RADIOLARIA IN THE SEDIMENTS FROM THE NORTHWEST PACIFIC AND ITS MARGINAL SEAS

西北太平洋及其边缘海沉积物中的放射虫

陈木宏　张　强　张兰兰　刘　玲　著
Chen Muhong, Zhang Qiang, Zhang Lanlan and Liu Ling

科学出版社

RADIOLARIA IN THE SEDIMENTS FROM THE NORTHWEST PACIFIC AND ITS MARGINAL SEAS

Summary

As a newest research result, this book shows the radiolarian species descriptions and their phylogenetic systematics in the high latitude areas of the northwestern Pacific, recording a total of 42 Families, 152 Genus and 397 species/subspecies of Spumellaria and Nassellaria, most of them belong to new records in this area and 21 new species were established. Total 85 plates provide cleared photo pictures of all 397 radiolarian species, which were arranged in sequence according to the order in species descriptions. In this book, we have first analysed the biogeographic features of modern radiolaria in the Bering Sea, the Sea of Okhotsk, the Japan Sea, the East China Sea, the Philippine Sea and the South China Sea. Referring to the circulation system and the western boundary currents (Kuroshio and Oyashio) in the North Pacific, influence factors of marine dynamic environments to ecological conditions in the marginal seas of different latitude were discussed, illustrating the likeness and otherness between different marginal seas and explaining their relations. Furthermore, the biostratigraphy and age framework of the Bering Sea since Pliocene have been established, and the evolutions of paleoceanography, character events and their responses to the global climatic changes were also revealed by radiolarian analysis.

DESCRIPTION OF NEW SPECIES

Cenosphaera cornospinula sp. nov.

(Pl. 1, Figs. 5–8)

Single spherical lattice-shell, with very thick walled, rough, covered with short conical spine. Pores roundish or elliptical, different size, subregular or irregular arrange, 1–3 times as broad as the bars, 11–13 on the half equator; with thick hexagonal, pentagonal or quadrilateral frames, in which external pores enlarge and bars ridge, conic raises at the join points, forming pyramid spicules with three, four or five edges; broad at base of spicule, but sharp terminal.

Measurements: Diameter of the shell 175–183 μm, pores 10–16 μm, length of spines 8–13 μm.

Locality of holotype: BS-R1 deposited in the South China Sea Institute, CAS, from sample U1344A-6H-cc of IODP 323 in the Bering Sea, pictured in Plate 1, Figs. 7, 8.

This new species is similar to *Cenosphaera cristata* Haeckel (1887, p. 66), but the latter has unclearly polygonal frame and thin spine without edges at pyramidal side.

***Cenosphaera exspinosa* sp. nov.**

(Pl. 2, Figs. 6–10)

Shell small thin walled, smooth or rough with dispersive small spines or thorns. Pores quasi-circular or irregular in different sizes, no double-edged frame, irregular arranged, 10–14 on the half equator; bars lamelliform, as broad as most pores, with small conic raise at each joint, some extend as thin spicules, sparse pyramid spicules. Surface of smaller individual seems smooth. Shell size of this species is variable.

Measurements: Diameter of the shell 108–170 μm, pores 4–16 μm, length of spines 4–10 μm.

Locality of holotype: BS-R2 deposited in the South China Sea Institute, CAS, from sample U1339C-14H-cc of IODP 323 in the Bering Sea, pictured in Plate 2, Figs. 9, 10.

This species is similar to *Cenosphaera cristata* Haeckel, the main distinction between them is the latter with thick walled shell, polygonal crested frames and narrow bars.

***Thecosphaera entocuba* sp. nov.**

(Pl. 4, Figs. 11–14)

Skeleton consists of 1 cortical and 2 medullary shells, with the approximately ratio of 1∶3∶7. Cortical shell thin walled, with some tiny thorns at joints on surface; pores roundish, similar size and 2–3 times as the bars, sub-regular distribution, about 9–11 pores on the half equator. Outer medullary obvious cube or rhombus, pores polygon with different sizes, irregular arranged, thin bars, 8 radial beams from the cube corner connect with cortical shell and other 8 beams from octahedral middle connect to inner medullary shells, which is a very small latticed polygon or like sphere. The beams that connect only two medullary shells not extend to cortical shell and beams that connect outer medullary and cortical shells never penetrate the cortical shell as radial spine on the surface.

Measurements: Diameter of the cortical shell 98–108 μm, outer medullary shell 39–45 μm, inner medullary shell 10–14μm, cortical pores 5–10 μm.

Locality of holotype: BS-R3 deposited in the South China Sea Institute, CAS, from sample U1344A-13H-cc of IODP 323 in the Bering Sea, pictured in Plate 4, Figs. 13, 14.

This new species is similar to *Actinomma henningsmoeni* Goll et Bjorklund (1989, p. 728, pl. 2, figs. 10–15), which has 2 medullary and 1 cortical shell with small size and no radial spine. The distinction is the latter with thick walled and spherical medullary shells. Feature of Genus *Actinomma* should be with radial spines on surface.

Acrosphaera arachnodictyna sp. nov.

(Pl. 7, Figs. 13−15; Pl. 8, Figs. 1−4)

Shell sphere or sub-sphere, sometimes outline slight irregular or near ellipsoidal, thin walled, brief smooth surface. Pore sizes and forms have great differences, the larger pores as forms of irregular triangle, quadrangle or polygon, the smaller pores distribute among larger pores, size differences of them may up to 8−10 times. Narrow bars between pores like slabby strip, which intertexture as irregular arachnoid formation. Surface has a few spines, sparse appearance at some converge areas of bars, thin pyramid or thin rodlike, short.

Measurements: Diameter of shell 215−235 μm, maximum pore 32 μm, length of spines 5−15μm.

Locality of holotype: BS-R4 deposited in the South China Sea Institute, CAS, from sample U1342D-1H-cc of IODP 323 in the Bering Sea, pictured in Plate 8, Figs. 3, 4.

This new species is similar to *Acrosphaera hirsuta* Perner, but the latter has regular spherical shell, more radial spines, most pores as quasi-circular and the surface spines as trilateral flake.

Lonchosphaera multispinota sp. nov.

(Pl. 12, Figs. 1, 2)

Lonchosphaera sp. C, Petrushevskaya, 1975, pl. 17, figs. 11−15.

Cortical shell large spheroidal, thick walled, surface rough with slight ups and downs; pores ellipse or circle, with great difference in size, very irregular distributed, 10−16 pores across equator, bars width in big difference. Medullary shell polygon or irregular form, composed of thick beams; some radial beams from corners of medullary shell connecting to cortical shell, these radial beams have side branches which joined each other and terminal furcations which connected to cortical shell. Main spicules 20−30 from the radial beam penetrations, coniform and strong, length less than radius of cortical shell; other by-spicules formed at bar joins or nodes, as short coniform or small spines.

Measurements: Diameter of cortical shell 203−208 μm, pore 10−30 μm, medullary shell 50−68 μm, length of main spicule 63−73 μm.

Locality of holotype: BS-R5 deposited in the South China Sea Institute, CAS, from sample U1339B-13H-cc of IODP 323 in the Bering Sea, pictured in Plate 12, Figs. 1, 2.

This new species is distinguished from other species of this Genus mainly by its thicked cortical shell, developed main spicules and rough surface.

Hexalonche calliona sp. nov.

(Pl. 12, Figs. 9, 10)

Cortical shell thin walled, surface smooth, pores circular with hexagon framwork,

arranged very regular, size of pores 4 times as bar width, about 7–8 pores across equator. Medullary shell moderate thickness, near 1/2 size as cortical shell, with hexagon pores about similar size, sub-regular arranged, 7–8 pores across the equator, pore size 3 times as bar width. Six radial beams, triangular prism, connecting medullary and cortical shells, and extend outward as 6 spicules, thin coniform, short, which length generally less than diameter of medullary.

Measurements: Diameter of cortical shell 90 μm, pores 10 μm, medullary shell 43 μm, length of spicule 20–25 μm.

Locality of holotype: BS-R6 deposited in the South China Sea Institute, CAS, from sample U1344A-6H-cc of IODP 323 in the Bering Sea, pictured in Plate 12, Fig. 10.

This new species is similar to *Hexalonche aristarchi* Haeckel, but the latter has thicker wall and irregular pore forms, sizes and distributions, and the latter radial spicules show as pyramid form with three arrises.

***Centrolonche furcata* sp. nov.**

(Pl. 14, Figs. 1–3)

Single lattice shell, spherosome, with some moundy risehigh on surface, as sags and crests, moderate or thin walled, pores sub-circle or irregularity, different sizes, irregular distribution, thin bar. About 6 radial beams rise from the central point, generally bifurcate at near shell wall and penetrate to form main radial spicules, which as three edges cone-shaped or triangular prism, the latter usually divaricating terminal, inconsistent with forms and sizes, with small pores around the base of spicules. Surface of shell rough, with some by-spines rise from the bars.

Measurements: Diameter of shell 130–138 μm, length of main spicule 48–52 μm, base width of spicule 32–42 μm, length of by-spines 17–28 μm.

Locality of holotype: BS-R7 deposited in the South China Sea Institute, CAS, from sample U1344A-1H-3 w22-23cm of IODP 323 in the Bering Sea, pictured in Plate 14, Figs. 1–3.

Features of this new species is near *Centrolonche hexalonche* Popofsky (1912, p. 89, Taf. 1, Fig. 1), which have the same as inner radial beams join at a central point. The distinctions are the latter shows a smooth surface, no moundy risehigh, same form and size of spicules, with no divaricating terminal, simple by-spine, and similar size of circle pores.

***Haliomma asteroeides* sp. nov.**

(Pl. 15, Figs. 3, 4)

Cortical shell small spherical, slight thick walled; pores quasi-circular, slight large, approximately same sizes, sub-regular arrangement, 6–7 pores across equator, pores enlarged toward, with obvious hexagonal framwork. Medullary shell about half size as cortical shell,

with sub-circular or polygonal pores, sub-regular arrangement, 5–6 pores across equator, thin bars. 20–24 radial beams connecting cortical and medullary shells, which not extend outside. The surface thorny, spines rise from join points of bars as three edges pyramidal, short, similar forms and sizes, some with terminal forfications.

Measurements: Diameter of cortical shell 80–93 μm, medullary shell 38–43 μm, inner diameter of cortical shell 7–10 μm, length of spine 7–10 μm.

Locality of holotype: BS-R8 deposited in the South China Sea Institute, CAS, from sample U1344A-1H-4 w42–43 cm of IODP 323 in the Bering Sea, pictured in Plate 15, Figs. 3, 4.

This new species is similar to *Haliomma entactinia* Ehrenberg, but the latter has relative thin cortical shell, not obvious thorny surface, but a few longer spine, and with smaller medullary shell, only about 1/3 size as cortical shell.

***Actinomma pellucidata* sp. nov.**

(Pl. 21, Figs. 15, 23)

Echinomma leptodermum Jørgensen, Bjørklund, 1976, pl. 2, figs. 1–6 (not pl. 1, figs. 13, 14).

Shell spheroidal, rate of three shells as 1∶3∶9. Cortical shell thin walled, with large pores, circular or hexagon, similar sizes, regular or sub-regular distribution, 6–7 pores across equator, diameter of pores 2–4 times as bars, bars between pores very thin. Out medullary shell spheroidal or like sphere, with small pores, sub-regular, 6–7 pores across equator; inner medullary shell very small, like sphere; 12–18 radial beams connecting medullary and cortical shells and some penetrate cortical shell to extend as radial spines, these spines usually short and thin. Surface smooth, without any by-spine.

Measurements: Diameter of cortical shell 86–108 μm, outer medullary shell 42–46 μm, inner medullary shell 14–5 μm, pores of cortical shell 7–18 μm, length of spines 10–20 μm.

Locality of holotype: BS-R9 deposited in the South China Sea Institute, CAS, from sample U1344A-1H-cc of IODP 323 in the Bering Sea, pictured in Plate 21, Figs. 15, 16.

This new species is similar to *Actinomma leptodermum* (Jørgensen), the key distinction is by the latter with obvious more numbers, stronger and longer radial spines, but undeveloped spines for this new species.

***Actinomma polyceris* sp. nov.**

(Pl. 22, Figs. 3–8)

Echinomma leptodermum Jørgensen, Bjørklund, 1976, pl. 1, figs. 13, 14.

Moderate individuals, ratio of three shells as 1∶3∶9. Configuration of cortical shell hexagon or polyhedral, thin walled, with invaginations at contact places of radial beams and cortical shell; pores circle or sexangle, similar sizes, sub-regular distribution, 12–14 pores across equator, 2–3 times as broad as bar, bar thin and fine. Outer medullary shell sub-global or polyhedral, medium wall thickness, pores small; inner medullary shell very small, near

spherical, with a few pores. 14–20 radial beams, triangular prism, from outer medullary shell connect to cortical shell, most of them extend outside cortical shell as radial spines, short, three edges pyramid. Surface smooth, without any by-spine.

Measurements: Diameter of cortical shell 122–130 μm, outer medullary shell 46–48 μm, inner medullary shell 18–21 μm, length of spines 10–20 μm.

Locality of holotype: BS-R10 deposited in the South China Sea Institute, CAS, from sample U1345D-5H-cc of IODP 323 in the Bering Sea, pictured in Plate 22, Figs. 3, 4.

This new species is similar *Actinomma brevispiculum* Popofsky as thin wall and many small pores, but the latter has a spherical (not polyhedral) cortical shell and no invagination on surface.

***Centrocubus alveolus* sp. nov.**

(Pl. 28, Figs. 1–4)

Cenosphaera? sp. aff. *C. perforata* Haeckel, Benson, 1966, p. 125, pl. 2, figs. 6, 7; 1983, p. 501, pl. 4, fig. 4.

Shell spheroidal, small, resemble spongy inner structure, honeycomb, with hexagonal or polygonal opens on surface; medullary shell very small, like a cube, from the vertex angles arise 8 or 16 main radial beams, slender prismatic, with a total of 60–80 side branches make up a regular framwork of cortical shell, between main radial beams there are thin horizontal beams, mutual paralleled, uniform distribution, and between every two radial beams there are 2–3 longitudinal second thin beams, they cross each other intersed many near quadrate inner pores; each deep holes surrounded by 5–6 radial beams and their connecting inner walls, hexagon or polygon, become enlarge outward; shell surface smooth, radial beams not extend outside, no other coverings.

Measurements: Diameter of cortical shell 113–125 μm.

Locality of holotype: BS-R11 deposited in the South China Sea Institute, CAS, from sample U1344A-1H-4 w42–43 cm of IODP 323 in the Bering Sea, pictured in Plate 28, Figs. 1–4.

This new species is similar to *Centrocubus cladostylus* Haeckel (1887, p. 278, pl. 18, fig. 1), but the latter has mussy spongy net between radial beams, which become thick terminal and extend outside.

***Stylacontarium pachydermum* sp. nov.**

(Pl. 34, Figs. 1–4)

Shell ellipsoid or oval, very large, surface rough, ratio of three shells about 1∶3∶12. Cortical shell very thick walled, with obvious dimorphism structures, inner wall with hexagon or quasi-circular pores, large, sub-regular arrangement, 10–12 pores across equator, outer surface covered with small pore net, which formed by apophysis and lateral branches, surface pores small, different shapes and sizes, close together, irregular distribution. Two medullary

shells spheroid, very small, outer medullany shell about a fourth or afifth of cortical shell in diameter, while three times of inner medullary shell, several thick radial beams connect medullary and cortical shells, two on the long axis extend as 2 pole spines, which are short and stout, similar forms, conical shape, width base and sharp terminal, about as long as diameter of outer medullary shell, or slight longer.

Measurements: Diameter of cortical shell long axis 225–248 μm, minor axis 185–195 μm, wall thickness 35–42 μm, outer medullary shell 45–50 μm, inner medullary shell 18 μm, length of pole spines 48–50 μm, base width of spines 20–25 μm.

Locality of holotype: BS-R12 deposited in the South China Sea Institute, CAS, from sample U1344A-76X-cc of IODP 323 in the Bering Sea, pictured in Plate 34, Figs. 3, 4.

This species is obviously distinguished from other species by its larger individuals, very thick wall and its special dimorphism structure of cortical shell.

***Dictyocoryne inflata* sp. nov.**

(Pl. 43, Fig. 1)

Shell symmetry of two sides, three spongy arms very hairchested and lenience; included angles of arms as two similar and another obvious smaller, wide base of each arm and slight broader terminal, arm short, as length as width, or less length, the two arms (even arms) with smaller angle nearly joined together, only a narrow interspace at terminal between them; concentric rings in central area covered by compact spongy texture; patagiums undeveloped or very narrow, with clearly shell margin.

Measurements: Diameter of shell 360–390 μm, arm length 110–170 μm, arm width 190–240 μm.

Locality of holotype: BS-R13 deposited in the South China Sea Institute, CAS, from sample U1344A-35X-cc of IODP 323 in the Bering Sea, pictured in Plate 43, Fig. 1.

This new species is similar to *Dictyocoryne truncatum* (Ehrenberg) and *Dictyocoryne trimaculatum* Tan et Tchang, but the latter two are narrow base of arms near central area, similar included angles and with developed patagiums which may nearly cover all the shell.

***Streblacantha globolata* sp. nov.**

(Pl. 51, Figs. 18, 19)

Outer shell sub-spherical, surface near enclosed, pores quasi-circular or oval, with different sizes, irregular arranged, 6–8 pores across equator, diameter of pore 1–3 times as bar width, which like broad flake. Inner shell composed of revolving structure that surrounding primary chamber, with loose irregular inner pores. 20–24 radial beams protrude outer shell, form pyramid radial spines, spine length less than half radius of shell; some other scattered small conic thorns on the surface.

Measurements: Diameter of shell 125–138 μm, outer pores 4–27 μm, bar width 5–

14 μm, length of radial spines 18–33 μm.

Locality of holotype: BS-R14 deposited in the South China Sea Institute, CAS, from sample U1339B-13H-cc of IODP 323 in the Bering Sea, pictured in Plate 51, Figs. 18, 19.

This new species is similar to *Streblacantha circumyexta* (Jørgensen), but the latter has irregular outline, more pores, fine bars, long and thin radial spines.

***Tristylospyris beringensis* sp. nov.**

(Pl. 53, Figs. 16–19; Pl. 54, Figs. 1–4)

Triceraspyris sp., Ling *et al*., 1971, p. 713, pl. 2, figs. 1–3.

Shell double chambers seperated by sagittal constriction, compressed; wall thickness medium or variable; pore sizes with great discrepancy, quasi-circular or irregular form, disarray distribution; short spines rised from every join points of bars, surface rough; three basal feet short, pyramid with three edges, broad at the base, where generally with one or more perforate, distal sharp and no forked. There is no any apex horn.

Measurements: Diameter of shell width 120–190 μm, shell high 90–140 μm, length of basal feet 35–62 μm.

Locality of holotype: BS-R15 deposited in the South China Sea Institute, CAS, from sample U1344D-5H-cc of IODP 323 in the Bering Sea, pictured in Plate 53, Figs. 18, 19.

This new species is similar to *Triceraspyris antarctica* (Haecker), but the latter is with smooth surface, similar pore size, sub-regular distribution, longer basal feet and may distal forked. Ling *et al*. (1971) firstly reported this species and regarded as a common species in the Bering Sea.

***Archipilium tanorium* sp. nov.**

(Pl. 55, Fig. 25; Pl. 56, Figs. 1–4)

Shell near oval or fat conical, top as moundy, expand downward, wide open mouth, margin even or out of flatness, no apex horn, some conic spines on surface; pores quasi-circular or ellipse, different sizes, slightly amplify from top to mouth, sub-regular or irregular distribution, diameter of pores 1.5–4 times as width of bars, 5–6 pores between two side wings; three side wings develop from the lower or bottom shell, inclined downward extend, long and thin pillar, distal slight outward curve, length of the solid wings about 1.5 times as the shell.

Measurements: Diameter of shell length 62–80 μm, shell width 90–98 μm, wing length 92–120 μm, spine length 8–15 μm.

Locality of holotype: BS-R16 deposited in the South China Sea Institute, CAS, from sample U1339C-12H-cc of IODP 323 in the Bering Sea, pictured in Plate 56, Figs. 3–4.

This new species is similar to *Dictyophimus histricosus* Jørgensen (1905, pl. 16, fig. 89), the main distinction is the latter wings formed from mouth fringe and short, only 1/2–2/3

length as the shell.

Euscenium sagittarium sp. nov.

(Pl. 56, Figs. 7–9; Pl. 57, Fig. 1)

Cephalis conical or hemispherical, no obvious convex, wall very loose with irregular latticed, pores polygonal, different sizes, irregular distribution, bar very thin, diameter of pore 2–8 times as width of bar; surface thorny, slender pyramid spines rised from some join points of bars; mouth uneven, some bars of peristoma extend downward as long spines (or terminal feet). Apical horn pyramid edged, robust or slender, apical sharp and no fork, about 1.5 times length as the cephalis long. Apical horn is formed from the upright sagittal beam extending, it join at the shell basal central point with 3–4 horizontal beams, which extend outside as main feet, long pyramid edged, curve at the up section and then develop oblique down, rare lateral spine at place of curve and smooth elsewhere.

Measurements: Diameter of shell length 90–98 μm, width 126–145 μm, length of apical horn 146–154 μm, length of mian feet 146–155 μm, length of peristoma spines 43–73 μm。

Locality of holotype: BS-R17 deposited in the South China Sea Institute, CAS, from sample U1341B-2H-cc of IODP 323 in the Bering Sea, pictured in Plate 56, Fig. 9 and Plate 57, Fig. 1.

This new species is similar to *Euscenium tricolpium* Haeckel (1887, p. 1147, pl. 53, fig. 1) and *Cladoscenium tricolpium* Bjørklund (1976, p. 1124, pl. 7, figs. 5–8), but the latter two have both apical horn and main feet with lateral spines as serration, and smooth surface. Feature of Genus *Cladoscenium* is apical horn and feet with terminal bifurcate.

Calpophaena pentarrhabda sp. nov.

(Pl. 59, Figs. 1–4)

Shell small, sub-sphere or helmet, surface general smooth, pores sub-circle or polygon, with different sizes, sub-regular distribution, bars thin, a few small spine on shell surface; one apical spine oblique, slender rod like which has no distal sharp, approximately length as shell length; mouth open, with unobvious peristoma ring, where develop 5 irregular terminal feet, slender rod like, with different growing orientations, side or inclined directions, similar length of all feet in one specimen, less than shell length, no forfication.

Measurements: Diameter of shell length 36–38 μm, shell width 46–49 μm, length of apical spine 37–39 μm, length of terminal feet 22–33 μm.

Locality of holotype: BS-R18 deposited in the South China Sea Institute, CAS, from sample U1340A-1H-cc of IODP 323 in the Bering Sea, pictured in Plate 59, Figs. 1–4.

This new species is basically similar to *Calpophaena tetrarrhabda* Haeckel and *Calpophaena hexarrhabda* Haeckel (1887, p. 1176, pl. 53, figs. 17, 18), the main distinction is the number of terminal feet and their growing direction, the two latter species have 4 and 6

feet, respectively, and also a basal plate with a cross of 4 or 6 pores, but this similar structure does not appear in the new species.

Eucecryphalus penelopus sp. nov.

(Pl. 69, Figs. 1, 2)

Shell small, cephalis and thorax ratio of length and width as 1∶6 and 1∶2, with one apical spine of slender rod like, about as long as cephalis. Cephalis hemispherical, collar stricture unobvious, slight thick walled, surface slight rough with some small spines, a few pores long elliptical. Three robust wings arise from the upper thorax, three edged and distal sharp, curve arc downward, about 1.5 times length as the thorax. Thorax fat conical or waistdrum, middle slight swell, mouth contract, pores quasi-circular or long elliptical, with different sizes, irregular arrangement, pore diameter 1−4 times as bar width, surface smooth, no coronal on the peristoma, uneven and no terminal spines.

Measurements: Shell length 78 μm, shell width 62 μm, mouth breadth 30 μm, length of apical spine 18 μm, length of wings 74 μm.

Locality of holotype: BS-R19 deposited in the South China Sea Institute, CAS, from sample U1344A-5H-cc of IODP 323 in the Bering Sea, pictured in Plate 69, Figs. 1, 2.

This new species is similar to *Eucecryphalus corocalyptra* Haeckel (1887, p. 1221), but the latter has a larger shell, with long conical apical spine, hexagonal pores regularly arranged and coronal peristoma.

Lychnocanoma gracilenta sp. nov.

(Pl. 69, Figs. 5, 6)

Shell slender and small, thick walled; cephalis near spherical, surface smooth, with many small circular pores, apical spine very small; thorax hemispherical, very thick walled, a few and large pores, circular, similar sizes, with hexagonal framwork, sub-regular arranged, horizontal 2−3 rows and longitudinal 5−6 rows, some short conical spines arise from join points of bars, thorax rib solid, may extending as wings of long triangular; three basal feet grow nearly vertical downward, strong and straight, three edged pyramid, distal sharp; seemly a undeveloped abdomen, or incomplete, thin walled, irregular pores with great different sizes, the peristoma broken.

Measurements: Diameter of cephalis 30 μm, length of thorax 38 μm, width of thorax 63 μm, length of apical spine 5 μm, length of basal feet 112 μm.

Locality of holotype: BS-R20 deposited in the South China Sea Institute, CAS, from sample U1344A-5H-cc of IODP 323 in the Bering Sea, pictured in Plate 69, Figs. 5, 6.

This new species is similar to *Lychnocanoma nipponica sakaii* Morley et Nigrini, but the latter has wider thorax, more smaller pores, and three basal feet outward-dipping obviously.

***Pterocanium brachypodium* sp. nov.**

(Pl. 75, Figs. 5–8)

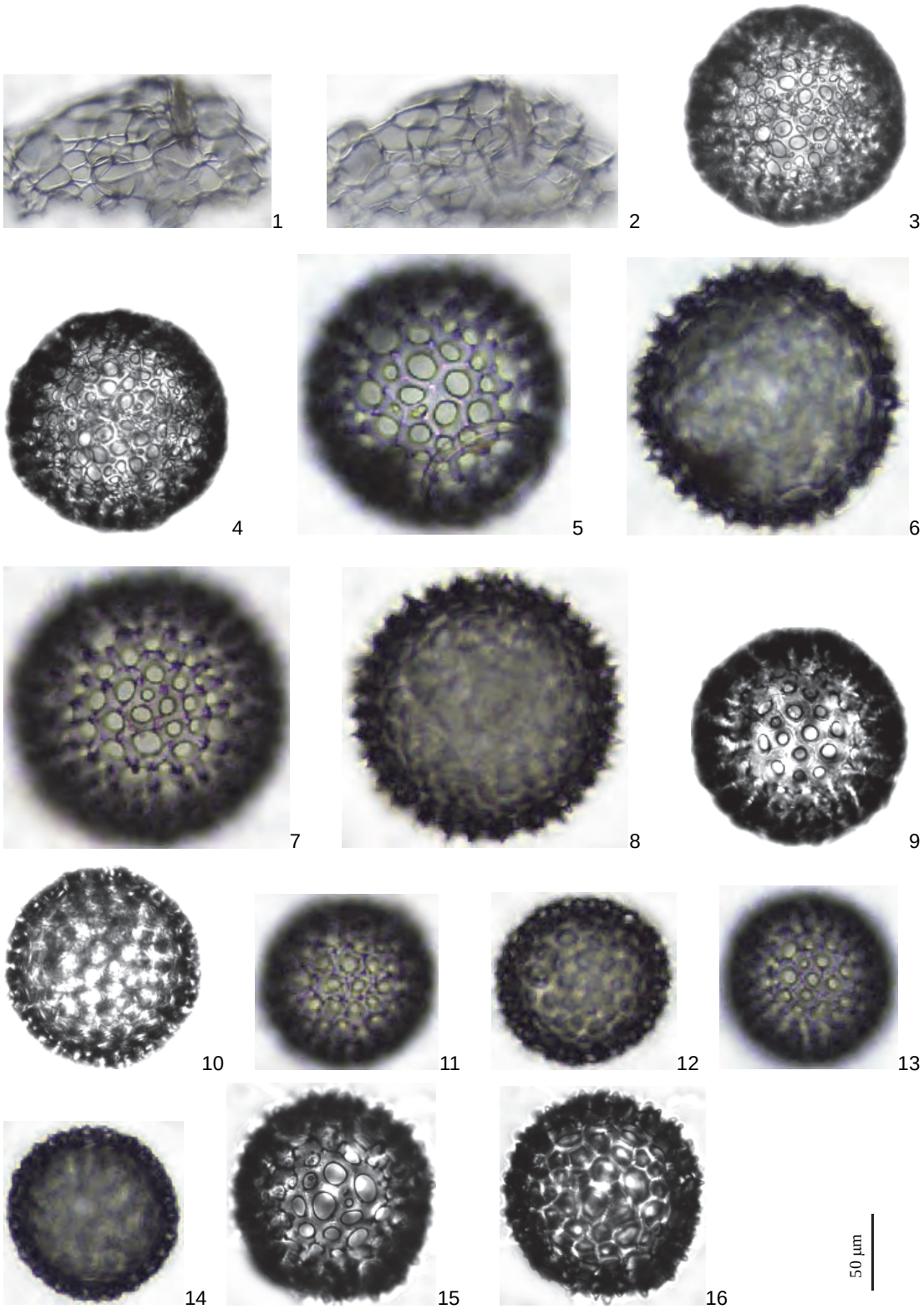
Shell small; cephalis hemispherical, transparency, with a few pores, different sizes, apical horn needle-rod like, slender, 1–2 times as length of cephalis; thorax conical or helmet, swelled walls between the ribs, thin walled, pores quasi-circular or hexagonal, similar or different sizes, sub-regular arrangement, diameter of pores 1–3 times as width of bars; peristoma slight contracted, truncated mouth; three ribs in thorax extend outward, form three short terminal feet, three edged pyramid, robust, only half length of thorax; the whole surface smooth, without any spine or thorn.

Measurements: Cephalis length 23–30 μm, width 35–40 μm, thorax length 58–73 μm, width 83–92 μm, length of apical horn 34–56 μm, length of basal feet 32–36 μm.

Locality of holotype: BS-R21 deposited in the South China Sea Institute, CAS, from sample U1340C-3H-cc of IODP 323 in the Bering Sea, pictured in Plate 75, Fig. 6.

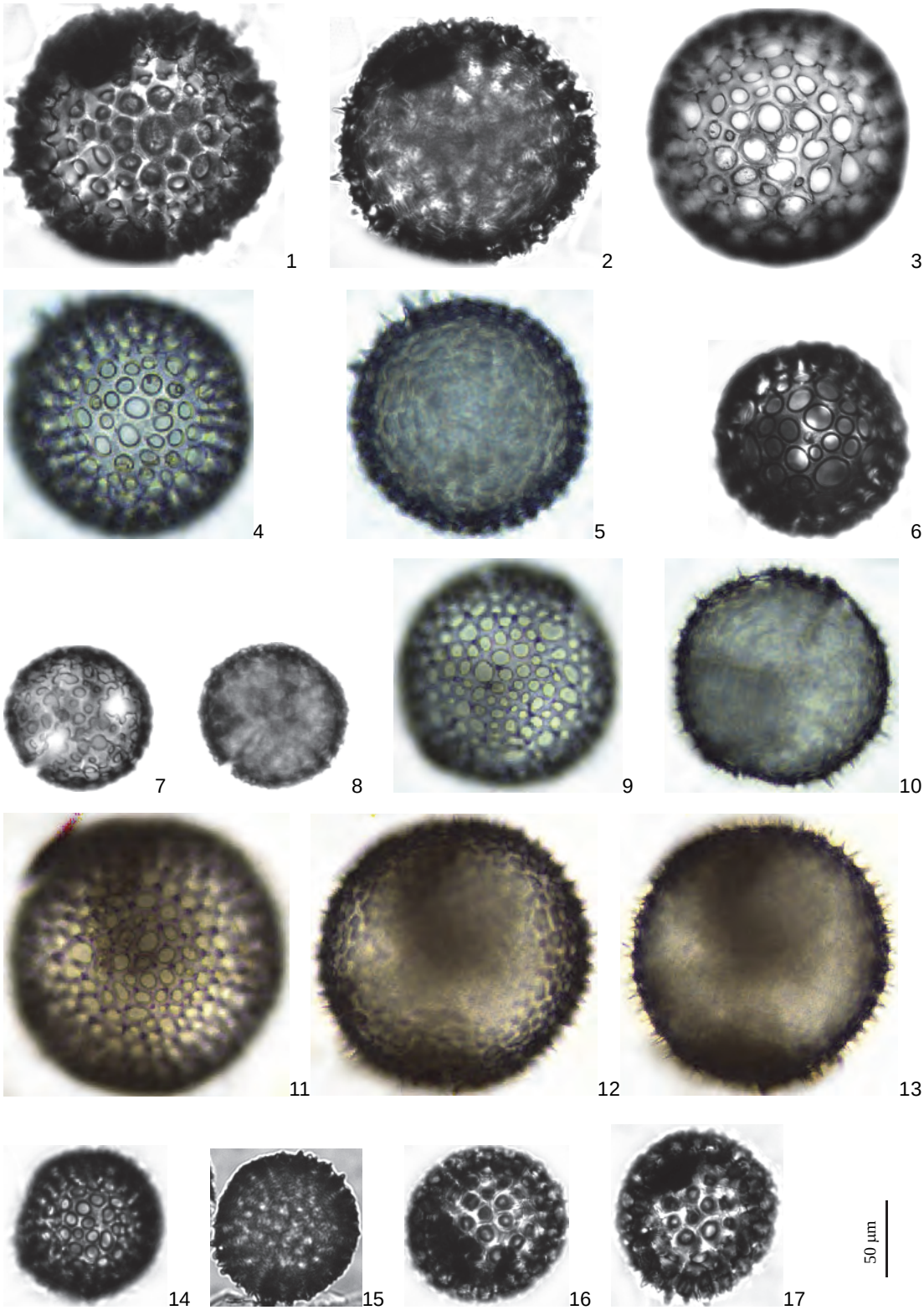
This new species is some similar to *Lychnocanium conicum* Clark et Campbell (1942, p. 71, pl. 9, fig. 38), but the latter has no ribs of thorax, the basal feet grow directly from the peristoma, thick walled and surface rough.

