The taxonomic status of *Thalassiosira concaviuscula* I.V.Makarova and *Thalassiosira ordinaria* I.V.Makarova (*Thalassiosiraceae*, Bacillariophyta)

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Thalassiosira concaviuscula I.V.Makarova was described from the south-west coast of Africa (Makarova 1978: 222, pl. I). Its overall morphology was very similar to *T. aestivalis* Gran, and Makarova (1988) later concluded that *T. concaviuscula* was a heterotypic synonym of *T. aestivalis*. Despite this, Harris *et al.* (1995) identified a Scottish *Thalassiosira* collection as *T. concaviuscula* and distinguished it from the African *T. concaviuscula* by the position of rimoportula, namely, in *T. concaviuscula* a rimoportula lies between the marginal fultoportula, whereas in African *T. concaviuscula* it takes the place of a single marginal fultoportula. Beside the rimoportula position, there are further morphological differences between African and Scottish *Thalassiosira* species. The most critical of these is the structure of the valve margin (Figs 1–4). The Scottish entity has a distinct hyaline (Harris *et al.* 1995: fig. 5), while African taxon has lips (Makarova 1978; figs 8–10). Additionally, areolae density of the Scottish taxon is denser than that of the African one (Table 1). According to Makarova's (1978) original description, the African *Thalassiosira* species is identical to *T. aestivalis*, but the Scottish *Thalassiosira* material is neither *T. aestivalis* or *T. concaviuscula.*

Thalassiosira ordinaria I.V.Makarova was described from Black Sea (Makarova 1977). The original Latin description is as follows

> "*Cellulae tympaniformes, humiles, 3.5–5.5 mkm altae, in catenulas breves conjunctae. Chloroplasti laminate parvi. Frustula copula unica praedita. Valvae orbicularis, planae, 15–30 mkm in diam. Structura areolate areolis parvulis, fasciculatis, 26 pro 10 mkm, seriatis, seriebus lateralibus mediali parallelis. Rimoportula prope limbum sita, parte exterior tubuliformi, ca 1 mkm longa, interior brevissima. Fultoportulae marginales anulum in limbo formantes, regulariter 5 pro 10 mkm dispositae, centrales una (raro duae) parte exterior ca 0.8 mkm, interiorem superante, a facie valvae interior poris 4 cinctae. Limbus angustissimus, structura areolate, areolis parvis, subelongatis, radialiter seriatis, 35–38 pro 10 mkm.*"

The Black Sea species is therefore characterised as (1) a chain-forming colony with 3.5–5.5 distances between cells; (2) cells 15–30 µm diameter; (3) having 26 areolae in 10 µm; (4) with fasciculate areolation; (5) one central fultoportula (rarely two); (6) a ring of marginal fultoportulae; (7) a rimoportula close to the marginal fultoportula; and, (8) an external tube of rimoportula longer than marginal fultoportula. Although Makarova (1977) did not describe the valve margin shape, her micrographs showed the distinct hyaline valve margin (Makarova 1977: figs 4, 5). Overall morphological characters of *T. ordinaria* clearly match the Scottish *Thalassiosira* material as described by Harris *et al.* (1995). Additionally, material previously identified as *T. concaviuscula* is reidentified as *T. ordinaria* (Table 1).

In conclusion, *T. concaviuscula* should be considered a heterotypic synonym of *T. aestivalis* as proposed by Makarova (1988), and later records of *T. concaviuscula* are correctly *T. ordinaria* (Table 1), the distribution of which is expanded to the Black Sea (Makarova 1977), the North Sea (Hoppenrath *et al.* 2007), the north-west Pacific (Park *et al.* 2016), and the Indo-Pacific (Li *et al.* 2013)

Table 1. Morphological and distributional data and distribution for misidentified *Thalassiosira.*

Previous identification	Correct identification	Diameter (µm)	Areolae in 10 µm		MFP in 10 µm	Distribution
			Valve	Margin		
T. aestivalis[1]	*T. aestivalis*	14–56	18	>20	4–6	Puget Sound and Vancouver Island
T. concaviuscula[2]	*T. aestivalis*	30–43	20–22	NM	3–4	West coast of Africa
T. ordinaria[3]	*T. ordinaria*	15–30	26	NM	5–10	Black Sea
T. concaviuscula[4]	*T. ordinaria*	9–26	24–32	30–40	4–5	Loch Creran, Scotland
T. concaviuscula[5]	*T. ordinaria*	19.1–27.0	20	NM	4	Helgoland and Sylt
T. angulata[6]	*T. ordinaria*	7–16	13–24	18–28	3–4	off the Guangdong coast
T. concaviuscula[7]	*T. ordinaria*	6.4–20.4	22–27	27–33	4–8	Korean coastal waters
T. concaviuscula[8]	*T. ordinaria*	7.4–14.4	22–27	27–33	6–9	Korean coastal waters

