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Middle Eocene diatoms from the marine Paleogene stratigraphic key section of northeast Kamchatka

Andrey Yu. GLADENKOV

Geological Institute of Russian Academy of Sciences, Pyzhevskii per., 7, Moscow 119017, Russia;
agladenkov@ilran.ru

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Abstract

A first report on the Eocene diatoms from the Paleogene stratigraphic key section of northeast Kamchatka on the Il'pinskii Peninsula, west coast of the Bering Sea, is presented. Diatom-bearing sediments are located within the uppermost part of the Kylan Formation. Planktic taxa including *Triceratium inconspicuum* var. *trilobata*, *Pyxilla gracilis*, *Riedelia borealis* are typical of the studied marine neritic diatom assemblage. The occurrence of these species implies a middle Eocene age for the studied sediments which is in agreement with the age determined using planktic foraminifera.

1. Introduction

The stratigraphic section on the Il'pinskii Peninsula is a key section for the marine Paleogene in northeast Kamchatka (Fig. 1) including an essentially continuous and complete sequence composed of 2500 m of Paleocene through Oligocene sediments. Planktic foraminifera and calcareous nannofossils of Paleocene and Eocene age have been documented from different stratigraphic levels of the section (Benyamovskiy et al., 1992; Volobueva et al., 1994). These assemblages, which are correlative with their analogues from standard Paleogene zones (Berggren et al., 1985, 1995) have been used to subdivide the sedimentary succession and to determine the age of the established stratigraphic units (Benyamovskiy et al., 1992; Volobueva et al., 1994; Benyamovskiy, personal communication, 2011). Until recently the section was considered barren of fossil diatoms. However, new sampling made it possible to discover remains of diatoms from the Paleogene sediments. These first data on the middle Eocene diatoms from the Il'pinskii Peninsula section are presented in this paper.

2. Results and Discussion

Samples for diatom analysis were collected by the author during field work at the Il'pinskii Peninsula section conducted in July 2003 by joint Russian-Japanese group under the leadership of Prof. Yuri Gladenkov from Geological Institute of Russian Academy of Sciences, Moscow, Russia (Gladenkov and Gladenkov, 2007). Firstly, since they have previously been considered barren of both calcareous and siliceous planktic microfossils, the focus had been on the Alugivayam and Gailkhavilanvayam formations, which are up to 1150 m thick (Fig. 2). As already recently reported a number of samples from the Alugivayam Formation yield fossil marine diatoms (Gladenkov and Gladenkov, 2007, Gladenkov, 2009). Study of their assemblages allowed determination of the "beds with diatoms" from different stratigraphic intervals and suggests an Oligocene age of these strata (Gladenkov, 2009) (Fig. 2). In addition thirteen samples were collected from the older Kilakirnun (about 530 m thick) and Kylan (up to 685 m thick) formations (Fig. 2). From the total number of samples collected from these formations the only sample that yields diatoms is #GIN03-70/33 (a carbonate concretion) from the uppermost part of the Kylan Formation. This diatom-bearing sample derives from Member 10 (numeration of members herein follows Volobueva et al., 1994) of the Upper Kylan Subformation and is collected just below the boundary with the overlying Kilakirnun Formation (Fig. 2). This 60 m thick member is composed of tuffaceous argillites with interbeds of tuffaceous sandstones and carbo-

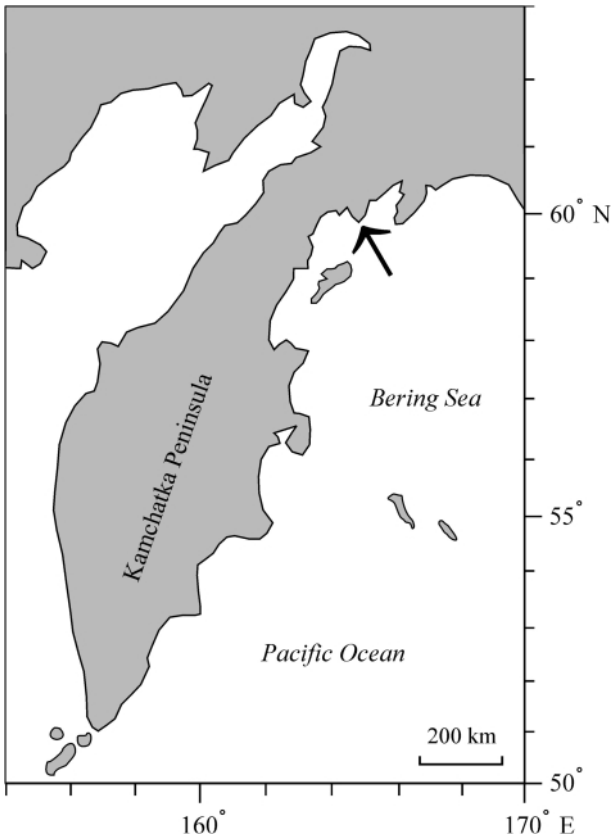


Figure 1: Location of the Il'pinskii Peninsula (shown by arrow) in Kamchatka, Russia.