图版及说明

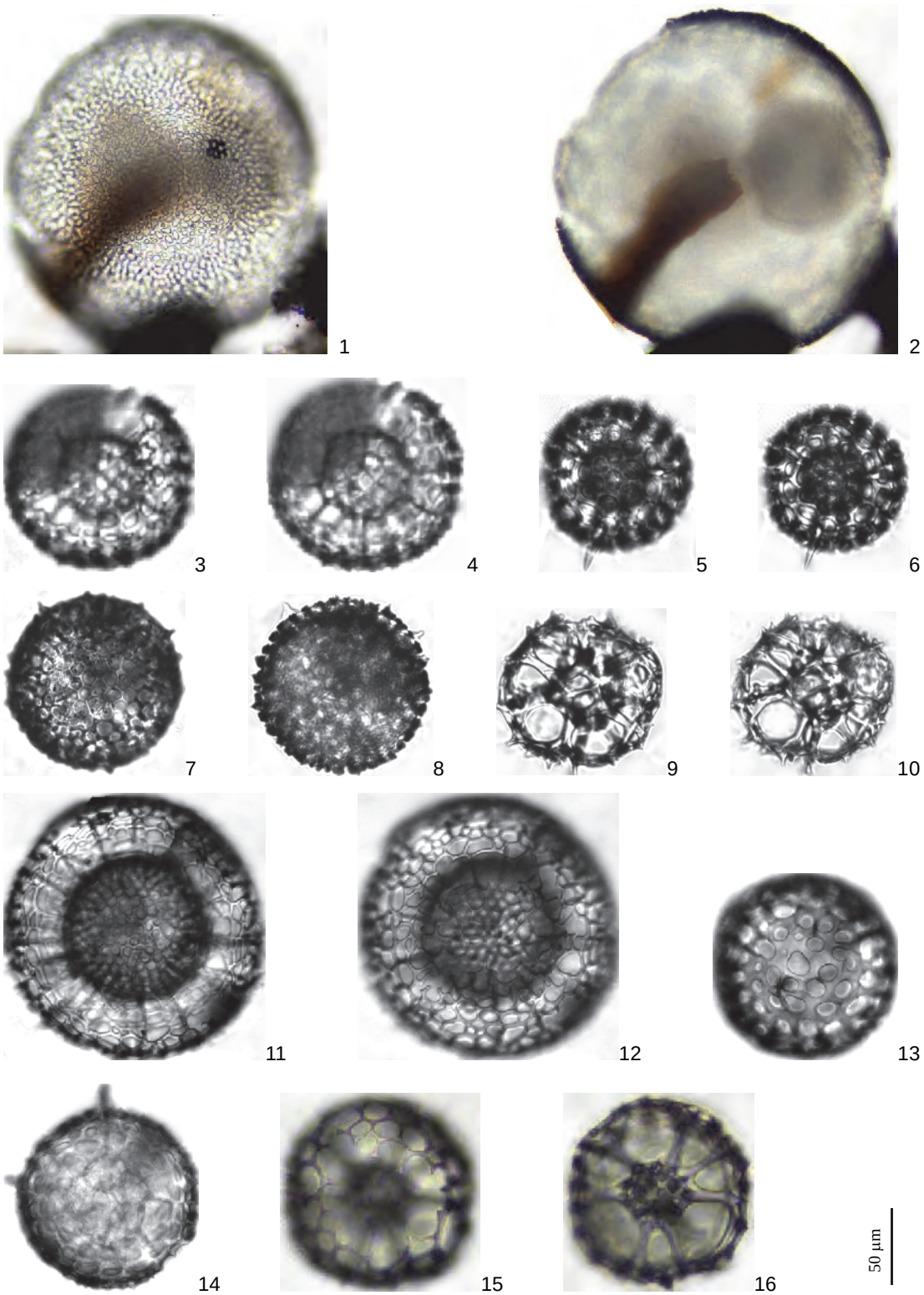


1, 2. 鹿角海黄虫 *Thalassoxanthium cervicorne* Haeckel；3, 4. 南极空球虫 *Cenosphaera* (*Cyrtidosphaera*) *antarctica* Nakaseko；5–8. 锥形针空球虫（新种） *Cenosphaera cornospinula* sp. nov.；9, 10. 花冠空球虫 *Cenosphaera coronata* Haeckel；11–14. 花冠状空球虫 *Cenosphaera coronataformis* Shilov；15, 16. 冠空球虫 *Cenosphaera cristata* Haeckel

图版 2

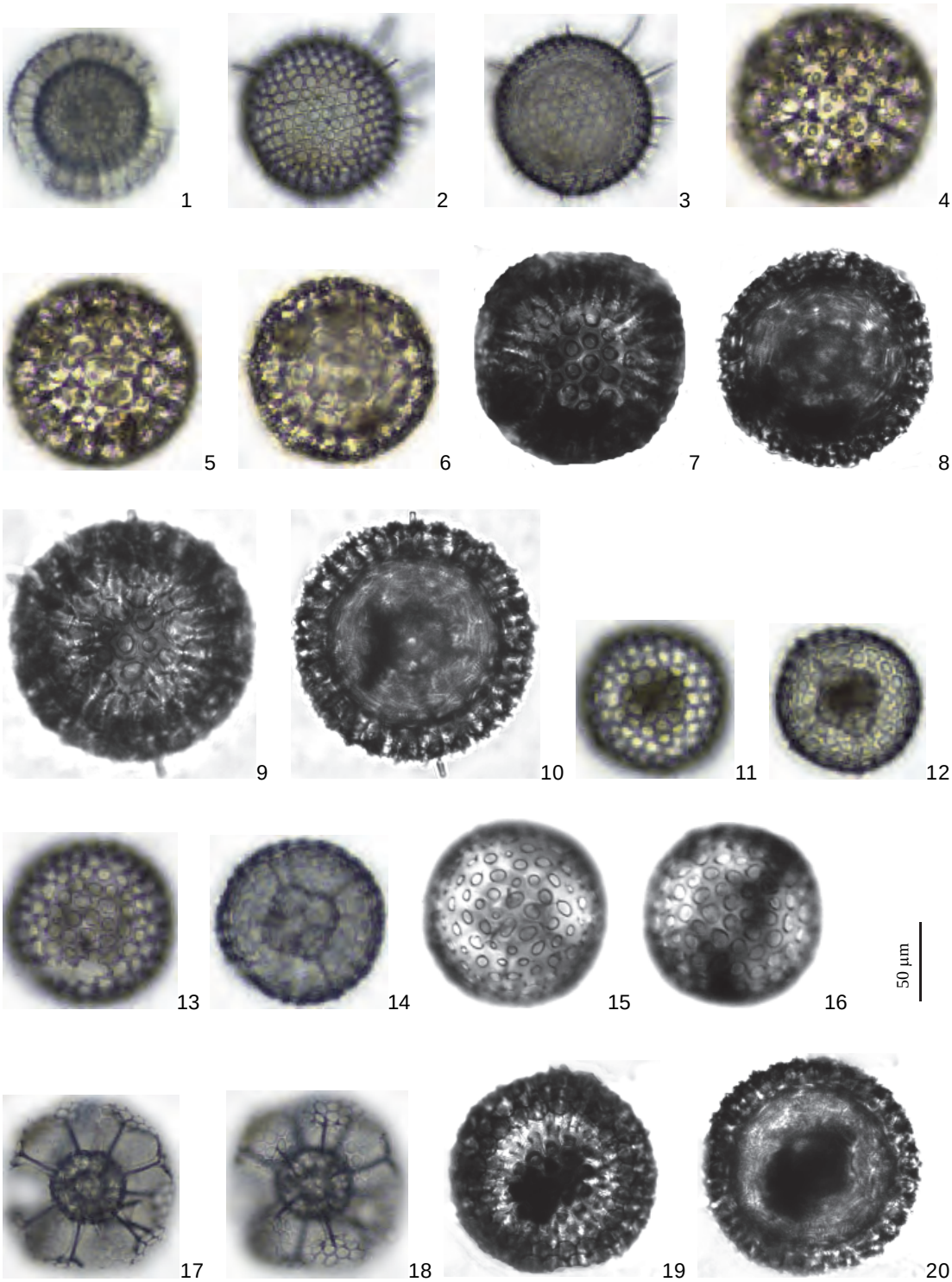


1–5. 冠空球虫 *Cenosphaera cristata* Haeckel；6–10. 表棘空球虫（新种）*Cenosphaera exspinosa* sp. nov.；11–13. 巢空球虫 *Cenosphaera favosa* Haeckel；14, 15. 狐空球虫 *Cenosphaera huzitai* Nakaseko；16, 17. 魔边空球虫 *Cenosphaera megachile* Clark et Campbell

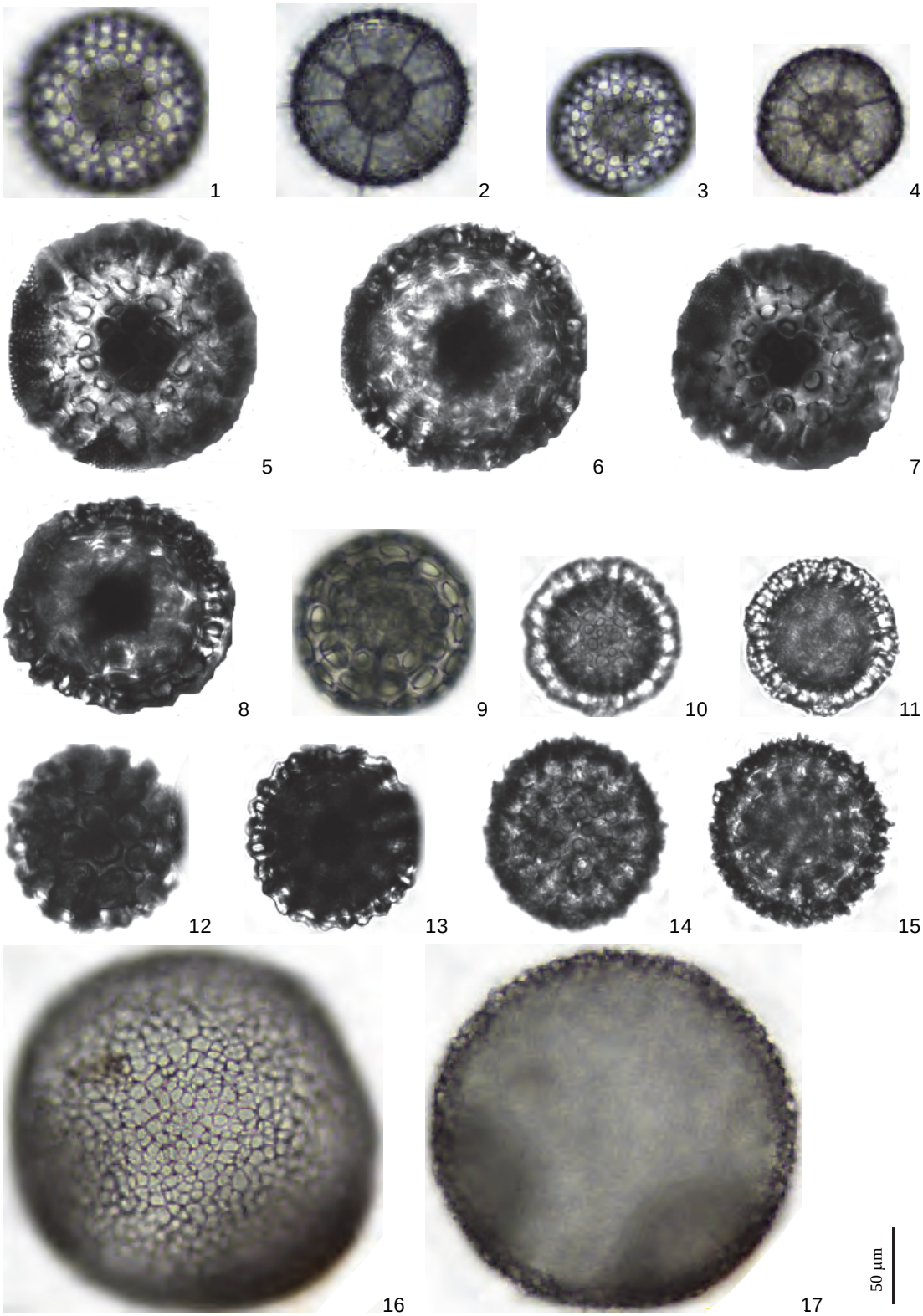


1, 2. 大洋空球虫 *Cenosphaera oceanica* Clark et Campbell；3, 4. 圆果球虫 *Carposphaera globosa* Clark et Campbell；5, 6. 大孔果球虫 *Carposphaera* (*Melittosphaera*) *magnaporulosa* Clark et Campbell；7, 8. 稀果球虫 *Carposphaera rara* Carnevale；9, 10. 果球虫（未定种 1） *Carposphaera* sp. 1；11, 12. 亚薄果球虫 *Carposphaera subbotinae* Borisenko；13, 14. 果球虫（未定种 2） *Carposphaera* sp. 2；15, 16. 果球虫（未定种 3）*Carposphaera* sp. 3

图版 4

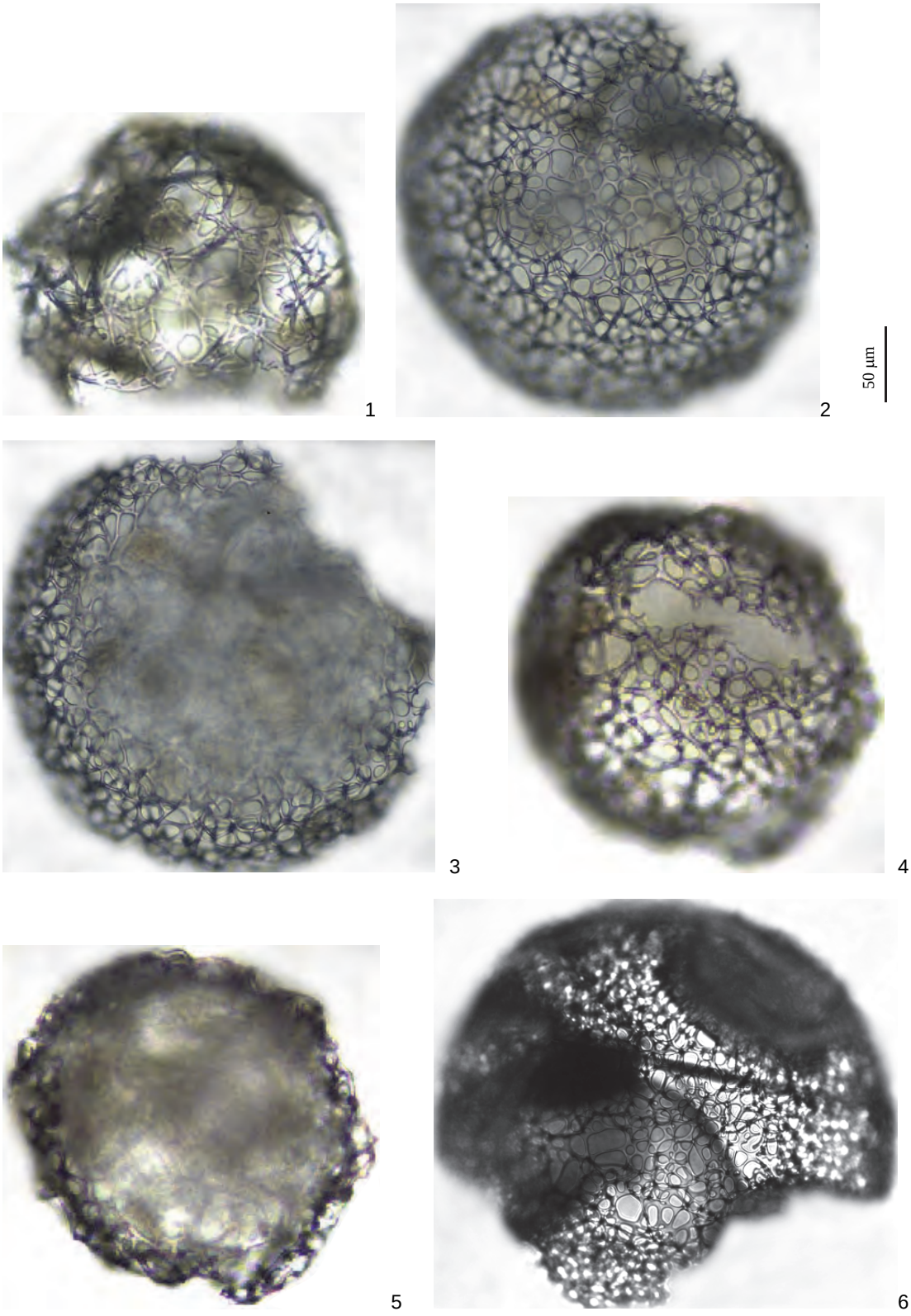


1–3. 六角光滑球虫 *Liosphaera hexagonia* Haeckel；4–6. 光滑球虫（未定种） *Liosphaera* sp.；7–10. 尖纹荚球虫 *Thecosphaera akitaensis* Nakaseko；11–14. 内方荚球虫（新种）*Thecosphaera entocuba* sp. nov.；15–18. 格里可荚球虫 *Thecosphaera grecoi* Vinassa de Regny；19, 20. 日本荚球虫 *Thecosphaera japonica* Nakaseko

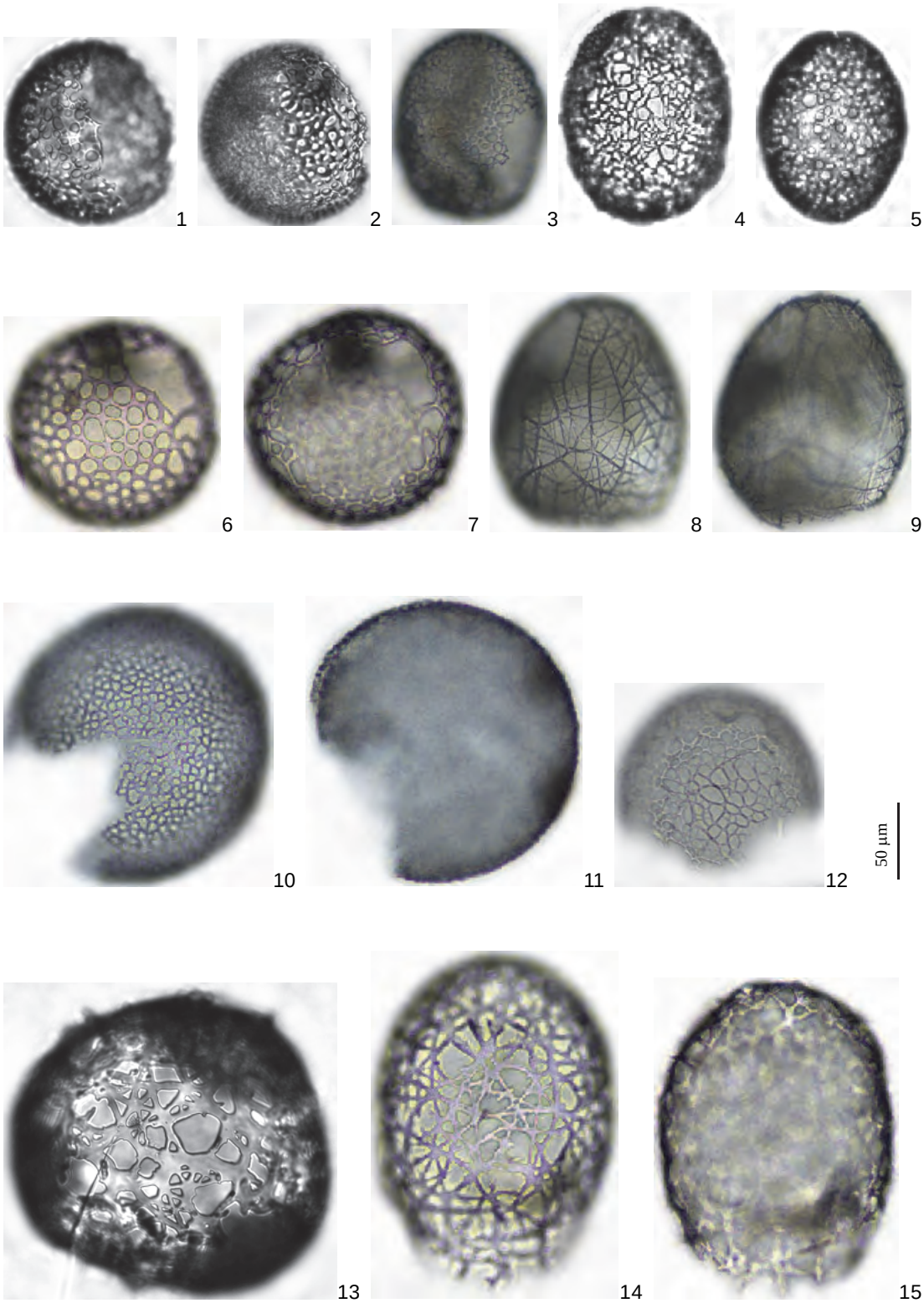


1–4. 桑氏荚球虫 *Thecosphaera sanfilippoae* Blueford；5–8. 兹特荚球虫 *Thecosphaera zittelii* Dreyer；9. 荚球虫（未定种）*Thecosphaera* sp.；10, 11. 适玫瑰球虫 *Rhodosphaera idonea* Ruest；12, 13. 玫瑰球虫（未定种 1）*Rhodosphaera* sp. 1；14, 15. 玫瑰球虫（未定种 2）*Rhodosphaera* sp. 2；16, 17. 空球编枝球虫 *Plegmosphaera coelopila* Haeckel

图版 6

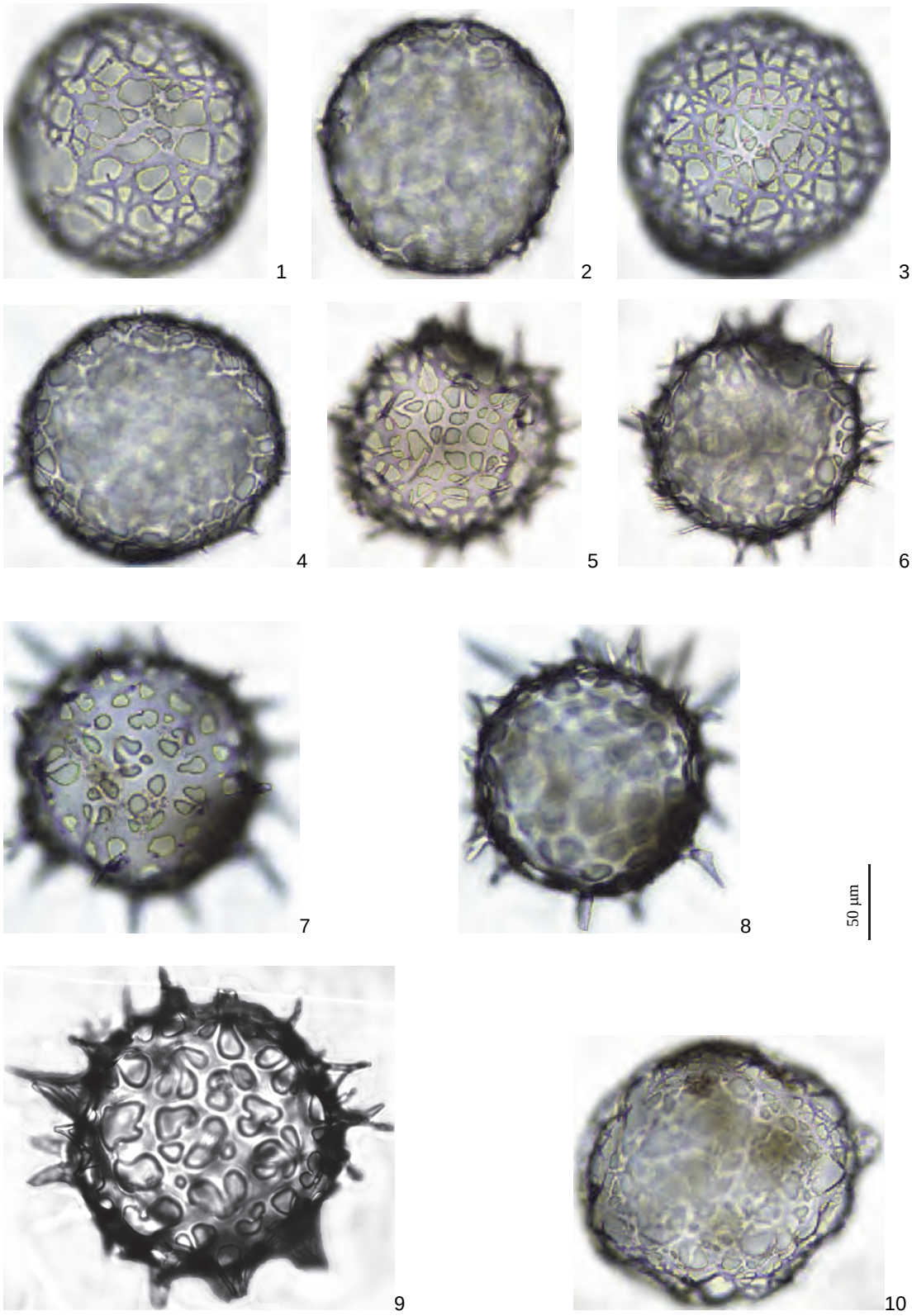


1. 内网编枝球虫 *Plegmosphaera entodictyon* Haeckel；2, 3. 细编枝球虫 *Plegmosphaera leptoplegma* Haeckel；4–6. 编枝球虫（未定种）*Plegmosphaera* sp.

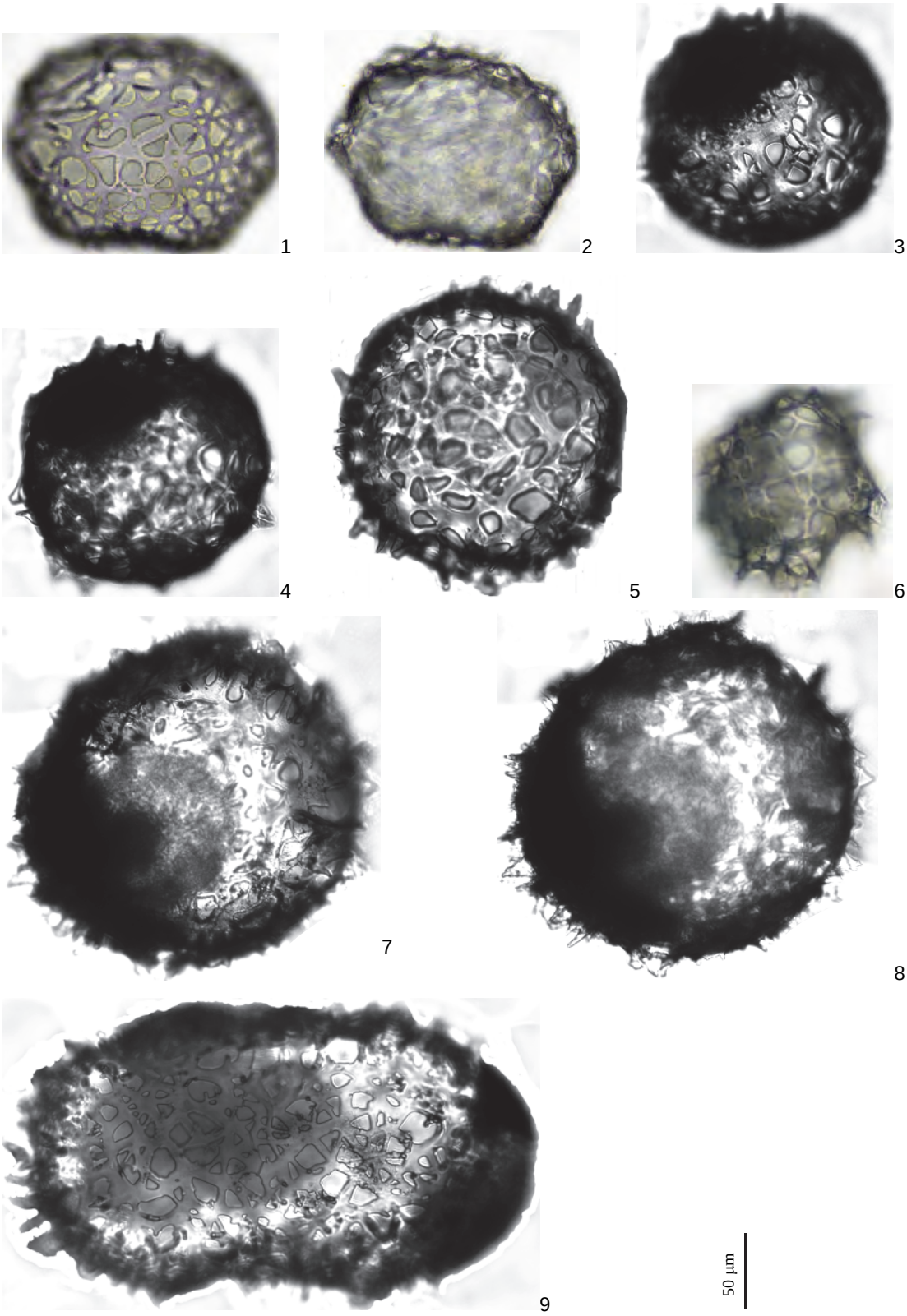


1, 2. 百孔胶球虫 *Collosphaera confossa* Takahashi；3–5. 卵胶球虫 *Collosphaera elliptica* Chen et Tan；6, 7. 胶球虫 *Collosphaera huxleyi* Müller；8, 9. 复卵胶球虫 *Collosphaera ovaiireialis* (Takahashi)；10, 11. 胶球虫（未定种 1）*Collosphaera* sp. 1；12. 胶球虫（未定种 2）*Collosphaera* sp. 2；13–15. 蛛网尖球虫（新种）*Acrosphaera arachnodictyna* sp. nov.

图版 8

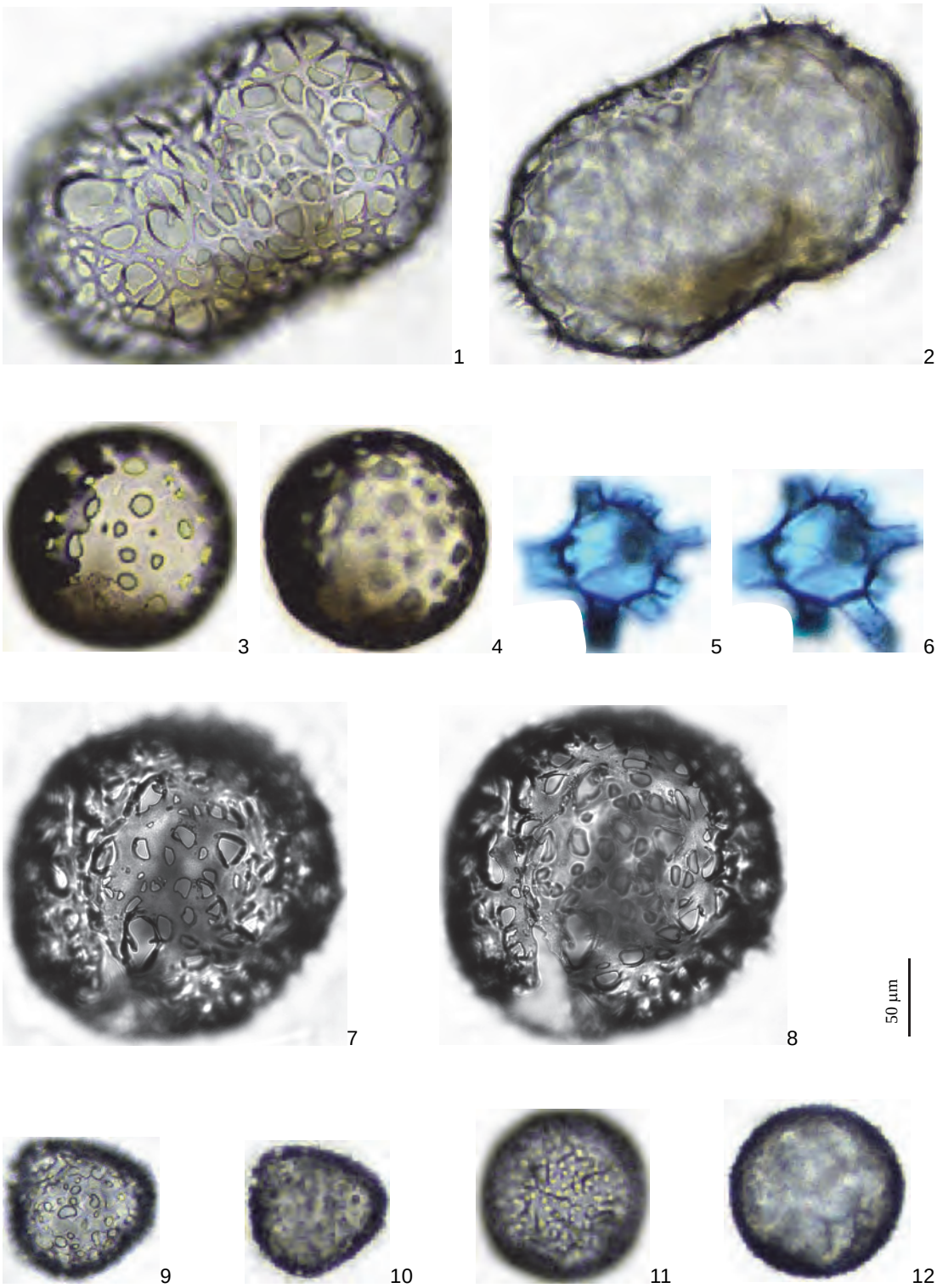


1–4. 蛛网尖球虫（新种）*Acrosphaera arachnodictyna* sp. nov.；5–9. 阿克尖球虫 *Acrosphaera arktios* (Nigrini)；10. 丘尖球虫 *Acrosphaera collina* Haeckel

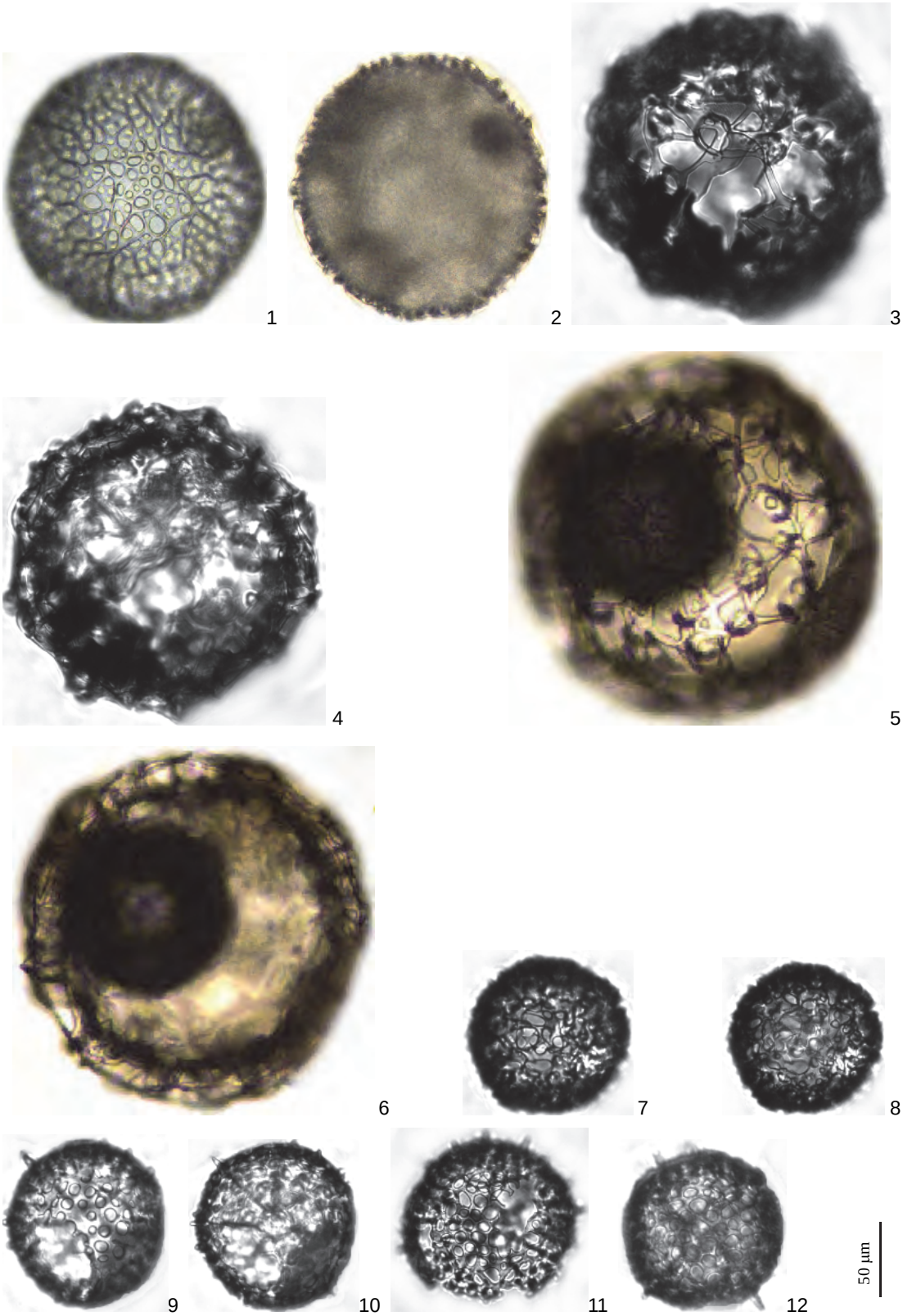


1, 2. 丘尖球虫 *Acrosphaera collina* Haeckel；3–5. 松尖球虫 *Acrosphaera hirsuta* Perner；6. 胀尖球虫 *Acrosphaera inflata* Haeckel；7, 8. 刺尖球虫 *Acrosphaera spinosa* (Haeckel)；9. 尖球虫（未定种）*Acrosphaera* sp.

图版 10

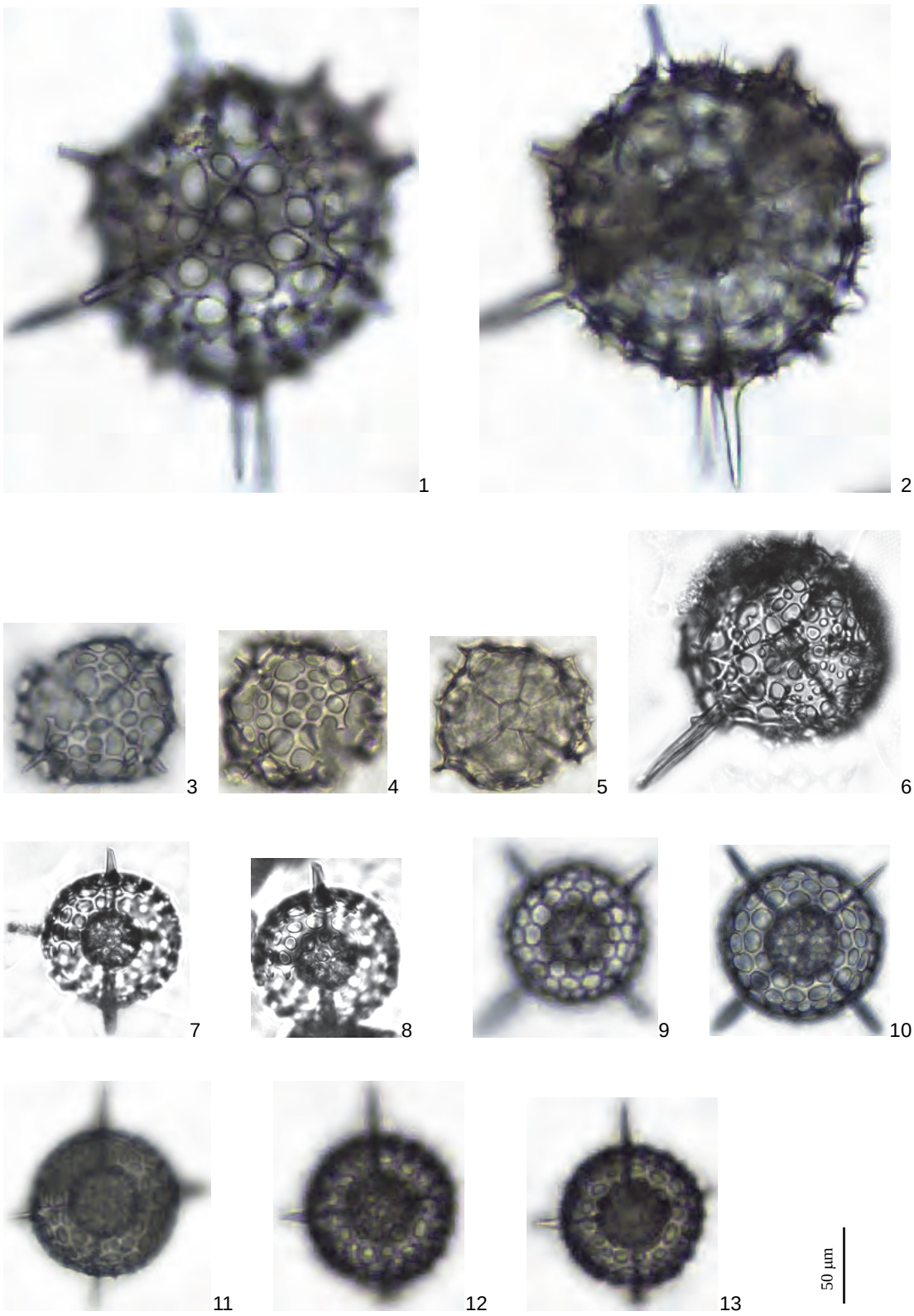


1, 2. 尖球虫（未定种）*Acrosphaera* sp.；3, 4. 貂管球虫 *Siphonosphaera martensi* Brandt；5, 6. 筒管球虫 *Siphonosphaera tubulosa* Müller；7, 8. 管球虫（未定种 1）*Siphonosphaera* sp. 1；9, 10. 管球虫（未定种 2） *Siphonosphaera* sp. 2；11, 12. 管球虫（未定种 3）*Siphonosphaera* sp. 3；

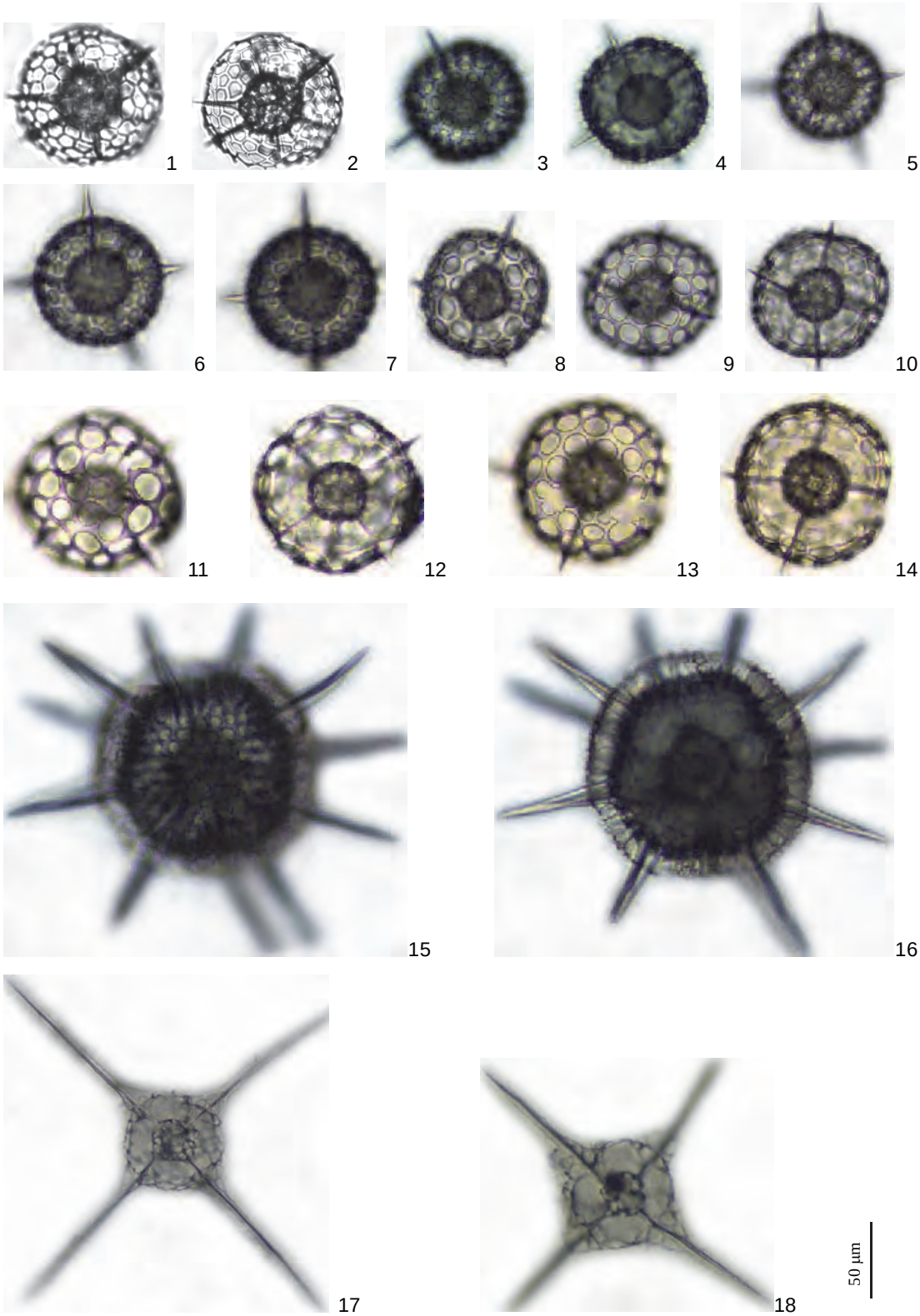


1, 2. 管球虫（未定种 4）*Siphonosphaera* sp. 4；3–6. 表织格球虫 *Clathrosphaera circumtexta* Haeckel；7, 8. 格球虫（未定种）*Clathrosphaera* sp.；9–12. 考勒矛球虫 *Lonchosphaera cauleti* Dumitrica

