reported N. denticula and may well be only a variety of it, since in its dimensions, stria density, etc. it falls within the limits of N. denticula (see Table 17, and Hustedt 1930, 1942).

N. sinuata and its var. tabellaria, which requires study in order to confirm that it is not sufficiently different from the type to warrant its separation at species level, constitute the second group. Here, the valve is expanded centrally and the fibulae take the form described in detail above.

In the third group there is a similar fibula morphology to that in N. sinuata, but the valve outline is lanceolate or linear-elliptical. The taxonomy of this group is most confused. There seems to be a whole series of forms (species?) of similar shape and structure, differing only in the linear densities of striae and fibulae. Thus, there is a range from the coarseness of N. subdenticula through N. kittonii/interrupta to the delicacy of N. solgensis. Authors often call similar or identical diatoms in this group by quite different names: thus, for instance, Foged (1959, Pl.12 f.11) illustrated a diatom which is almost certainly N. solgensis, but called it N. heidenii (i.e. N. interrupta) var. pamirensis. Biswas (1964) described N. solgensis-like individuals as N. sinuata var. denticuloides, while Gandhi (1960) described a new variety of N. denticula, var. rostrata, which in fact seems to belong nearer N. kittonii. Much work is necessary on these forms; possibly all form part of a single series, representing a highly variable species, similar in the breadth and continuity of variation to Hantzschia marina or H. distinctepunctata.

4.6.6.9 The section Epithemioideae

'Kiel mässig exzentrisch. Kielpunkte mehr oder weniger in Rippen verlängert, die vom Kiel aus beide Schalenteile in transapikaler

Richtung durchlaufen' (Hustedt 1930).

This section was first described by Grunow (in Cleve & Grunow 1880), although the name itself had been published a little earlier as a nomen nudum (in Grunow 1880). Grunow presumably considered that there was a resemblance between this group of Nitzschia species and the genus Epithemia (see below); similar considerations in the genus Hantzschia led him to create a 'Gruppe Pseudoepithemia' to include H. marina.

Hustedt (1930) changed the name of the section, calling it the 'Costatae'. He did so because 'Epithemioideae' was required as the name for one of the subfamilies of the Epithemiaceae - the name of a subfamily 'is formed by adding the suffix -oideae to the stem of a legitimate name of an included genus' (I.C.B.N. 1972). Other authors, e.g. Cleve-Euler (1952) and Hendey (1964) have continued to use Grunow's name, but Hustedt (e.g. 1955) always held to 'Costatae': was he justified?

'Epithemioides', the epithet of the type species of the group, is of Greek derivation, the suffix -oides indicating that there is a supposed resemblance to Epithemia (see Stearn 1966). Grunow could have used this name for the section itself (I.C.B.N. 1972, Rec.21B), but he chose instead to use the plural adjective 'Epithemioideae', this being derived not from 'Epithemia', but from 'epithemioides'. In the I.C.B.N. there is no objection to such a practice - the epithet of a section 'is either of the same form as a generic name, or a plural adjective agreeing in gender with the generic name'. Hustedt's alteration to 'Costatae' is, therefore, not justifiable, although understandable, and is illegitimate: since 'the name of a subdivision of a genus is a combination of a generic name and a subdivisional epithet connected by a term (subgenus, section, series, etc.) denoting its rank ' (the emphasis is mine), there should never be any confusion between the subfamily Epithemioideae and Nitzschia sect. Epithemioideae. Grunow's

Nitzschia sect. Epithemioideae

TABLE 18

SPECIES	Length µm.	Width µm.	Fibulae no. in 10 µm.	'Rippen' no. in 10 µm.	Costae no. in 10 µm.	Central raphe endings	Eccentricity of raphe	Source of information
N. epithemioides	15-65	4-12	6-9	3-5	22-25	present	+++	Cleve & Grunow (1880), Hustedt (1930), Cleve-Euler (1952), this thesis
N. erosa	36-56	5-8	10-14	6-8	almost invisible	present	+	Giffen (1966)
N. gradifera	30-40	7-8	4-5	4-5	almost invisible	absent	0	Hustedt (1922)
N.'incognita' (nom. illeg.)	86	?	8-10	8-10	30	absent	0	Hustedt (1955)
N. janischii	245	10	2.5-4	2.5-4	22-23	present	++	Cleve & Grunow (1880) Grunow (1880)
N. muranensis	30-35	6	5-6	5-6	16	absent	++	Cholnoky (1961)
N. rhopalodioides	40-50	4-5	8-12	8-12	almost invisible	present	+	Hustedt (1955)
N. romanowiana	106-130	12-14 (at centre)	2-3	2-3	?	present	0	Pantocsek (1902)
N. thienemannii	47-90	9.5	3-6	3-6	20-22	present	++	Hustedt (1938)

nomenclature is quite proper.

The sect. Epithemioideae is a small group containing only nine species. Of these, Grunow (1880 and in Cleve & Grunow 1880) described two, viz. N. epithemioides and N. janischii; Pantocsek (1902) added N. romanowiana, and Krasske (1941, teste Hustedt 1955) N. incognita. Hustedt described three, namely N. gradifera (1922), N. thienemannii (1938) and N. rhopalodioides (1955), while Cholnoky (1961) found a new species, N. muranensis, in the Venetian lagoon, and Giffen (1966) described N. erosa from brackish pools in S. Africa.

In this study cells of N. epithemioides, obtained from various salt marshes, especially those at Sandbay and Portland (Ferrybridge), have been examined using LM, TEM and SEM.

