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Skenea profunda (Vetigastropoda: Skeneidae) in the central Arctic

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ABSTRACT. This paper describes finding of 3 specimens of *Skenea profunda* (Friele, 1879) in the Arctic Basin from a depth of 3700-3800 m. The species had been previously reliably known only from the bathyal part of the North Atlantic and is confined to communities of sunken wood. This is the second finding of a taxon obligate for such habitats in the Arctic Ocean and confirms the assumption that there is a fauna associated with wood falls on the path of the Transpolar Drift Flow in the Central Arctic.

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Skenea profunda (Vetigastropoda: Skeneidae) в центральной Арктике

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РЕЗЮМЕ. В работе описана находка трёх экземпляров *Skenea profunda* (Friele, 1879) в открытой части Северного ледовитого океана с глубины 3700-3800 м. *Skenea profunda* ранее достоверно был известен только из батиальной части северной Атлантики и приурочен к сообществам затопленной древесины. Это вторая находка таксона, облигатного для таких местообитаний в Северном ледовитом океане, что подтверждает предположение о наличии специальной для мёртвой древесины фауны на пути Трансполярного дрейфового потока в центральной Арктике.

Introduction

The family Skeneidae is known to be represented in the Eastern Arctic by five species: *Skenea trochoides* (Friele, 1876), *Skenea basistriata* (Jeffreys, 1877), *Skenea rugulosa* (G.O. Sars, 1878) and *Skenea ossiansarsi* (Warén, 1979) [Galkin, 1955; Nekhaev, 2014]. Gorbunov [1946] reported two more species of the genus *Ganesa sensu lato* (which previously included representatives of *Skenea*) from the bathyal part of the central Arctic Ocean: *Ganesa bujnitzkii* Gorbunov, 1946 and *Ganesa profundum* (Friele, 1879). Study of the shell and radula morphology of the former species had been demonstrated that it belongs to the genus *Leptogyra,* subclass Neomphaliones [Krol, Nekhaev, 2020]. *Ganesa profundum* was synonymized with *Skenea basistriata* by Galkin [1955], who also studied the material described by Gorbunov [1946].

Later, Warén [1991] redescribed *Skenea profunda*, based on the type series and a small material from the bathyal part of the Norwegian Sea. Thus, all confirmed records of *Skenea profunda* are limited to the deep-water basin of the northern Atlantic, and the status of the specimens discovered by Gorbunov [1946] remains unclear.

The purpose of this work is to describe specimens of *Skenea profunda* from the central part of the Arctic and discuss the biogeographical and ecological consequences of this finding.

Material and methods

The study is based on the examination of specimens identified as *Ganesa profundum* by Gorbunov [1946] and stored in the collection of the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia). The syntypes of *Cyclostrema profundum*, kept in the Zoological Museum of the University of Bergen (Norway), were also studied. For comparison, specimens of conchologically similar *Skenea basistriata* described by Galkin [1955] and Nekhaev [2014] were used.

Shell and soft body morphology of one specimen of *Skenea profunda* was studied using a scanning electron microscope. The body was carefully removed from the shell and being kept for a day in pure ethanol, after this it was dried with a hexameth-