图版 12

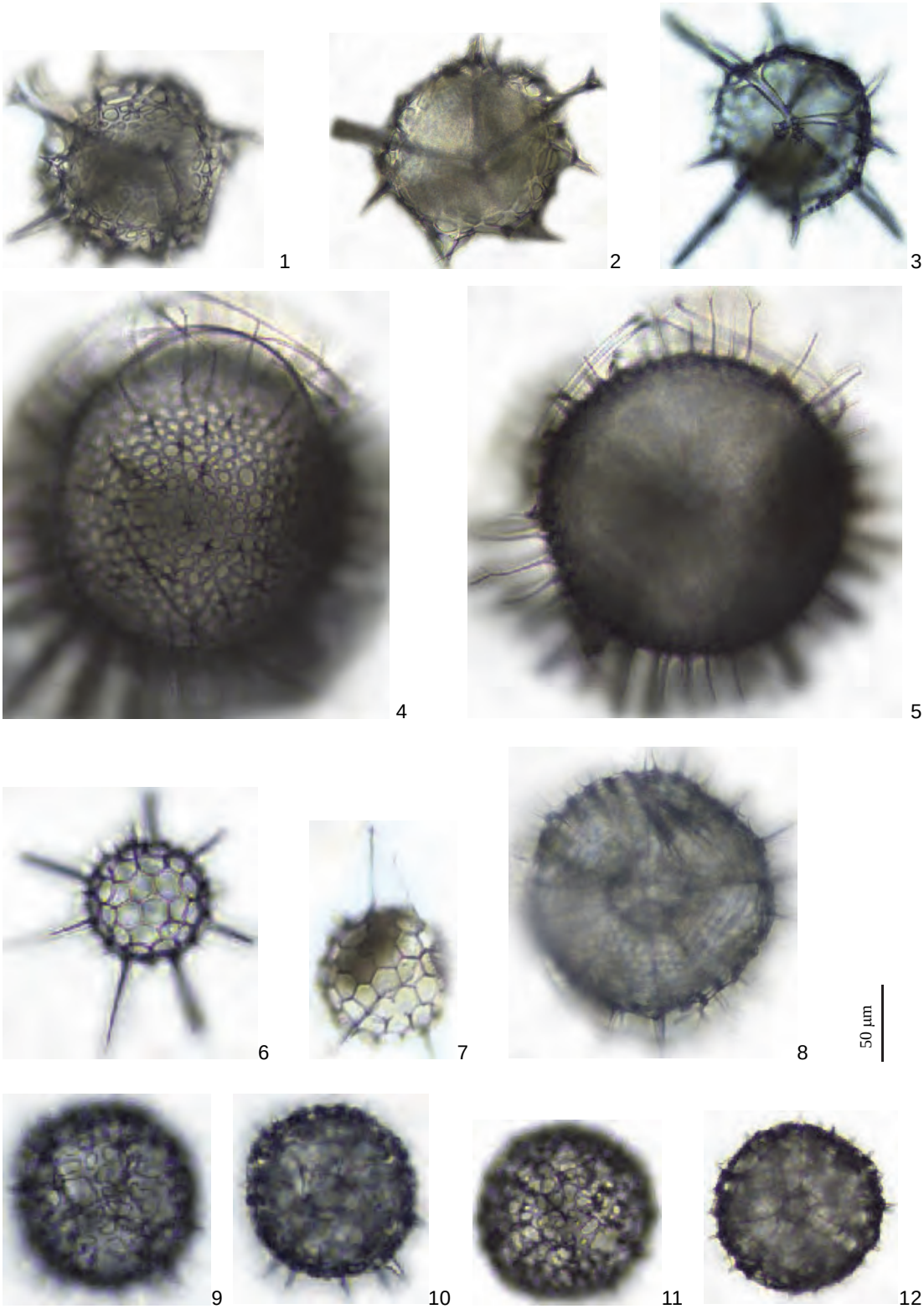


1, 2. 多棘矛球虫（新种）*Lonchosphaera multispinota* sp. nov.；3–5. 矛球虫（未定种 1）*Lonchosphaera* sp. 1；6. 矛球虫（未定种 2）*Lonchosphaera* sp. 2；7, 8. 芒六矛虫 *Hexalonche aristarchi* Haeckel； 9, 10. 秀丽六矛虫（新种）*Hexalonche calliona* sp. nov.；11–13. 小针六矛虫 *Hexalonche parvispina* Vinassa

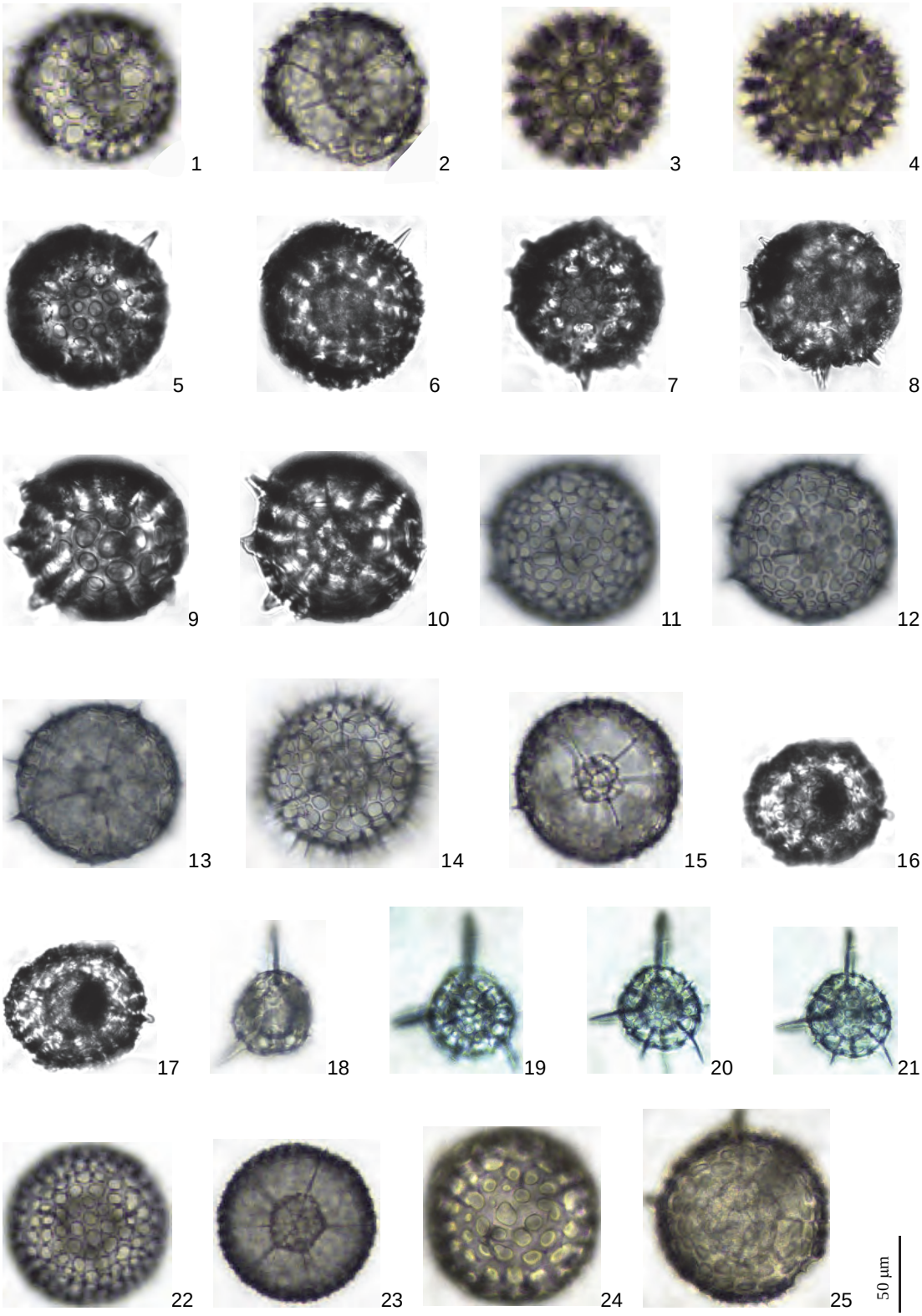


1, 2. 内棘六枪虫 *Hexacontium enthacanthum* Jørgensen；3–7. 厚棘六枪虫 *Hexacontium pachydermum* Jørgensen；8–14. 方六枪虫 *Hexacontium quadratum* Tan；15, 16. 美六葱虫 *Hexacromyum elegans* Haeckel；17, 18. 双羽六树虫 *Hexadendron bipinnatum* Haeckel

图版 14

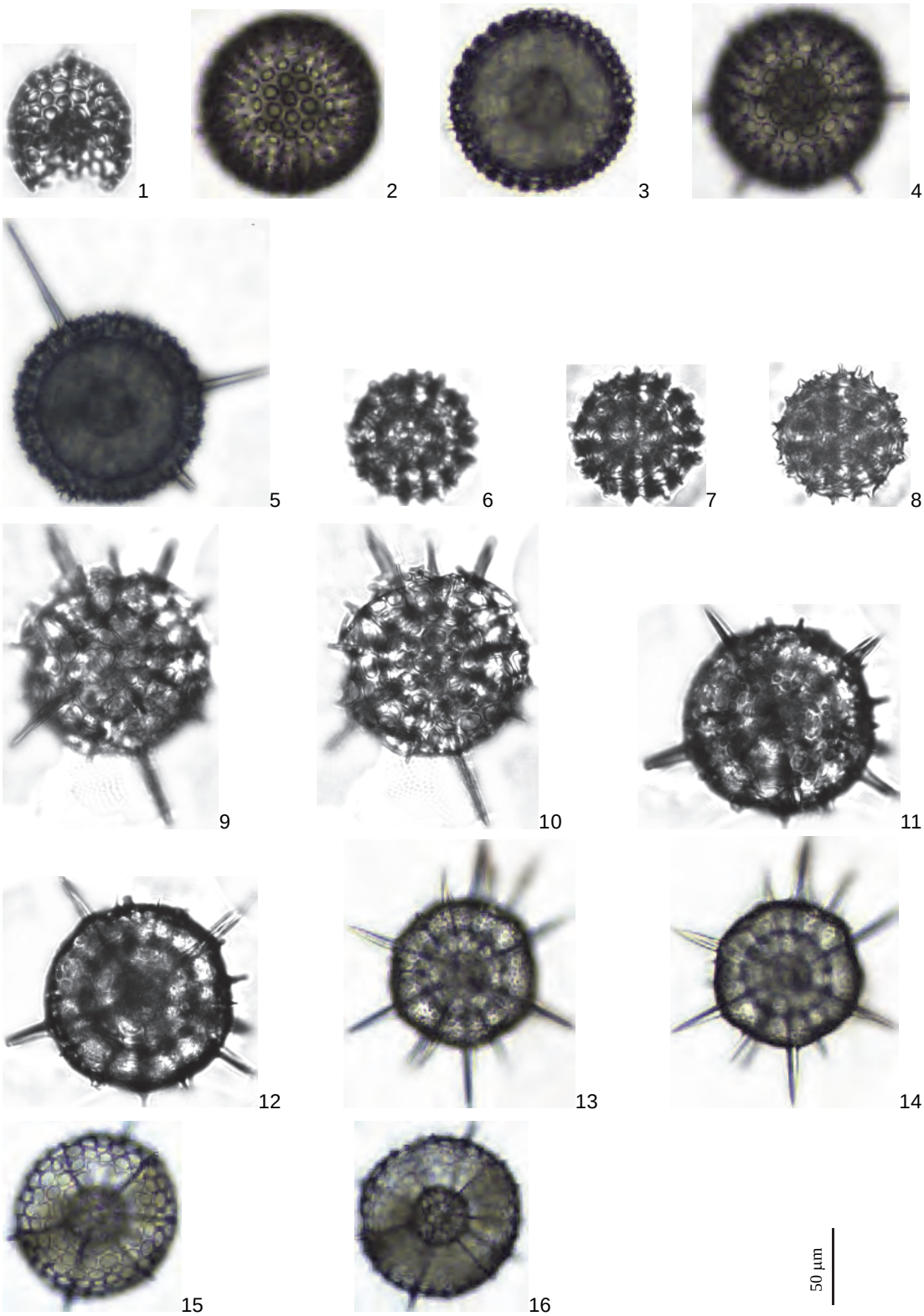


1–3. 叉中矛虫（新种）*Centrolonche furcata* sp. nov.；4, 5. 棘球虫（未定种）*Acanthosphaera* sp.；6, 7. 大六角日球虫 *Heliosphaera macrohexagonaria* Tan；8. 太阳星虫 *Heliaster hexagonium* Hollande et Enjumet；9–12. 棘动海眼虫 *Haliomma acanthophora* Popofsky

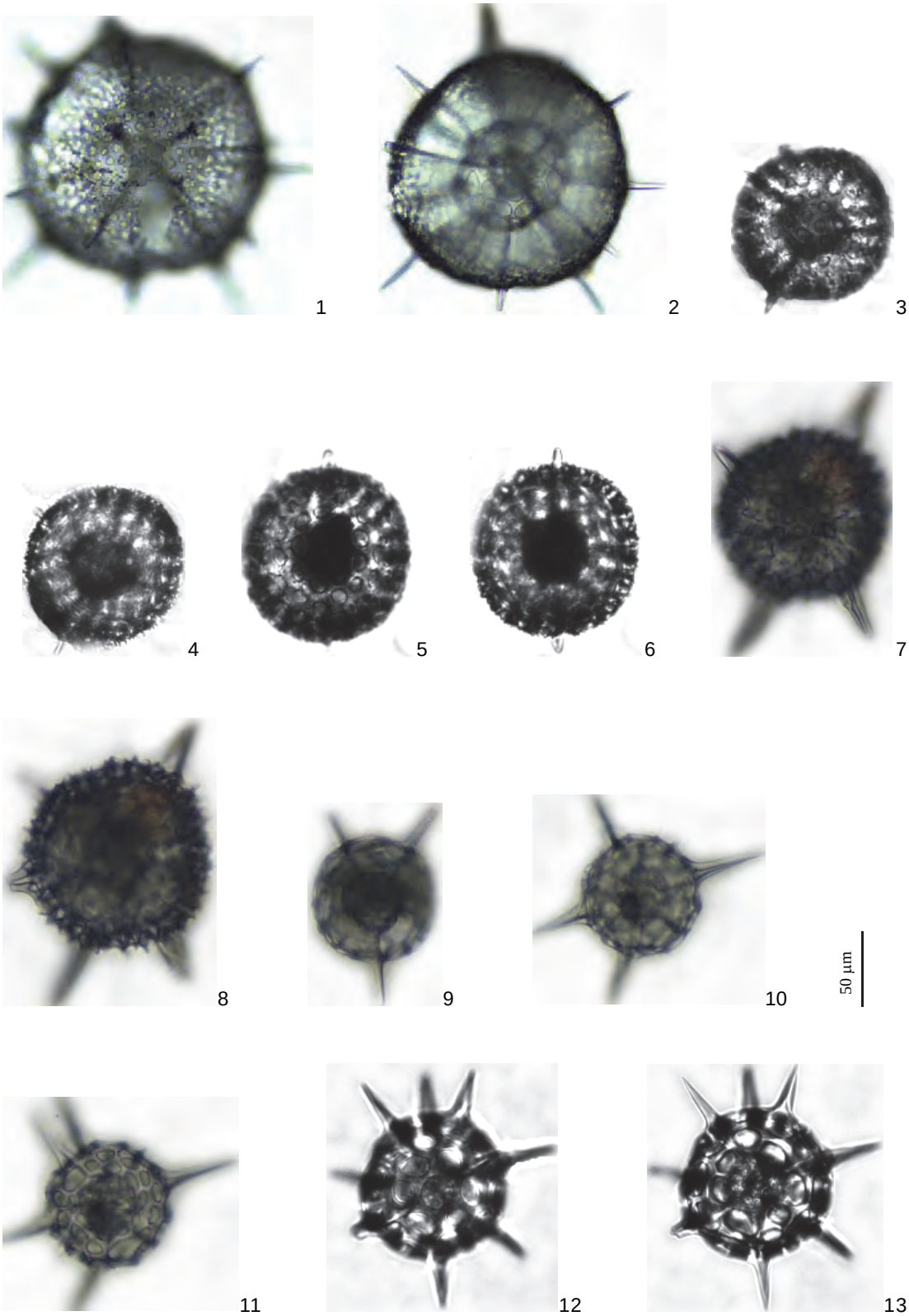


1, 2. 棘动海眼虫 *Haliomma acanthophora* Popofsky；3, 4. 星海眼虫（新种）*Haliomma asteroeides* sp. nov.；5–10. 内光海眼虫 *Haliomma entactinia* Ehrenberg；11–15. 猬海眼虫 *Haliomma erinaceus* Haeckel；16, 17. 卵海虫眼 *Haliomma ovatum* Ehrenberg；18–21. 梨形海眼虫 *Haliomma pyriformis* Bailey；22–25. 海眼虫（未定种）*Haliomma* sp.

图版 16

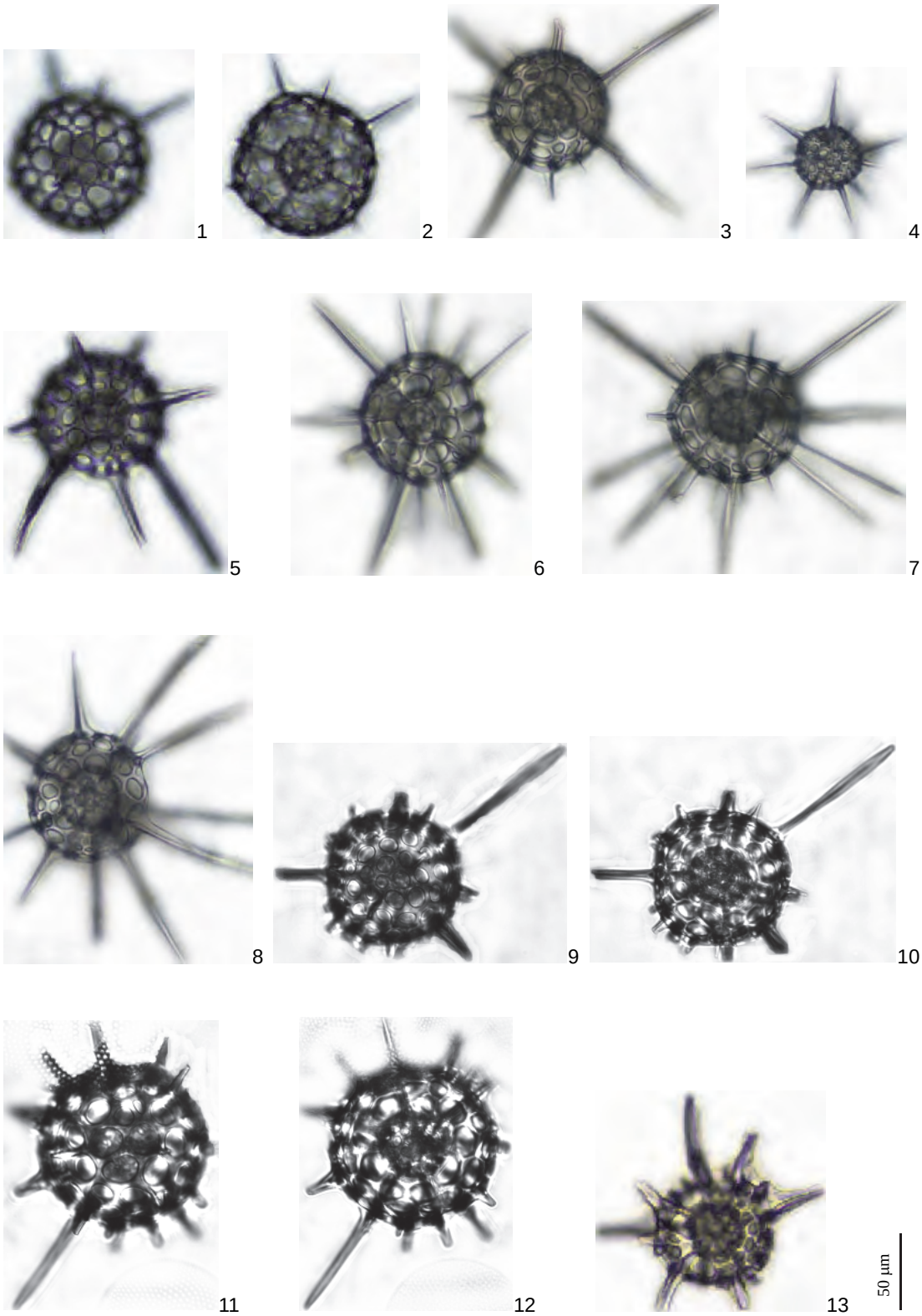


1. 水母小海眼虫 *Haliommetta medusa* (Ehrenberg)；2–5. 中新世小海眼虫 *Haliommetta miocenica* (Campbell et Clark) group；6–8. 异太阳虫 *Heliosoma dispar* Blueford；9–14. 北方光眼虫 *Actinomma boreale* Cleve；15, 16. 短刺光眼虫 *Actinomma brevispiculum* Popofsky

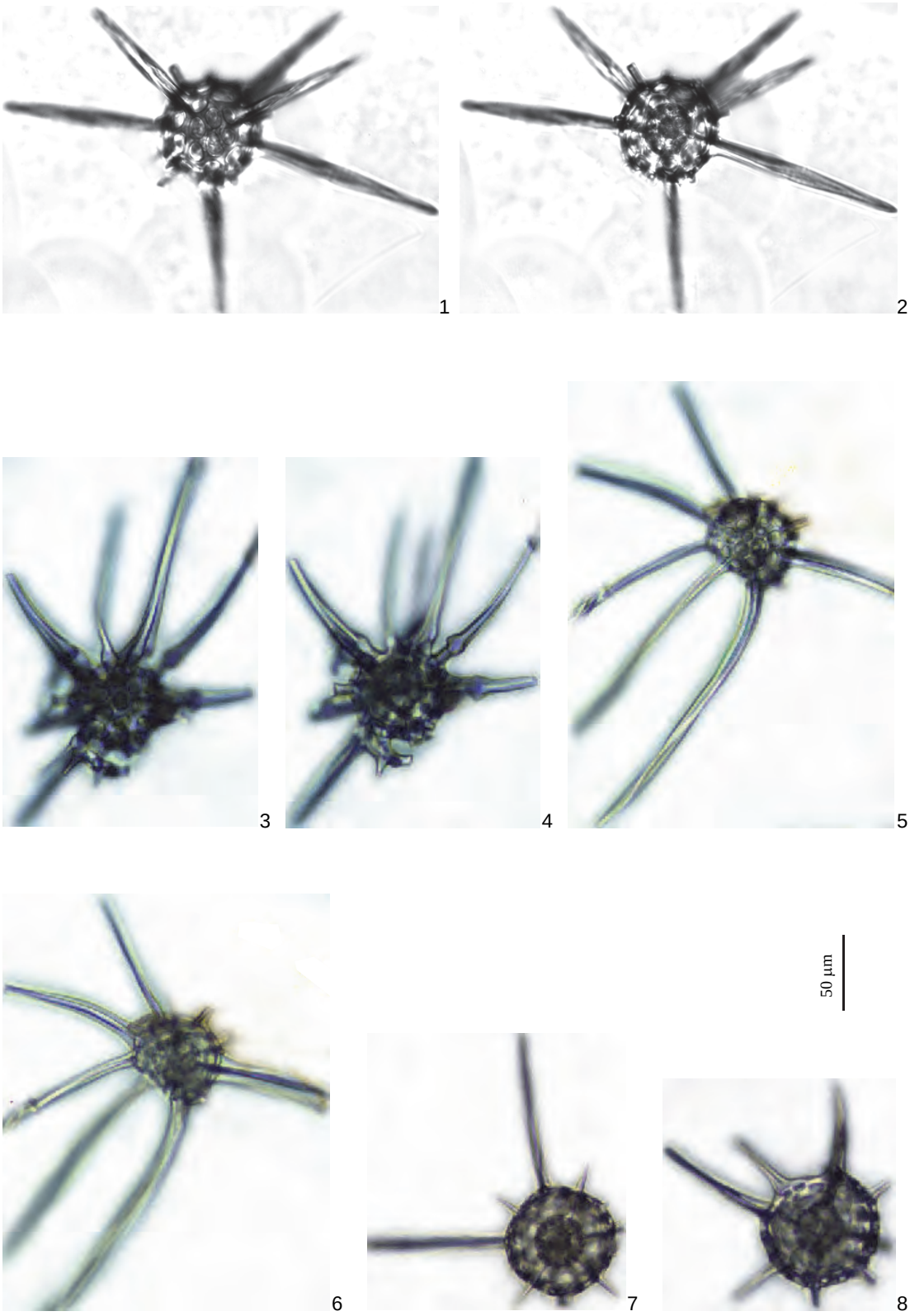


1, 2. 北方光眼虫 *Actinomma boreale* Cleve；3–6. 亨宁光眼虫 *Actinomma henningsmoeni* Goll et Bjørklund；7, 8. 六针光眼虫 *Actinomma hexactis* Stohr；9–13. 瘦光眼虫 *Actinomma leptodermum* (Jørgensen)

图版 18

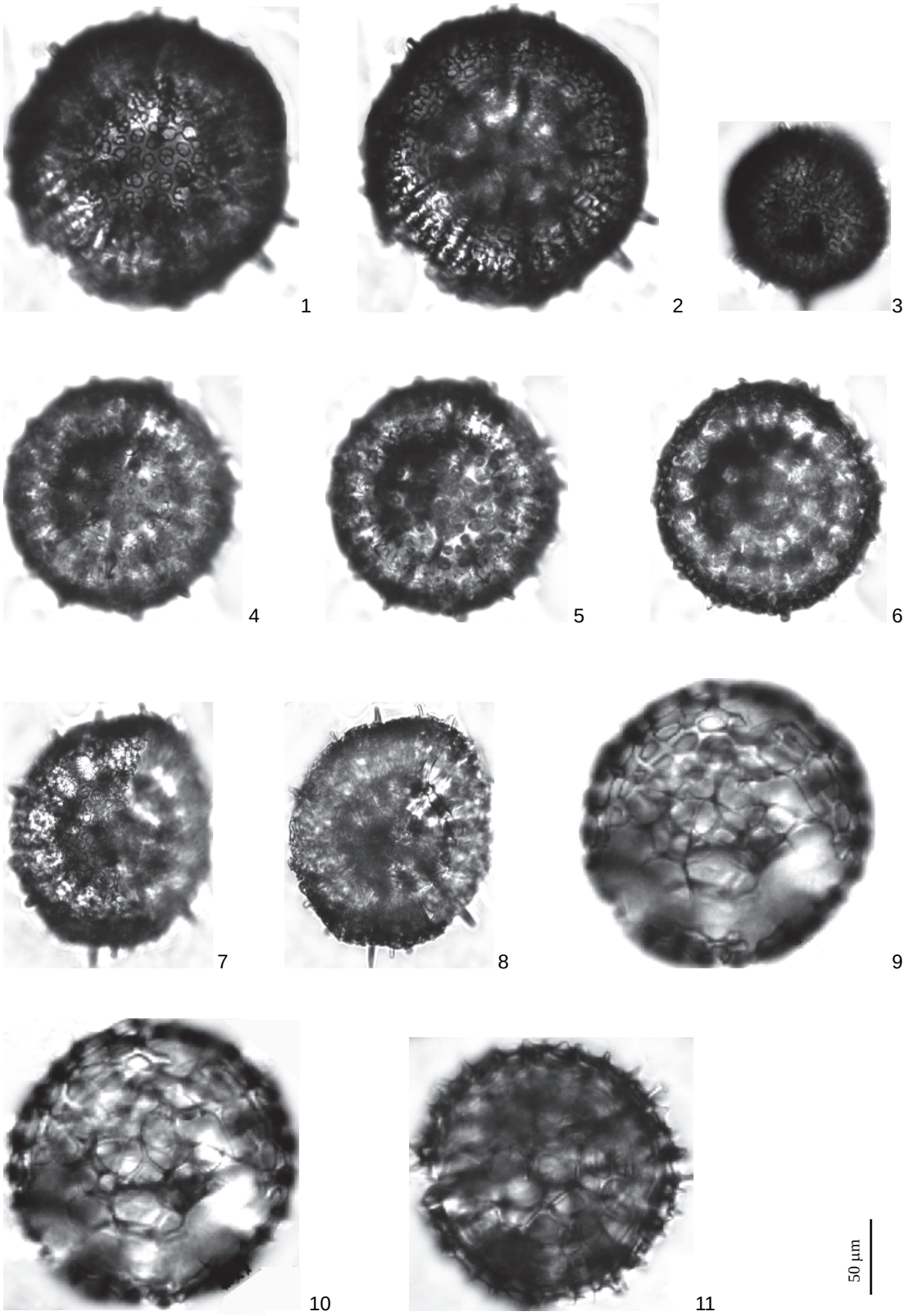


1, 2. 瘦光眼虫 *Actinomma leptodermum* (Jørgensen)；3–13. 瘦光眼虫长针亚种 *Actinomma leptoderma longispina* Cortese et Bjørklund group

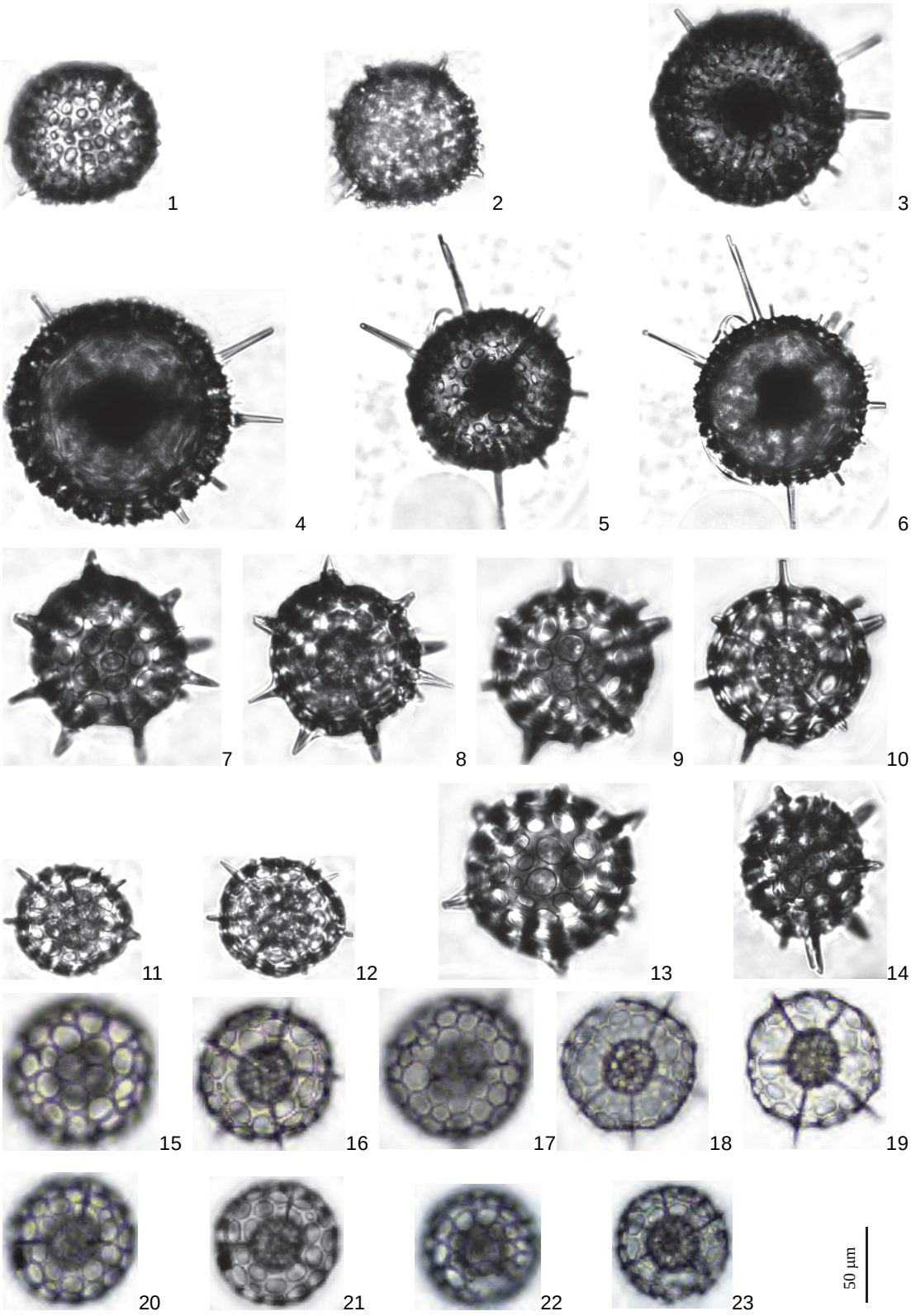


1–8. 瘦光眼虫长针亚种 *Actinomma leptoderma longispina* Cortese et Bjørklund group

图版 20

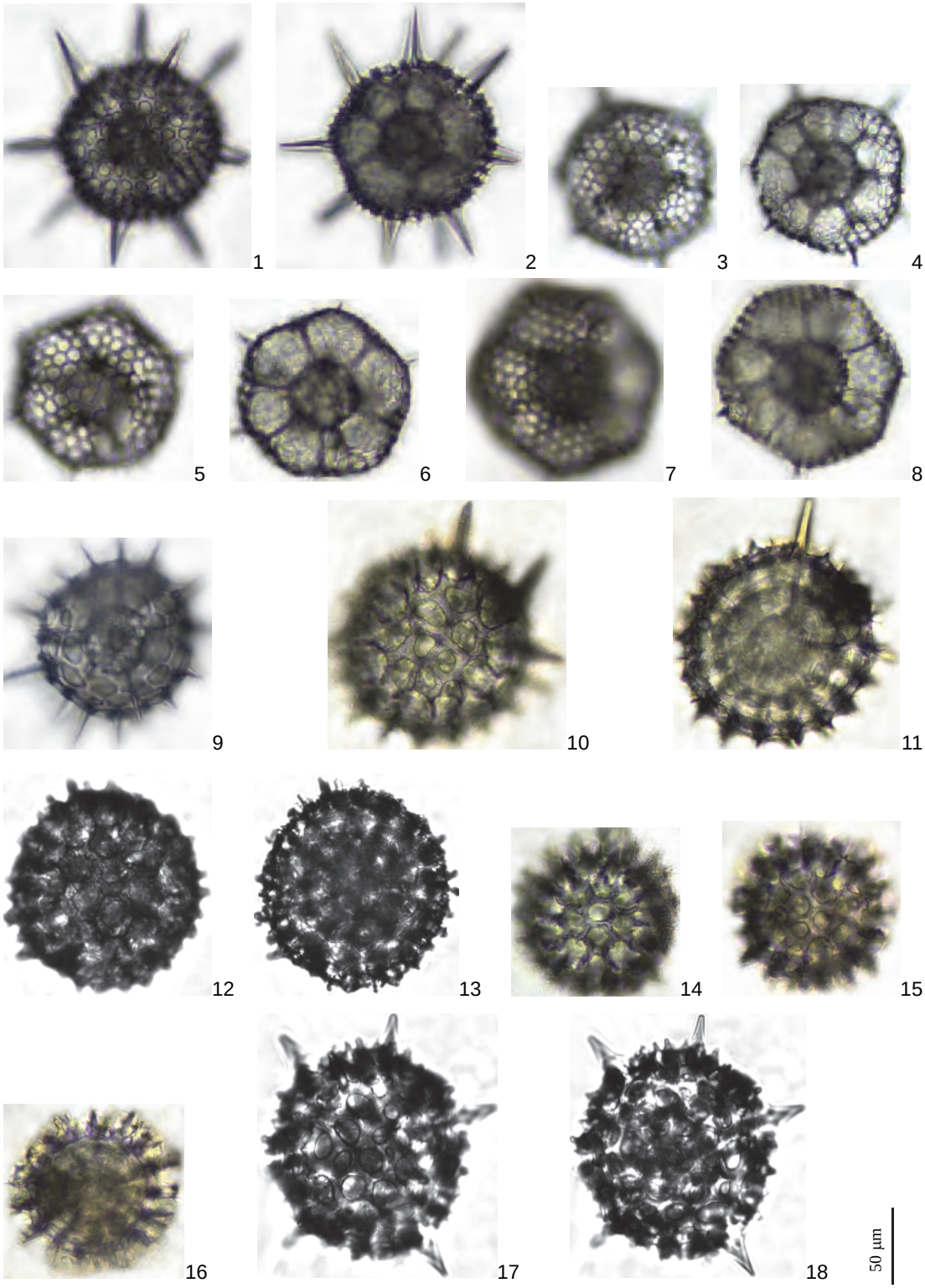


1–8. 灰光眼虫 *Actinomma livae* Goll et Bjørklund；9–11. 中央光眼虫 *Actinomma medianum* Nigrini

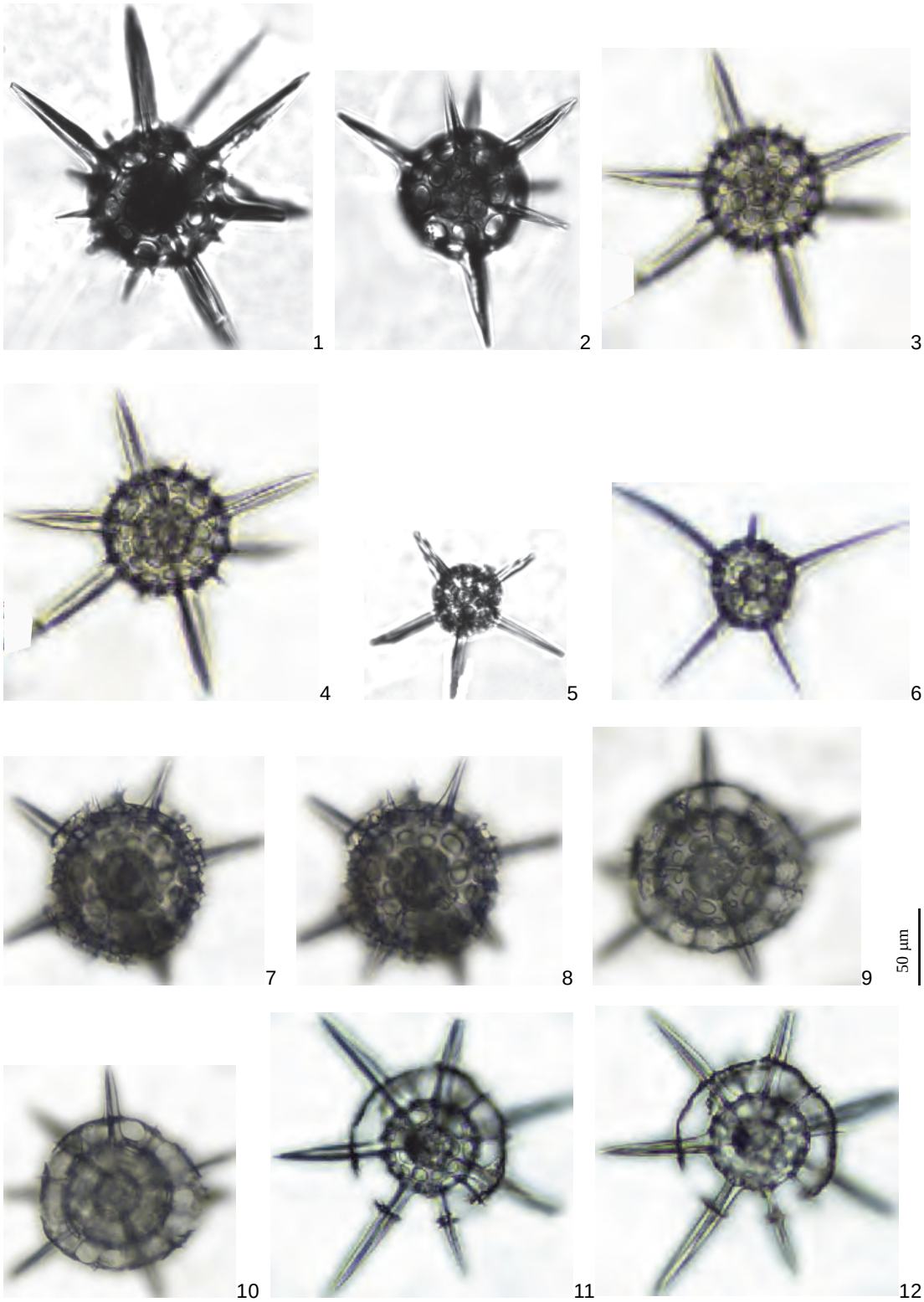


1, 2. 海女光眼虫 *Actinomma medusa* (Ehrenberg) group；3–6. 奇异光眼虫 *Actinomma mirabile* Goll et Bjørklund；7–14. 厚皮光眼虫 *Actinomma pachyderma* Haeckel；15–23. 透明光眼虫（新种）*Actinomma pellucidata* sp. nov.

