

NOTE

OBSERVATIONS ON *NAVICULA THALLODES* (BACILLARIOPHYCEAE),
A BLADE-FORMING DIATOM FROM THE BERING SEA¹

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ABSTRACT

A thallus-forming diatom, *Navicula thalloses* Proschkina-Lavrenko, previously known only from the original collection at Bering Island (U.S.S.R.), has been found at Amchitka Island in the Aleutians, Alaska. The most remarkable observation of the present report is that *N. thalloses* may form blades up to 50 cm long, which to our knowledge is the greatest length reported for a colonial diatom. SEM observations of this diatom are presented for the first time.

Key index words: Bacillariophyceae; Bering Sea; *Navicula thalloses*; thallus-forming diatom

In the past decade marine and freshwater blade-forming and tube-dwelling diatoms have received considerable attention (Cox 1975, 1977, 1979, Hancic and Lobban 1979, Millie and Wee 1981, Lobban 1983, 1984, 1985, 1986, Chastain and Stewart 1985, Carr and Hergenrader 1987, Houpt 1987, Lobban and Mann 1987). Commonly encountered diatoms with tube- or thallus-forming capabilities include *Berkeleya*, *Haslea*, *Nitzschia*, *Navicula* and *Cymbella* (*Encyonema*). A collection from the Aleutians of *Navicula thalloses* Pr.-Lavr., previously known from its original description only, provided us with the opportunity to amplify our knowledge of its structure and taxonomic position. The additional noteworthy element of this account is the observation that blades of *N. thalloses* are the longest ever described for a colonial diatom.

Thalli were collected by Phillip A. Lebednik at 2-3 m depth on rocks at Kirilof Point (51°24'50" N, 179°17'45" E), Amchitka Island (Rat Islands), the Aleutians, Alaska (Fig. 1). Six herbarium mounts were made by floating the delicate, slimy blades onto herbarium paper (Lebednik collection numbers AM-1000-5). Some thalli were preserved in 5% formalin in seawater (AM-1006). Specimens are deposited at MICH and PH.

For observations on valves, preserved material was rinsed in distilled water, then boiled in HNO₃ for 2 h. This material was alternately settled and rinsed until neutral. For light microscopy cleaned material was settled and air-dried onto coverglasses, then mounted on slides with Hyrax. Observations were made with a

Leitz Ortholux microscope providing 1.30+ numerical aperture. For scanning electron microscopy (SEM) cleaned material was air-dried onto coverglasses which were attached to aluminum stubs. Stubs containing the dried material were sputter-coated with approximately 20 nm of gold-palladium and viewed on a JEOL-T100 SEM at an operating voltage of 15kV. Light microscopic preparations are deposited at MICH, PH, and the Diatom Herbarium of the Great Lakes Research Division.

The initial impression of this population of blades was that of a foliose brown alga, such as *Akkesiphycus lubricus* Yamada & Tanaka (1944) or a *Punctaria* with a slimy texture. Subsequent microscopic observations revealed this alga to be a colonial diatom. Each blade was attached by a discrete holdfast. All blades were simple (Fig. 2). Most blades ranged in width from 18-30 mm; young blades were about 6 mm wide and the largest thalli were up to 40 mm wide. Blade length varied from 15-50 cm. Young blades had entire margins, whereas the largest blades had undulate or irregular margins.

Light microscopic observations (Figs. 3-10) show that valves of *Navicula thalloses* are narrowly elliptical with smooth (Figs. 3-6) or irregular (Fig. 10) outlines. Some valves appear slightly asymmetrical about the transapical axis (Fig. 10). Valves range from 12-28 μm in length and 4-6 μm in breadth. Striae are indistinctly punctate and parallel near the

