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Pliocaenicus costatus: an emended species description

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INTRODUCTION

Pliocaenicus is a small, mainly fossil diatom genus that nowadays only rarely occurs in some freshwater lakes in eastern Asia. The genus was introduced by Round & Håkansson (1992) to accommodate some cyclotelloid taxa that differ by a set of nine morphological characters from the related genera *Cyclostephanos* Round, *Cyclotella* (Kütz.) Bréb., and *Stephanodiscus* Ehrenb. Eight species were hitherto described in the genus *Pliocaencius* (including one manuscript name; Table 1).

Table 1. Stratigraphic ranges and biogeography of species in the genus *Pliocaenicus*.

Species	Stratigraphy and biogeography
Pliocaenicus cathayanus G.Wang	Pliocene: China.
Pliocaenicus costatus (Loginova, Lupikina et Khurs.) Flower, Ozornina & A.I.Kuzmina sensu lato	Miocene–Pleistocene: Alaska, Japan, Latvia, Russia. Holocene–modern: Mongolia, Russia.
Pliocaenicus hercynicus Round et Håk.	Pliocene: Germany.
Pliocaenicus jilinensis G.Wang	Pliocene: China.
Pliocaenicus montana Round (manuscript name)	Not given.
Pliocaenicus omarensis (Kuptsova) Round et Håk.	Pliocene–Pleistocene: Japan, Russia.
Pliocaenicus pantocsekii (Fricke) Round et Håk.	Pliocene: Georgia, Russia.
Pliocaenicus undulatus Round & Håk.	Pliocene: Germany.
Pliocaenicus (not specified)	Miocene–Pleistocene: Balkan Peninsula.

The only extant taxon of this genus, *Pliocaenicus costatus* (Loginova, Lupikina et Khurs.) Flower, Ozornina & A.I.Kuzmina, has been studied in the past years mainly from three regions: the Lake Baikal region (Flower et al. 1998, Genkal et al. 2001), Lake El'gygytgyn (Cremer & Van de Vijver 2006, Cremer et al. 2005), and Lake Jana in the Verkhojansk Mountains (Stachura-Suchoples 2006). These studies demonstrated that *Pliocaenicus costatus* exhibits a large morphological variability. For this contribution the morphological and morphometric characteristics of *Pliocaenicus costatus* in Lake El'gygytgyn are summarized and compared with findings from other regions in eastern Siberia.

MATERIAL & METHODS

We have studied sediment trap and sediment material from Lake El'gygytgyn, a deep, cold, monomictic, low-conductive and ultra-oligotrophic lake in Chukotka, eastern Russia (Fig. 1). Lake El'gygytgyn is located in an 18 km wide impact crater and measures approximately 12 km across. The crater was presumably formed by a meteorite impact ~3.6 Ma ago (Gurov & Koeberl 2004). Lake El'gygytgyn is 175 m deep and ice-covered for 9–10 months. Basic hydrological, limnological and meteorological data of the lake are published in Cremer & Wagner (2003), Cremer et al. (2005) and Nolan & Brigham-Grette (2007).

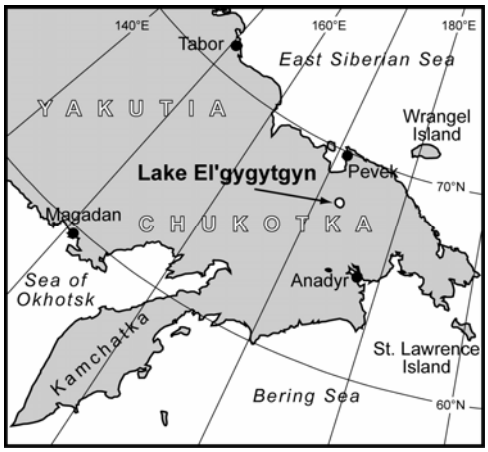

Fig. 1. Geographical location of Lake El'gygytgyn in north-eastern Russia.

RESULTS & DISCUSSION

Fig. 2 shows the basic morphology of *Pliocaenicus costatus* from Lake El'gygytgyn on light and scanning electron micrographs. Typical characters of the species include the colliculate external valve surface, the absence of spines, the single rimoportula, the presence of marginal fultoportulae on every interfascicle, the domed cribra and the large number of central area fultoportulae.