[1]Hasle (1978), [2]Makarova (1978), [3]Makarova (1977), [4]Harris *et al.* (1995), [5]Hoppenrath *et al.* (2007), [6]Li *et al.* (2013), [7]Park and Lee (2010), [8]Park *et al.* (2016)

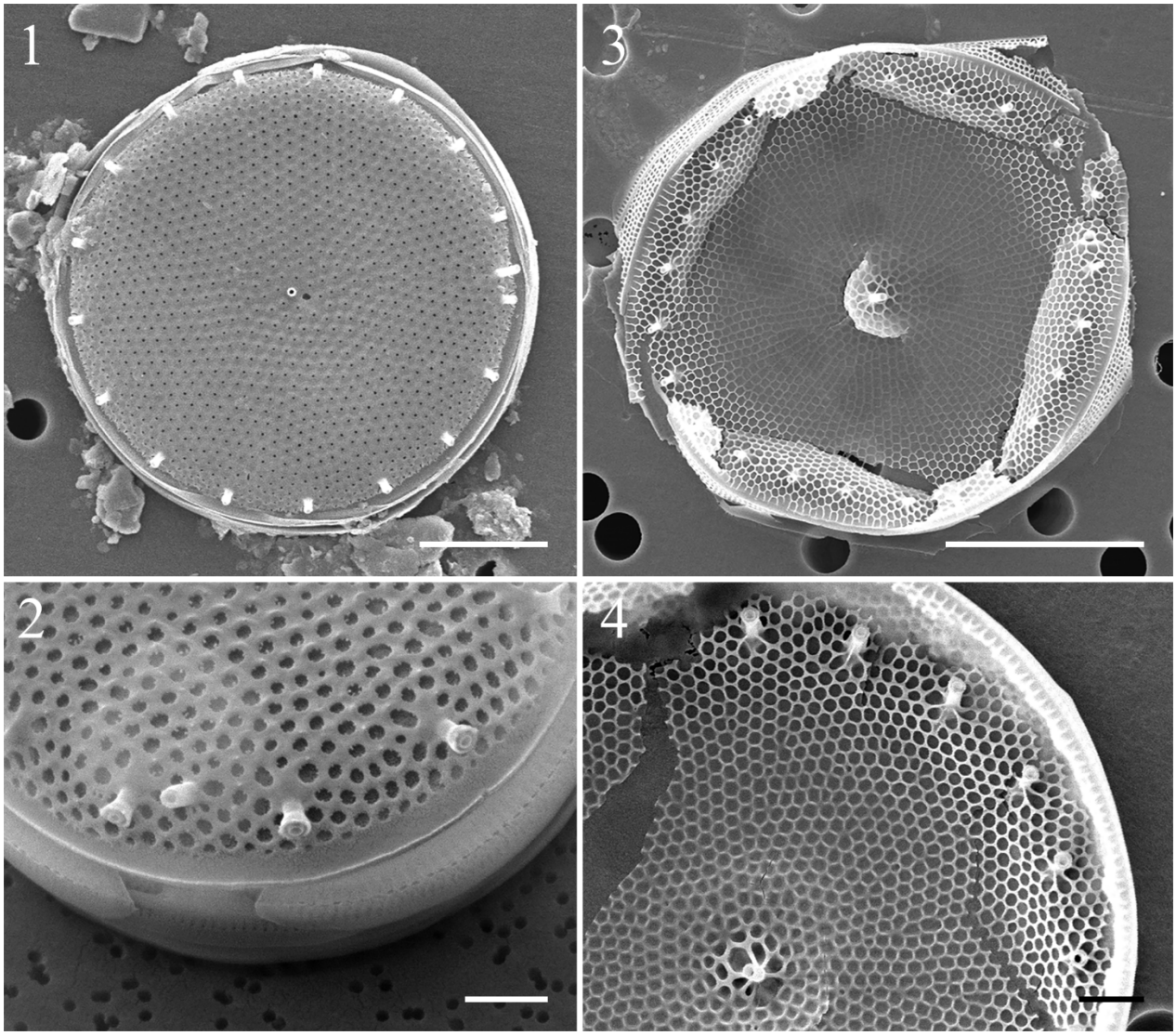

Fig. 1. External whole view of *Thalassiosira ordinaria*. **Fig. 2.** *T. ordinaria* showing distinct marginal hyaline rim. **Fig. 3.** External whole view of *Thalassiosira aestivalis*. **Fig. 4.** *T. aestivalis* showing marginal ribs. Scale bars: 10 µm (Fig. 3), 5 µm (Fig. 1), 2 µm (Fig. 4), 1 µm (Fig. 2).

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