

On the siliceous structure of the septum and related forms in diatoms

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The current concept concerning the structure, of the septum which develops from an intercalary band toward the inner cell space, obviously has two different elements. The one is the structure developed to the inner cell space, and therefore the cell space is divided, but incompletely. For instance, the structure of the genus *Climacosphenia* EHR., *Grammatophora* EHR., *Licmophora* C. A. AG., *Rhabdonema* KÜTZ., *Striatella* C. A. AG., *Tabellaria* EHR. and *Tetracyclus* RALFS. And the other, although it develops from an intercalary band, but not divide an inner cell space. It grows attached to an inner valve surface, especially costae or fibulae. For instance, the structure of the genus *Epithemia* BRÉB., *Denticula* KÜTZ., *Denticulopsis* SIMONSEN, *Nitzschia* HASSALL sect. *Fragilariopsis* and the species *Nitzschia valdestriata* AL. & HUST. The former is termed as septum *sensu stricto*, but the later will be required a new term. So I propose the new term, septum-like plate.

Key Index Words: diatom; *Epithemia adnata*; *intercalary band*; *Nitzschia valdestriata*; *SEM fine structure*; *septum*; *septum-like plate*.

A septum is "a sheet or ridge of silica in the valvar plane projecting from a girdle band into the interior of the frustule" (ROSS *et al.* 1979). In some cases a cell space is divided, but incompletely, into several compartments by the structure which develops from the intercalary band. If the structure of the genus *Climacosphenia* EHR. is regarded as a type of septum, although the component of the genus *Epithemia* BRÉB. has been named as septum, it is obviously that it is different fundamentally from the type. It is necessary to reconsider the current concept regarding a septum and related structure.

Materials and Methods

The structure of an intercalary band of *Climacosphenia moniliger* EHR., *Nitzschia valdestriata* AL. & HUST. and *Epithemia adnata* (KÜTZ.) BRÉB. were investigated by LM and SEM. The materials were collected from Shichirui, Shimane Pref., the River Kinokawa estuary and the northern part

of Lake Biwa, respectively. The materials were cleaned and prepared for LM and SEM in the ways described by GOTOH (1980).

Results and Discussion

The siliceous structure develops from an intercalary band to the transapical axis, and the inner cell space surrounded by a valve and an intercalary band is divided incompletely by it, was termed as septum by MÜLLER (1886). And his concept has been accepted by many authors (e.g. HUSTEDT 1930, PATRICK & REIMER 1966, v. STOSCH 1975, Anonymous 1975, ROSS *et al.* 1979).

Two special features of a septum exist: 1. the structure develops from an intercalary band. 2. the inner cell space is divided incompletely by its structure. Only the structure which satisfies the above two conditions should be termed as septum *sensu stricto*. For instance, *Climacosphenia moniliger* EHR. (Fig. 2) satisfies clearly two con-

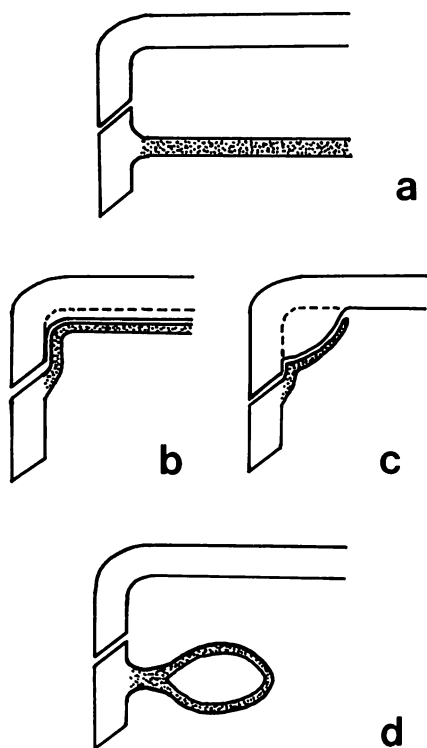


Fig. 1. Schematic sketch of transverse section of the septum and the related structures: a. septum; b, c. septum-like plate; d. partectal ring. upper: valve, lower: copula.