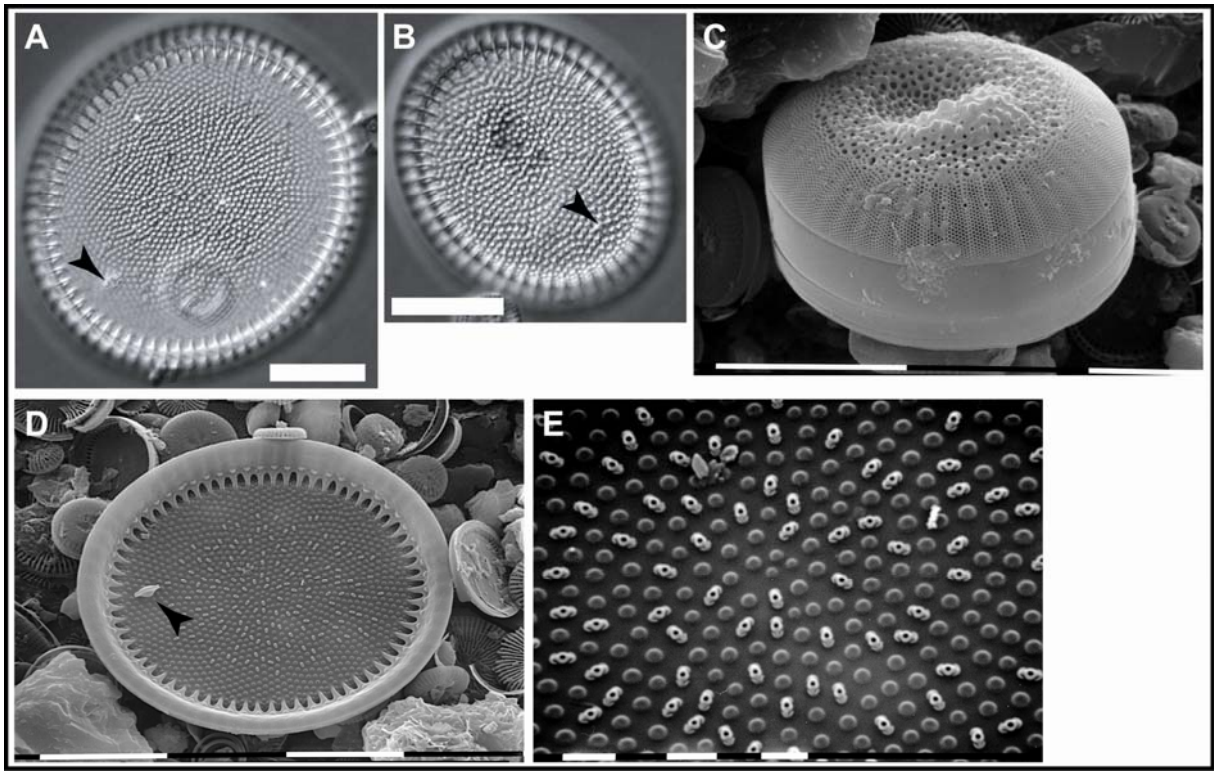

Fig. 2. Morphology of *Pliocaenicus costatus* from Lake El'gygytgyn. A, B. LM micrographs; arrows indicate the rimoportula. C-E. SEM micrographs. C. Frustule in girdle view showing the structure of the external valve surface and the mantle. D. Internal valve view showing the internal costae, the rimoportula with a fan-shaped labium (arrow) and the central area fultoportulae. E. Internal view of the central area (enlarged from D) showing the domed cribra and the fultoportulae which consist of a tubule and two satellite pores. – Scale bars: 10 µm (A-D) and 1 µm (E). B-E taken from Cremer & Van de Vijver (2006).

Table 2. Morphological and morphometric characteristics of *Pliocaencius costatus* s.l. from three different regions in Siberia. [1]Genkal et al. (2001) have described valves with spines in Lake El'gygytgyn. N.i.: no information.