图版 22

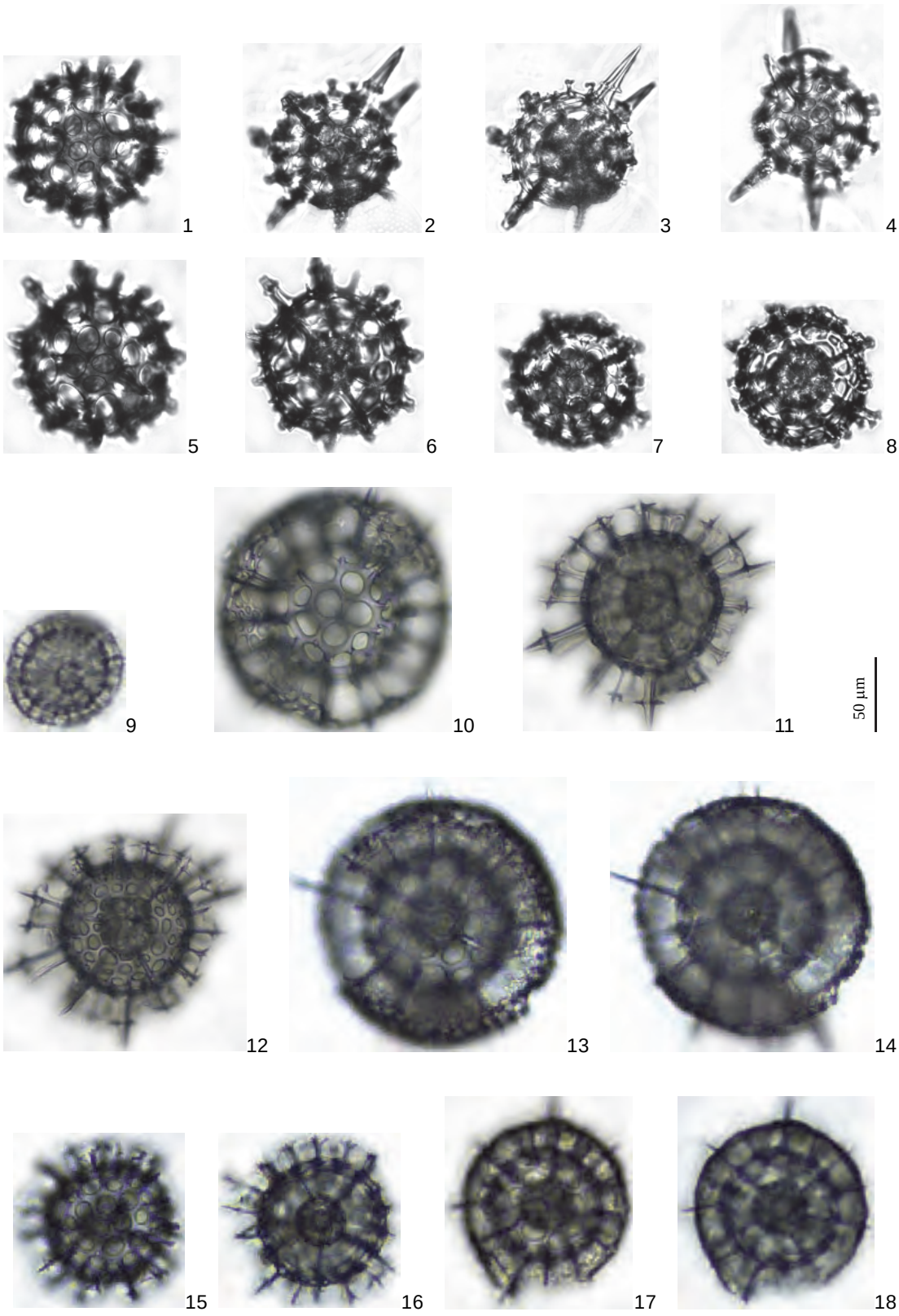


1, 2. 宽光眼虫 *Actinomma plasticum* Goll et Bjørklund；3–8. 多角光眼虫（新种）*Actinomma polyceris* sp. nov.；9. 球蝐光眼虫 *Actinomma sphaerechinus* Haeckel；10, 11. 光眼虫（未定种 1）*Actinomma* sp. 1；12, 13. 光眼虫（未定种 2）*Actinomma* sp. 2；14–16. 光眼虫（未定种 3）*Actinomma* sp. 3；17, 18. 光眼虫（未定种 4）*Actinomma* sp. 4

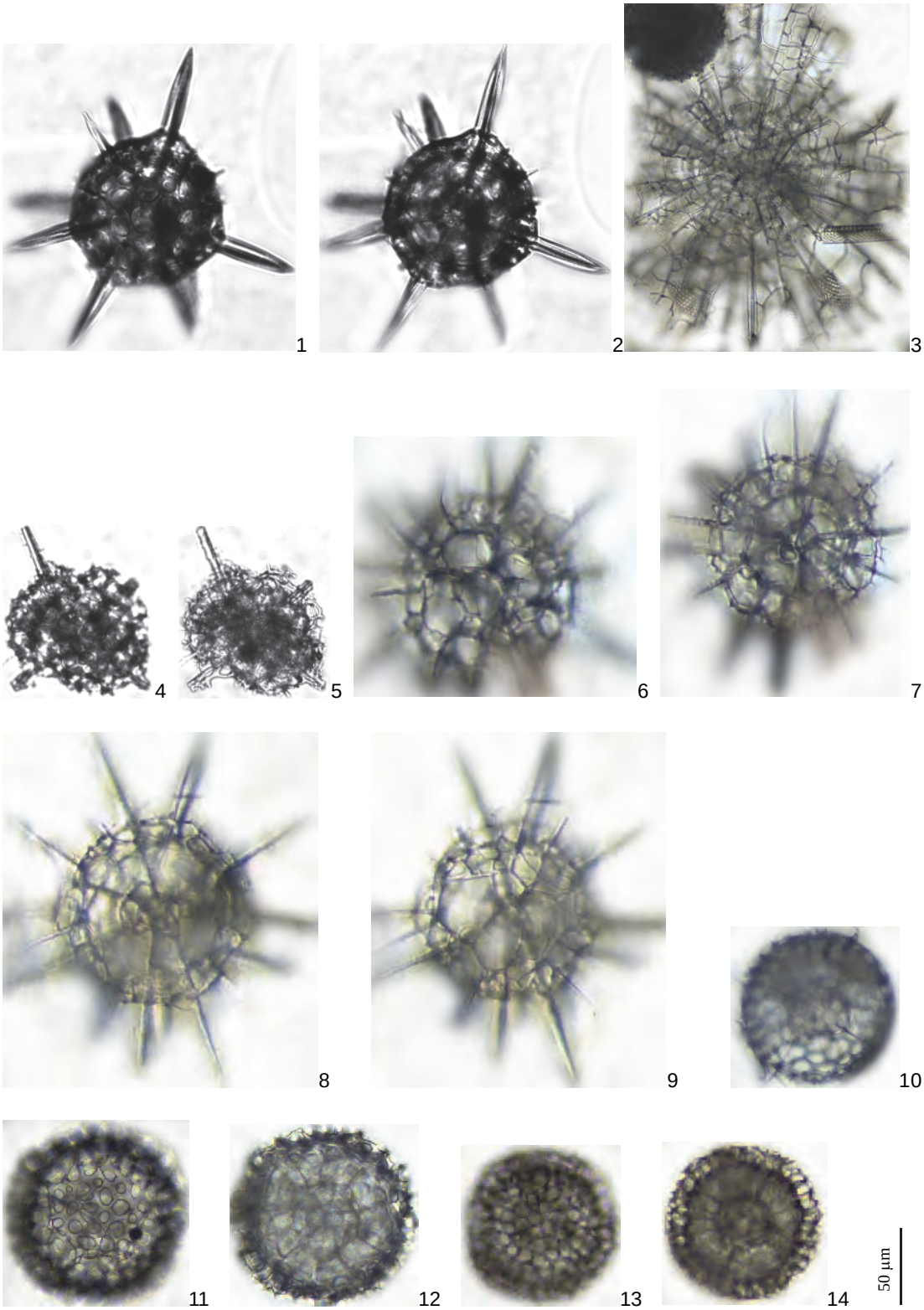


1–6. 光眼虫（未定种 5）*Actinomma* sp. 5；7–12. 围织葱眼虫 *Cromyomma circumtextum* Haeckel

图版 24

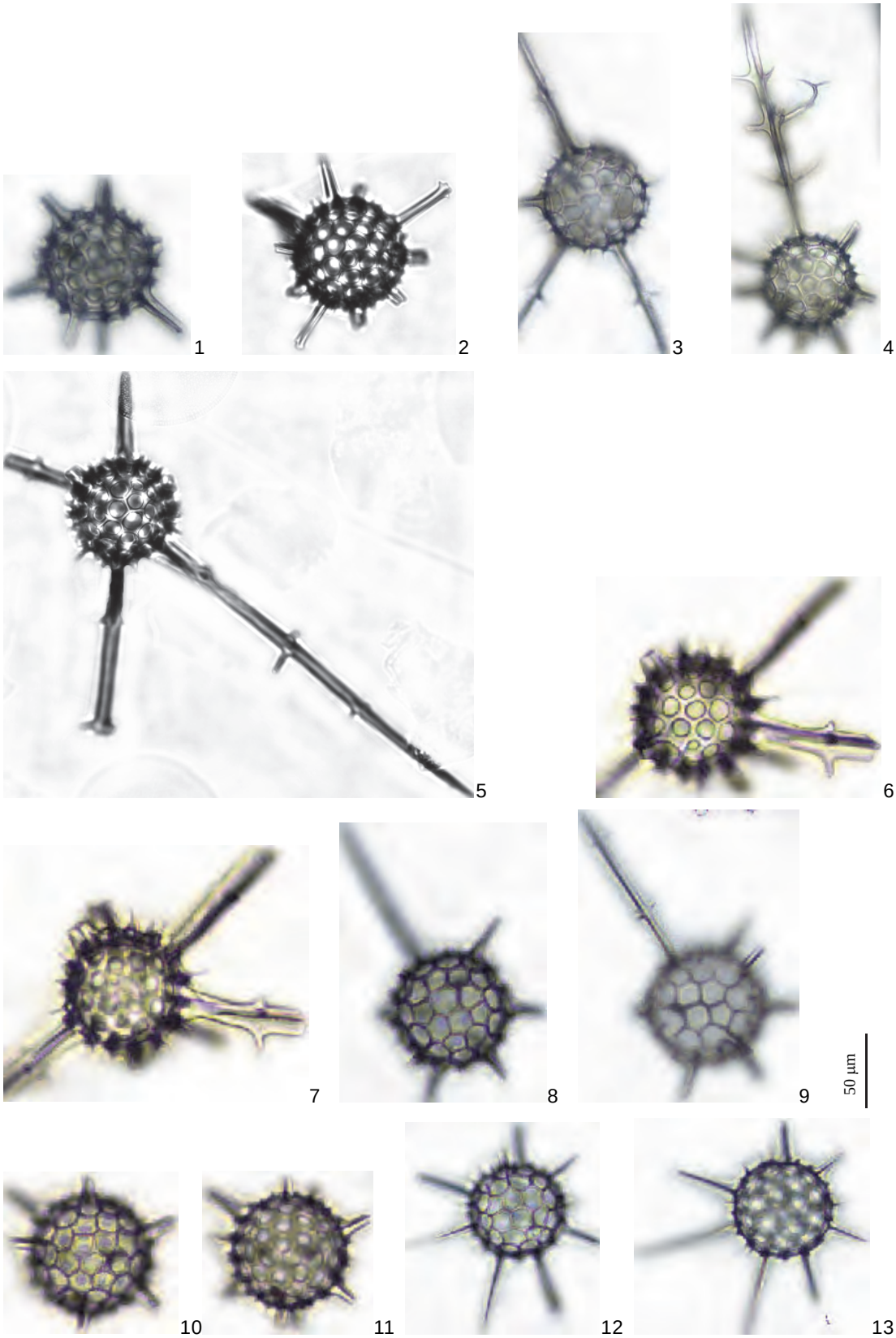


1–8. 围织葱眼虫 *Cromyomma circumtextum* Haeckel；9. 穿刺葱眼虫 *Cromyomma perspicuum* Haeckel；10–18. 南极葱海胆虫 *Cromyechinus antarctica* (Dreyer)

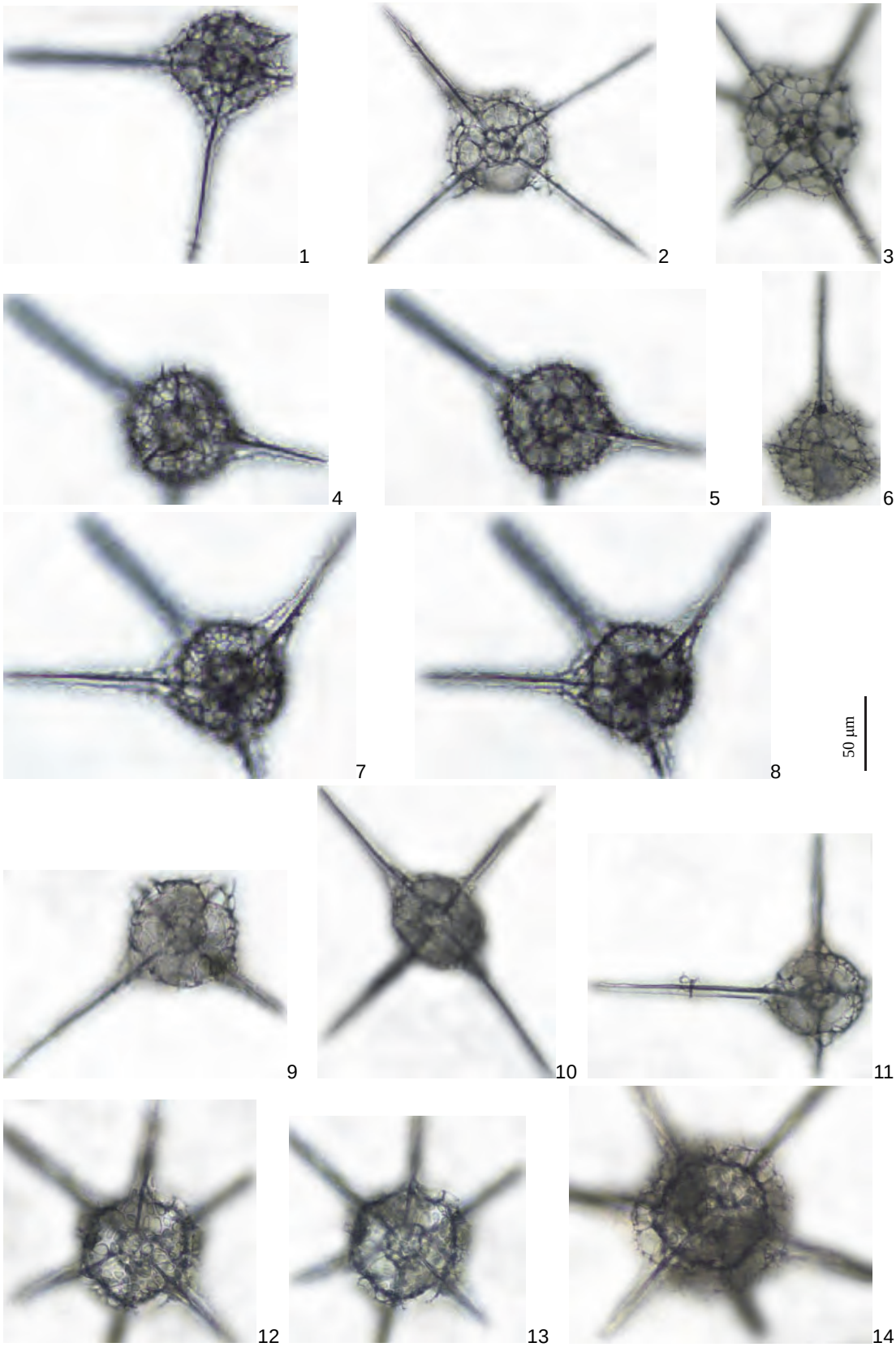


1, 2. 十二棘葱海胆虫 *Cromyechinus dodecacanthus* Haeckel；3. 中方虫 *Centrocubus cladostylus* Haeckel；4, 5. 棘海绵眼虫 *Spongiomma spinatum* Chen et Tan；6–9. 中方八枝虫 *Octodendron cubocentron* Haeckel；10–14. 顶枝根球虫 *Rhizosphaera acrocladon* Blueford

图版 26

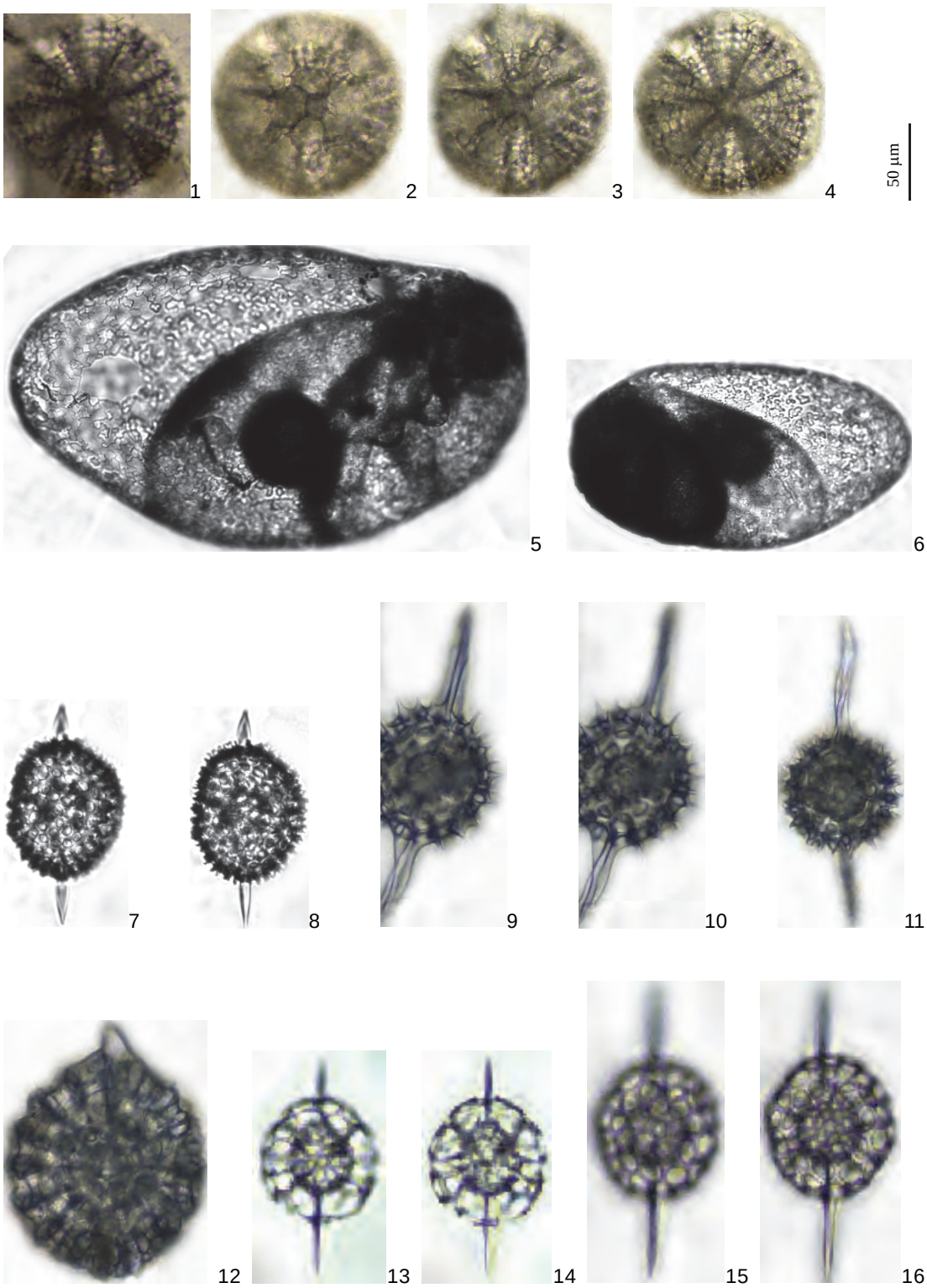


1–13. 王灯球虫 *Lychnosphaera regina* Haeckel

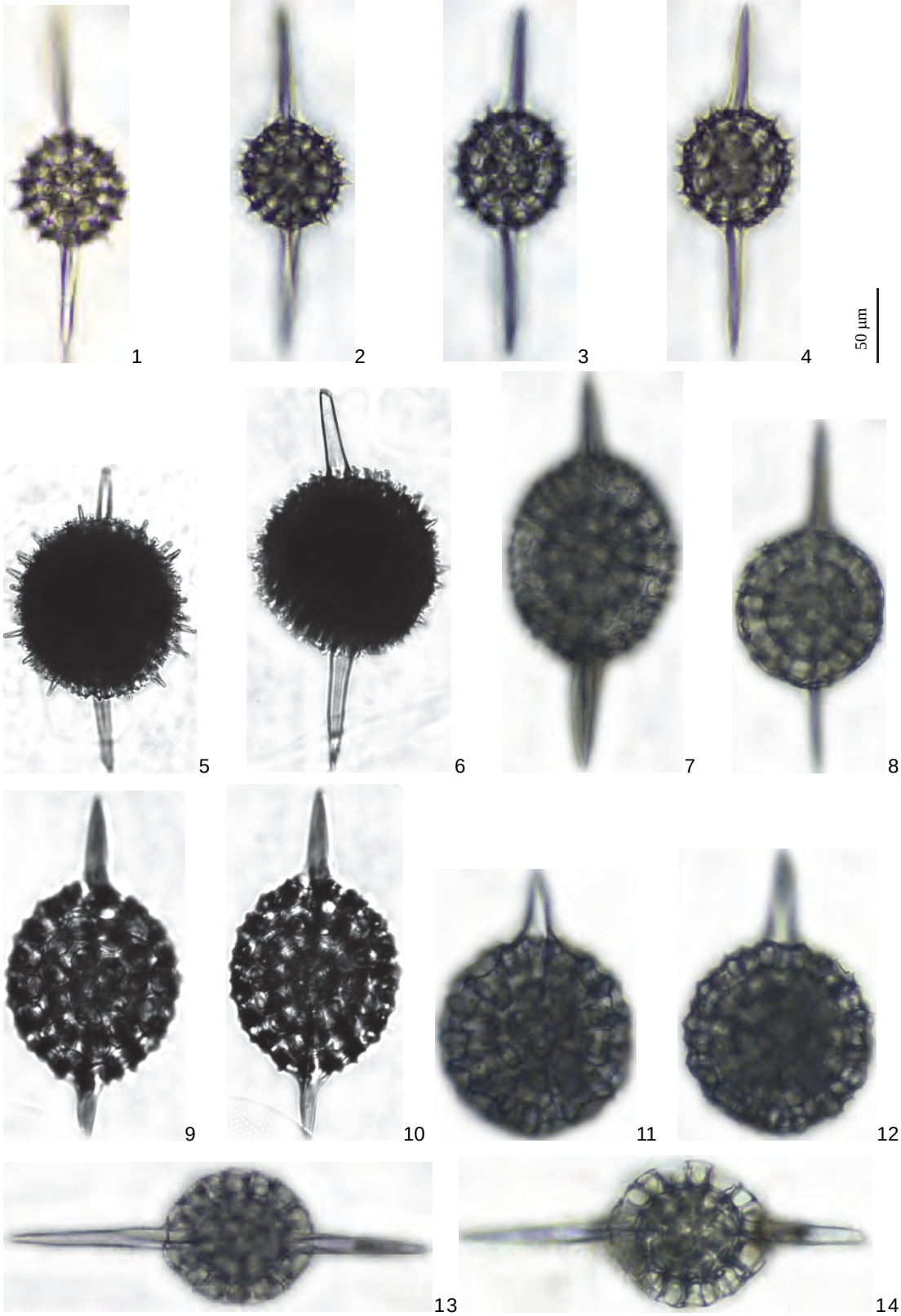


1–14. 北方根编虫 *Rhizoplegma boreale* (Cleve)

图版 28

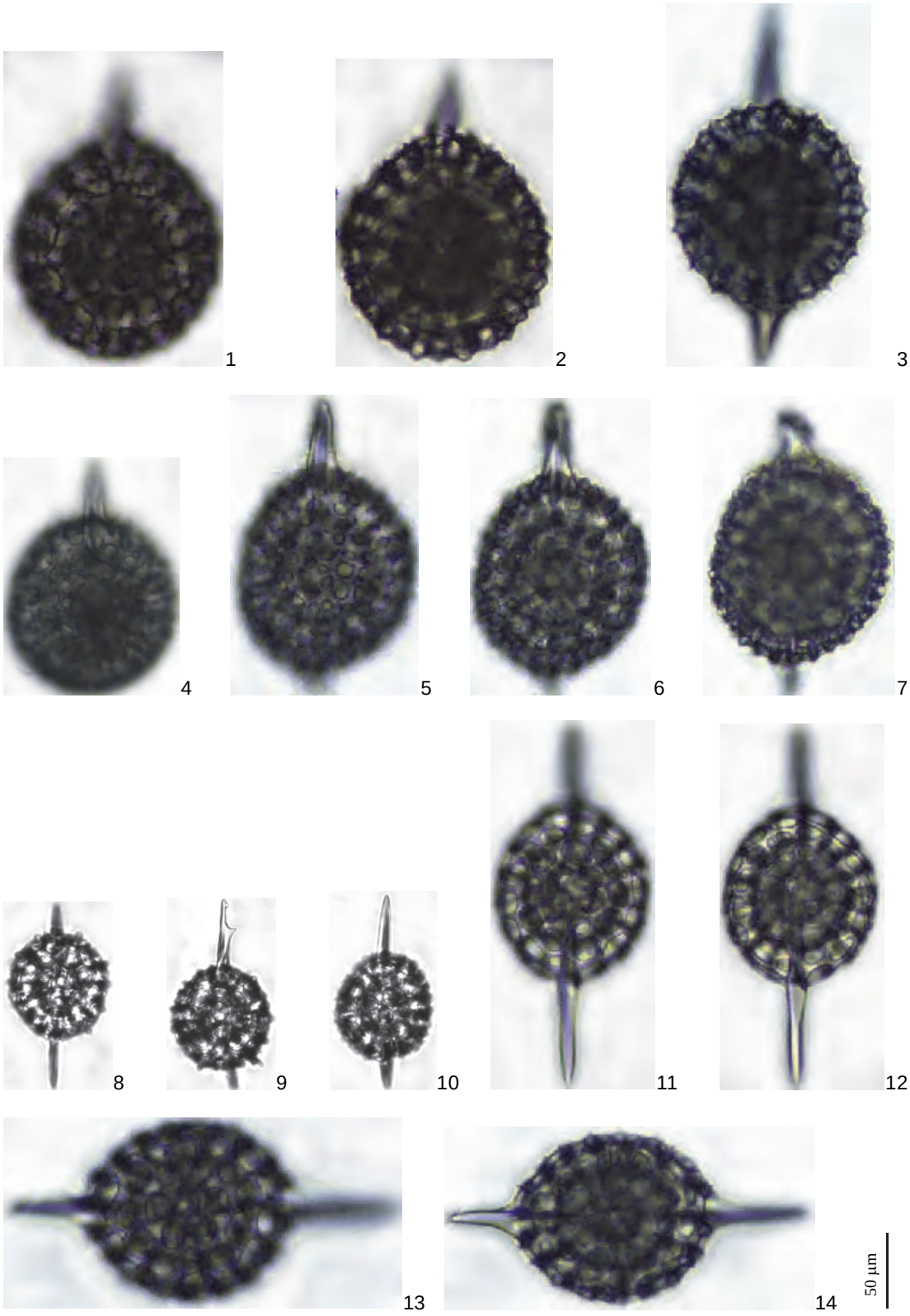


1–4. 蜂巢中方虫（新种）*Centrocubus alveolus* sp. nov.；5, 6. 卵空椭球虫? *Cenellipsis elliptica* Lipman?；7, 8. 针球虫（未定种 1）*Stylosphaera* sp. 1；9–11. 壳橄榄虫 *Druppatractus ostracion* Haeckel；12. 变异橄榄虫 *Druppatractus variabilis* Dumitrica；13–16. 橄榄虫（未定种 1）*Druppatractus* sp. 1

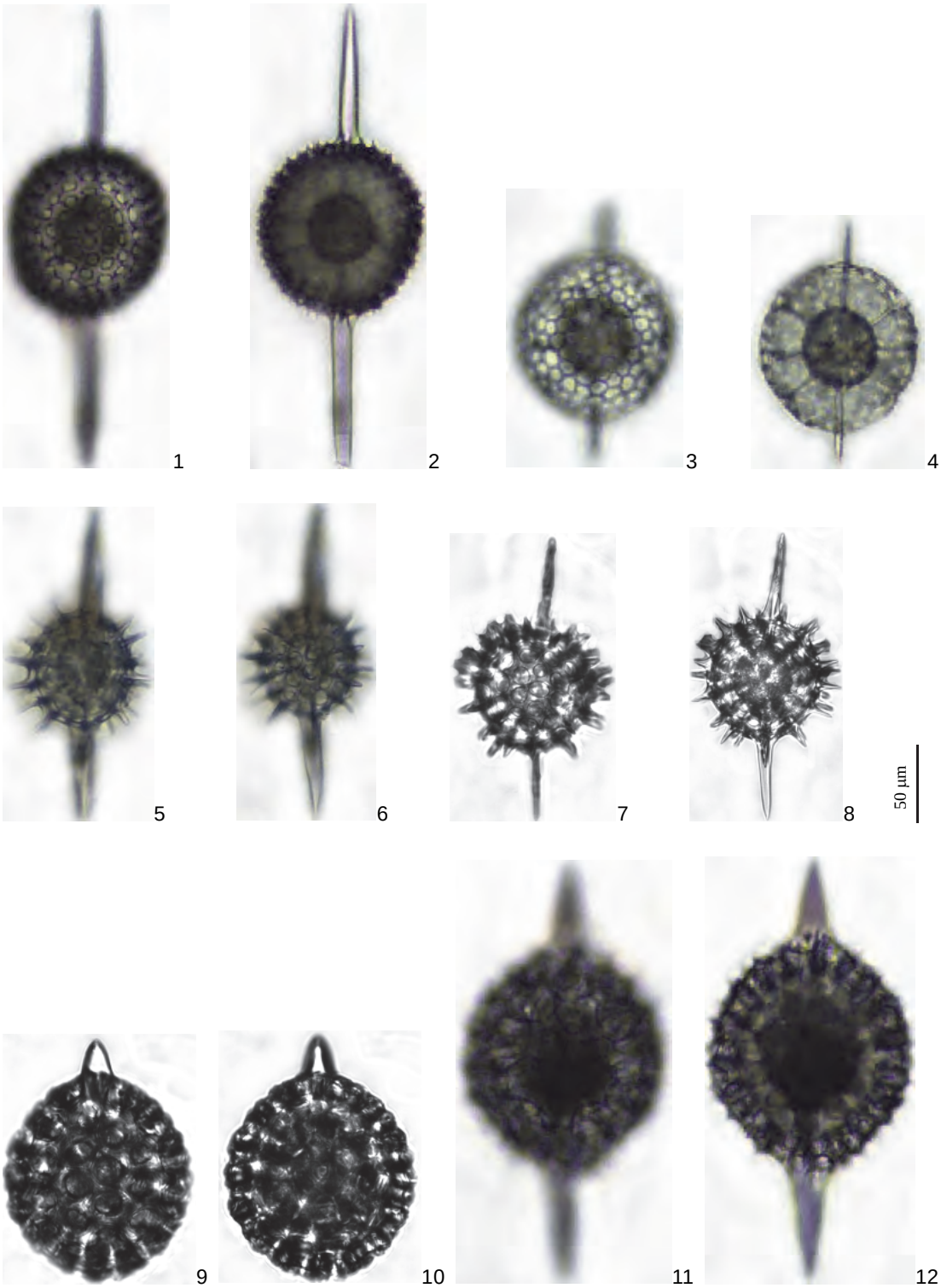


1–4. 橄榄虫（未定种 2）*Druppatractus* sp. 2；5, 6. 圣针蜓虫 *Stylatractus angelinus* (Campbell et Clark)；7–10. 双针针蜓虫 *Stylatractus disetanius* Haeckel；11, 12. 双啄剑蜓虫早亚种 *Xiphatractus birostractus praecursor* (Gorbunov)；13, 14. 克罗剑蜓虫 *Xiphatractus cronos* (Haeckel)

图版 30

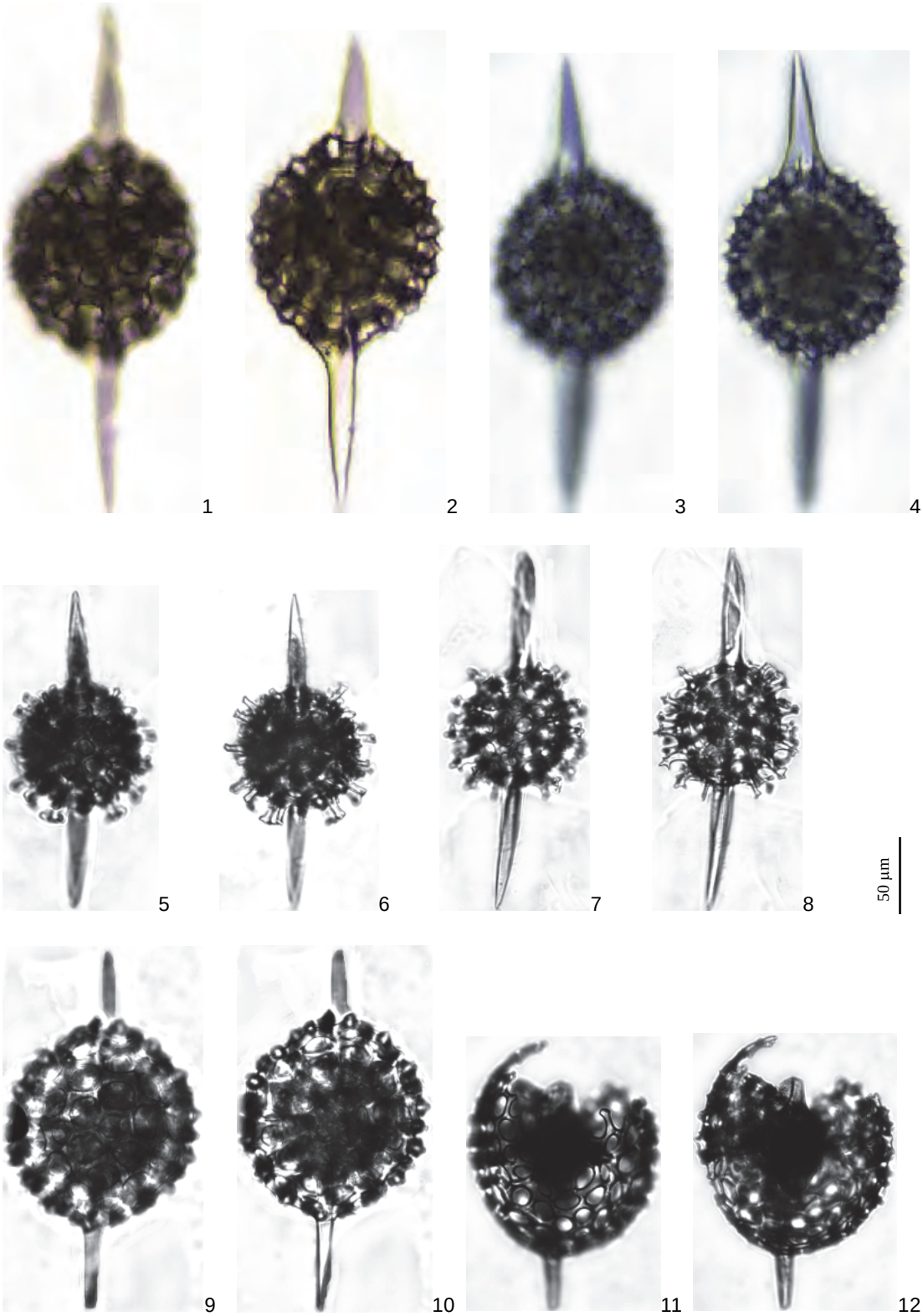


1–3. 双啄剑蜓虫早亚种 *Xiphatractus birostractus praecursor* (Gorbunov)；4–7. 糙皮剑蜓虫 *Xiphatractus trachyphloius* Chen et Tan；8–10. 剑蜓虫（未定种 1）*Xiphatractus* sp. 1；11–14. 剑蜓虫（未定种 2）*Xiphatractus* sp. 2