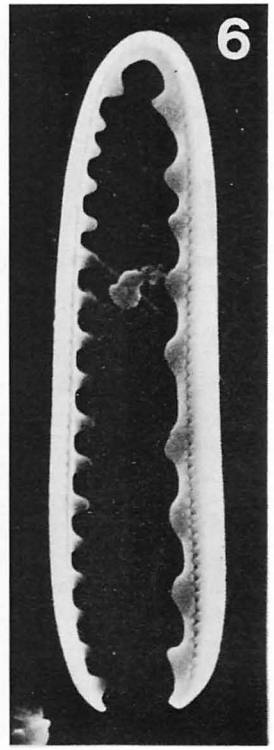
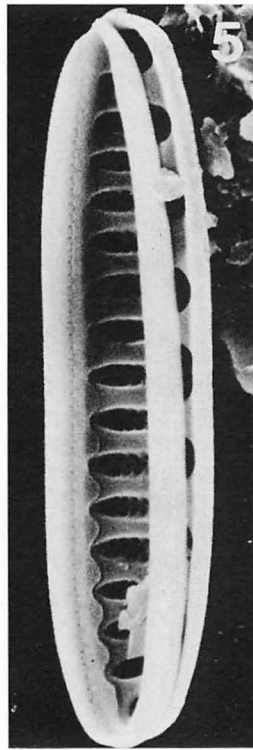
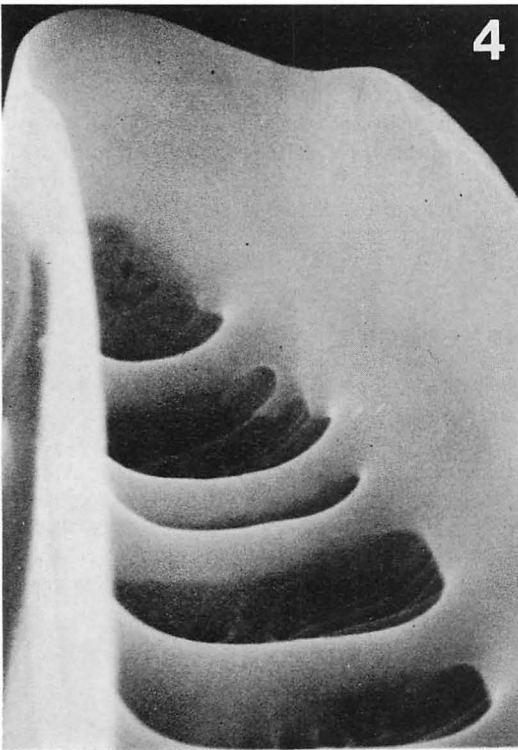
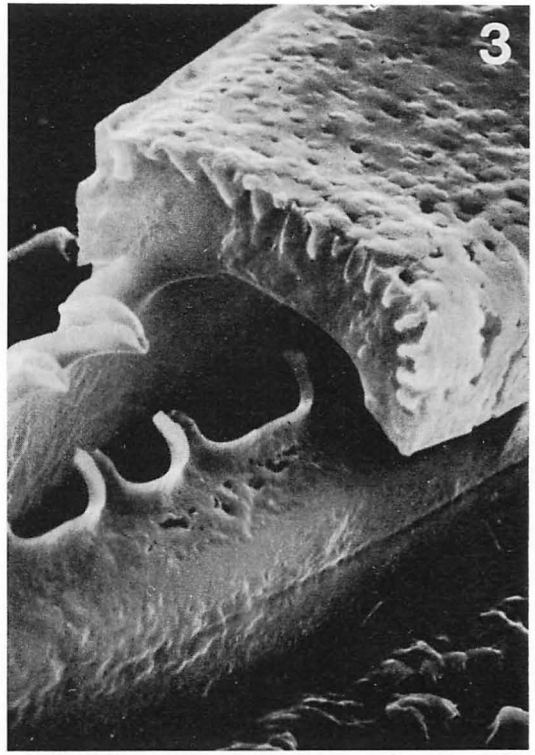
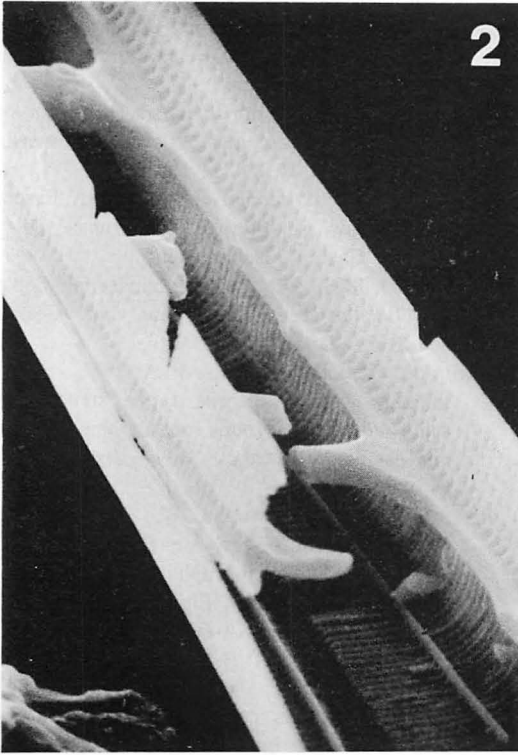
ditions. *Epithemia adnata* (KÜTZ.) BRÉB. has the siliceous structure developing from the intercalary band but it attaches to the costae (pseudoseptum) of the valve inner surface, therefore the inner cell space is not divided (Figs. 3, 4). In this case it doesn't satisfy the second condition. The intercalary band structure of *Nitzschia valdestriata* AL. & HUST. (Figs. 5, 6) is the same manner as *Epithemia adnata* (KÜTZ.) BRÉB.