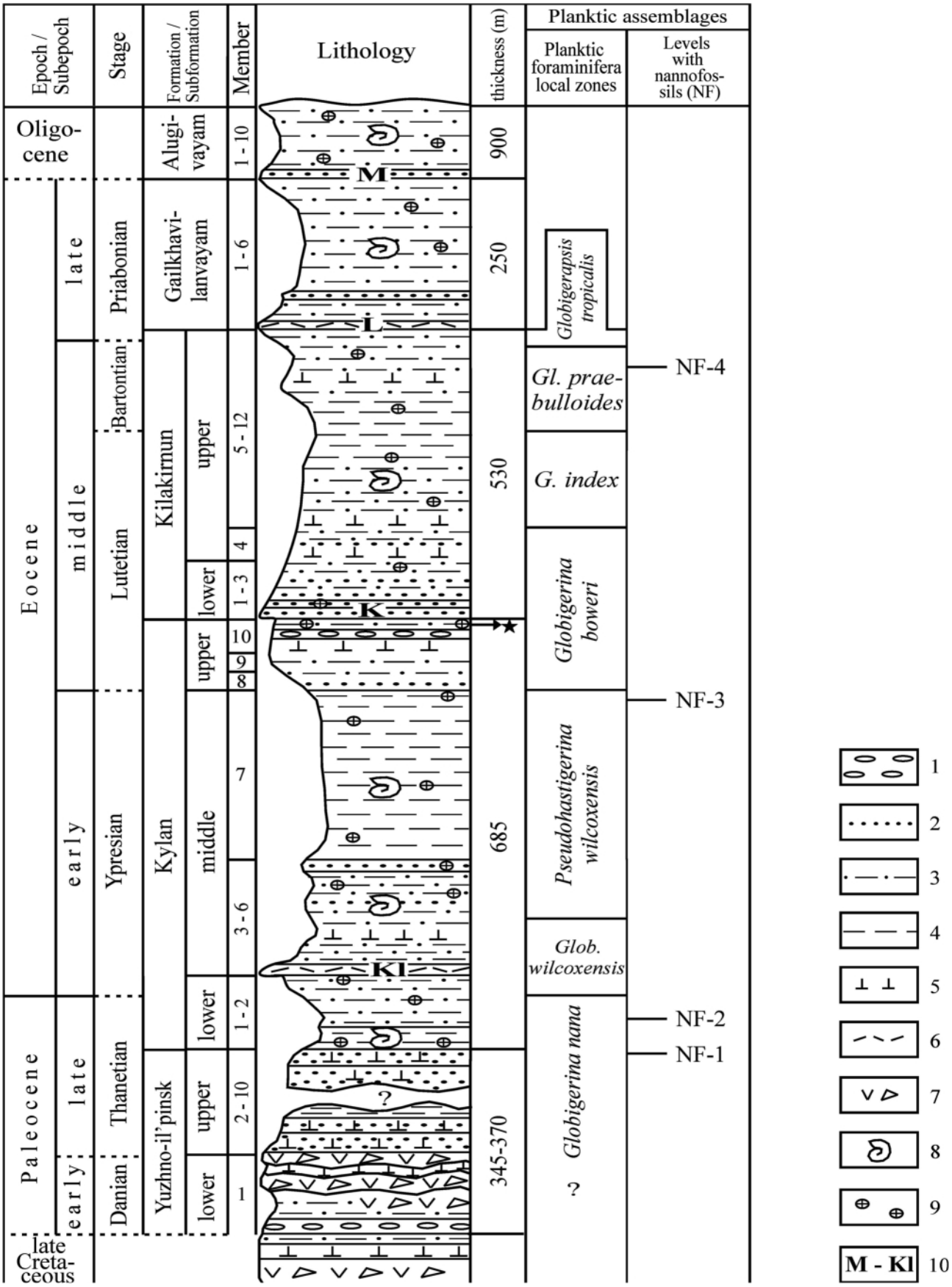