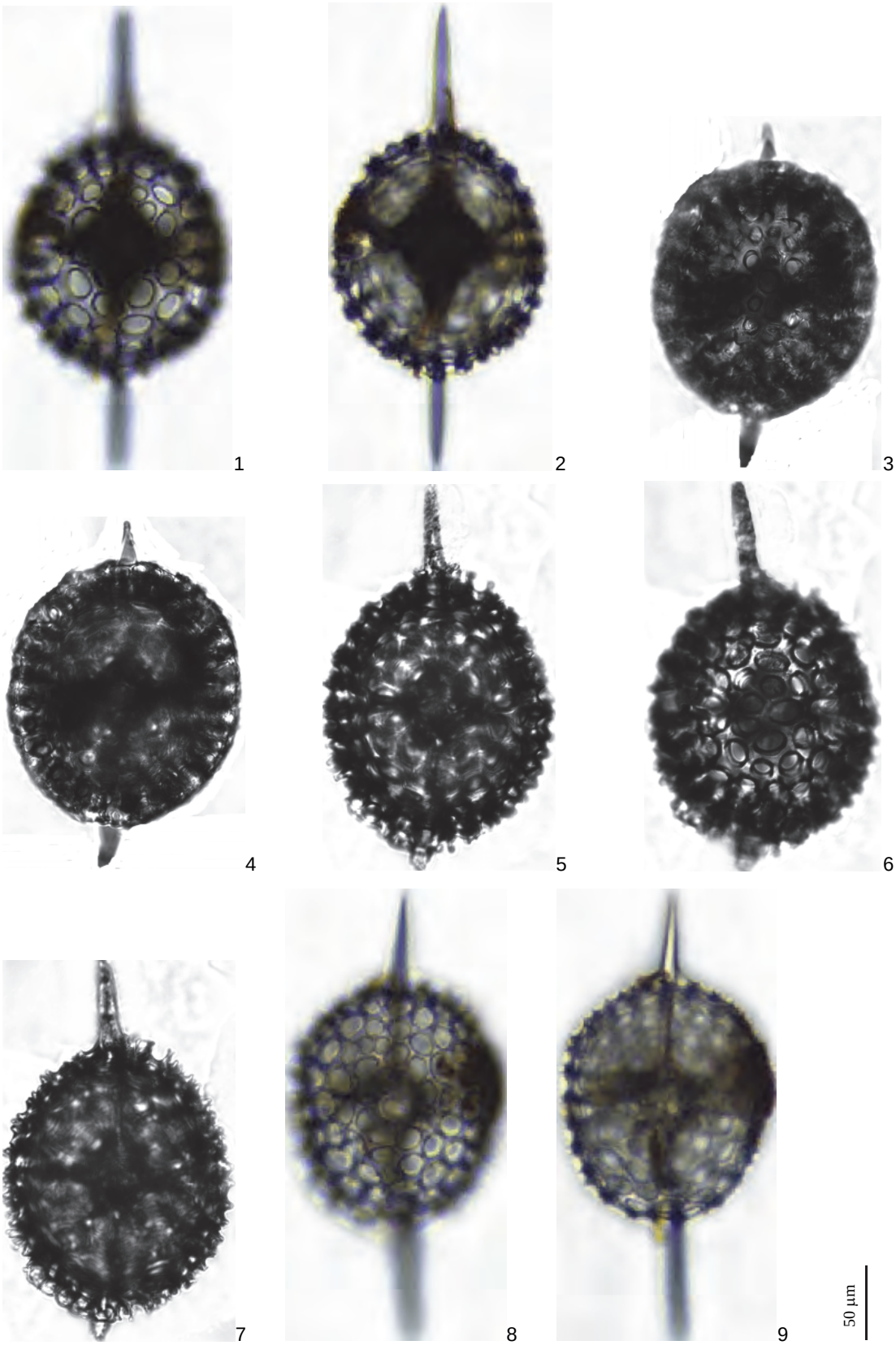


1, 2. 冠倍球虫 *Amphisphaera cristata* Carnevale；3, 4. 裂蹼倍球虫 *Amphisphaera dixyphos* (Ehrenberg)；5–8. 薄壁倍球虫 *Amphisphaera* (*Amphisphaerella*) *gracilis* Campbell et Clark；9, 10. 辐射倍球虫 *Amphisphaera radiosa* (Ehrenberg)；11, 12. 双啄剑蜓虫早亚种 *Xiphatractus birostractus praecursor* (Gorbunov)

图版 32

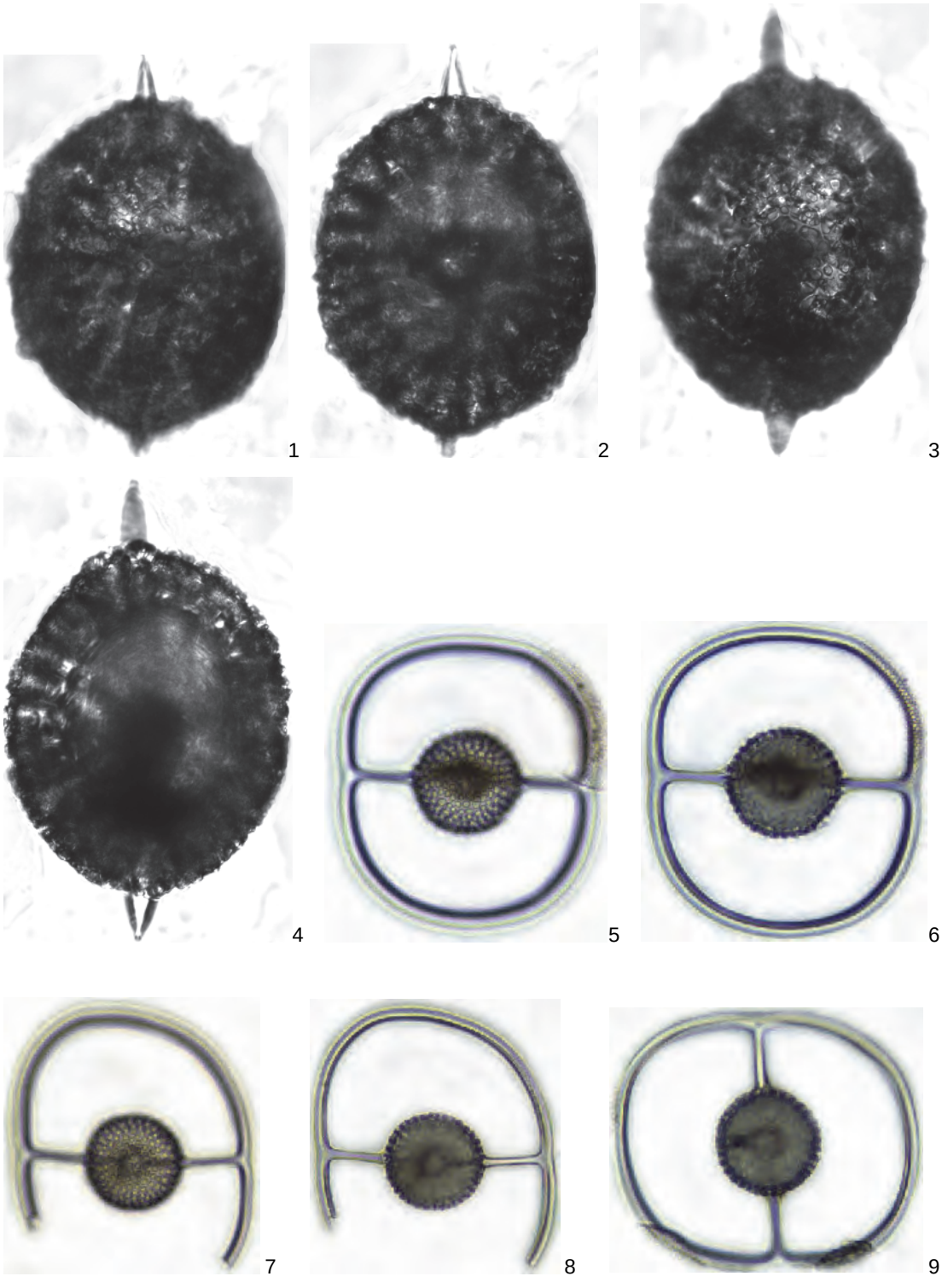


1–4. 桑塔倍球虫 *Amphisphaera santaennae* (Campbell et Clark)；5–8. 倍球虫（未定种 1）*Amphisphaera* sp. 1；9, 10. 倍球虫（未定种 2）*Amphisphaera* sp. 2；11, 12. 阿克针矛虫 *Stylacontarium acquilonium* (Hays)

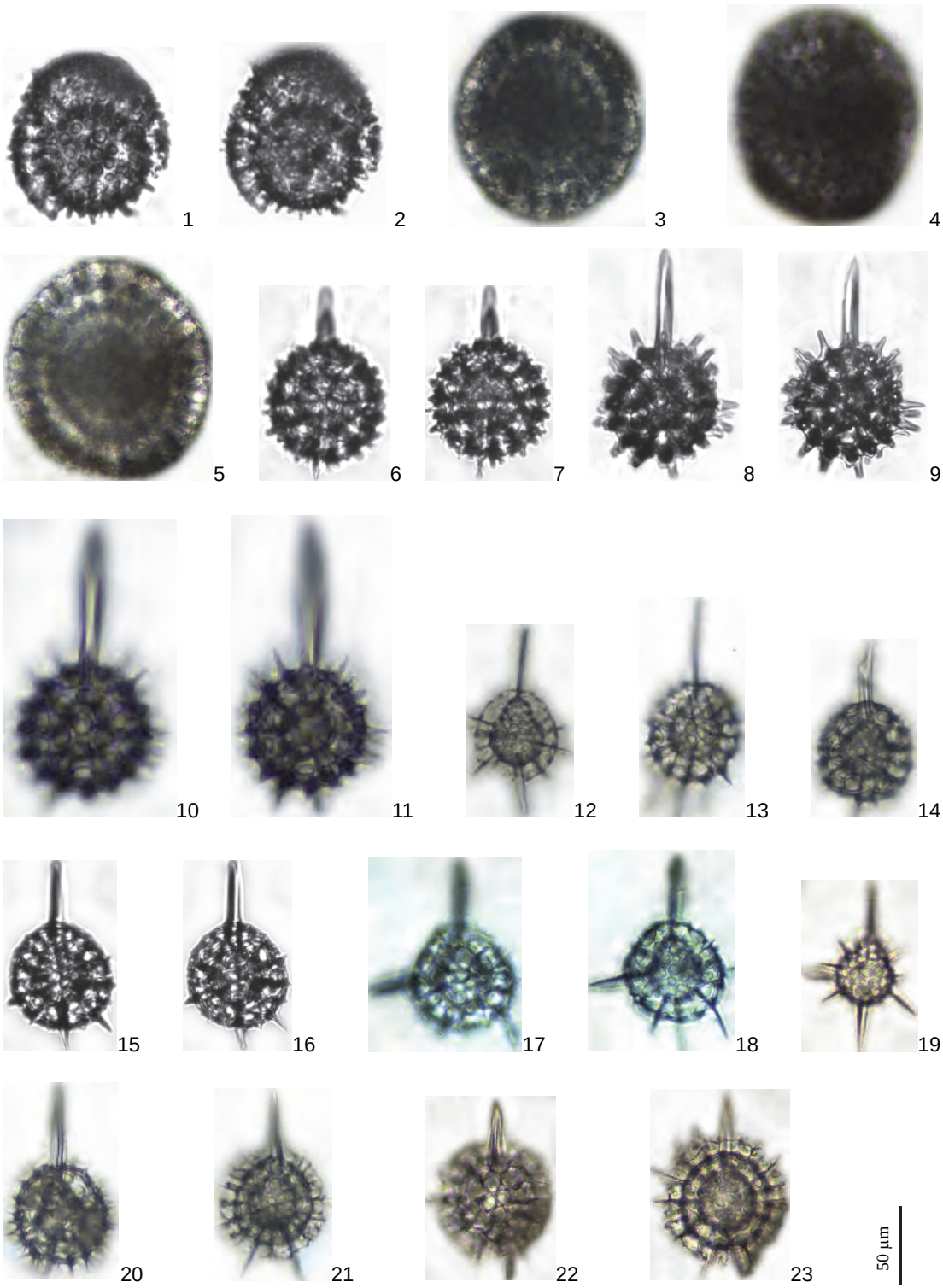


1–4. 阿克针矛虫 *Stylacontarium acquilonium* (Hays)；5–9. 双尖针矛虫 *Stylacontarium bispiculum* Popofsky

图版 34

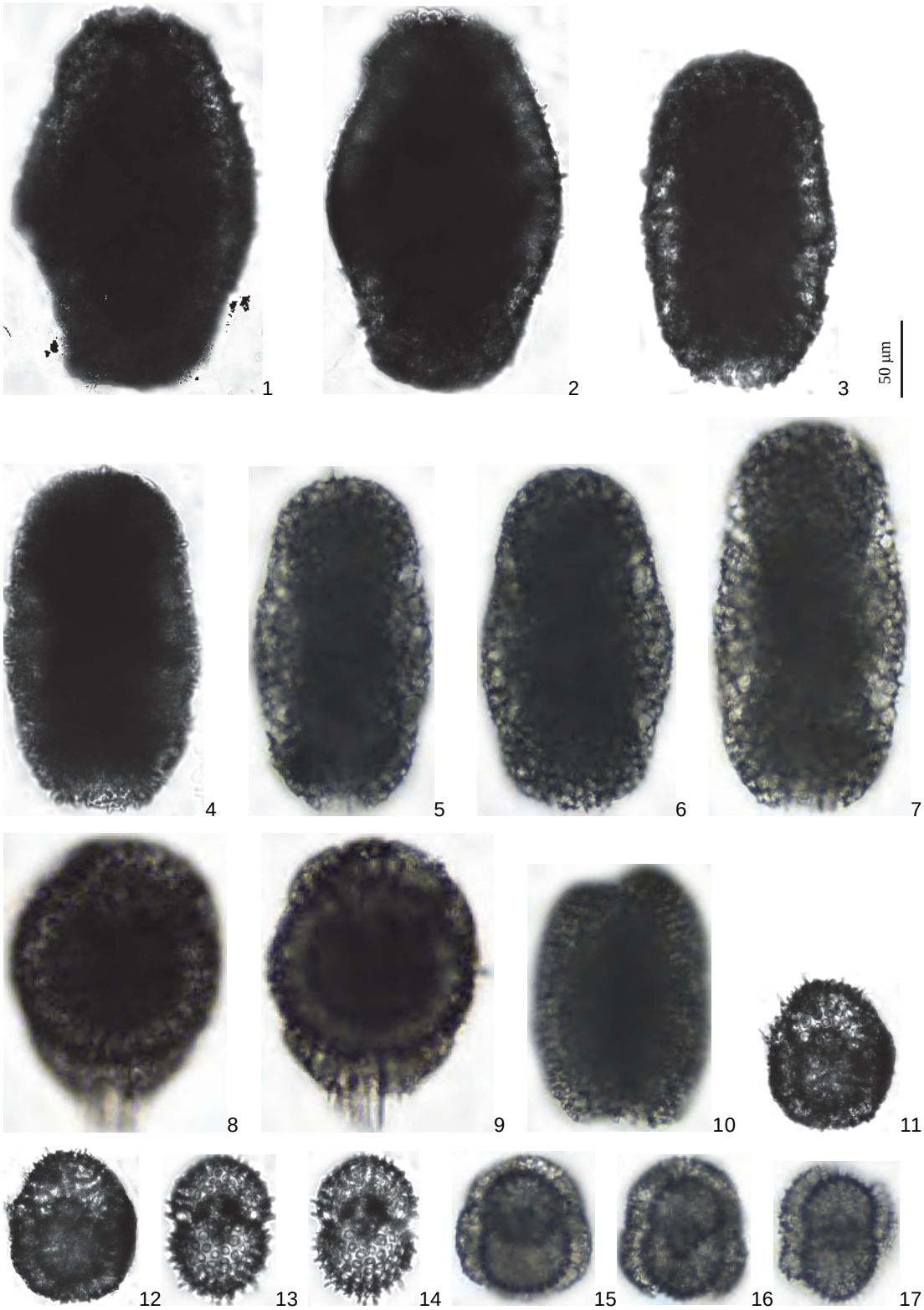


1–4. 厚壁针矛虫（新种）*Stylacontarium pachydermum* sp. nov.；5–9. 椭圆小环土星虫 *Saturnulus ellipticus* Haeckel

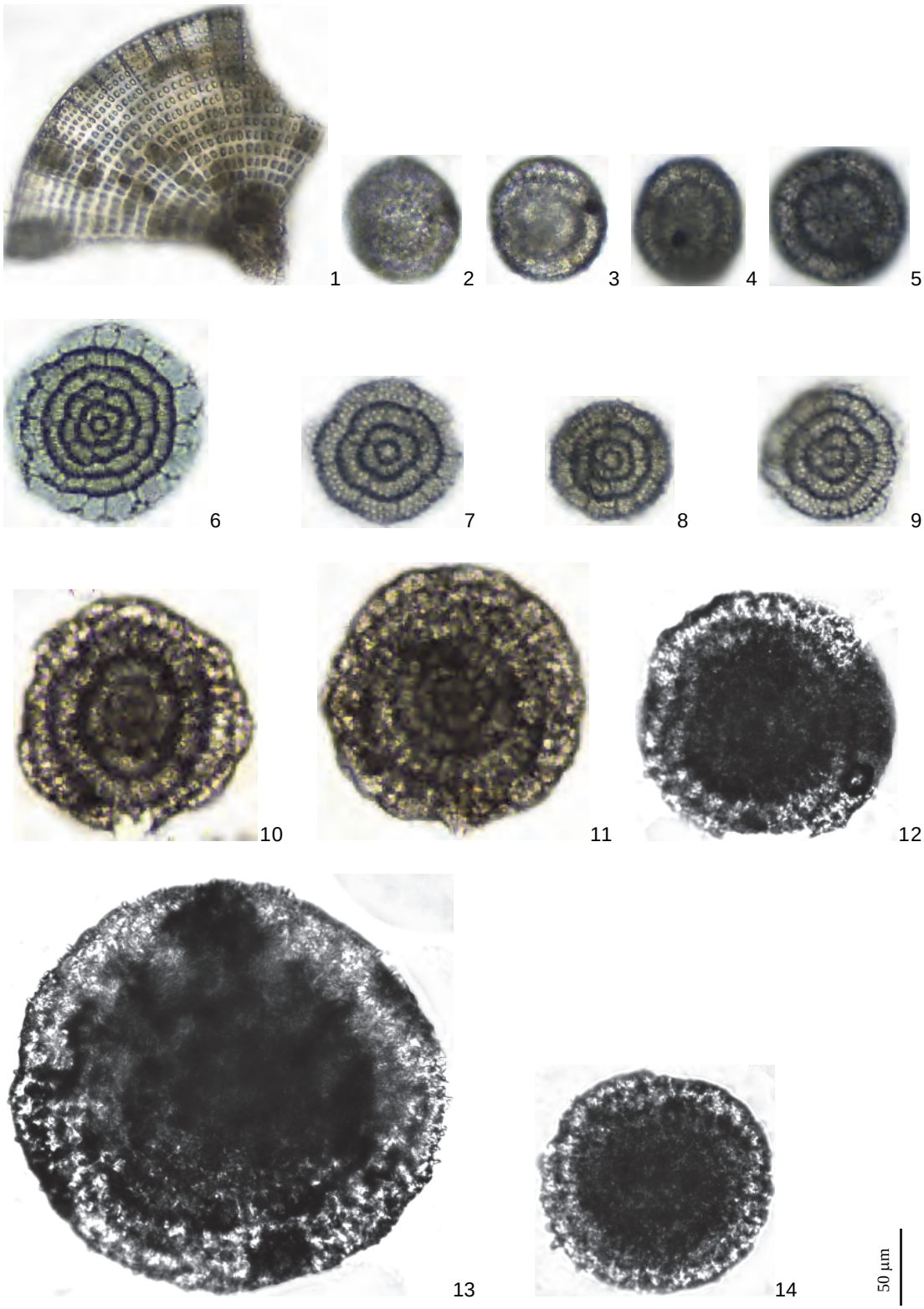


1, 2. 布谷梅虫 *Prunulum coccymelium* Haeckel；3–5. 葱皮虫（未定种 1）*Cromyocarpus* sp. 1；6, 7. 里奇葱核虫 *Cromydruppocarpus esterae* Campbell et Clark；8–11. 葱核虫（未定种）*Cromydruppocarpus* sp.；12–19. 本松矛核虫 *Dorydruppa bensoni* Takahashi；20–23. 矛核虫（未定种）*Dorydruppa* sp.

图版 36

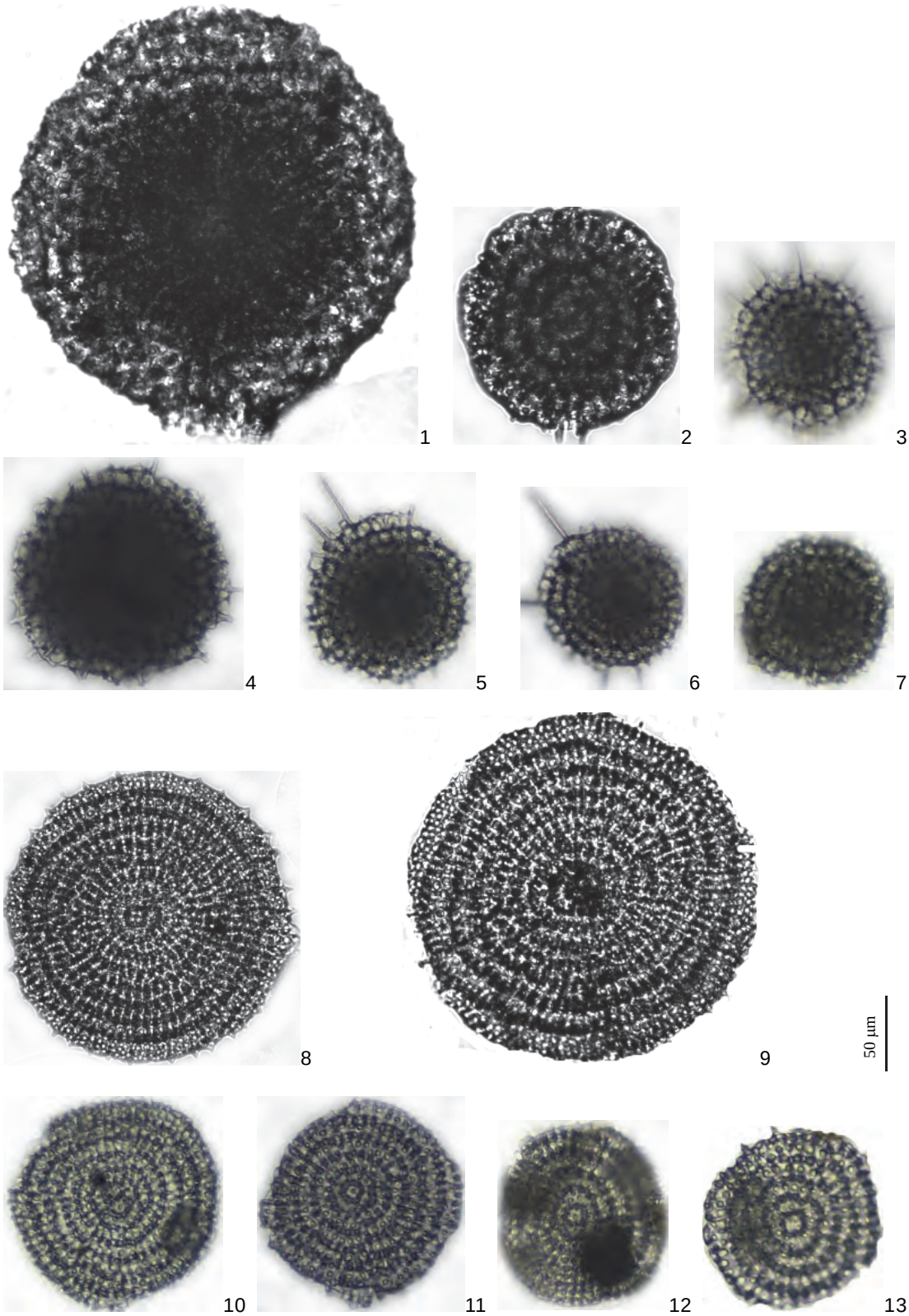


1–7. 极口海绵虫 *Spongurus pylomaticus* Riedel；8, 9. 石果虫（未定种）*Lithocarpium* sp.；10. 巨人石果虫 *Lithocarpium titan* (Campbell et Clark)；11–17. 女腰带虫 *Cypassis puella* Haeckel

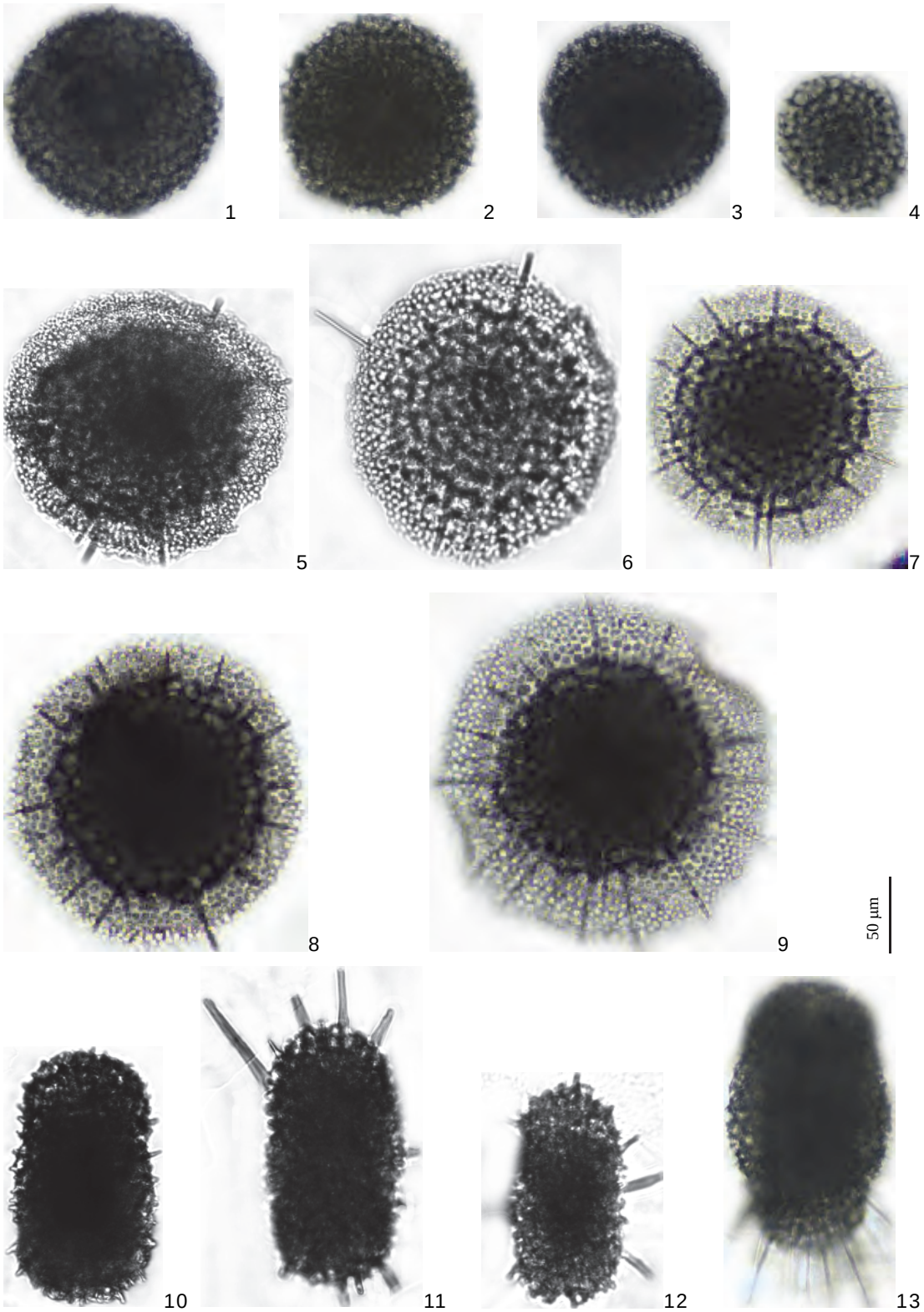


1. 圆石虫（未定种）*Lithocyclia* sp.；2–5. 始盘虫（未定种）*Archidiscus* sp.；6–9. 环孔盘虫 *Porodiscus circularis* Clark et Campbell；10, 11. 椭圆围盘虫 *Circodiscus ellipticus* (Stohr)；12–14. 编膜包虫 *Perichlamydium praetextum* (Ehrenberg)

图版 38

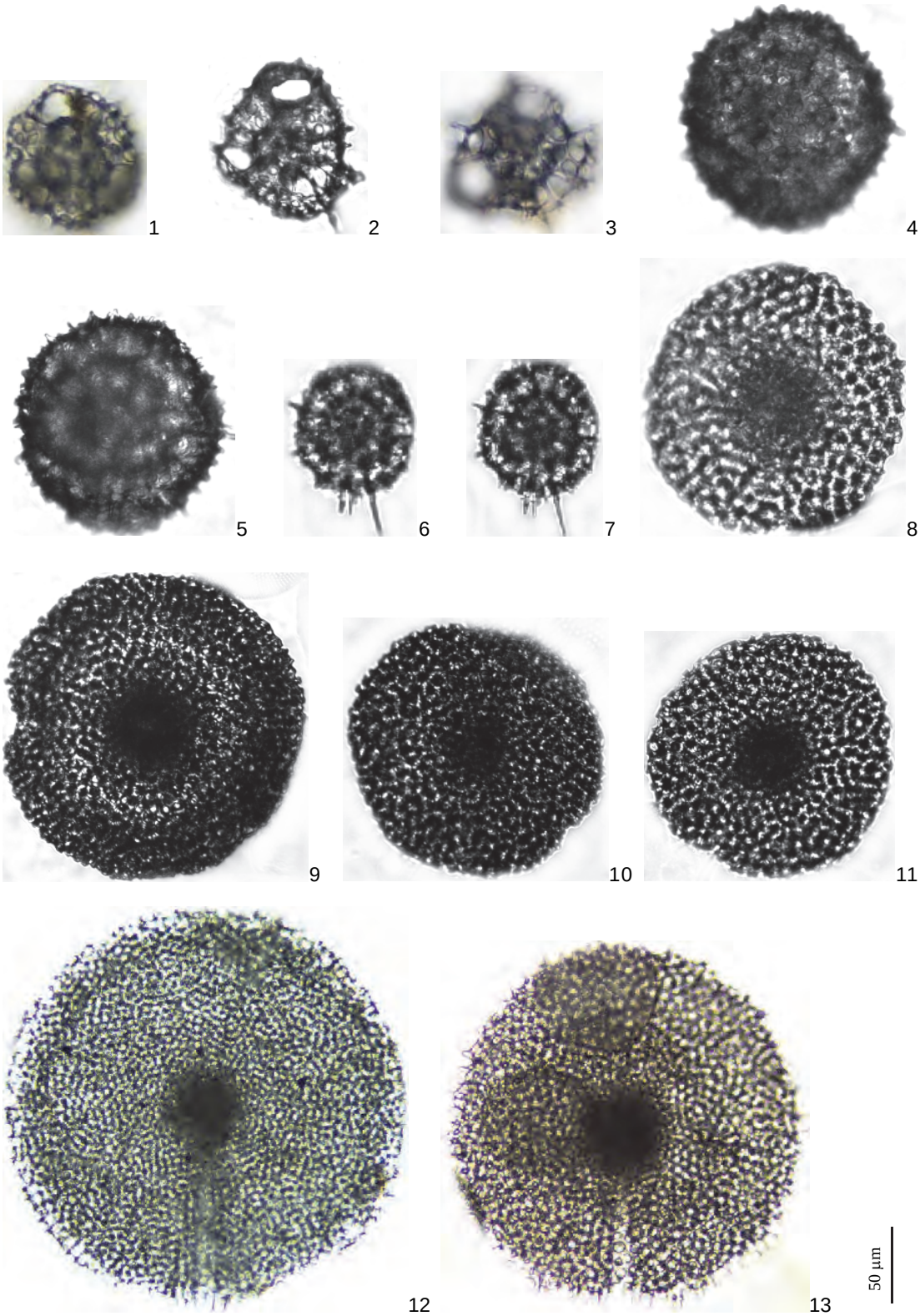


1, 2. 哈克眼盘虫? *Ommatodiscus haeckelii* Stöhr?；3. 毛刺针网虫 *Stylodictya lasiacantha* Tan et Tchang；4–6. 多针针网虫 *Stylodictya multispina* Haeckel；7. 多角针网虫 *Stylodictya polygonia* Popofsky；8–13. 强刺针网虫 *Stylodictya validispina* Jørgensen

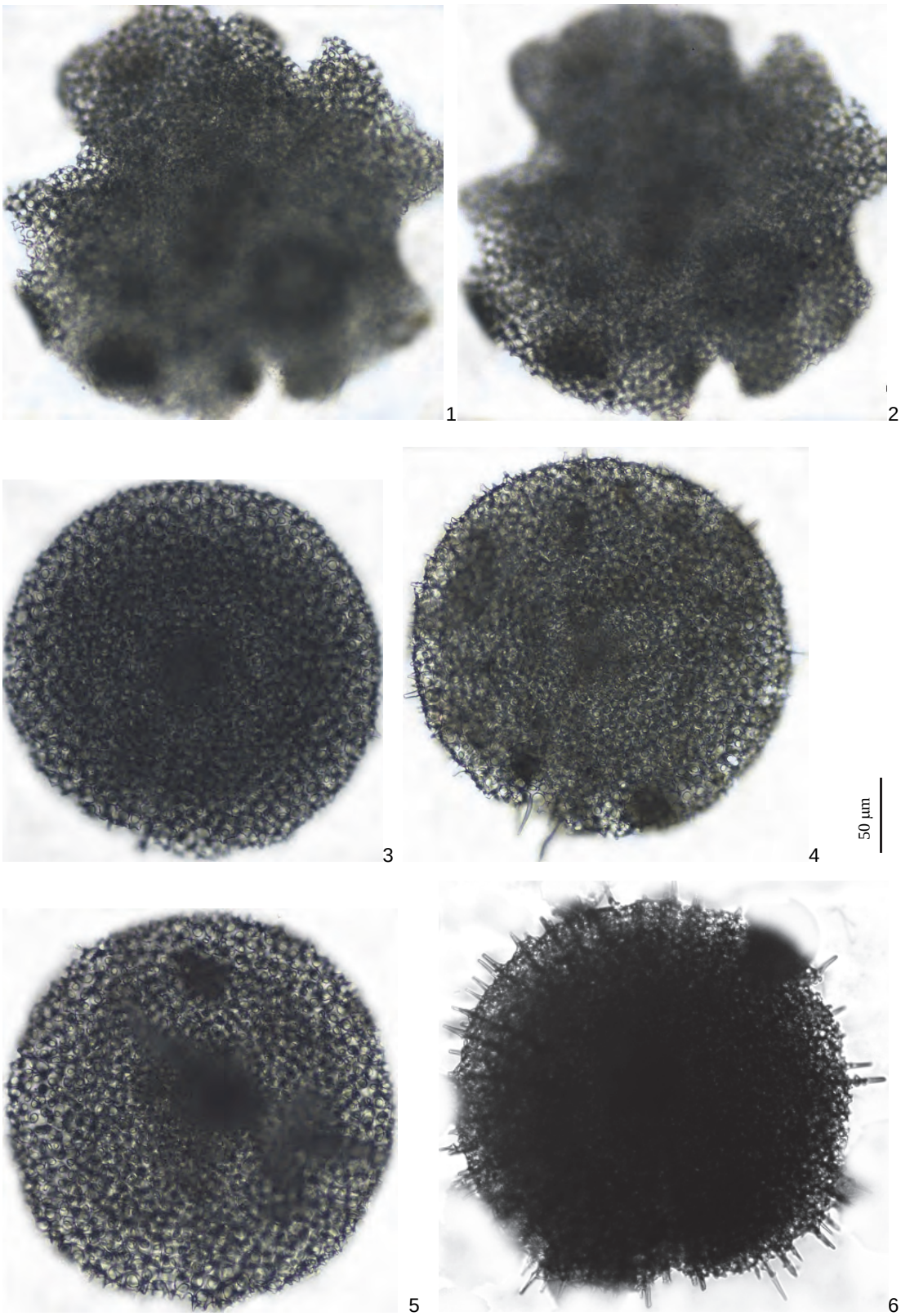


1–4. 针网虫（未定种）*Stylodictya* sp.；5–9. 雅针膜虫 *Stylochlamydium venustum* (Bailey)；10–13. 双腕虫（未定种）*Amphibrachium* sp.