Septum and its related structure is summarized in Fig. 1. Fig. 1-a modifies the structure of the genus *Climacosphenia* EHR., *Grammatophora* EHR., *Licmophora* C. A. AG., *Rhabdonema* KÜTZ., *Striatella* C. A. AG.,

Tabellaria EHR. and *Tetracyclus* RALFS. Fig. 1-b modifies the structure of the genus *Epithemia* BRÉB. (*E. adnata*; Figs. 3, 4). Fig. 1-c showing the schematic sketch of *Denticula* KÜTZ. (cf. *D. tenuis*; PADDOCK & SIMS 1977, pl. 2, fig. 12), *Denticulopsis* SIMONSEN (cf. *Denticulopsis seminae*; HASLE 1972, figs. 3, 4 as *Denticula*), *Nitzschia* HASSALL sect. *Fragilariopsis* (cf. *Nitzschia kerguelensis*; HASLE 1972, fig. 1) and the species *Nitzschia valdesriata* AL. & HUST. (Figs. 5, 6). Fig. 1-d modifies the structure of the genus *Mastogloia* THWAITES (cf. *M. minutissima*; STEPHENS and GIBSON 1980, pl. 4, fig. 22) and it names as "partectal ring" (ROSS *et al.* 1979). The structure, fig. 1-b and 1-c, which divided from the group, fig. 1-a, by its structure and later discussed its function, will be required the new term. So I propose the new term "septum-like plate" for the structure of the group fig. 1-b and 1-c. Pars interior is "the advalvar part of a cingular element that lies under the abvalvar edge of an adjacent element or, in the case of a valvocopula, the part underlying the edge of the valve" (v. STOSCH 1975). Although the septum-like plate develops from the intercalary band toward the inner cell direction, it doesn't divide an inner cell space, but it grows attached to the inner valve surface over the valve mantle, especially to costae or fibulae. Namely, septum-like plate is the special name of the advalvar part of the pars interior.

The degree of development of the septum-like plate is different among various taxa. In the case of *Nitzschia valdestriata* AL. & HUST., the development of the septum-like plate is a little, but clearly (Figs. 5, 6), as against the structure of the *Epithemia adnata* (KÜTZ.) BRÉB. is furthermore developed, septum-like plate overlaps the valve inner

Fig. 2-6. SEM photographs of the septum and the related structures. 2. *Climacosphenia moniligera*, inner view, valve and valvocopula having septum. $\times 4000$; 3. outer view of *Epithemia adnata*, showing the comb-shaped septum-like plates which separate defectively from the pseudosepta. $\times 6000$; 4. inner view of *Epithemia adnata*, septum-like plates overlaps the pseudosepta. $\times 7000$; 5. *Nitzschia valdestriata*, inner view showing the septum-like plates attached to the costae. $\times 8000$; 6. valvocopula of *Nitzschia valdestriata* with septum-like plates. right: on fibulae, left: on costae. $\times 8000$.



costae, entirely (Figs. 3, 4).

The septum is the structure to divide the inner cell space, but we have no idea to explain its function. Septum-like plate is considered as connective tissue. And by extending the combination area between a valve and an intercalary band, that is the area of the septum-like plate, an increase of strength of junction is estimated.

In Order Pennales, the diatoms which have the septum are of almost belonging to the Family Diatomaceae, Suborder Araphidineae (after the diatom system in the sense of SIMONSEN 1979). It consider that the septum is the good key to discuss the phylogenetic relationships among many diatom taxa Family Diatomaceae.

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後藤敏一：珪藻の隔壁とその類似構造

珪藻において中間帯片 (intercalary band) の1部が細胞内部へ突出する構造は隔壁 (septum) と称されているがその概念は明らかに2つの異なる構造を含む。*Climacosphenia*, *Grammatophora*, *Licmophora*, *Rhabdonema*, *Striatella*, *Tabellaria*, *Tetracyclus* などでは帯殻より突出する構造によって不完全ではあるが細胞内部が分割される。一方, *Epithemia*, *Denticula*, *Denticulopsis*, *Nitzschia* sect. *Fragilariopsis*, *Nitzschia valdestrata* などでは光顕レベルの観察では前者の場合と同様の構造と考えられたが, それらは細胞内部へ突出する構造ではなく蓋殻の内面と付着した形で発達する構造であることが明らかになった。従来, 後者の構造も含めて隔壁と称されてきたが両者は構造的にも機能的にも異なると考える。そこで前者を真の隔壁とし, 後者に対して類隔壁板 (septum-like plate) の名称を提案した。(577 大阪府東大阪市小若江 3-4-1, 近畿大学教養部)