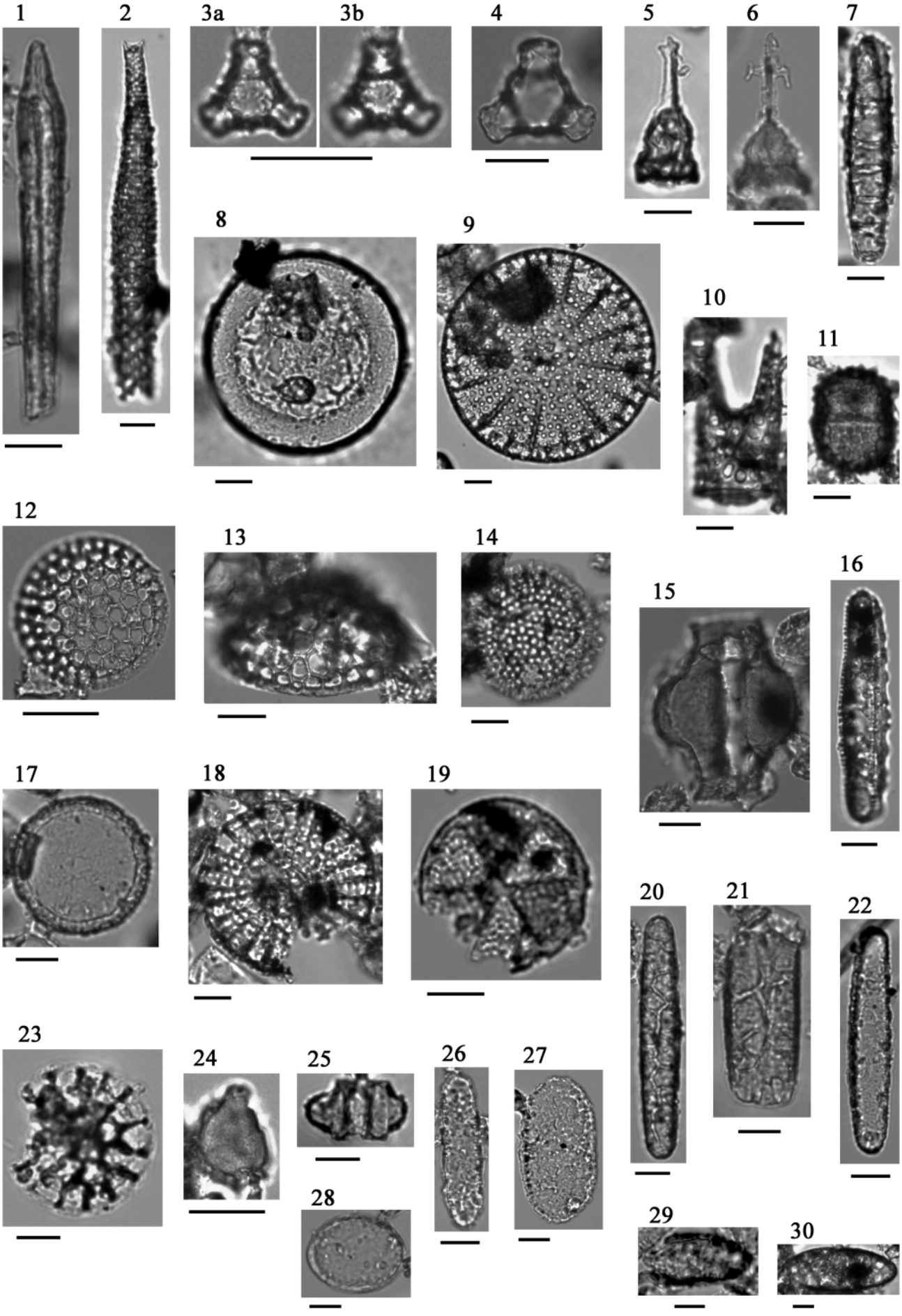


