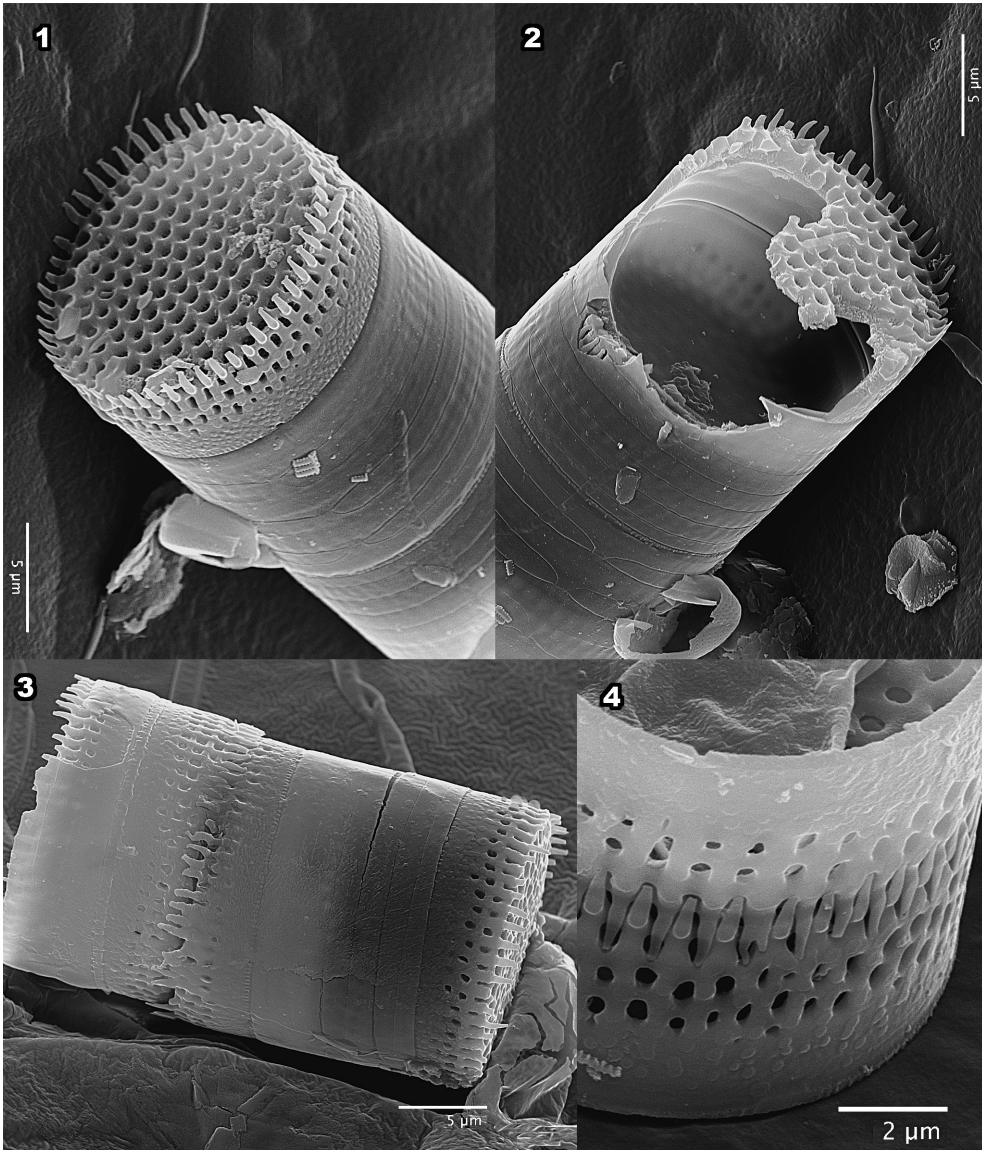
≡ *Aulacosiera pfaffiana* (Reinsch) Krammer

Nova Hedwigia **52**: 94. 1991.

I have found only three colonies of *M. nivalis* in the syntype material under SEM. Two to three areolae are found on perivalvar striae (Figs. 1, 3 and 4). This number is smaller than the number of areolae on a mantle view photograph presented by Krammer and Lange-Bertalot (1991). However, their photograph was not from the type material, and they did not present mantle view photograph from the type material. The number of areolae on perivalvar striae, are three to six for the type material of *A. pfaffiana* (Tuji and Williams, 2006), and this number may not be a good character for the identification of both taxa. The arrangement of valve face areolae in this study (Fig. 1) agrees with the arrangement on the photographs by Krammer and Lange-Bertalot (1991) including types. Since sizes ranges in this study (diameter: 10.8, 15.5, 17.0  $\mu\text{m}$ , mantle height: 4.0, 4.6  $\mu\text{m}$ ) also agree with the original description, the individuals examined in this study should belong to the same taxon, *M. nivalis*.