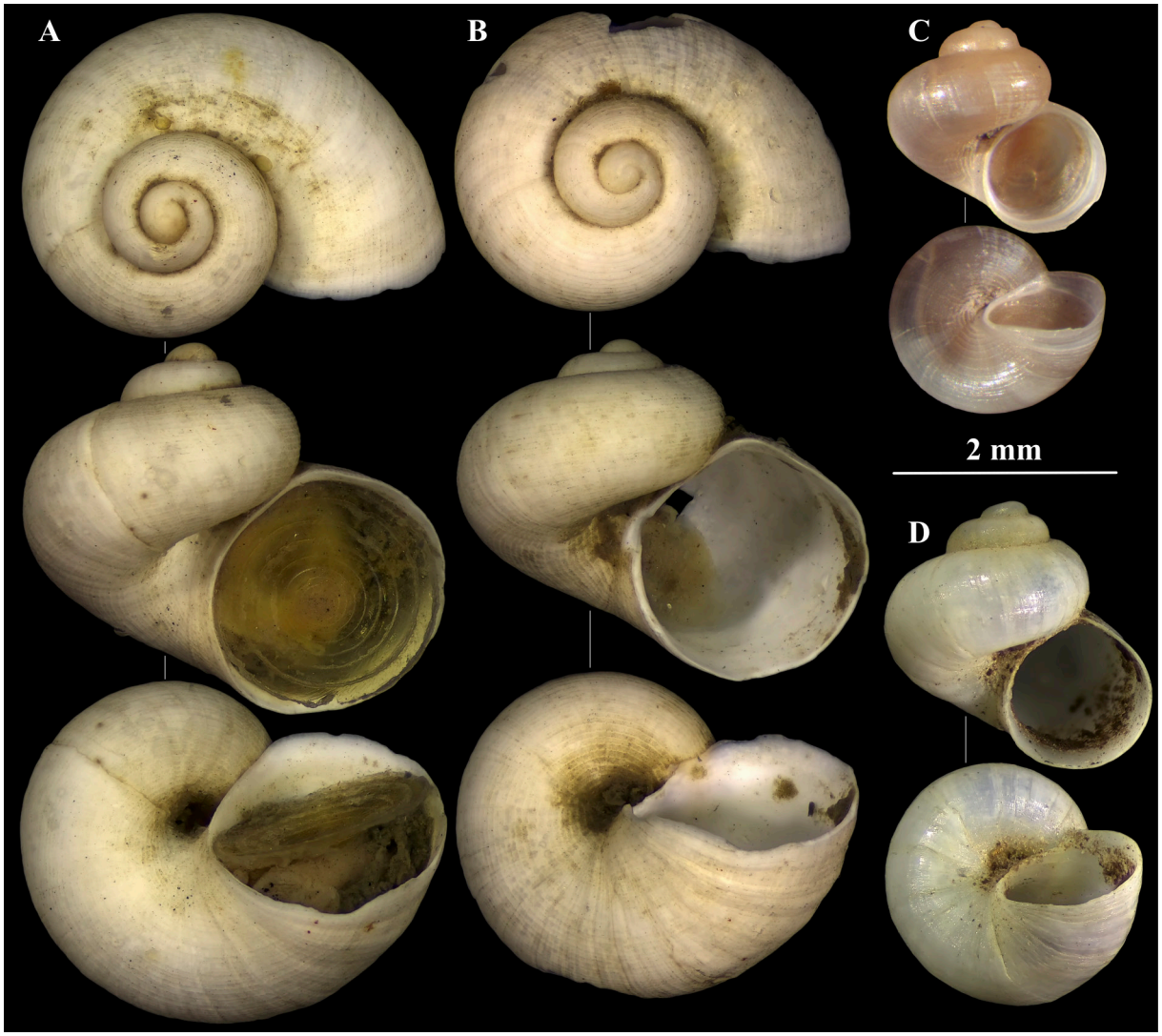

FIG. 1. Shells of *Skenea* from the Arctic. **A, B.** *Skenea profunda*, Arctic Ocean, 81°50'N, 136°14'E. **C, D.** *Skenea basistriata*; **C.** Barents Sea, 70°00'N, 33°30'E. **D.** Kara Sea, 76°40'N, 88°09'E, ZIN 1900/6.

РИС. 1. Раковины *Skenea* из Арктики. **A, B.** *Skenea profunda*, Северный Ледовитый океан, 81°50'N, 136°14'E. **C, D.** *Skenea basistriata*; **C.** Баренцево море, 70°00'N, 33°30'E. **D.** Карское море, 76°40'N, 88°09'E, ZIN 1900/6.

yldisilizane [Geiger *et al*., 2007]. After studying the soft body morphology, a radula was cleaned from tissue with a water solution of sodium hypochlorite and studied separately.

Shells had been measured according to the scheme by Nekhaev [2019].

Abbreviations

SEM – scanning electron microscope

ZIN – Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia)

ZMB – Zoological Museum of the University of Bergen (Norway)

ZMO – Zoological Museum of the University of Oslo (Norway)

Results

Subclass Vetigastropoda
Family Skeneidae
Skenea profunda (Friele, 1879)
(Figs 1 A-B, 2 A-D, 3)

Cyclostrema profundum Friele, 1879: 272.
Cyclostrema profundum: Friele, 1886: 34.
Lissospira profunda: Bouchet, Warén, 1979: fig 9A, 40-41.
Skenea profunda: Warén, 1991: 65, figs 5C, 7B, 9E.