Figure 2: Generalized stratigraphic column of the Il'pinskii Peninsula section (after Volobueva et al., 1994; Benyamovskiy, personal communication, 2011), with the position of the diatom-bearing sample from the Upper Kylan Subformation (marked by arrow and asterisk). *G.* - *Globigerapsis*, *Gl.* - *Globigerina*, *Glob.* - *Globorotalia*, 1 – conglomerate, gritstone; 2 – sandstone, tuffstone; 3 – siltstone, argillite, tuffaceous siltstone and argillite; 4 - mudstone; 5 - base and intermediate tuff; 6 - acidic tuff; 7 - lava and lava-breccia; 8 – fossil mollusks; 9 - carbonate concretions; 10 - marker lithological "horizons": the Mulatkhan (M), Laparelam (L), Kilakirnun (K), Kylan (Kl).



nate concretions.

The preserved diatom assemblage is dominated by *Stephanopyxis grunowii* Grove et Sturt, Genus et sp. indet., *Xanthiopyxis* spp. and other resting spores. Rarely occur the following taxa: *Actinoptychus* sp., *Arachnoidiscus russicus* Pantocsek, *Azpeitia* cf. *tuberculata* var. *atlantica* (Jousé) Sims, *Coscinodiscus* cf. *decrescens* Grunow, *C.* cf. *decrescenoides* Jousé, *Distephanosira architecturalis* (Brun) Gleser, *Goniothecium rogersii* Ehrenberg, *Hemiaulus polymorphus* Grunow, *Hyalodiscus* sp., *Odontella* sp., *Paralia sulcata* (Ehrenberg) Cleve, *Pterotheca aculifera* Grunow, *Pyxilla gracilis* Tempère et Forti, *Riedelia borealis* Sheshukova, *Stephanopyxis* spp., *St. marginata* Grunow, *Stictodiscus kittonianus* Greville, *Triceratium inconspicuum* var. *trilobata* Fenner, *Trinacria* sp., *Trochosira spinosa* Kitton (Fig. 3). The dominance of neritic taxa and the rare occurrence of oceanic planktic elements implies deposition in relatively shallow marine environments. The determination of a precise age for the diatom assemblage is difficult owing to the absence of the majority of age-diagnostic Cenozoic taxa. The most biochronologically important taxa are *Pyxilla gracilis*, *Riedelia borealis* and *Triceratium inconspicuum* var. *trilobata*. Their co-occurrence is typical for the middle Eocene sediments in low latitudes and in the Norwegian Sea (Fenner, 1985). In the northwest Pacific however, the stratigraphic ranges of these taxa are not yet precisely constrained. Reports on Eocene diatoms are extremely limited in the study region and known only from a few localities at the ocean margins lacking direct correlation with carbonate plankton or magnetostratigraphy.

The middle Eocene age indicated by diatoms is in agreement with the age determination based on planktic foraminifera from that part of the Il'piskii Peninsula section possessing the diatom-bearing horizon of the Kylan Formation (Benyamovskiy et al., 1992; Volobueva et al., 1994; Fig. 2). The assemblages of foraminifera from the Upper Kylan Subformation (Members 8 to 10) and the overlying Kilakirnun Formation (Members 1 to 4) were assigned to the *Globigerina boweri* local zone (Benyamovskiy et al., 1992; Volobueva et al., 1994) of the Lutetian Stage, which has been correlated to zones from P10 to the lower part of P12 of the standard planktic foraminiferal zonation (Berggren et al., 1985, 1995) (49.0-42.5 Ma) (Benyamovskiy et al., 1992; Volobueva et al., 1994; Benyamovskiy, personal communication, 2011). In the underlying Middle Kylan Subformation the *Pseudohastigerina wilcoxensis* local zone of planktic foraminifera of late Ypresian age that is correlative with zones P7 to P9 has been recognized (Volobueva et al., 1994; Benyamovskiy, personal communication, 2011). Moreover, an Eocene nannofossil assemblage (NF-3, Fig. 2), which is correlative with Zone NP14 of the standard nannofossil zonation of latest Ypresian to early Lutetian age (Martini, 1971; Berggren et al., 1995) has been documented from the uppermost part of Member 7 of the Middle Kylan Subformation (Volobueva et al., 1994). Hence, the ages determined from calcareous plankton groups agree with the middle Eocene age based on the diatom flora.

In summary, first data on the Eocene diatoms from the Il'pinskii Peninsula stratigraphic section are obtained. The middle Eocene age determined from diatoms agrees with the age based on planktic foraminifera indicating a Lutetian age and correlates to Zones P10 – P12 of the standard zonation. These are the first finds of Eocene diatoms in the northwest Pacific having a direct correlation with calcareous plankton.

Figure 3: Biostratigraphically significant species and taxa typical of diatom assemblage from the Upper Kylan Subformation (sample #GIN03-70/33). 1 - *Riedelia borealis* Sheshukova; 2 - *Pyxilla gracilis* Tempère et Forti; 3, 4 - *Triceratium inconspicuum* var. *trilobata* Fenner; 5, 6 - *Pterotheca aculifera* Grunow; 7, 16 – Genus et sp. indet.; 8 – *Hyalodiscus* sp.; 9 - *Arachnoidiscus russicus* Pantocsek; 10 - *Hemiaulus polymorphus* Grunow; 11, 14 – *Stephanopyxis* spp.; 12, 13 - *Stephanopyxis grunowii* Grove et Sturt; 15 - *Goniothecium rogersii* Ehrenberg; 17 - *Paralia sulcata* (Ehrenberg) Cleve; 18 - *Stictodiscus kittonianus* Greville; 19 - *Actinoptychus* sp.; 20, 21, 22, 25, 28 – resting spores; 23 - *Stephanopyxis marginata* Grunow; 24 – *Odontella* sp.; 26, 27, 29, 30 - *Xanthiopyxis* spp. Black line segments are scale bars = 10 microns; a, b - valve in different focus.

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Andrey Yu. GLADENKOV
Geological Institute of Russian Academy of Sciences, Pyzhevskii per., 7, Moscow 119017, Russia;
agladenkov@ilran.ru