The valve of N. epithemioides is relatively broad, but shallow (F.349, 804, 806): the raphe is eccentric, though not as strongly so as in the sects. Tryblionella or Lanceolatae. The cincture is quite broad and so complete frustules often lie in girdle view (unpubl. obs.). Viewed with the light microscope, the valve's most prominent features (and the character which makes identification of any member of this section quite simple) are the widely and irregularly spaced bars traversing the valve from raphe to margin (F.349). Apart from these bars the valve is only very lightly silicified, and the transapical striae are to be seen only with great difficulty, even though there are but 22-25 in 10 μm. (Cleve-Euler 1952; unpubl. obs.).

The SEM reveals that the valve construction is of type 1 (F.805-807). The costae are no deeper than the frets, however, and the poroids are large in relation to the costae, unusually so for Nitzschia. Each poroid, which is somewhat rectangular in outline, possesses a delicate cribrum, the pores of which are presumably closed by hymena (F.552, 805). That some kind of siliceous structure closes the cribrum pores is indicated by SEM observations of the valve exterior, which is smooth, as

in Hantzschia virgata, with no suggestion of any perforation through the valve (F.806 and unpubl. obs.): it is likely that the hymena lie external to the cribra and flush with the outer surface of the valve.

There is a plain, narrow marginal strip: sterna are absent (F.806-807).

The raphe is interrupted centrally: this was suspected from LM observations, which show that the subraphe canal, which is well defined in N. epithemioides, is constricted centrally, and that a 'central nodule' is present (F.349). The internal and external central raphe endings are very similar and are coaxial-symmetrical (F.807 and unpubl. obs.). Opposite the central endings on the distal side is a small, semicircular 'area' of the valve face without poroids (F.807). At the poles, internally there are small, simple helictoglossae (unpubl. obs.): the external endings are unknown.

Type viii fibulae are present (F.807). Some of the fibulae are extended into long ribs which traverse the whole width of the valve distal to the raphe, ending immediately adjacent to the marginal strip (these are the bars visible in the light microscope), while others are hardly extended at all: all intermediate states exist (F.349, 806-807). Some of the fibulae are also extended across the much smaller fraction of the valve proximal to the raphe, and it is noticeable that those fibulae which are greatly extended distally are usually of below average extent proximally, i.e. in general a fibula is not extended both proximally and distally (F.807). The fibulae are like flattened ribs, being narrowest in the apical direction, but they are very variable in form. Some are joined to the next by delicate membranes of silica, which may be entire or may contain a smaller or larger portula (compare N. ventricosa, sect. Nitzschiella).

The subraphe canal walls are rounded with no ridges or flanges bordering the raphe externally: they are perforate - distally at least there appears to be one poroid within the canal opposite each trans-

apical stria (unpubl. obs.).

The mature cingulum consists of several narrow bands, of which the first and at least some of the others are porose. The first band has 30-32 longitudinal rows of poroids in 10 μm., the poroids being arranged in 4 transverse rows. The pars interior of the first band is of approximately the same width as the marginal strip of the valve, and it has an entire margin (unpubl. obs.). It is not known whether the bands are closed or open.

The chromatophores of N. epithemioides, which are arranged as in most Nitzschia species, are quite small relative to the total cell volume. They are separated centrally by a wide gap, in which the nucleus sits, and they do not usually approach very close to the poles: the small chromatophores, together with the shape of the cell, give the living diatom a very distinctive appearance (F.350-1). Bütschli globules are not obvious, if present, but other inclusions are frequent. The nucleus is approx. 3 μm. in diameter and contains a single nucleolus (F.350).

The members of the sect. Epithemioideae are all diatoms of moderate size, being over 15 μm., but under 250 μm. long; most are 30-100 μm. in length (see Table 18). Six of the nine species belonging to the section, namely N. epithemioides, N. erosa, N. janischii, N. rhopalodioides, N. romanowiana and N. thienemannii, probably belong very close to one another. In these some or all of the fibulae are extended across the whole width of the valve, the raphe is interrupted centrally (in all except N. epithemioides this being inferred from the presence of a 'central nodule', a consistently wider separation of the median fibulae, or a central constriction of the subraphe canal), and the valve structure is very delicate. These species differ from each other, however, in such matters as the degree of eccentricity of the raphe, the linear densities of striae and fibulae, and the shape of the valve.

Thus, N. erosa is set apart from all the others by its possession of a peculiar 'sinus' at each pole (Giffen 1966, T.62 f.85-87). It is interesting that in the same samples in which N. erosa was found, Giffen observed a new species of Amphiprora, A. galerita (ibid., T.59 f.1-3), in which there is a similar 'sinus', a morphology not found elsewhere in that genus.

N. thienemannii and N. romanowiana are similar to N. epithemioides, except that they are larger (see Table 18): moreover, virtually all the fibulae are extended across the valve, while the raphe is perhaps a little less eccentric than in the type. In N. rhopalodioides too all the fibulae are extended into transapically directed ribs, but here the raphe is almost central.

N. janischii is similar to the above except for its larger size and heavier silicification: the raphe is fairly eccentric, and the fibulae are all extended transapically. N.B. in this and other species not studied here details of morphology, etc. were obtained from the original descriptions (see Table 18).

In the three remaining species (N. gradifera, N. muranensis and N. incognita) the raphe seems to be continuous from pole to pole - there is no central constriction or depression of the subraphe canal, nor sign of a 'central nodule' (see Hustedt 1922, Pl.10 f.65, 66; Cholnoky 1961, f.71; Hustedt 1955, Pl.15 f.17). Too much emphasis should not be placed upon this one character, since in other respects these species are quite like those of the first group. Further investigation may demonstrate, however, that subdivision of the section is possible along this line. There is no indication that the sect. Epithemioideae should be merged with any other group, or that it needs division. There are, however, some similarities with N. ventricosa of the sect. Nitzschiella, and with Gomphonitzschia clevei.