Type material. 4 syntypes of *Cyclostrema profundum*. ZMB 20999, Greenland Sea, 77°58'N, 5°10'E, 2438 m, *Vøringen* sta. 353, 10.08.1878. 3 syntypes of *Cyclostrema profundum*. ZMB 21000, Greenland Sea, 78°03'N, 11°18'E, 229 m, *Vøringen* sta. 357, 12.08.1878. Several syntypes of *Cyclostrema profundum*. ZMO D4423, Norwegian Sea,

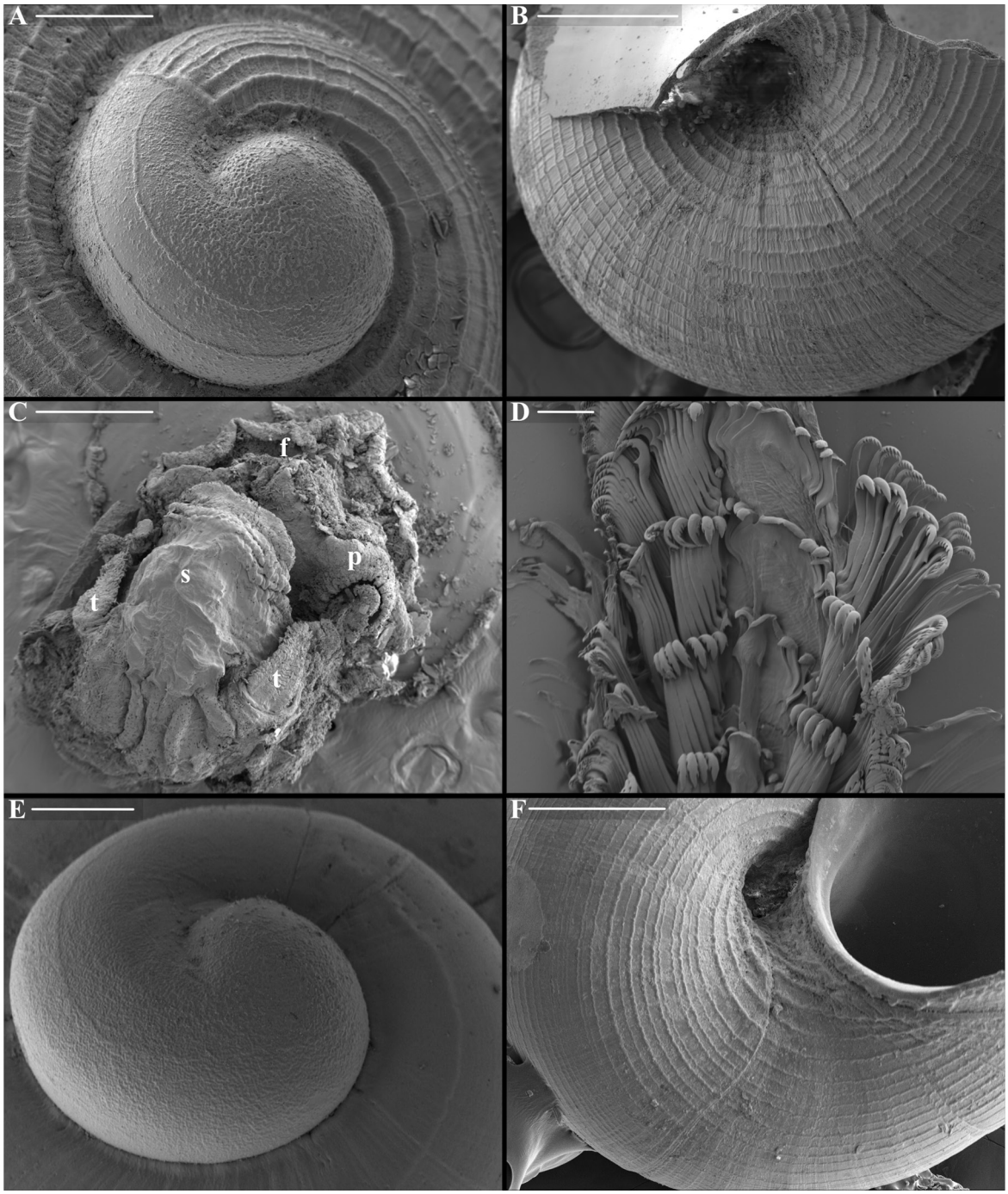

FIG. 2. SEM microphotographs of *Skenea* from the Arctic. **A–D.** *Skenea profunda*, Arctic Ocean, 81°50’N, 136°14’E. **A, B.** Shell. **C.** Soft body. **D.** Radula. **E, F.** Shell of *Skenea basistriata* Kara Sea, 76°40’N, 88°09’E, ZIN1900. f – foot, p – penis, s – snout, t – head tentacle. Scale bars: A = 200 μm, B = 500 μm, C = 500 μm, D = 40 μm, F = 100 μm, E = 400 μm.