	P. costatus **s.l. from Lake El'gygytgyn** (Cremer & Van de Vijver 2006)			***P. costatus*** **from Lake Baikal region** (Flower et al. 1998)			***P. costatus*** **s.l. from Lake Jana** (Stachura-Suchoples 2006)		
	LM	SEM: Morph 1	SEM: Morph 2	var. *costatus*	var. *sibiricus*	var. *leprindus*	Morph 1	Morph 2	Morph 3
Valve diameter [µm]				10–50	15–34	14–55	14–18	15–27.5	17–24
Length [µm]	17–38	29–36	21–25						
Width [µm]	14–34	20–24	16–17						
Valve shape	round–oval	round-oval	oval	round–oval	round	round–oval	round–oval	round-oval	round–oval
Structure of external valve face		colliculate	colliculate	colliculate	smooth	colliculate	smooth/colliculate	smooth/colliculate	colliculate
Central area areolae in 10 µm	13–18	15–18	14–17	12–16	14–22	10–12	13–15	16–18	18–20
Arrangement of central area areolae		radial	radial or irregular	n.i.	n.i.	n.i.	irregular	radial	radial
External interfascicles in 10 µm		8–9	8–9	7–9	6–10	5–8	n.i	8–9	8–9
Areolae rows in mantle fascicles		7–8	6–8	n.i.	n.i.	c. 7	5–6	5–6	5–6
Spines	no	no[1]	no[1]	no	no	yes (conic)	n.i.	n.i.	n.i.
Central area fultoportulae		146–160	62–74	7–37	6–25	50–120	16–30	>19	27–78
Rimoportulae	1	1	1	1	1	1	1	1	1
Internal costae in 10 µm	6–9	9	9–10	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.

Table 2 summarizes the morphometric data of *Pliocaenicus costatus* s.l. and demonstrates its great variability being particularly evident in the size and the number of central area fultoportulae. While Cremer & Van de Vijver (2006) and Stachura-Suchoples (2006) treated the communities of *P. costatus* from Lake El'gygytgyn and Lake Jana as *P. costatus* sensu lato, Flower et al. (1998) distinguished three varieties (Table 2) that were based on the external valve face structure, the number of central area areolae and fultoportulae and the presence of spines. However, Flower et al. (1998: 51, 53) themselves pointed out that the value of these highly variable characters as diagnostic features is debatable. Future studies of *P. costatus* will certainly help to reveal its full morphological and morphometric variability and, therefore, diatomists working on *P. costatus* should temporarily refrain from splitting the species into various varieties or species. Genkal et al. (2001) already argued that all described intraspecific taxa of *P. costatus* should be included into synonymy. The authors of this paper follow this opinion.

It is also evident that *P. costatus* is likely more widespread in eastern Asia than indicated by the presently known biogeography which is based on just a handful localities. However, the recent studies (Cremer & Van de Vijver 2006, Stachura-Suchoples 2006, Genkal et al. 2001, Flower et al. 1998) suggest that *P. costatus* preferably occurs in cool, oligotrophic, circumneutral and low-conductive lakes.

As a summary, we present an extended description of *Pliocaenicus costatus* s.l. which is based on the observations shown in Table 2 and morphometric data published by Genkal et al. (2001).

Pliocaenicus costatus (Loginova, Lupikina et Khurs.) Flower, Ozornina & A.I.Kuzmina 1998 emend. H.Cremer & Van de Vijver
Basionym: *Cyclostephanos costatus* Lupikina 1989.
Emended description: Frustules solitary. Valves round or oval, with a colliculate or smooth external central area. Diameter 14–70 µm. Central area areolae radially or irregularly arranged, 8–22 areolae in 10 µm, internally with domed cribra. Mantle fascicles with 5–8 rows of areolae, interfascicles 5–10 in 10 µm. Central area fultoportulae 1–160, consisting internally of a tubule with two satellite pores. Internal marginal costae 6–10 in 10 µm, with one fultoportula on every costa. A single rimoportula, consisting of a fan-shaped labium on a stalk, usually located near the margin. Spines may be present at the valve margin.

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