图版 40

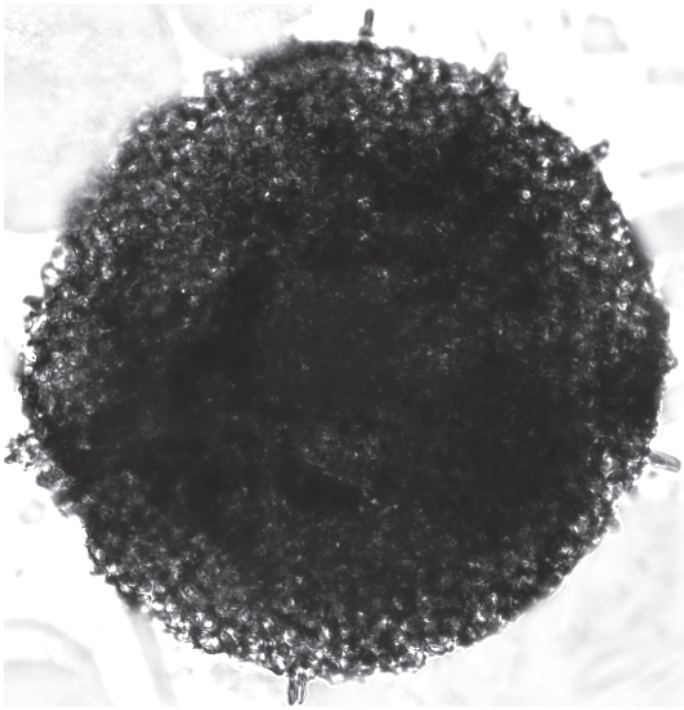


1, 2. 小刺六洞虫 *Hexapyle spinulosa* Chen et Tan；3. 多刺门盘虫 *Pylodiscus echinatus* Tan et Su；4, 5. 吻盘孔虫 *Discopyle osculate* Haeckel；6, 7. 盘孔虫（未定种）*Discopyle* sp.；8–11. 双凹海绵盘虫 *Spongodiscus biconcavus* Haeckel, emend. Chen *et al*.；12, 13. 多刺海绵盘虫 *Spongodiscus setosus* (Dreyer)

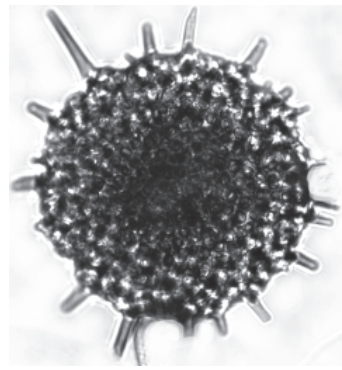


1, 2. 海绵盘虫（未定种 1）*Spongodiscus* sp. 1；3–5. 海绵盘虫（未定种 2）*Spongodiscus* sp. 2；6. 冰海绵轮虫 *Spongotrochus glacialis* Popofsky

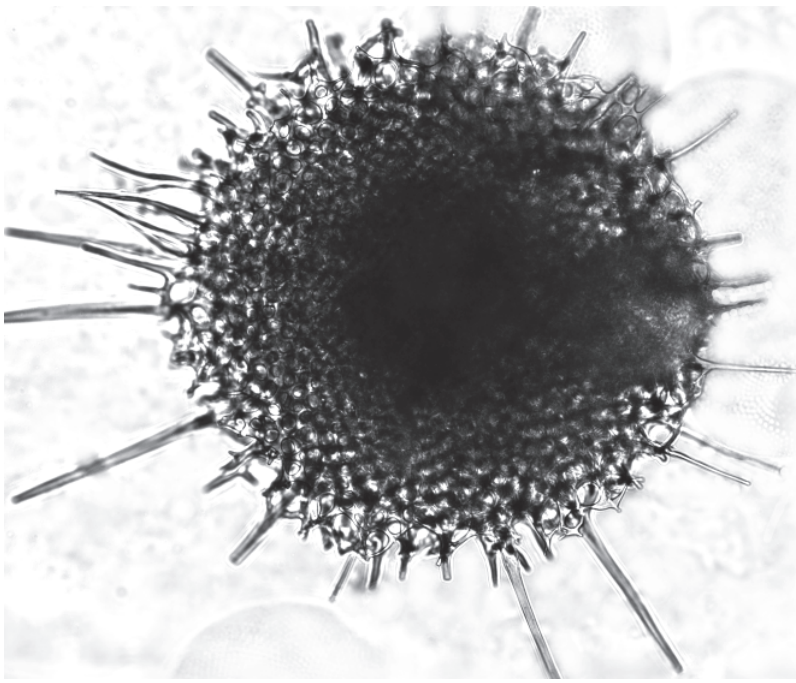
图版 42



1



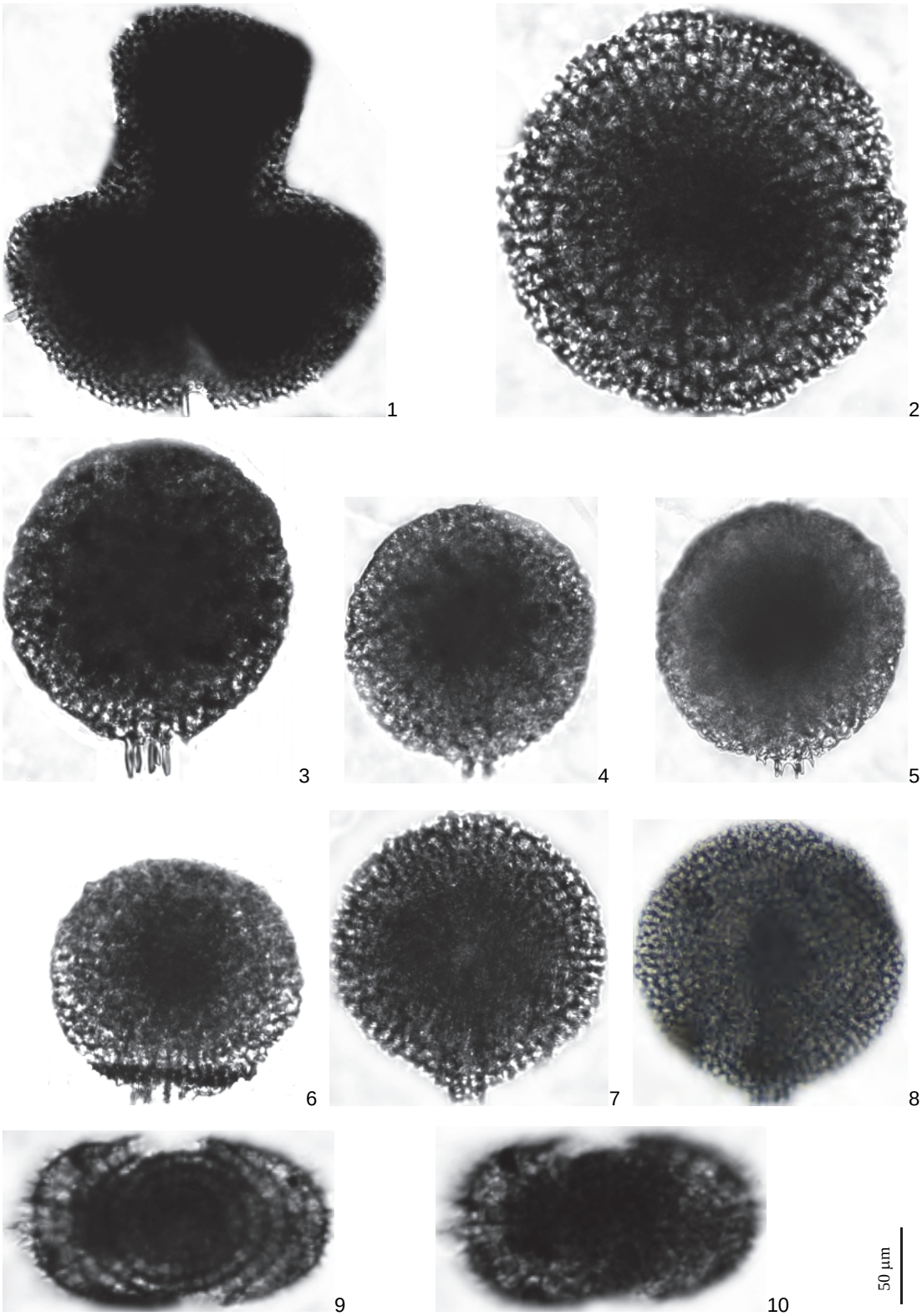
2



3

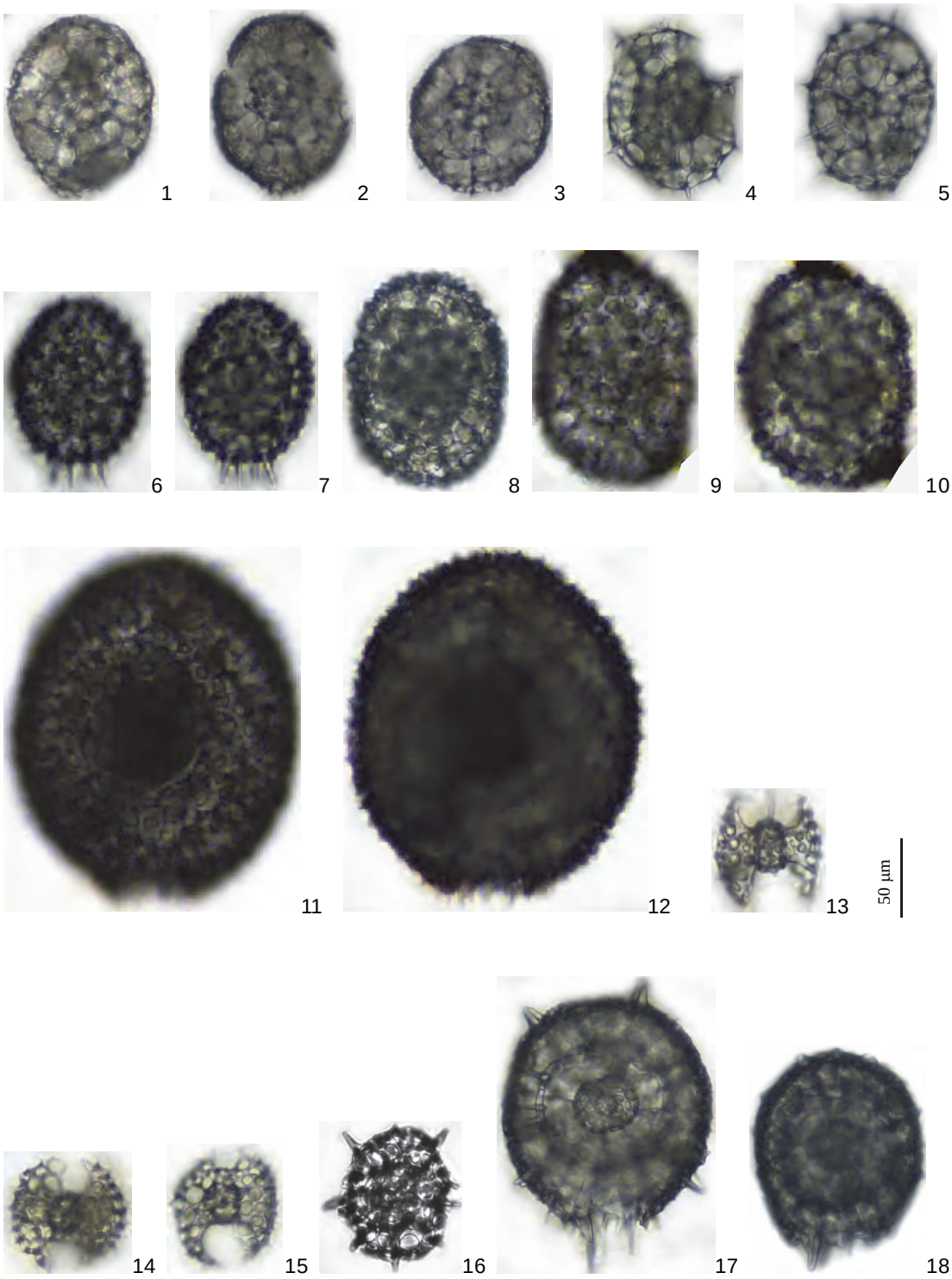
50 μm

1, 2. 冰海绵轮虫 *Spongotrochus glacialis* Popofsky；3. 异形海绵轮虫 *Spongotrochus vitabilis* Goll et Bjørklund

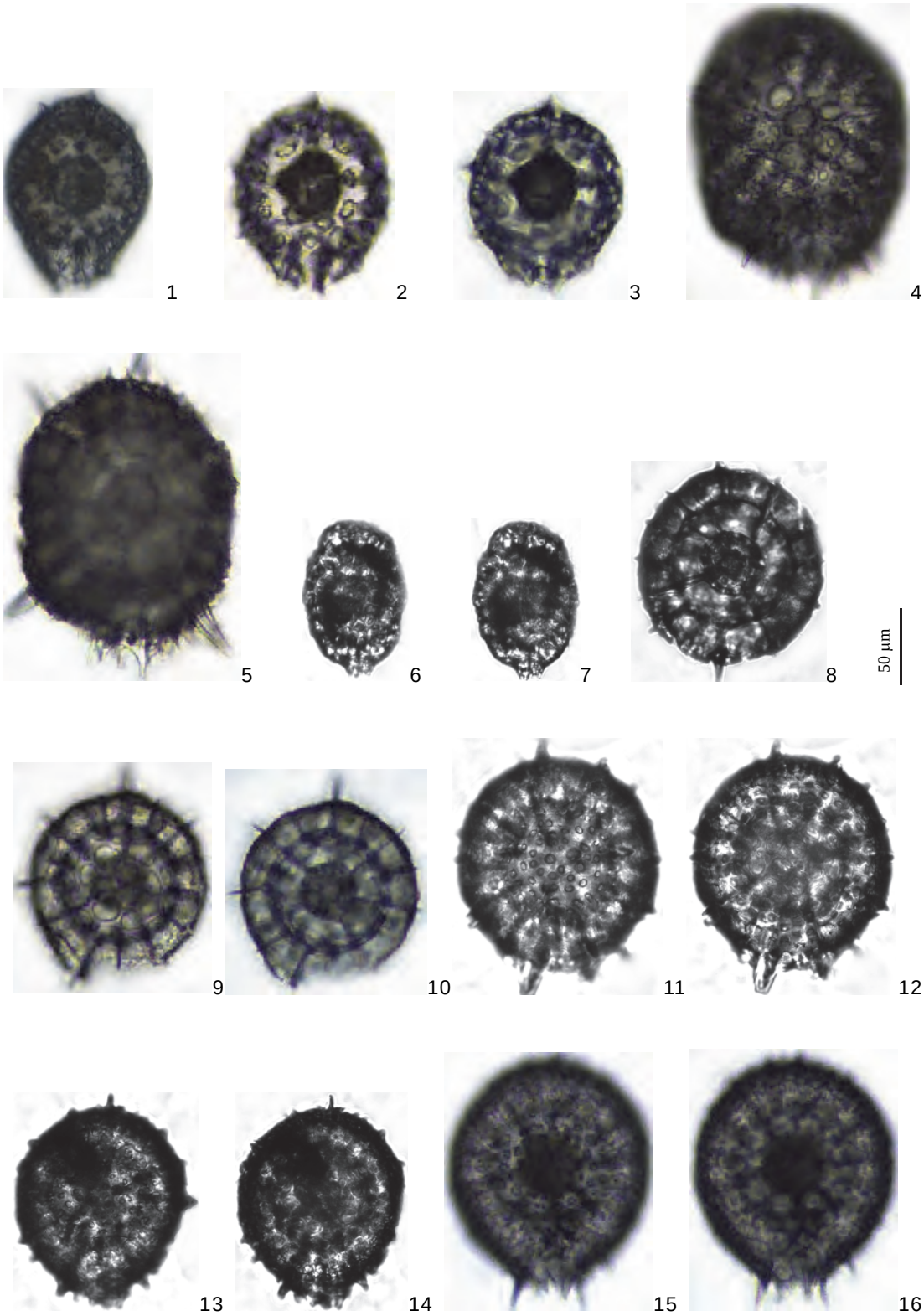


1. 胖棒网虫（新种）*Dictyocoryne inflata* sp. nov.；2–8. 吻海绵门孔虫 *Spongopyle osculosa* Dreyer；9, 10. 名炭篮虫 *Larcopyle augusti* Lazarus *et al*.

图版 44

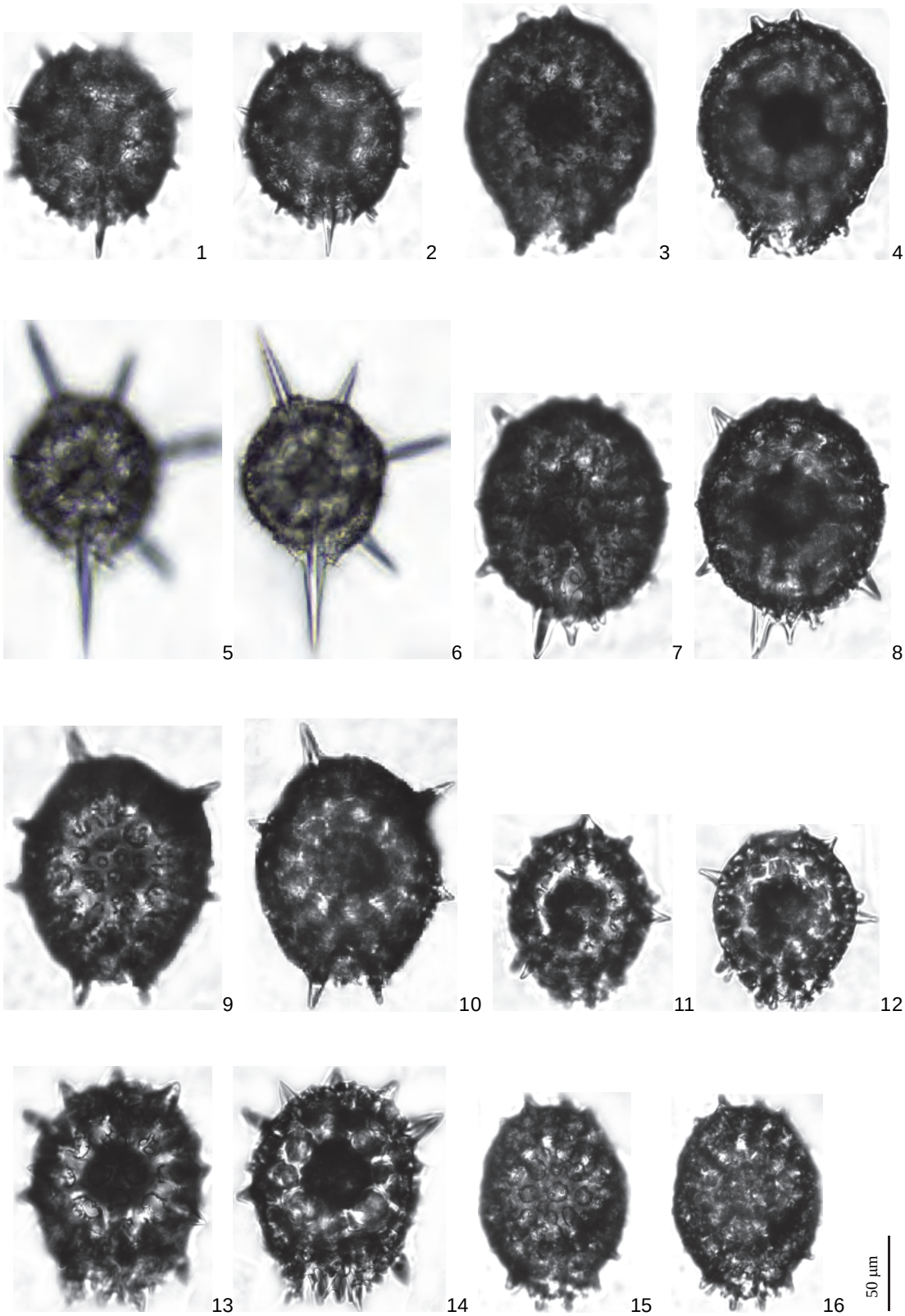


1–5. 炭篮虫 *Larcopyle butschlii* Dreyer；6–10. 外刺炭篮虫 *Larcopyle eccentricum* Lazarus *et al.*；11, 12. 奇异炭篮虫 *Larcopyle peregrinator* Lazarus *et al.*；13. 厚单环带虫 *Monozonium pachystylum* Popofsky；14, 15. 圆四门孔虫 *Tetrapyle circularis* Haeckel, emend. Tan et Chen；16. 八刺门带虫 *Pylozonium octacanthum* Haeckel；17, 18. 南极梅孔虫 *Prunopyle antarctica* Dreyer emend. Nishimura

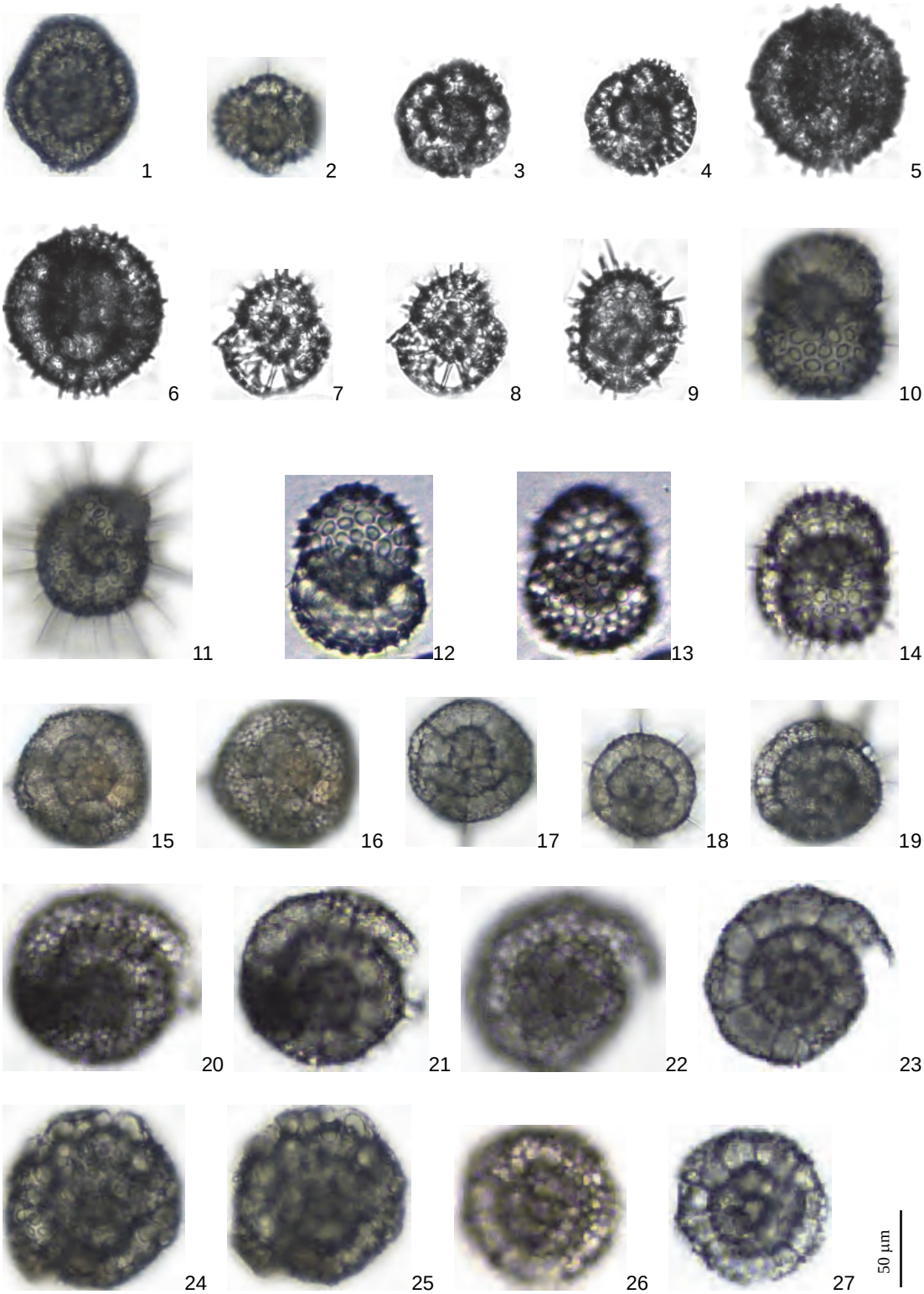


1–5. 南极梅孔虫 *Prunopyle antarctica* Dreyer, emend. Nishimura；6, 7. 梅孔虫（未定种）*Prunopyle* sp.；8–10. 朗球孔虫 *Sphaeropyle langii* Dreyer；11–16. 壮球孔虫 *Sphaeropyle robusta* Kling

图版 46

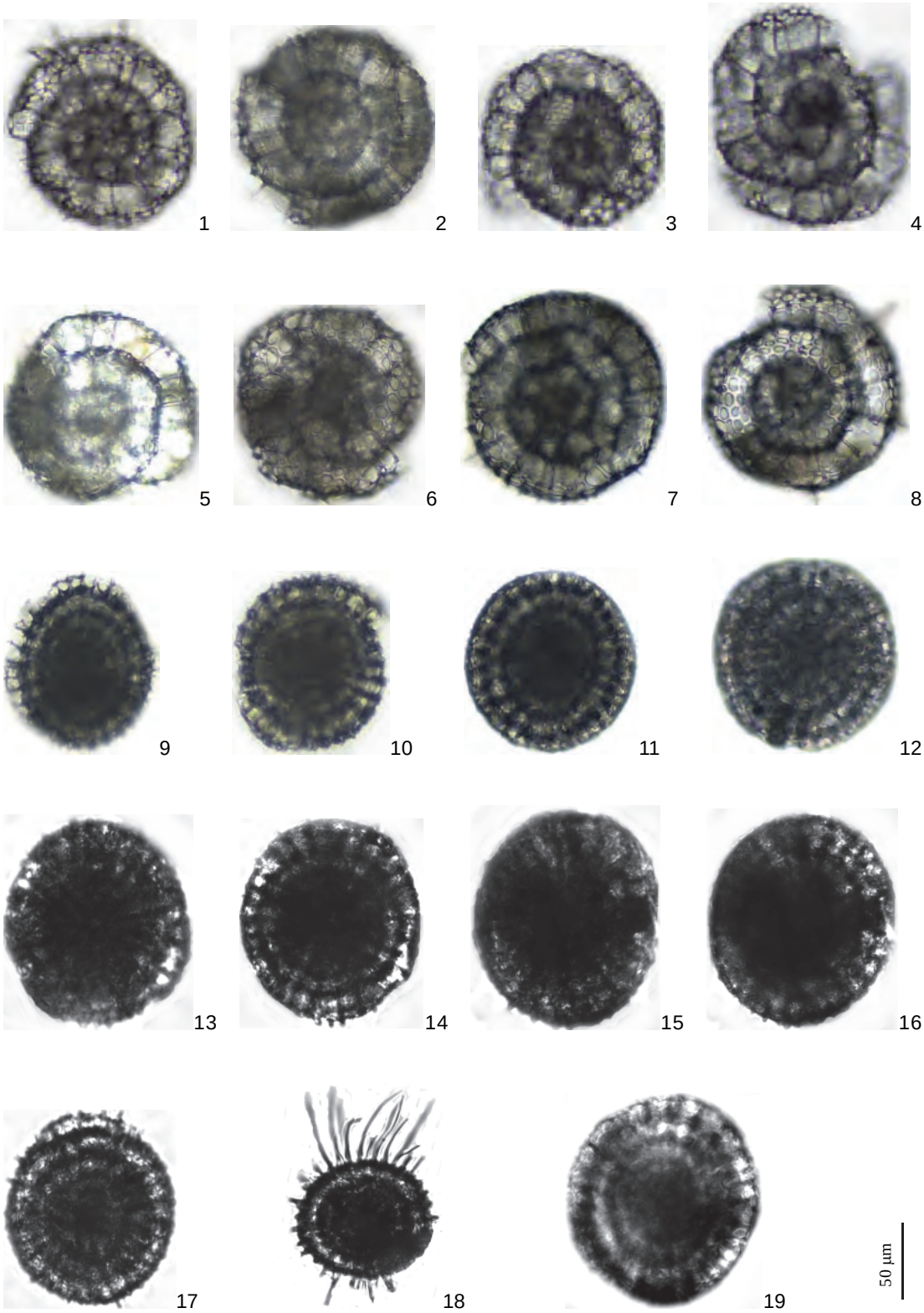


1–6. 球孔虫（未定种 1）*Sphaeropyle* sp. 1；7–10. 球孔虫（未定种 2）*Sphaeropyle* sp. 2；11–14. 球孔虫（未定种 3）*Sphaeropyle* sp. 3；15, 16. 球孔虫（未定种 4）*Sphaeropyle* sp. 4

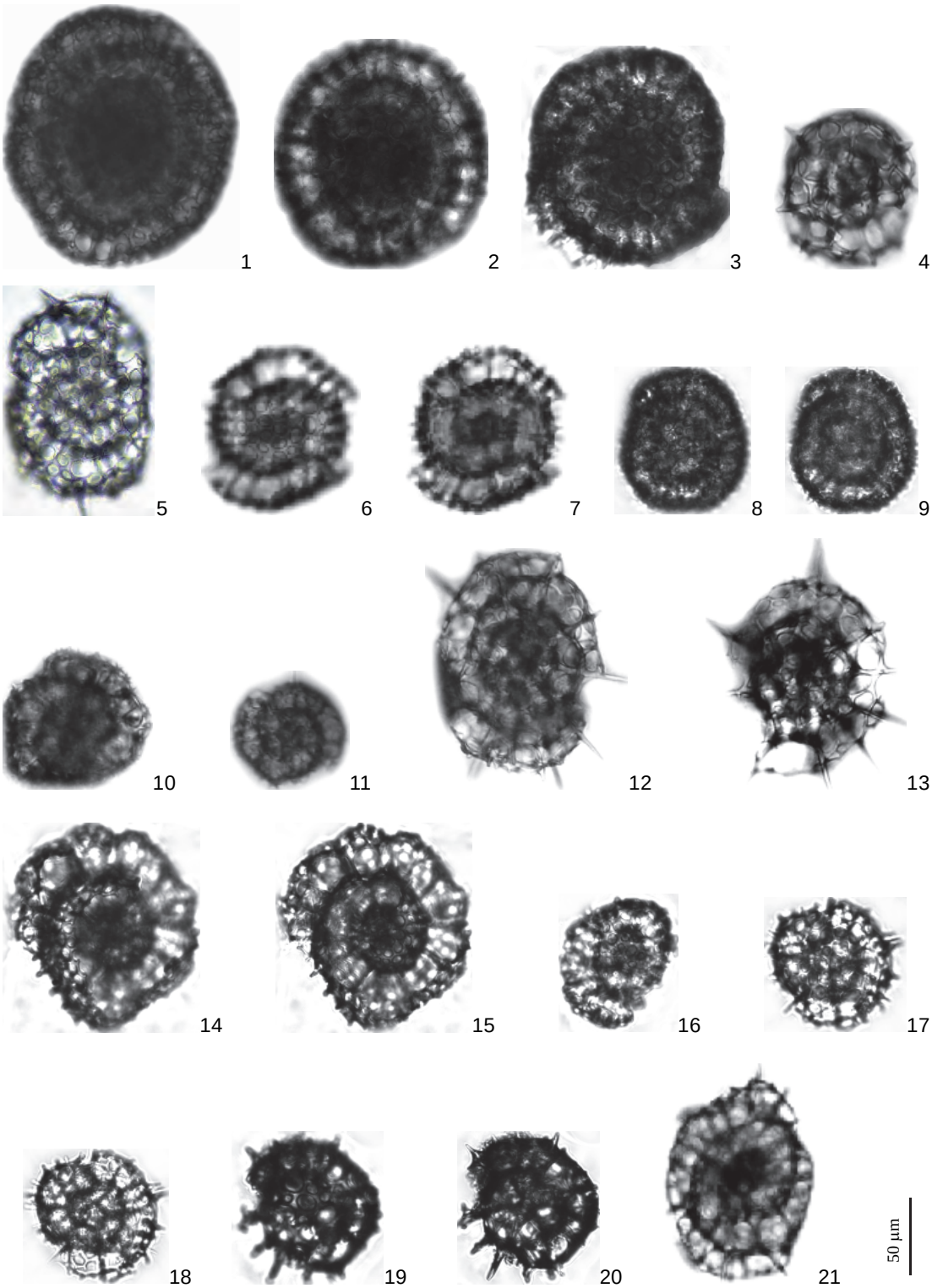


1, 2. 三体双顶虫 *Amphitholonium tricolonium* Haeckel；3, 4. 规则方顶虫 *Cubotholus regularis* Haeckel；5, 6. 似边顶虫 *Cubotholonium ellipsoides* Haeckel；7–14. 本松双口虫 *Dipylissa bensoni* Dumitrica；15–23. 苹果包卷虫 *Spirema melonia* Haeckel；24–27. 包卷虫（未定种）*Spirema* sp.

图版 48

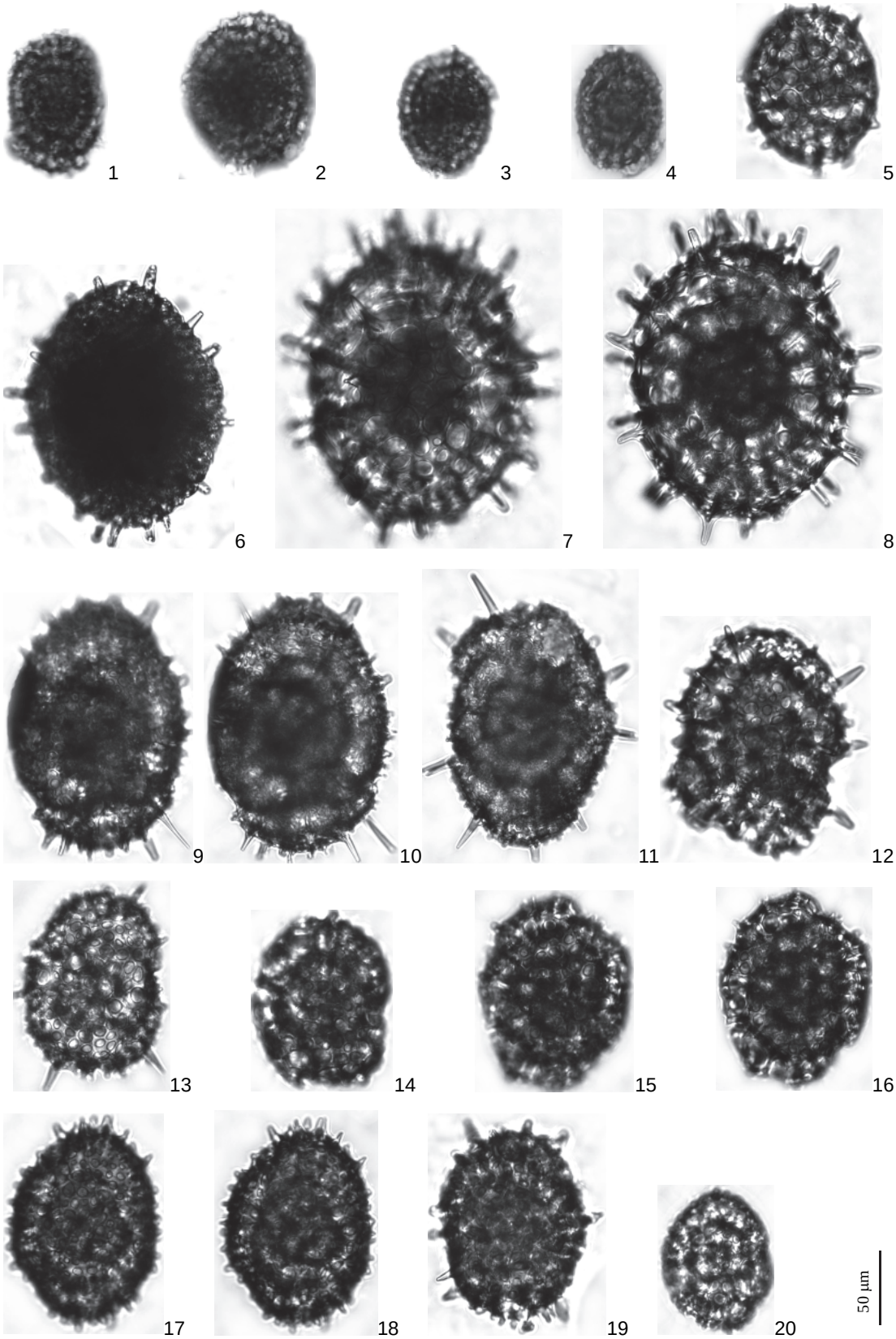


1–8. 蜂房石太阳虫 *Lithelius alveolina* Haeckel；9–19. 小石太阳虫 *Lithelius minor* Jørgensen

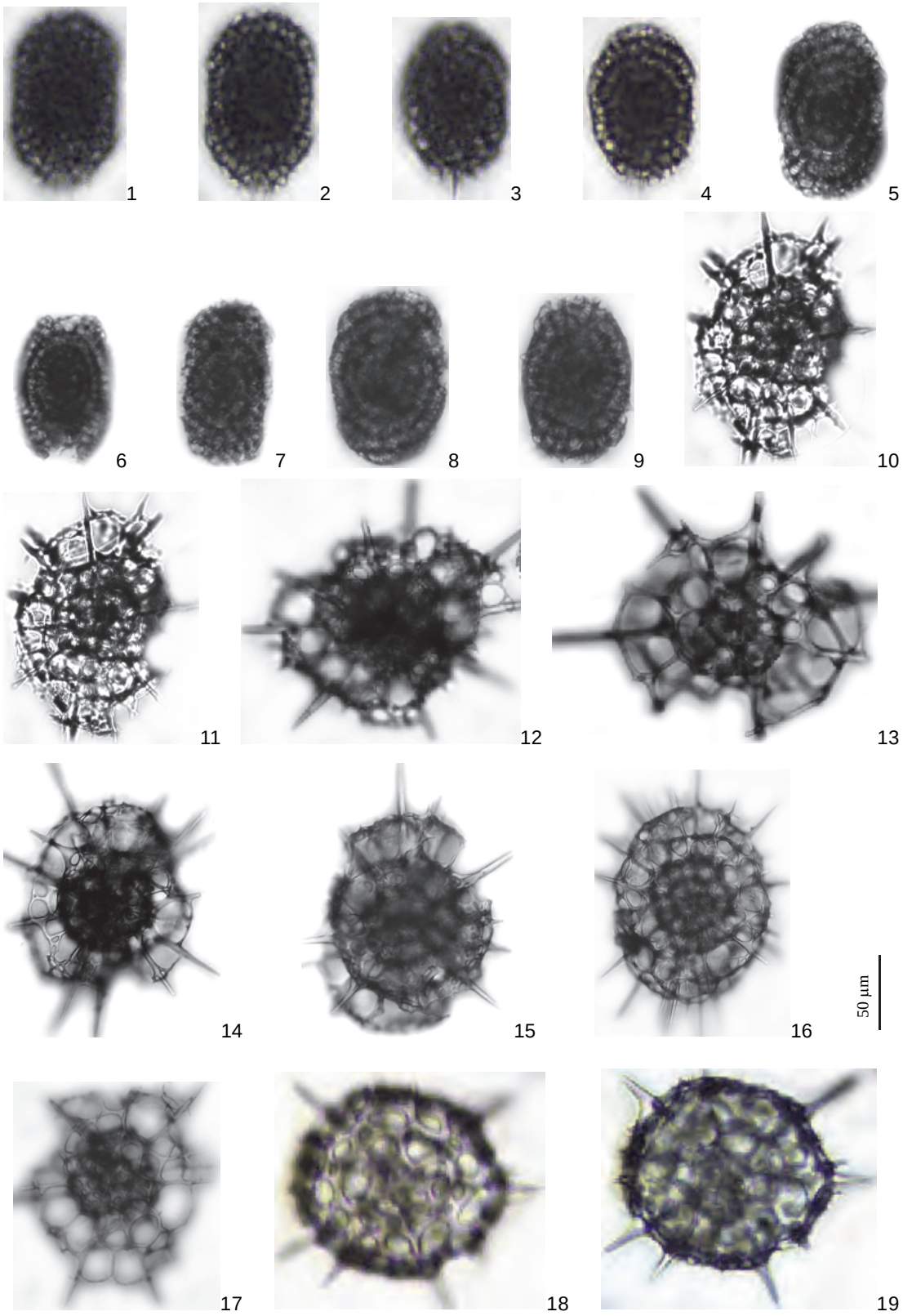


1–11. 水手石太阳虫 *Lithelius nautiloides* Popofsky；12, 13. 蜗牛石太阳虫 *Lithelius nerites* Tan et Su；14–21. 幼形石太阳虫 *Lithelius primordialis* Hertwig

图版 50

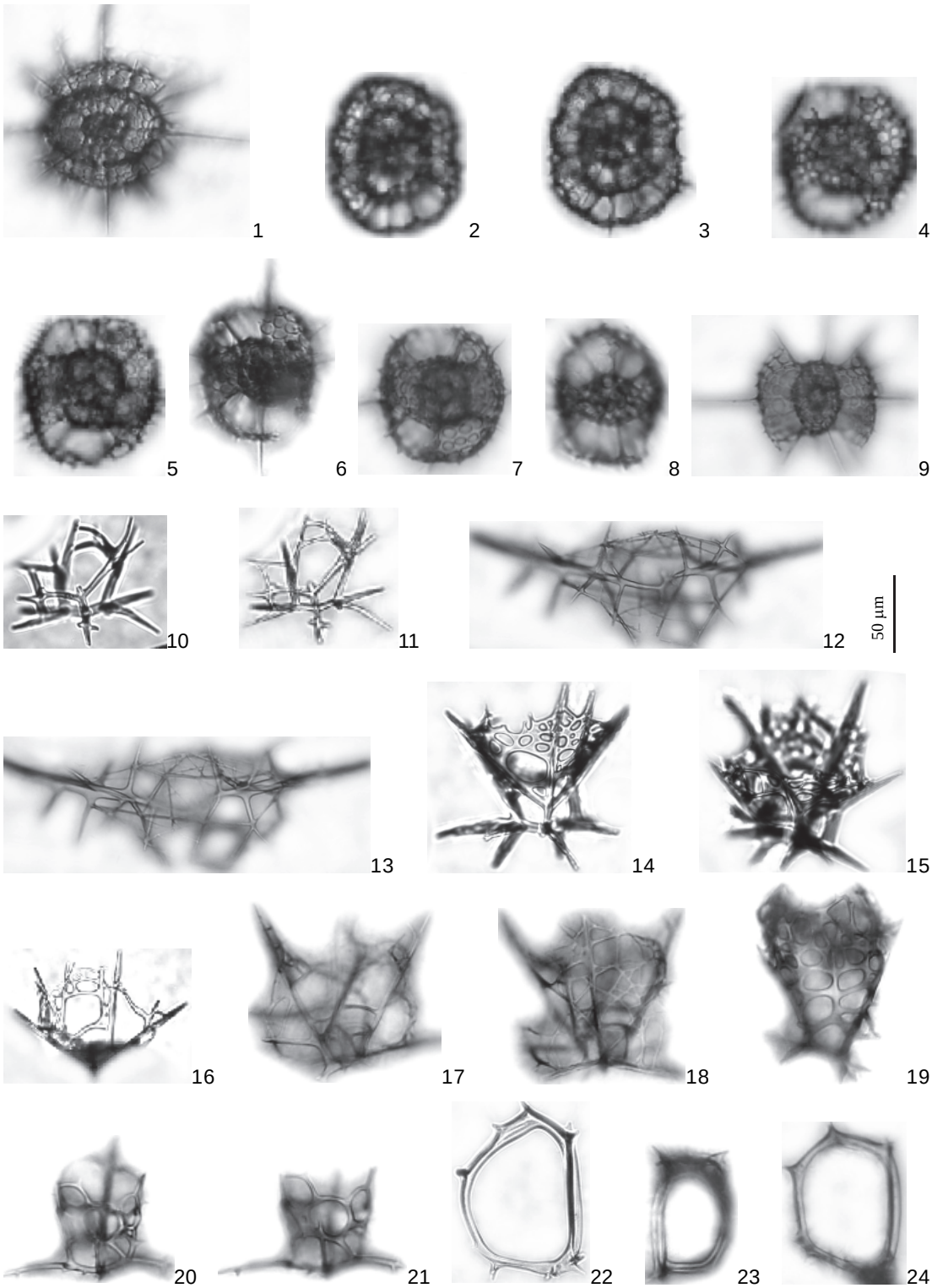


1–4. 螺石太阳虫 *Lithelius spiralis* Haeckel；5–8. 苍子石太阳虫 *Lithelius xanthiformis* Tan et Su；9–20. 石太阳虫（未定种）*Lithelius* sp.