РИС. 2. Микрофотографии *Skenea* из Арктики. **A–D.** *Skenea profunda*, Северный Ледовитый океан, 81°50’N, 136°14’E. **A, B.** Раковина. **C.** Мягкое тело. **D.** Радула. **E, F.** Раковина *Skenea basistriata* Карское море, 76°40’N, 88°09’E, ZIN1900. f – нога, p – пенис, s – морда, t – головное щупальце. Масштаб: A = 200 μm, B = 500 μm, C = 500 μm, D = 40 μm, F = 100 μm, E = 400 μm.

69°46’N, 16°15’E, 1187 m, *Vøringen* sta. 192, 7.07.1877 (see remarks for more information).

Material studied. Arctic Ocean, 81°50’N, 136°14’E, 3700-3800 m, R/V *Sadko*, sta. 101, 24.07.1938, ZIN 1907 (3 specimens).

Description. Shell small, skeneimorph, almost white, with convex rounded whorls, suture deep, periphery of penultimate whorl rounded, convex. Teleoconch surface with 20-30 thin spiral ribs crossed straight irregular growthlines. Protoconch covered with flocculate sculpture, partly organized

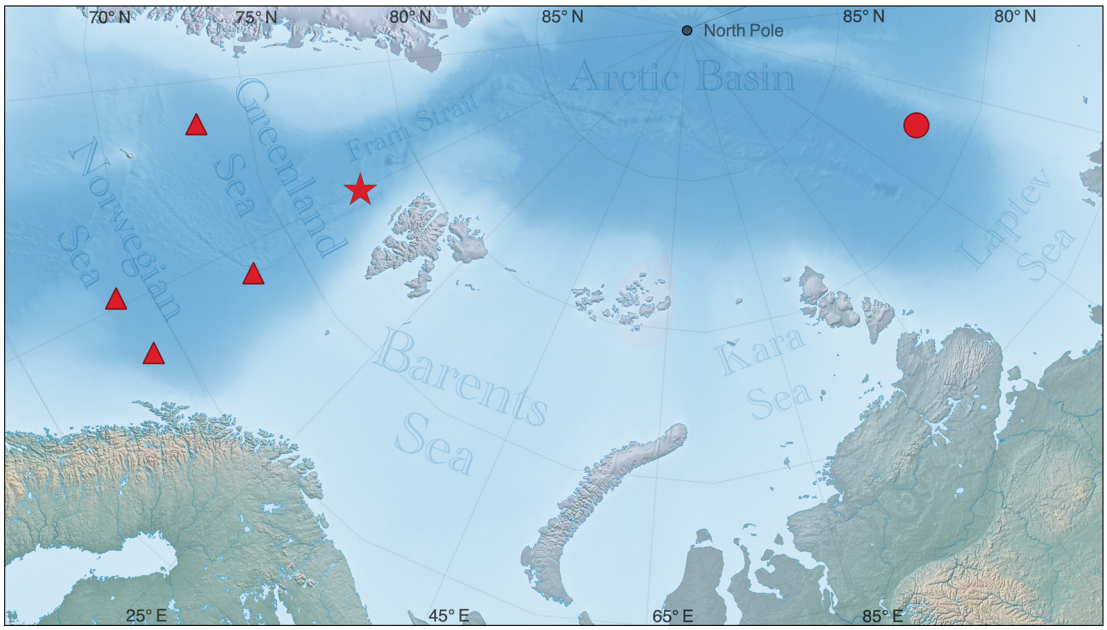

FIG. 3. Map of known localities of *Skenea profunda*. Star indicates type locality (*Vørengien* st. 353); circle indicates locality reported here at Arctic Ocean, 81°50'N, 136°14'E; triangles indicate localities from Bouchet and Warén [1979] and Holovachov *et al.* [2011].

РИС. 3. Карта известных находок *Skenea profunda*. Звездой показано типовое местонахождение (*Vørengien* st. 353); кружком показано местонахождение, описанное в настоящей работе, Северный Ледовитый океан, 81°50'N, 136°14'E; трегольниками показаны находки из Bouchet и Warén [1979] и Holovachov *et al.* [2011].

in 2-3 spiral ribs. Aperture almost round with wide rounded angle in upper part. Umbilicus wide, deep. Operculum multispiral, semitransparent.