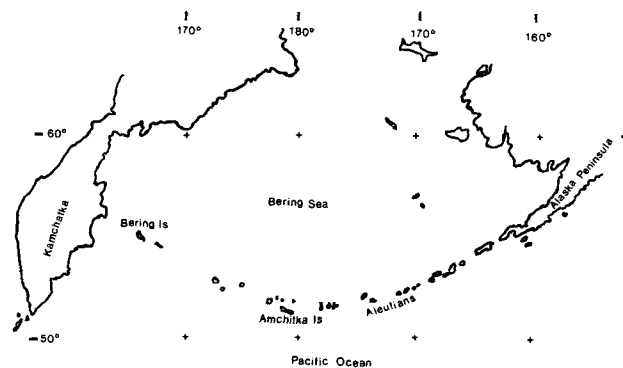
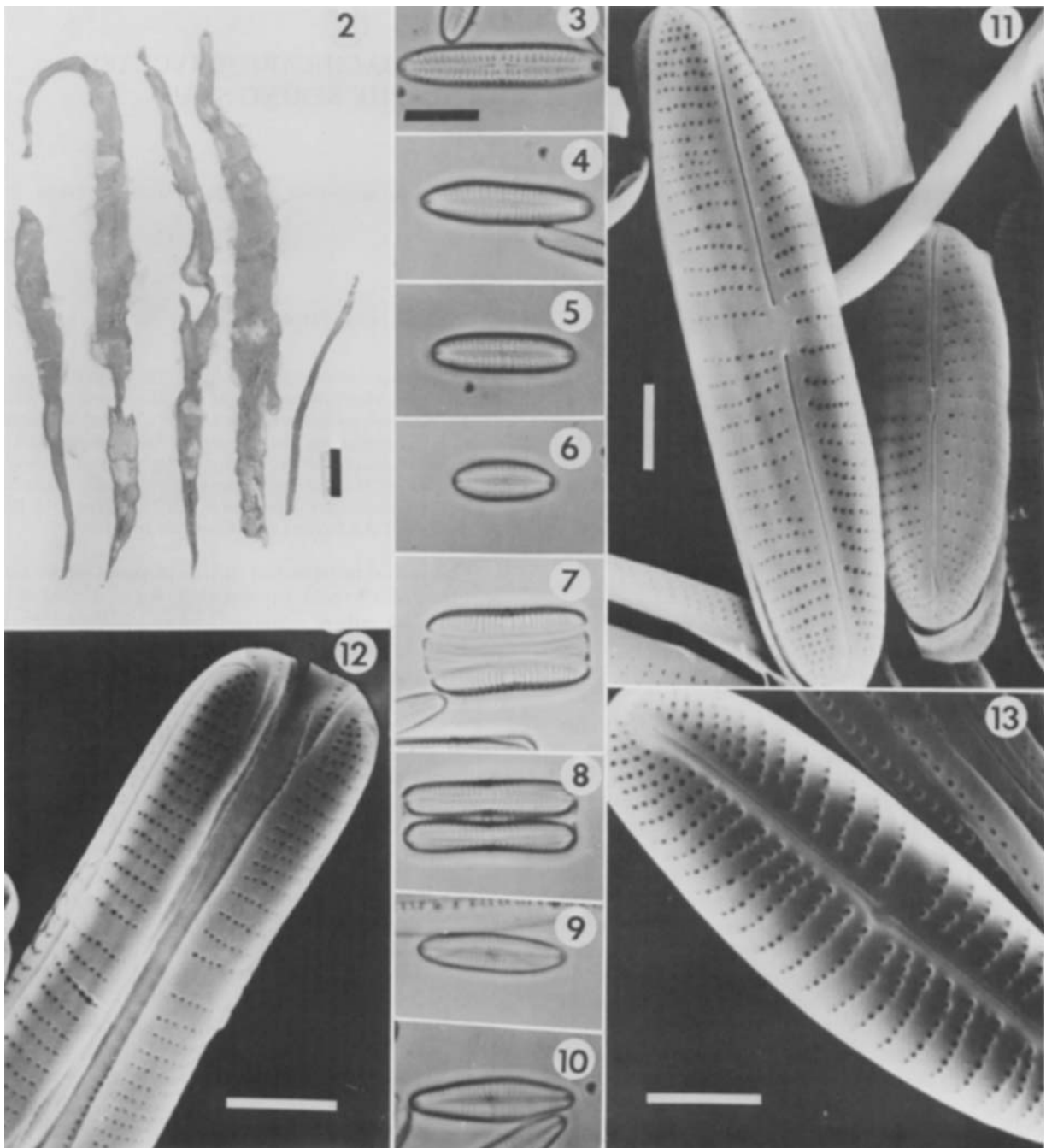


FIG. 1. Map of Bering Sea showing Bering and Amchitka Islands.