Other characters are as follows. The pseudoseptum does not exist (Figs. 2, 5 and 6). The collum (the area without puncta) is developed (Figs. 2, 5 and 6). The valve face has areolae. In the central part of the valve face areolae are circular, those on the margin are elongated (Figs. 1 and 2). Spines exist on each costa of valve-mantle junction (Figs. 1–4). The tip of each spine has an anchor-like shape (Figs. 1–4). The number of rimoportulae is not established with certainty because of the limited number of examined valves. At least one rimoportula was observed on the collum close to striae (Figs. 5 and 6).

These morphological characters observed under SEM agree with the morphological characters of type material for *A. pfaffiana* examined by Tuji and Williams (2006). Potapova *et al.* (2008) discussed the morphological differences between *A. nivalis* and *A. pfaffiana*, and concluded the synonymy of both taxa. My observation also supports the synonymy of both taxa. In this case *A. nivalis* has a priority from *A. pfaffiana* at species rank. Since, *A. distans* var. *distans* is an extinct

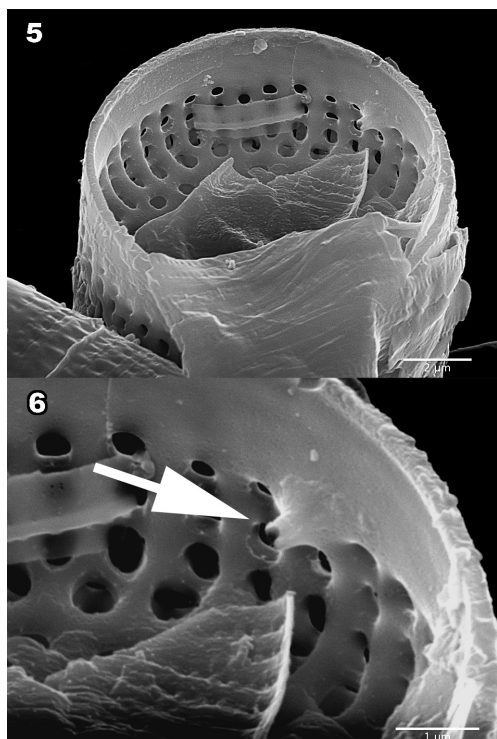


Figs. 1–4. *Aulacoseira nivalis* (W.Sm.) English & Potapova. Syntype. SEM. Pg. 307, Snow mud Den McDhui, 2800 ft. Dr. Dickie, 4. August 45) in AWH. 1–3. Bar=5 µm. 4. Bar=2 µm.

taxon, and the shapes of spine and areolae are very different between *A. distans* and *A. nivalis*, *A. nivalis* should be different from *A. distans* at species level.

*A. nivalis* is sometimes regarded at the variety rank as *Aulacoseira distans* var. *nivalis* (Potapova *et al.*, 2008). However in the variety rank, *M. distans* var. *pfaffiana* seems to have a priority for *M. distans* var. *nivalis*. *M. distans* var. *pfaffiana* was

described in the exsiccata by Cleve and Möller (1878) as a new combination. This exsiccata was introduced by the American Journal of Microscopy (Jan. 1878) as publishing ‘early this year’ (followed by Sayre, 1969). In the preface of Kirchner (1878), it was dated ‘September 1878’. Though, the publishing dates of both taxa are very close, Cleve and Moller (1878) seems to be published earlier than Kirchner (1878). Under the



Figs. 5 and 6. *Aulacoseira nivalis* (W.Sm.) English & Potapova. Syntype. SEM. Pg. 307, Snow mud Den McDhui, 2800 ft. Dr. Dickie, 4. August 45) in AWH. Showing rimoportula. 5. Bar=2  $\mu$ m. 6. Bar=1  $\mu$ m.

Internal Code of Botanical Nomenclature (ICBN) art 11.2 (Vienna code: McNeill *et al.*, 2006), a name does not have a priority outside the rank in which it is published. When *A. nivalis* regarded as a variety of *A. distans*, *M. distans* var. *pfaffiana*, should have a priority, and the combination, *A. distans* var. *nivalis*, should not be used. To use this taxon in species rank (English and Potapova, 2009), also help to avoid the confusing this nomenclatural problem.

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