Radula (Fig. 2D): n-4-1-4-n. Central tooth wide with narrow cutting edge, cusps on cutting edge of laterals less developed than on marginals.

Soft body (Fig. 2C) partially macerated. Pigmented eyes absent, head tentacles triangular short. Snout wide twice as long as tentacles. Propodial penis present in right corner of foot.

Measurements of largest specimen: shell height = 3.6 mm, aperture height = 2.3 mm, last whorl height = 3.1 mm, shell width = 3.8 mm, aperture width = 2.2 mm, diameter of protoconch = 0.6 mm, whorls number = 2.75, protoconch whorls number = 0.6.

Distribution. The species is known from the several localities in the northern Atlantic (the Norwegian and Greenland Seas) and Lomonosov Ridge in the Arctic Ocean, 2830–3800 m (Fig. 3).

Habitat. *Skenea profunda* is associated with the sunken wood habitats [Friele, 1886; Høisæter, 2009; Holovacev *et a*l., 2011].

Remarks. Friele [1879] described *Cyclostrema profundum* based on material from three stations by the Norwegian North Atlantic Expedition in 1877 and 1878. Samples from the stations 353 and 357 are currently stored in ZMB and collected from depths of 2438 and 229 m, respectively. The shells collected at both stations are identical, but the depth at station 357 is very different from the depths in other habitats of *Skenea profunda*. Bouchet and Warén [1979] suggested that the shallow-water finding of this species is erroneous. This opinion was supported by Hoisaeter [2009], who pointed out that the shallow-water sample (st 357) was taken immediately after the deep-water one (st 353). The material from station 192 (1187 m) should be stored in ZMO, but has not been studied by previous researchers and has not been found by me in the museum. Since the lectotype for this species has not been designated, formally all three samples are syntypes. However, when discussing the distribution of this species, I do not take into account samples from stations 192 and 357.

Skenea profunda differs from other species of the genus by the combination of a large diameter of the embryonic shell (more than 500 μm) and the presence of a sculpture on the teleoconch, which consists of many spiral ribs starting immediately from the border between the adult and embryonic shells (Fig. 2A). *Skenea basistriata* which is the most similar with *Skenea profunda* in shell shape and sculpture has only one rib in the initial part of the teleoconch (Fig 2F). Adult specimens of *Skenea profunda* have the largest sizes among the North Atlantic and Arctic representatives of *Skenea*: the shell width of *Skenea profunda* reaches 3.8 mm, whereas in other large species of the genus (*Skenea basistriata* and *Skenea turgida*) it usually does not exceed 3 mm [Warén, 1991; 1993; Nekhaev, 2014; unpublished observation].

Discussion

Krol and Nekhaev [2020], who studied *Leptogyra bujnitzkii* (Gorbunov, 1946), suggested that this species lives on wood falls, like other representatives of the genus *Leptogyra*. So far, it has been the only species known from the Arctic for which habitat in biotopes of this type has been proposed. However, prior to the confirmation of the *Skenea profunda* record, there were no invertebrate taxa known in the Arctic Ocean that were definitely confined to the sunken wood communities. Both species were collected at the same station (*Sadko*, sta. 101), thus, the assumption that there are communities of benthic invertebrates in the Arctic using sunken wood as main energy source seems very likely.

Wood falls are known as a kind of reducing habitat with fauna close to that of hydrothermal vents and methane seeps [Distel *et al*., 2000]. Such communities occupy relatively small areas in the ocean but differ greatly from background ecosystems in taxonomic composition, evolutionary history, and biogeography [Friele, 1879; Tarasov *et al*., 2005; Samadi *et al*., 2010]. Communities of sunken wood are known in the Norwegian and Greenland Seas divided from the Arctic Basin by the Fram Strait. However, there is no direct evidence of the existence of such communities directly in the central Arctic where location of *Skenea profunda* reported here is placed. All known wood fall communities in the Greenland and Norwegian seas are located on the way out of the Transpolar Drift Stream into the Atlantic Ocean [Warén, 1996; Ockelmann, Dinesen, 2011]. The site where *Skenea profundum* and *Leptogyra bujnitzkii* were found is located at the beginning of this current, transporting drifting wood from Siberian rivers further into the Arctic. Thus, it is likely that wood falls present in other deep-water areas of the Arctic Ocean that are in the path of the stream.

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