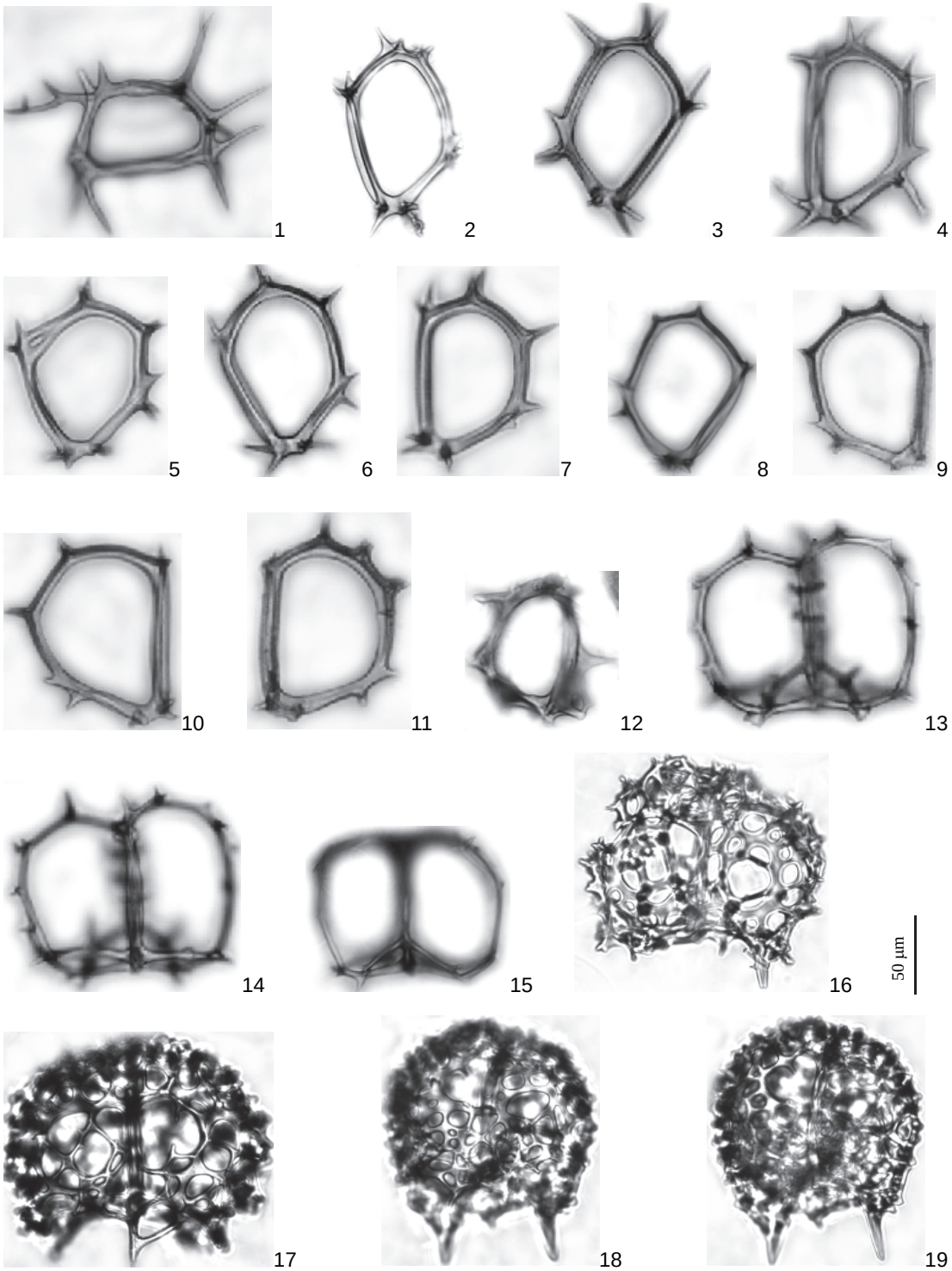


1–9. 多棘石果虫? *Lithocarpium polyacantha* (Campbell et Clark) group?；10–17. 转棘旋壳虫 *Streblacantha circumyexta* (Jørgensen)；18, 19. 圆球棘旋壳虫（新种）*Streblacantha globolata* sp. nov.

图版 52

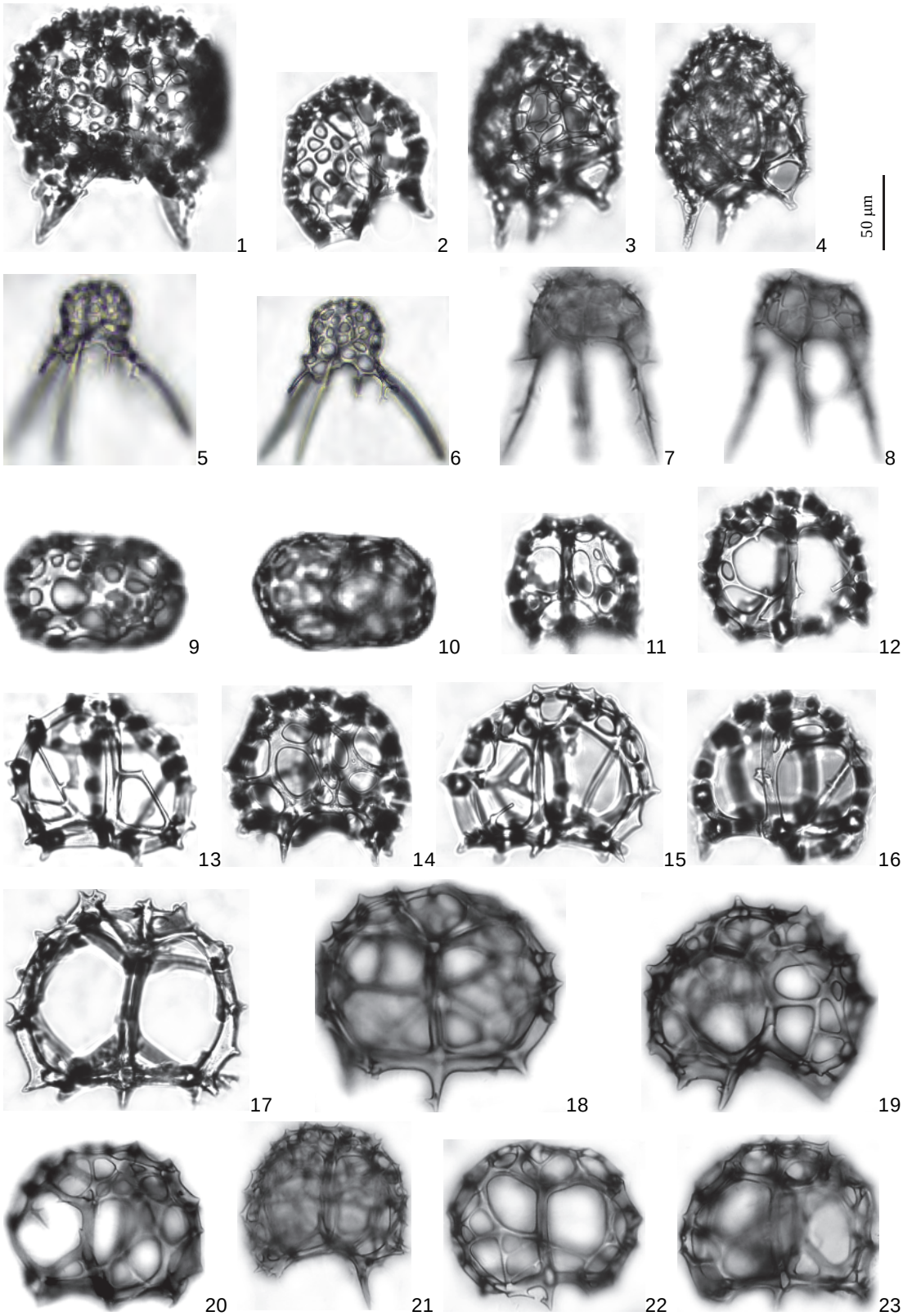


1–5. 多枝艇虫 *Phorticium polycladum* Tan et Tchang；6–9. 艇虫 *Phorticium pylonium* Haeckel；10, 11. 三棘编网虫 *Plectophora triacantha* Popofsky；12, 13. 帷巽编虫 *Plectaniscus cortiniscus* Haeckel；14–16. 悬柳棘编虫 *Plectacantha cremastoplegma* Nigrini；17–21. 房棘编虫 *Plectacantha oikiskos* Jørgensen；22–24. 小棘轮环虫 *Zygocircus acanthophorus* Popofsky

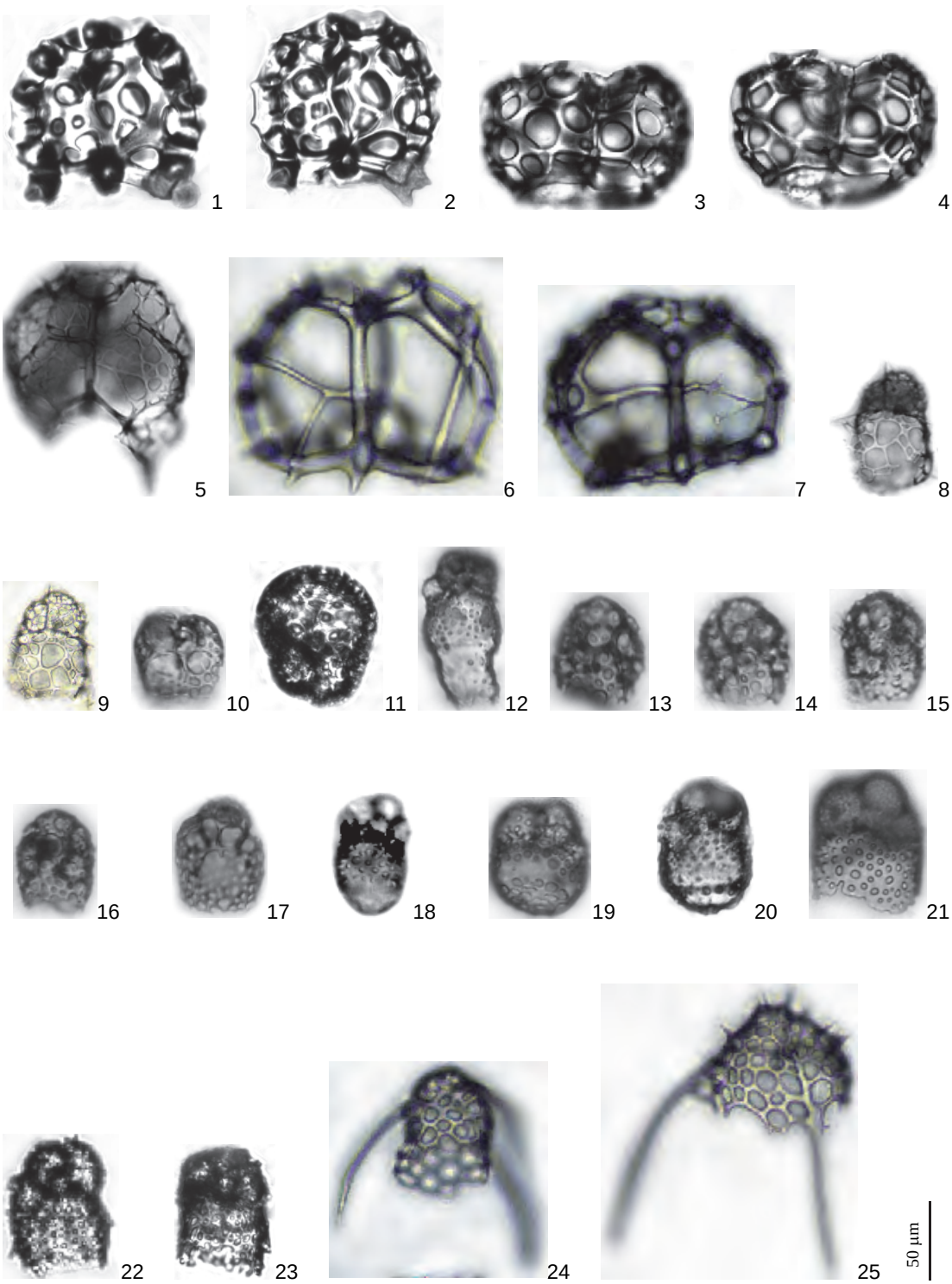


1. 长棘轮环虫 *Zygocircus longispinus* Tan et Tchang；2–7. 鱼尾轮环虫 *Zygocircus piscicaudatus* Popofsky；8–11. 轮环虫 *Zygocircus productus* (Hertwig)；12. 三棱轮环虫 *Zygocircus triquetrus* Haeckel；13–15. 角鹿篮虫 *Giraffospyris angulate* (Haeckel)；16–19. 白令三柱篓虫（新种）*Tristylospyris beringensis* sp. nov.

图版 54

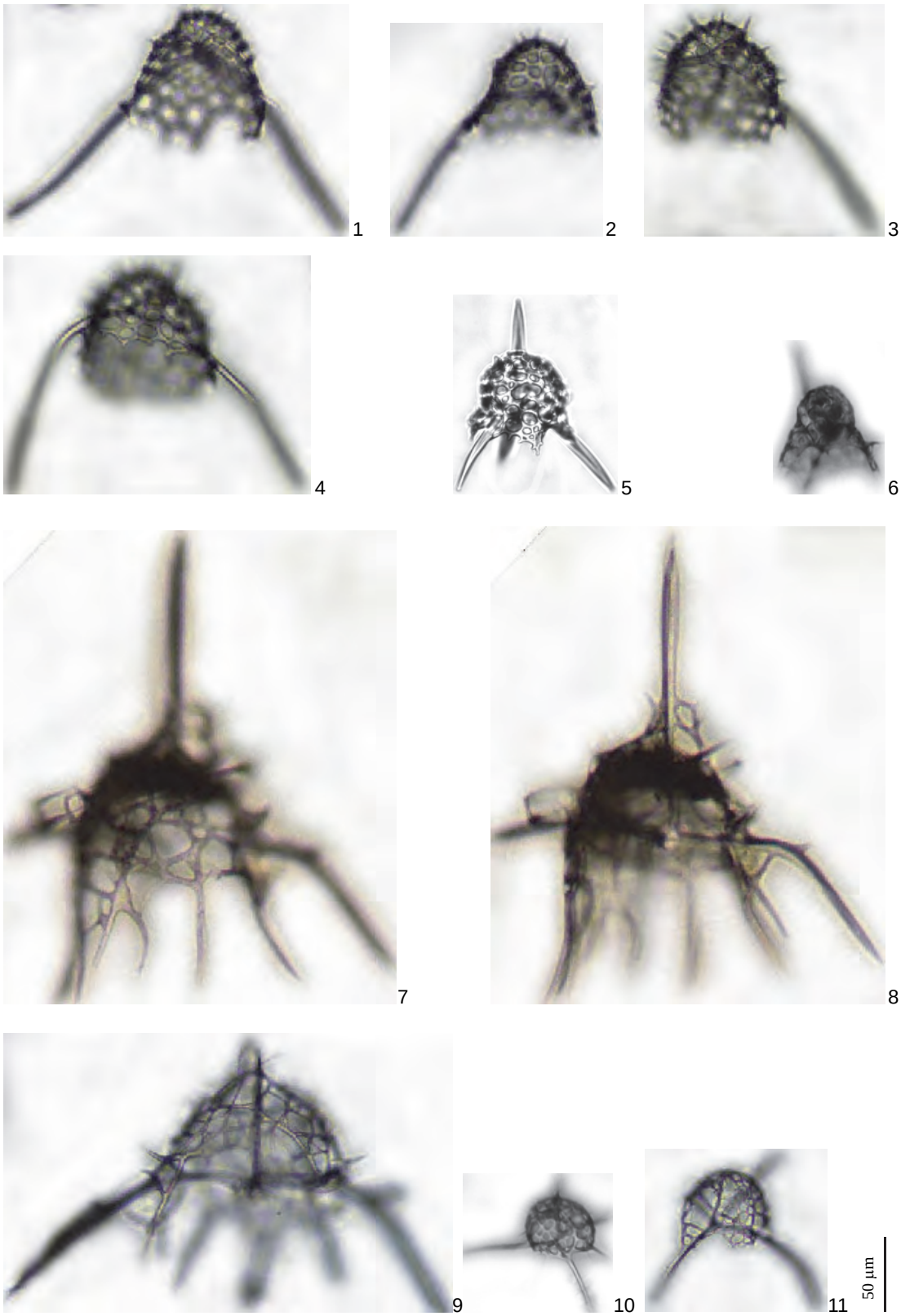


1–4. 白令三柱篓虫（新种）*Tristylospyris beringensis* sp. nov.；5, 6. 三柱篓虫 *Tristylospyris triceros* (Ehrenberg)；7, 8. 三柱篓虫（未定种）*Tristylospyris* sp.；9, 10. 脊篮虫（未定种）*Liriospyris* sp.；11–23. 北方角蜡虫 *Ceratospyris borealis* Bailey

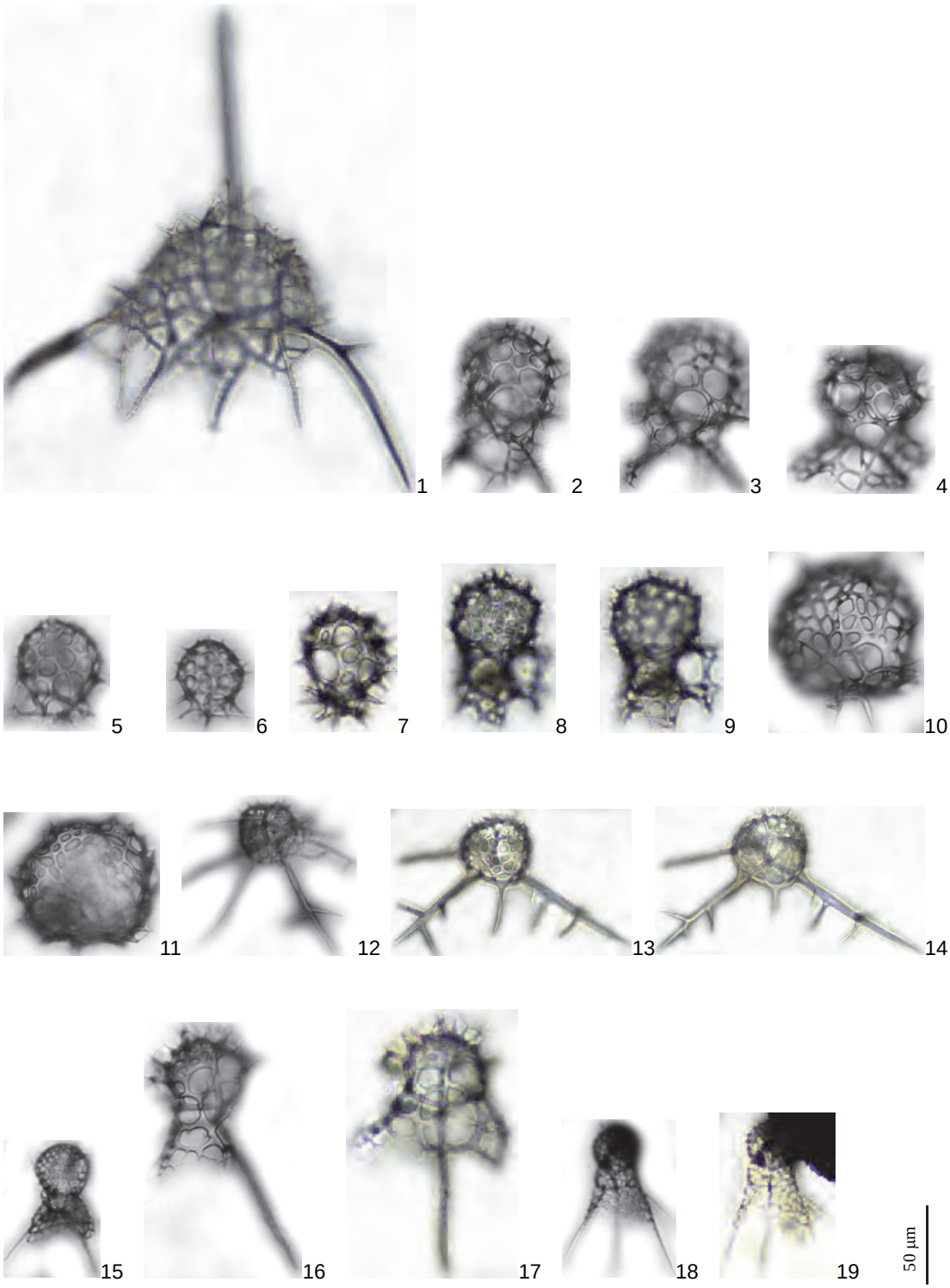


1, 2. 鬃盔篮虫榄亚种 *Corythospyris jubata sverdrupi* Goll et Bjørklund；3, 4. 盔篮虫（未定种）*Corythospyris* sp.；5–7. 鹅角篮虫 *Lophospyris cheni* Goll；8, 9. 疑蜂虫（未定种）*Amphimelissa* sp.；10. 双头虫（未定种）*Bisphaerocephalus* sp.；11. 五叶袋葡萄虫 *Botryopera quinqueloba* Haeckel；12. 石葡萄篮虫 *Botryocyrtis lithobotrys* Ehrenberg；13–17. 五葡萄篮虫 *Botryocyrtis quinaria* Ehrenberg；18–23. 棘葡萄门虫 *Botryopyle setosa* Cleve；24. 直翼原帽虫 *Archipilium orthopterum* Haeckel；25. 谭氏原帽虫（新种）*Archipilium tanorium* sp. nov.

图版 56

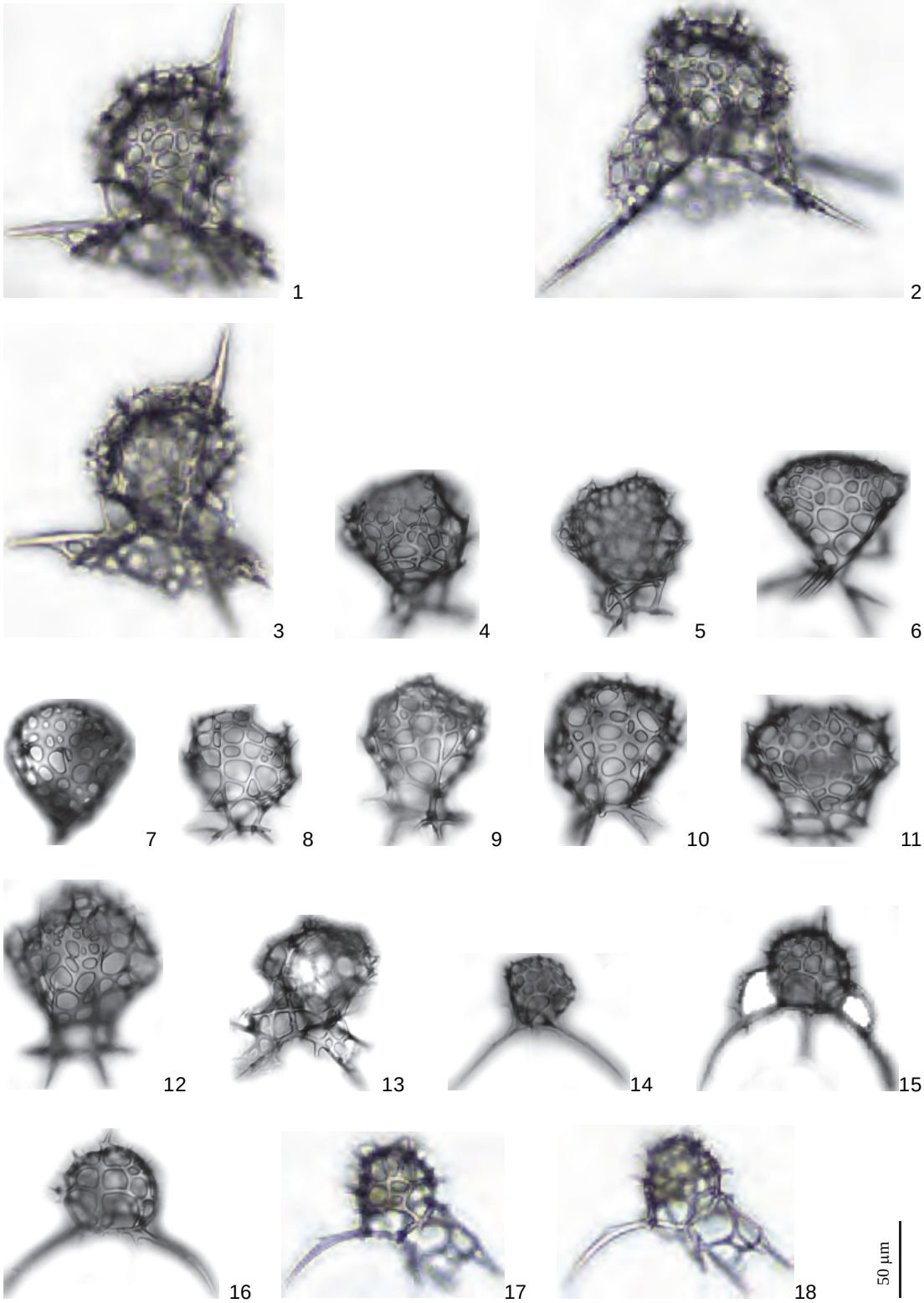


1–4. 谭氏原帽虫（新种）*Archipilium tanorium* sp. nov.；5. 三帽虫（未定种）*Tripilidium* sp.；6. 三脚虫?（未定种）*Tripodiscium* sp.?；7–9. 箭形美帐虫（新种）*Euscenium sagittarium* sp. nov.；10, 11. 三胸美帐虫 *Euscenium tricolpium* Haeckel

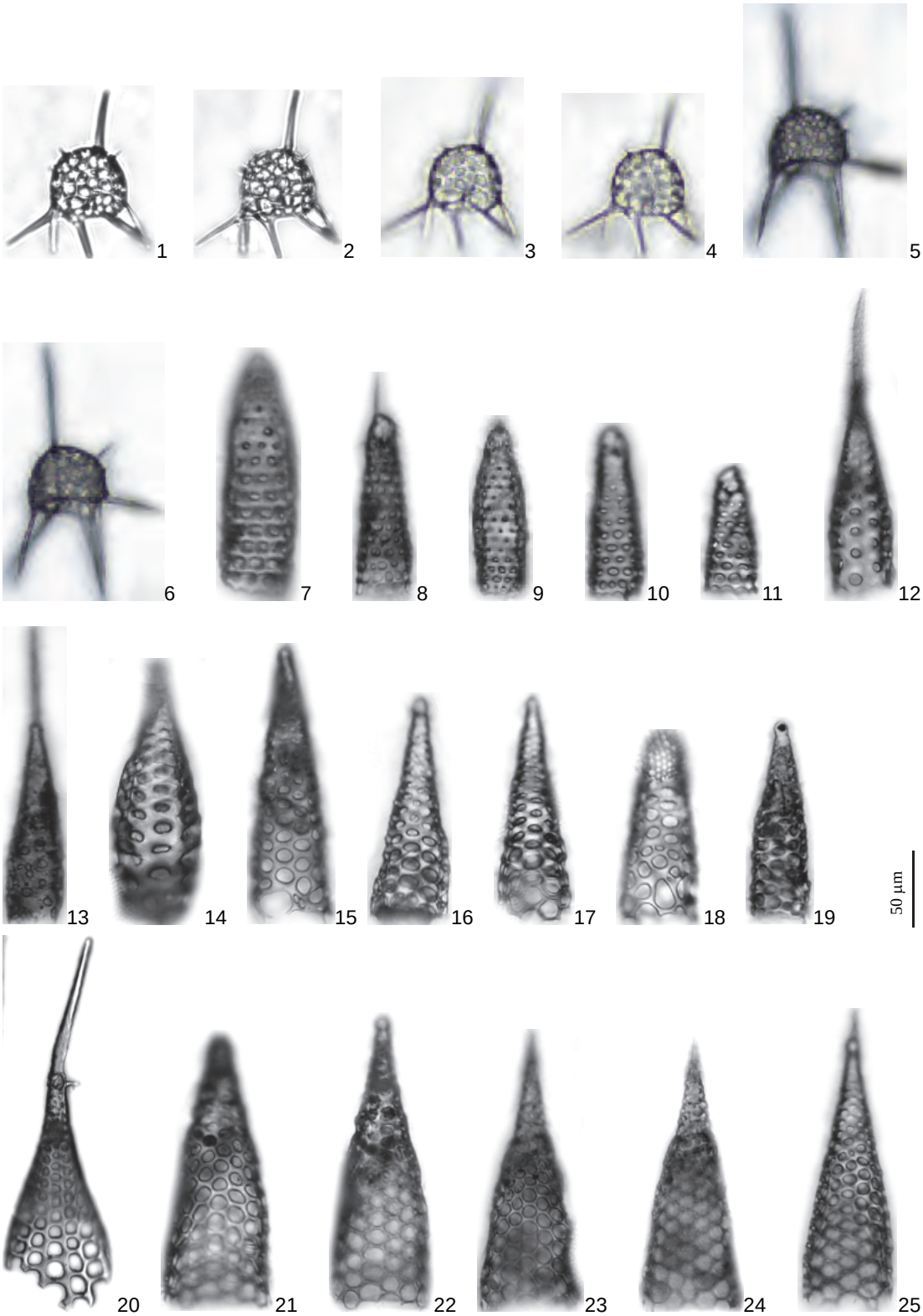


1. 箭形美帐虫（新种）*Euscenium sagittarium* sp. nov.；2–9. 长棘小袋虫 *Peridium longispinum* Jørgensen；10, 11. 小袋虫（未定种 1）*Peridium* sp. 1；12–14. 小袋虫（未定种 2）*Peridium* sp. 2；15. 小袋虫（未定种 3）*Peridium* sp. 3；16, 17. 小袋虫（未定种 4）*Peridium* sp. 4；18, 19. 小袋虫（未定种 5）*Peridium* sp. 5

图版 58

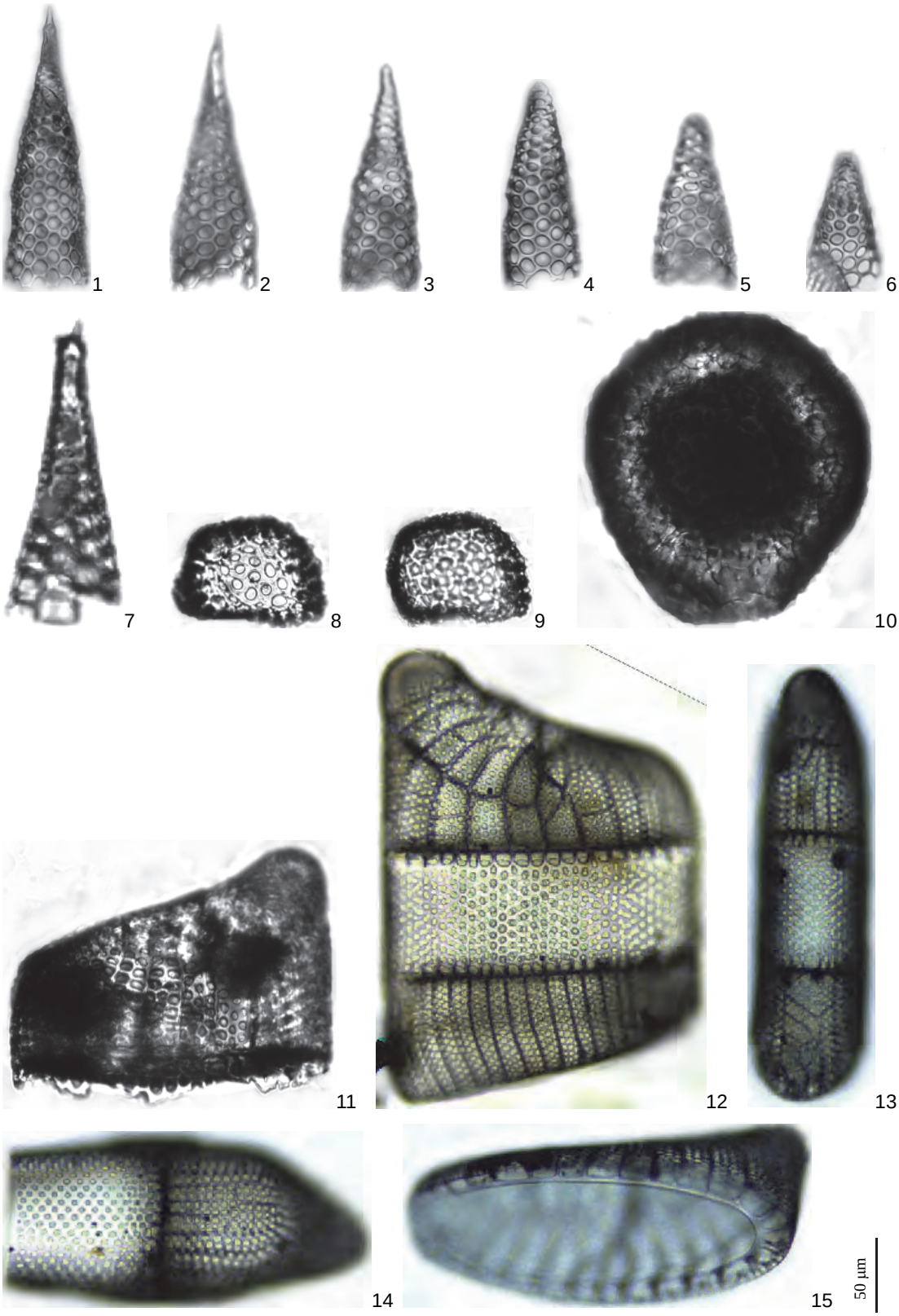


1–3. 小袋虫（未定种 6）*Peridium* sp. 6；4–13. 双肋袋虫 *Archipera dipleura* Tan et Tchang；14–18. 六角袋虫 *Archipera hexacantha* Popofsky

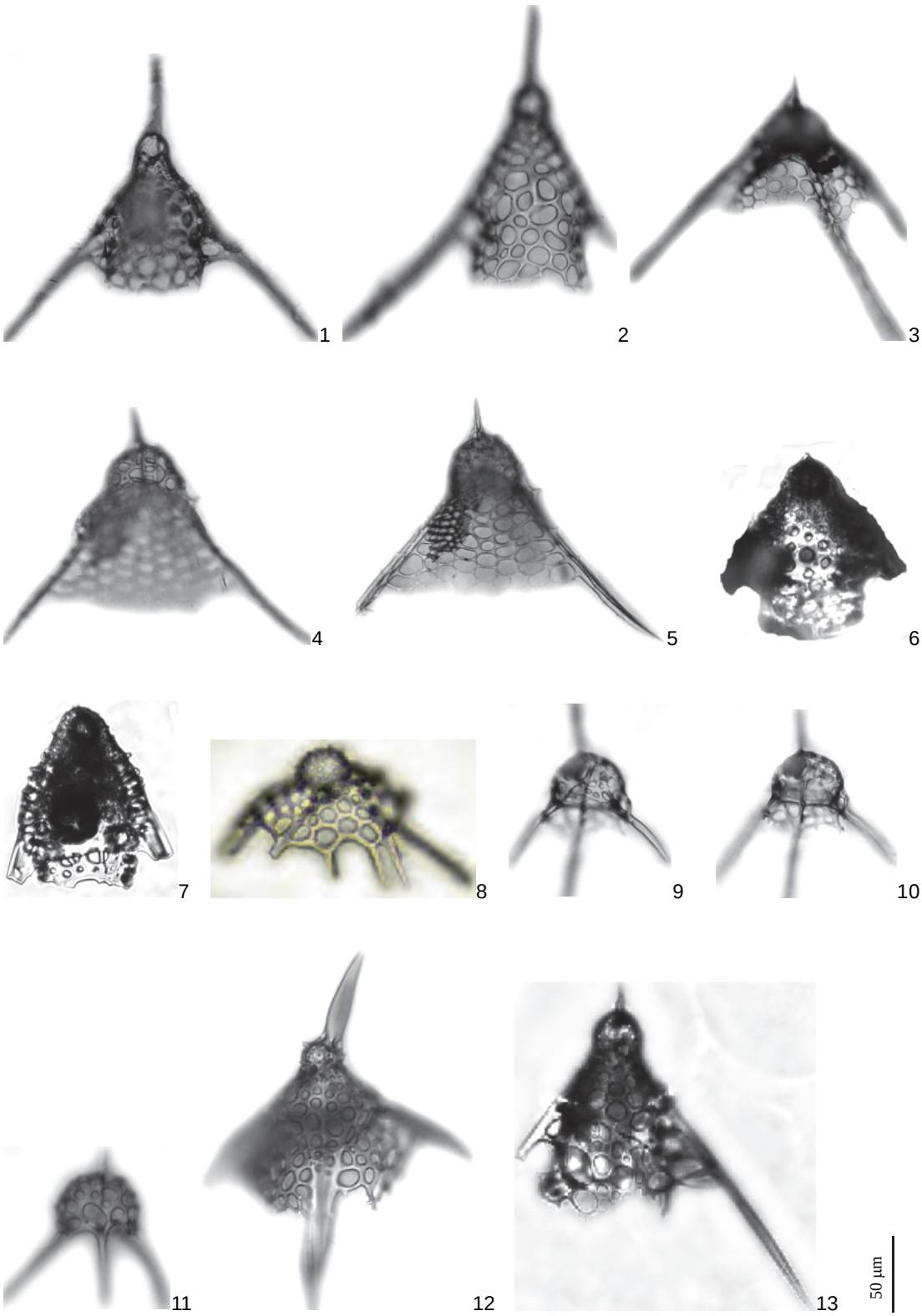


1–4. 五棒显甕虫（新种）*Calpophaena pentarrhabda* sp. nov.；5, 6. 显甕虫（未定种）*Calpophaena* sp.；7–11. 环小角虫 *Cornutella annulata* Bailey；12–14. 双缘小角虫 *Cornutella bimarginata* Haeckel；15–19. 棒小角虫 *Cornutella clava* Petrushevskaya et Kozlova；20. 六角小角虫 *Cornutella hexagona* Haeckel；21–25. 深小角虫 *Cornutella profunda* Ehrenberg