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FIGS. 2–13. *Navicula thalloses*. FIG. 2. Macroscopic blades of *Navicula thalloses*. Scale bar = 3 cm. FIGS. 3–10. Light microscopy. FIGS. 3–6. Valve views showing size diminution series. FIGS. 7, 8. Girdle views showing *cis* orientation of frustules and presence of girdle bands. FIG. 9. Specimen with fine striae density. FIG. 10. Specimen asymmetrical to transapical axis. Scale bar in Figures 3 = 10 μm for Figures 3–10. FIGS. 11–13. SEM. Scale bars = 2.5 μm . FIG. 11. Valve view showing punctate striae with finer striae densities at poles and deflected distal raphe ends. FIG. 12. External girdle view showing punctate girdle bands and *cis* orientation of valves. FIG. 13. Internal valve view showing small central and terminal nodules.

center of the valve but radiate to strongly radiate at the poles. Striae densities vary within and between cells. Valves usually have 12–14 striae in 10 μm at the center of the valve, but 17 striae in 10 μm have been observed. Striae densities are greatest at the poles, between 15 and 20 in 10 μm . The narrow axial area contains a filiform raphe whose distal ends

are highly deflected in the same direction. The central area is usually unilaterally expanded. In girdle view (Figs. 7, 8) several girdle bands are evident, and the valves appear slightly bent about the perivalvar plane.

SEM observations (Figs. 11–13) reveal punctate striae, with striae densities increasing towards the

poles. Terminal raphe endings are deflected, and on a single valve they are deflected in the same direction (Fig. 11). Valves of the same frustule have the unilaterally expanded central areas on the same side and this is true for deflection of the raphe ends (Fig. 12). This suggests that valves are of *cis* orientation (Mann 1983). Girdle bands (Fig. 12) are of the open type with two rows of pores internally. The raphe slit lies in a central raised rib (Fig. 13). The central nodule and terminal nodules (helictoglossae) are differentiated only slightly.

Light and scanning electron microscopic observations on the thallus-forming diatom from Amchitka Island indicate valve size and structure conform generally to the description of *Navicula thalloses*, a species described by Proschkina-Lavrenko (1955) from Bering Island. Observations concerning valve outline and striae density, as well as the larger size of thalli reported here, suggest the range of variation for *N. thalloses* is greater than previously described. Cox (1985) has described similar variability of valves in *N. ulvacea* (Berkeley ex Kütz.) Cleve. In addition, deflection of terminal raphe ends was neither mentioned nor illustrated by Proschkina-Lavrenko, although this feature may have gone unnoticed since curvature of the raphe occurs near valve extremities.

Navicula thalloses is similar to members of the *Naviculae microstigmaticae*, to which it belongs by virtue of its linear-lanceolate valves with deep mantles, numerous aseptate girdle bands, valves bent about the transapical plane, simple raphe, poorly developed central and terminal nodules, and colonial growth habit (Hustedt 1962). Similarities between *N. thalloses* and *N. ulvacea* include formation of blade-like thalli and highly deflected terminal raphe ends. Valves of *N. ulvacea* differ, however, by being longer and broader as well as by possessing a bilaterally expanded central area and swollen external proximal raphe ends (Hanic and Lobban 1979). *Navicula excepta* VanLandingham [= *N. aberrans* Simonsen] resembles *N. thalloses* in size and shape, as well as its unilaterally expanded central area and deflected distal raphe ends. *Navicula excepta* is differentiated from *N. thalloses* by its somewhat excentrically placed raphe system, finer striae density, and apparent lack of a colonial growth habit (Simonsen 1960). Plasticity of these valve features has been documented by Cox (1985) in closely allied species, raising the possibility that *N. thalloses* and *N. excepta* could be conspecific. VanLandingham (1975:2535) proposed *Navicula excepta* as a substitute for the illegitimate name *N. aberrans* (Simonsen 1960), a later homonym of a taxon described by Cleve-Euler. Elsewhere in his catalogue VanLandingham (p. 2387) proposed the name *N. expecta* as a substitute for *N. aberrans*

Simonsen. That entry, however, is an obvious *lapsus calami*, since the binomial *N. expecta* was offered by VanLandingham (pp. 2537 and 2792) as a substitute name for a different illegitimate name, *N. secreta* Krasske ex Hustedt.

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