图版 60

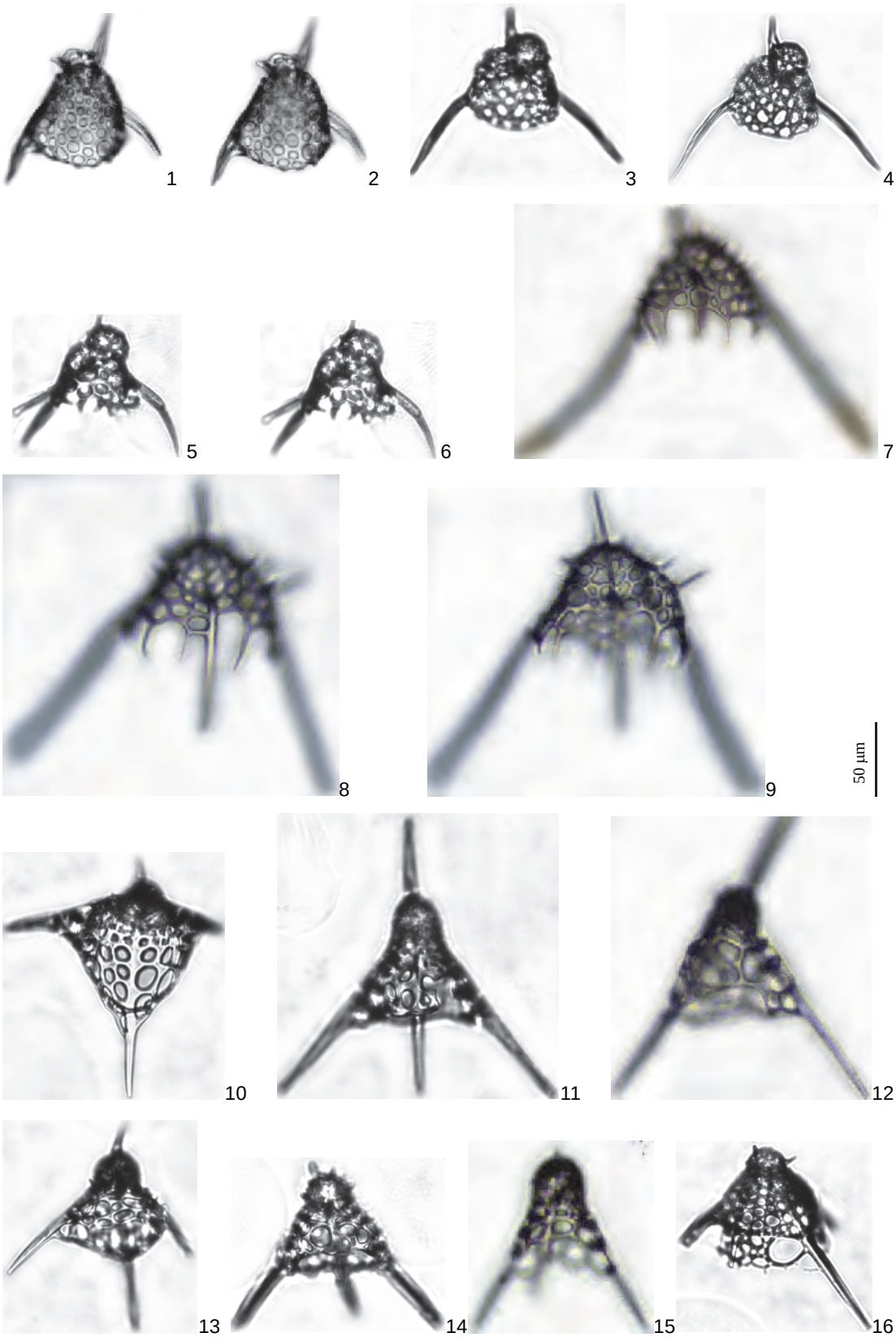


1–6. 深小角虫 *Cornutella profunda* Ehrenberg；7. 杖小角虫 *Cornutella stiligera* Ehrenberg；8, 9. 钝蓝壶虫 *Cyrtocalpis obtusai* Ruest；10. 蓝壶虫（未定种 1）*Cyrtocalpis* sp. 1；11–15. 蓝壶虫（未定种 2）*Cyrtocalpis* sp. 2

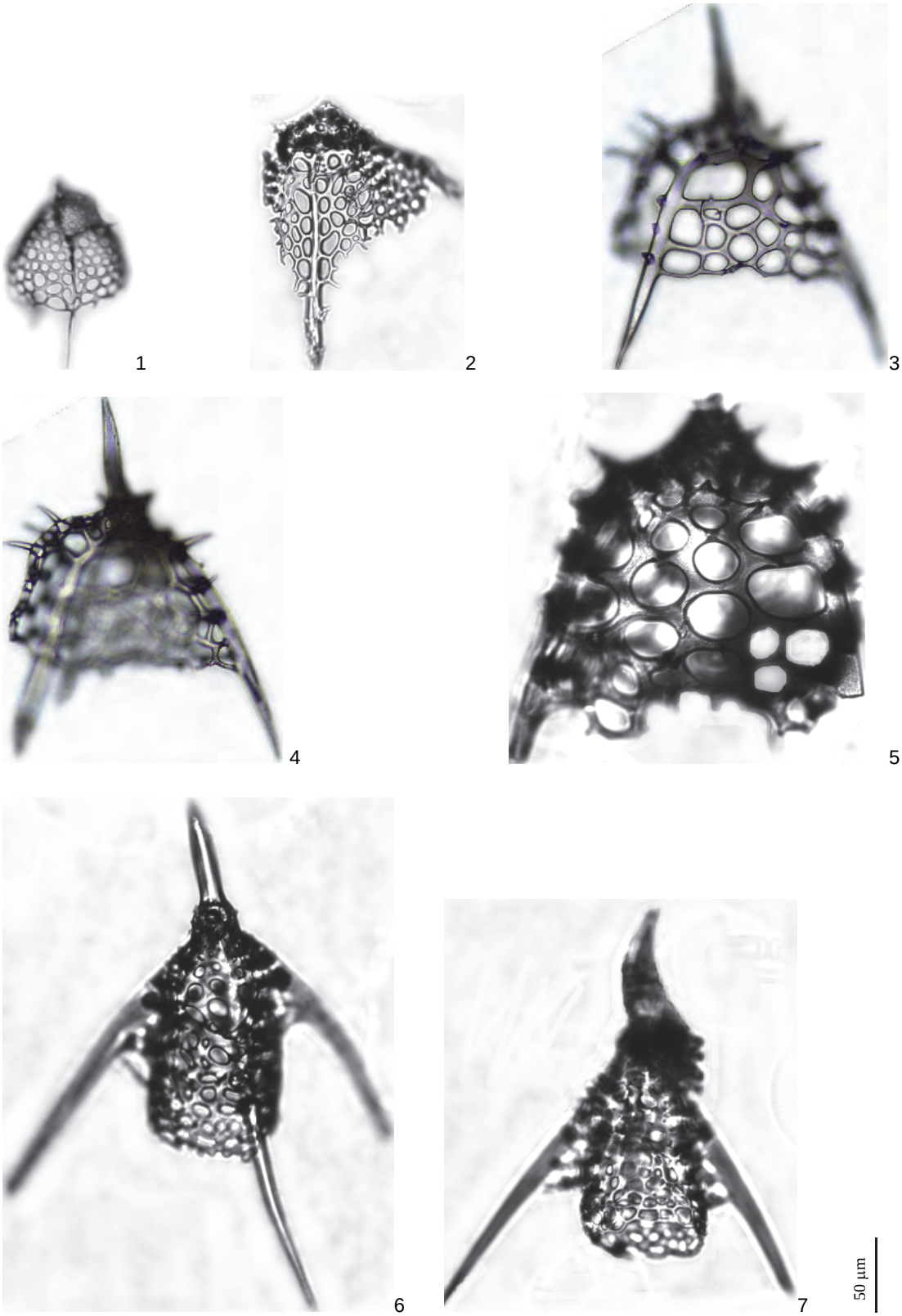


1, 2. 中肋网杯虫 *Dictyophimus archipilium* Petrushevskaya；3–5. 布朗网杯虫 *Dictyophimus brandtii* Haeckel；6, 7. 泡网杯虫 *Dictyophimus bullatus* Morley et Nigrini；8. 布斯里网杯虫 *Dictyophimus bütschlii* Haeckel；9–12. 可氏网杯虫 *Dictyophimus clevei* Jørgensen；13. 克莉丝网杯虫 *Dictyophimus crisiae* Ehrenberg

图版 62

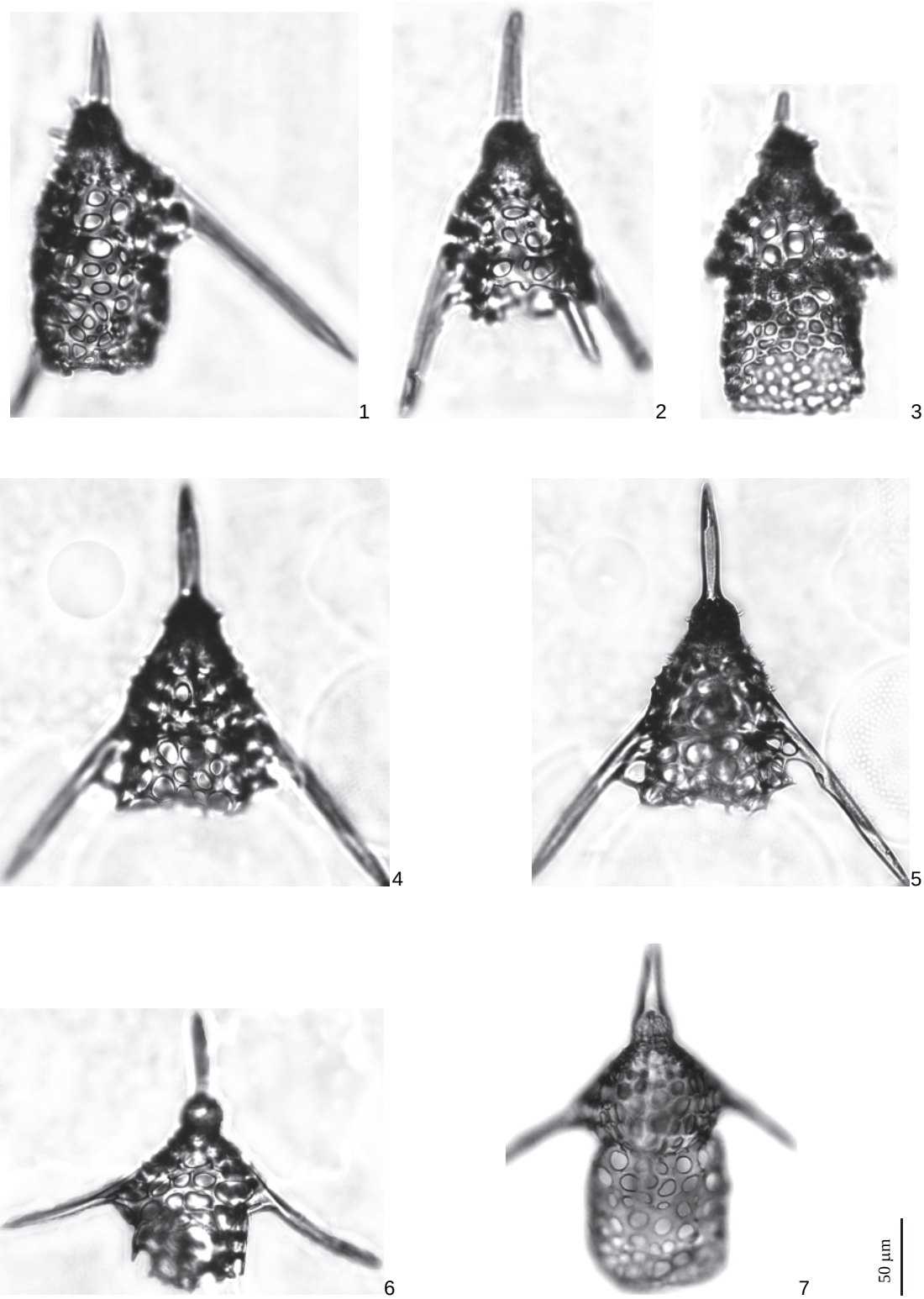


1–9. 细脂网杯虫 *Dictyophimus gracilipes* Bailey group；10–16. 燕网杯虫 *Dictyophimus hirundo* (Haeckel) group

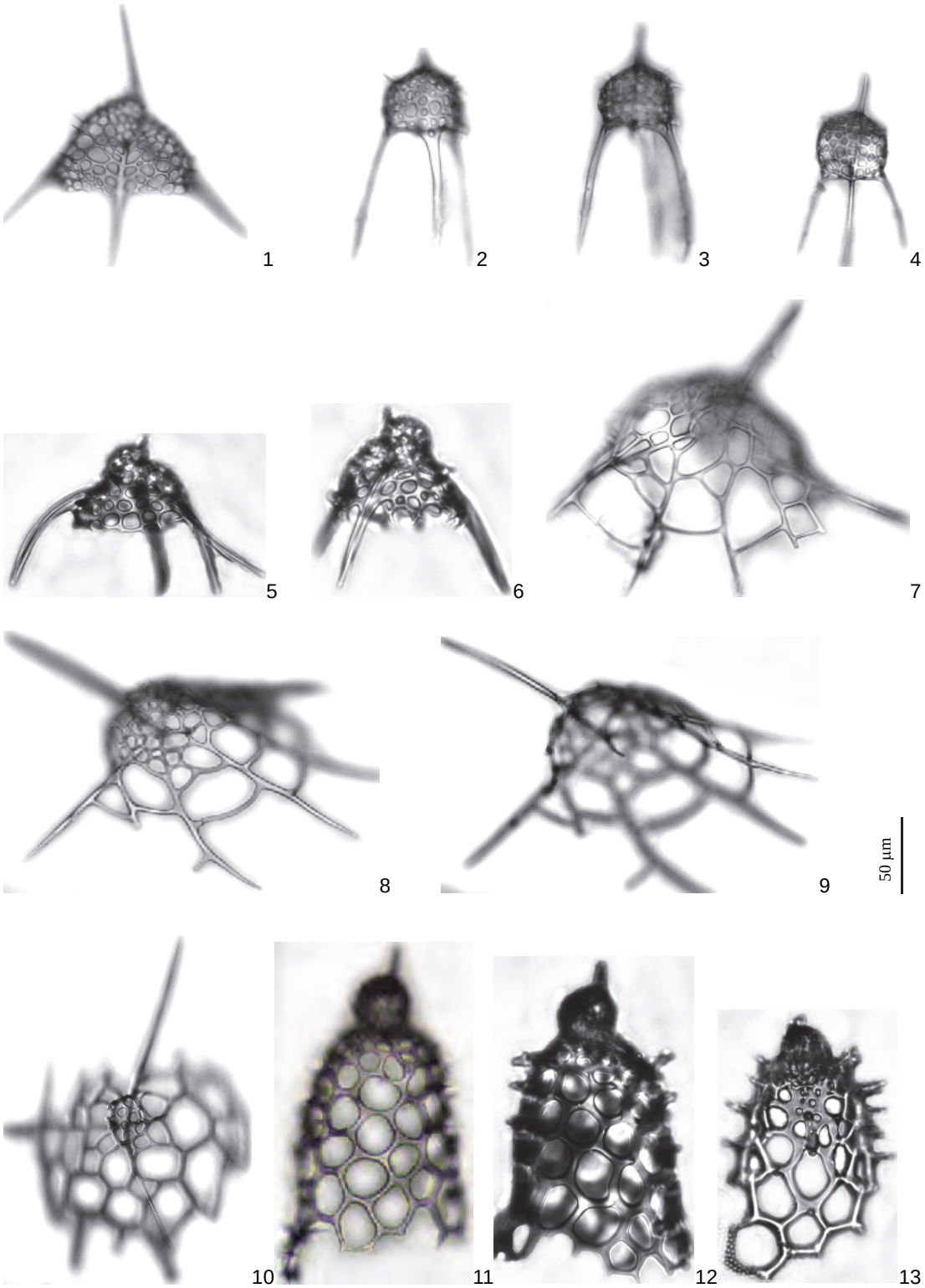


1. 伊斯网杯虫 *Dictyophimus histricosus* Jørgensen；2. 宽头网杯虫 *Dictyophimus platycephalus* Haeckel；3–5. 碗网杯虫 *Dictyophimus pocillum* Ehrenberg；6, 7. 稠脾网杯虫 *Dictyophimus splendens* (Campbell et Clark)

图版 64

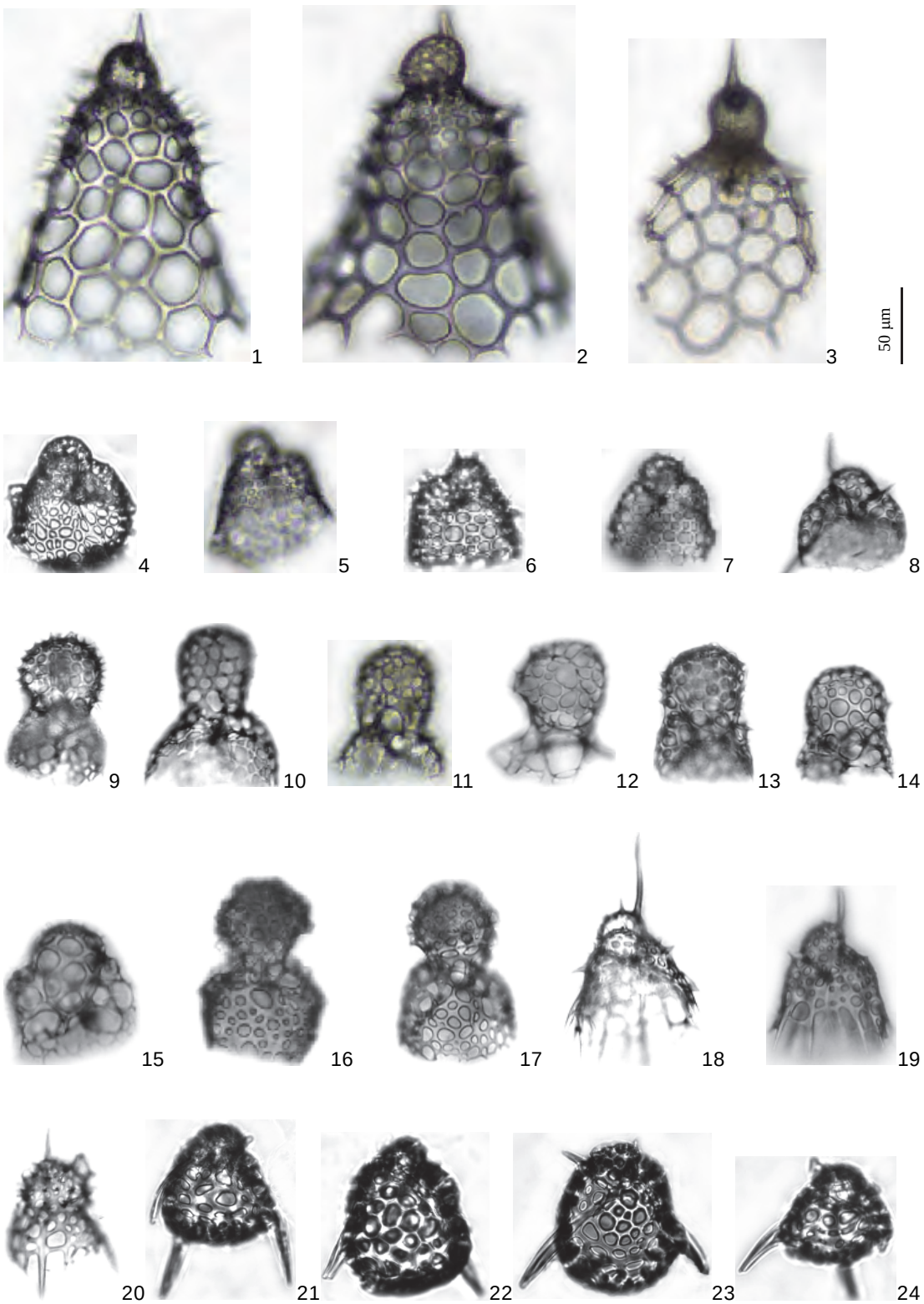


1–7. 稠脾网杯虫 *Dictyophimus splendens* (Campbell et Clark)

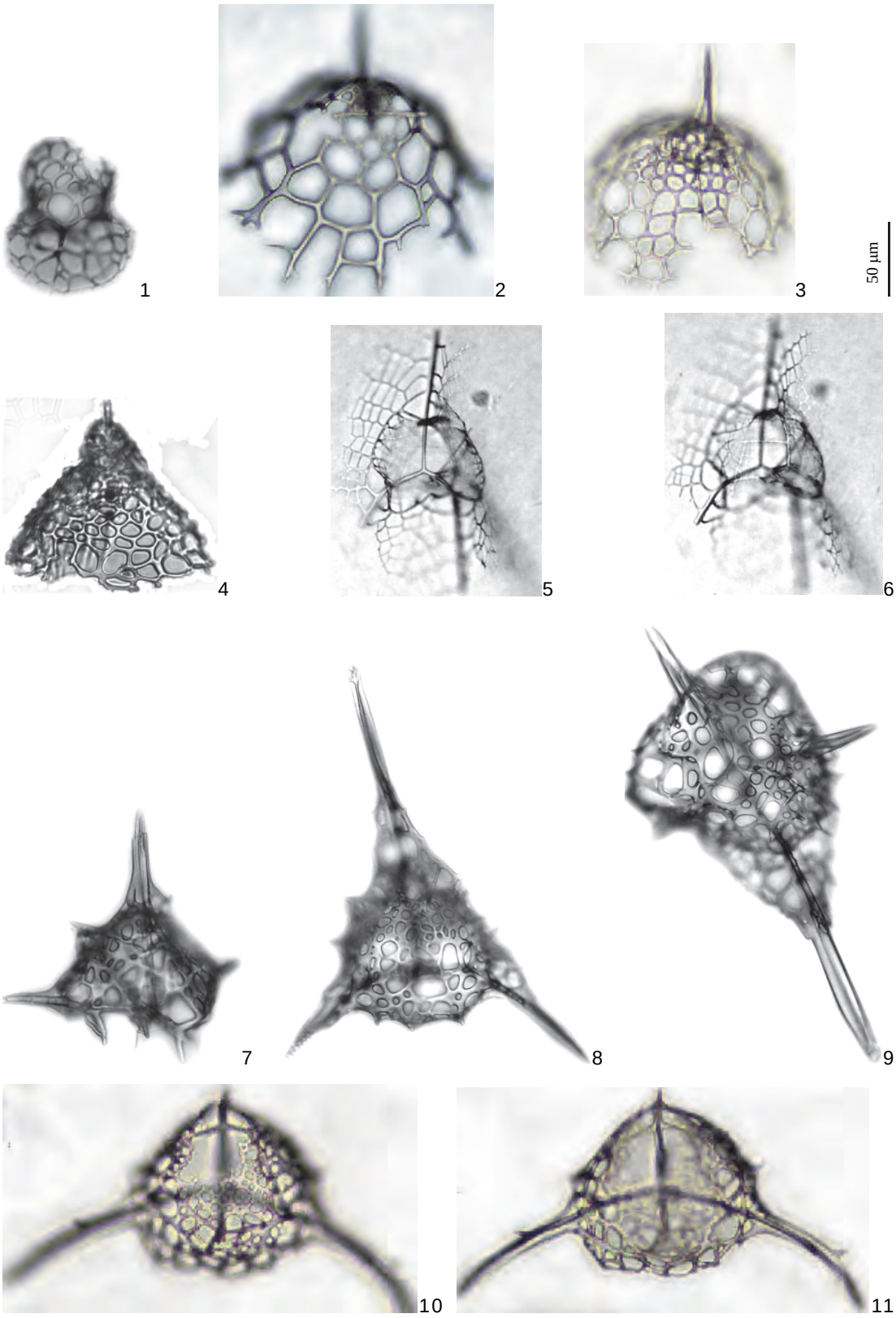


1. 四棘网杯虫 *Dictyophimus tetracanthus* Popofsky；2–4. 网杯虫（未定种 1）*Dictyophimus* sp. 1；5, 6. 网杯虫（未定种 2）*Dictyophimus* sp. 2；7–9. 明岸虫（未定种 1）*Lamprotripus* sp. 1；10. 明岸虫（未定种 2）*Lamprotripus* sp. 2；11–13. 钟石蜂虫 *Lithomelissa campanulaeformis* Campbell et Clark

图版 66

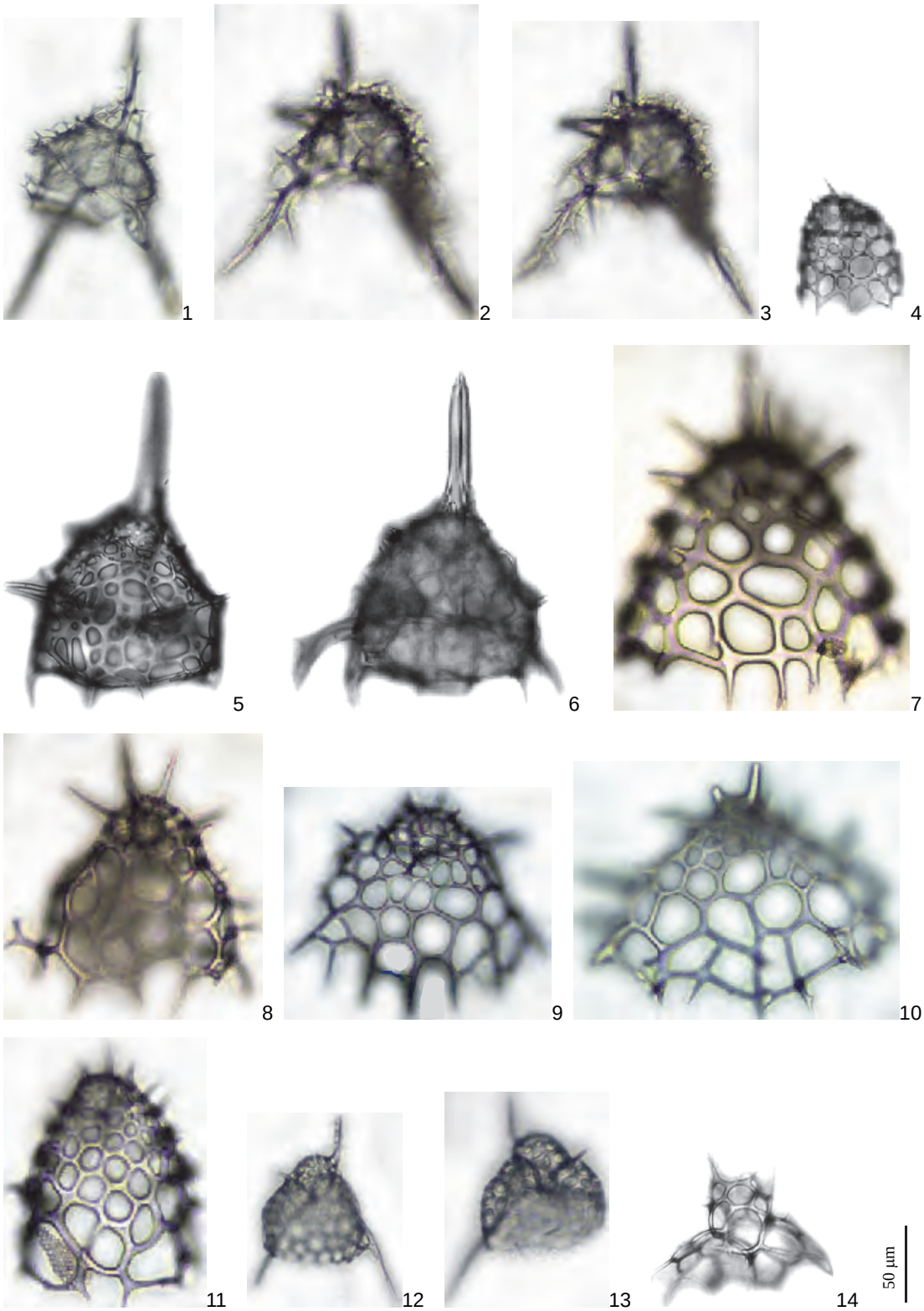


1–3. 钟石蜂虫 *Lithomelissa campanulaeformis* Campbell et Clark；4, 5. 豪猪石蜂虫 *Lithomelissa hystrix* Jørgensen；6–8. 棘刺石蜂虫 *Lithomelissa setosa* Jørgensen；9–14. 石蜂虫 *Lithomelissa thoracites* Haeckel；15. 石蜂虫（未定种 1）*Lithomelissa* sp. 1；16, 17. 石蜂虫（未定种 2）*Lithomelissa* sp. 2；18–20. 石蜂虫（未定种 3）*Lithomelissa* sp. 3；21–24. 小瓜海绵蜂虫 *Spongomelissa cucumella* Sanfilippo et Riedel

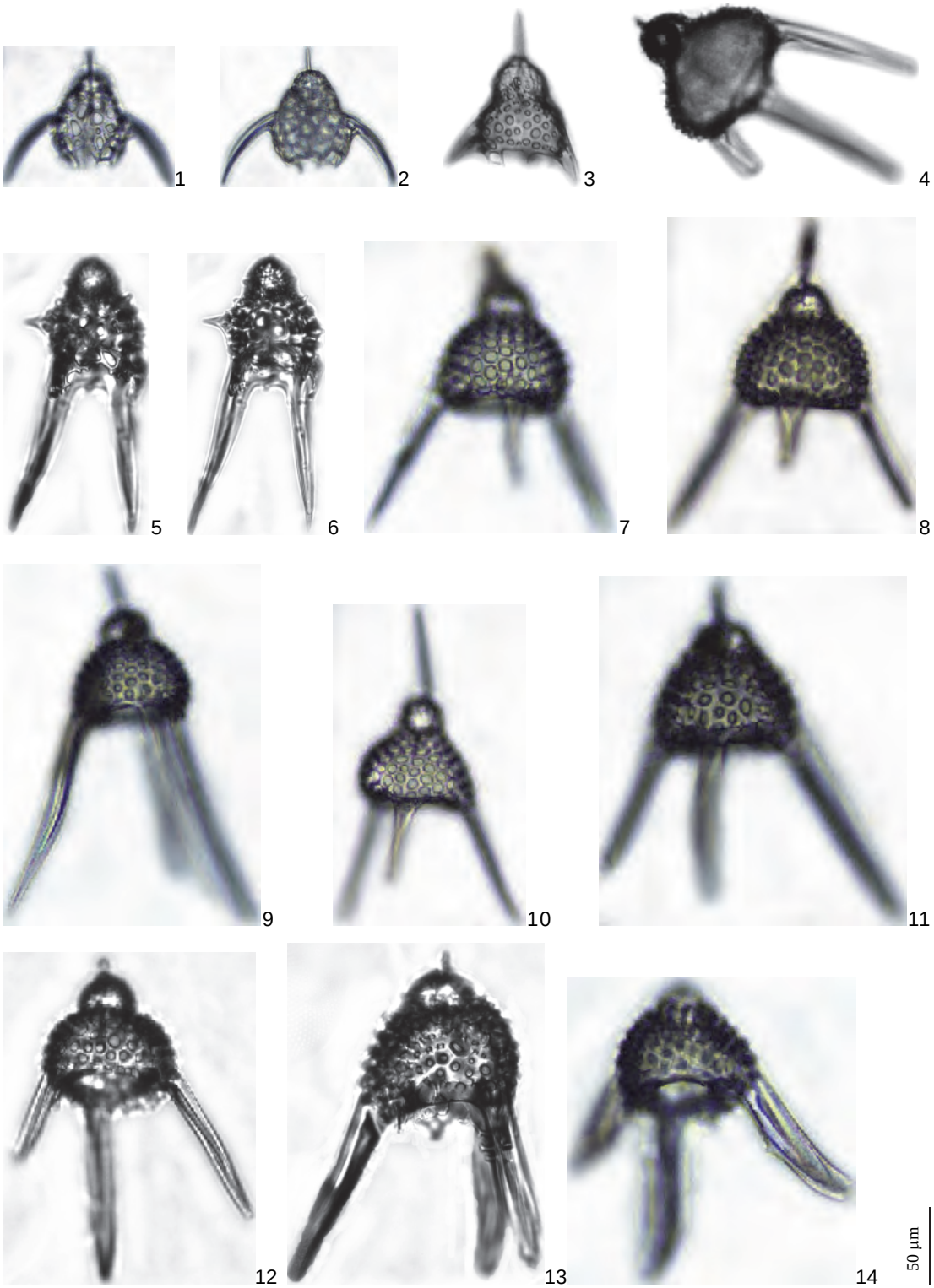


1. 围织美帽虫 *Lampromitra circumtexta* Popofsky；2–4. 美帽虫（未定种）*Lampromitra* sp.；5, 6. 巾帽虫（未定种）*Callimitra* sp.；7–11. 翼筐格帽虫 *Clathromitra pterophormis* Haeckel

图版 68

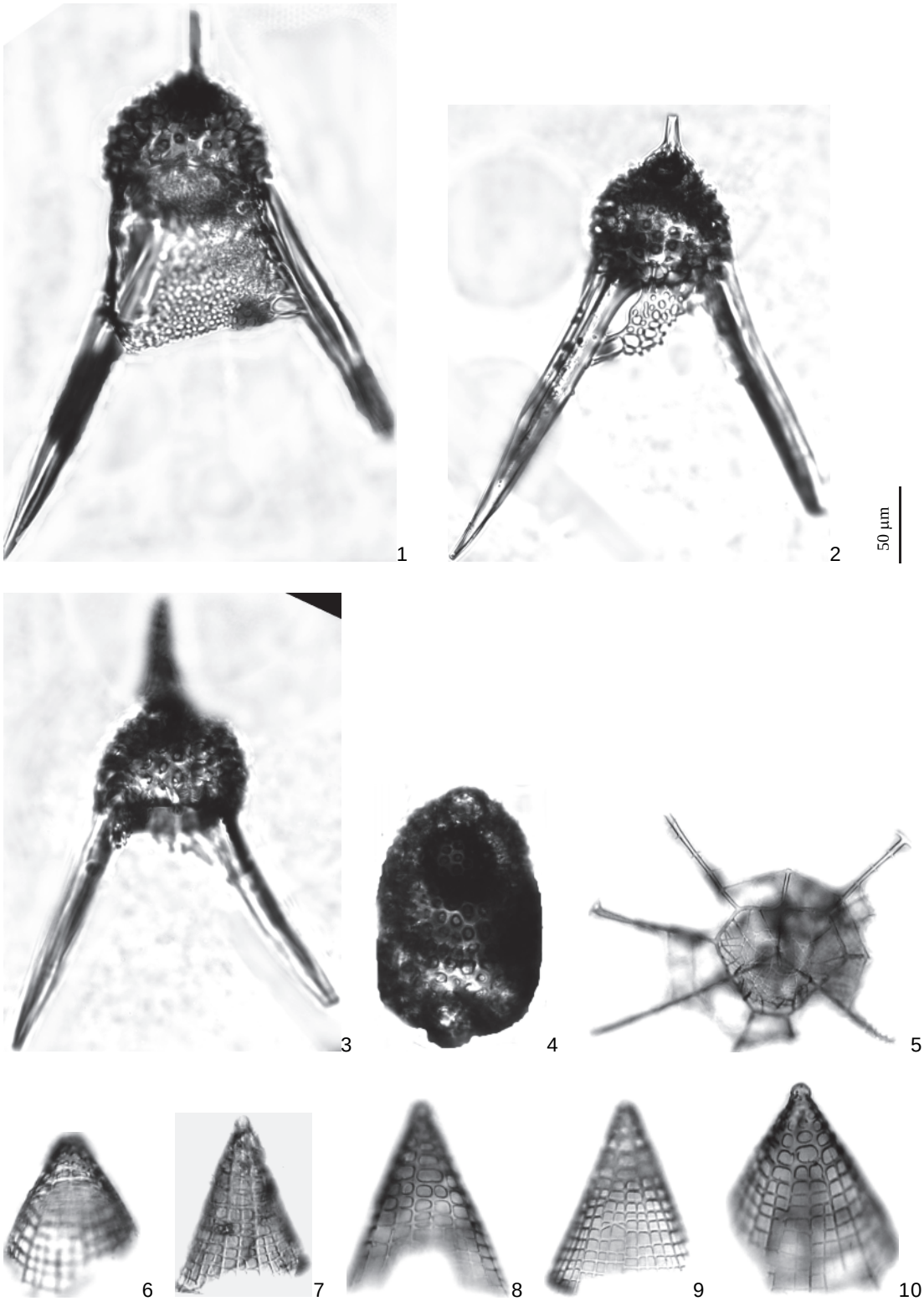


1–3. 格帽虫（未定种 1）*Clathromitra* sp. 1；5, 6. 格帽虫（未定种 2）*Clathromitra* sp. 2；4, 7–11. 笠虫 *Helotholus histricosa* Jørgensen；12, 13. 网灯虫 *Lychnodictyum challengeri* Haeckel；14. 顶口双孔编虫 *Amphiplecta acrostoma* Haeckel

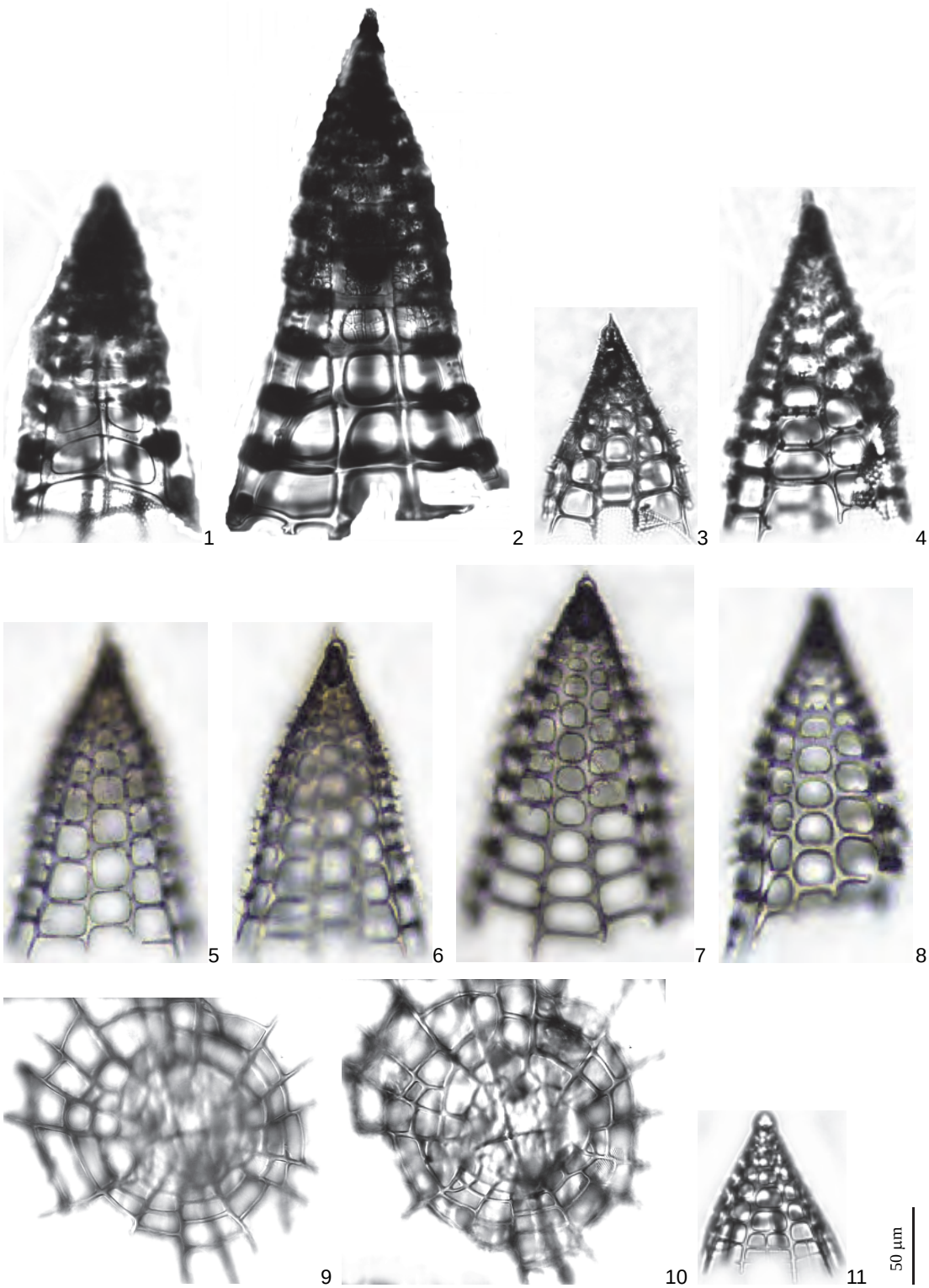


1, 2. 小鹰隐虫（新种）*Eucecryphalus penelopus* sp. nov.；3. 圆锥灯犬虫 *Lychnocanoma conica* (Clark et Campbell)；5, 6. 瘦小灯犬虫（新种）*Lychnocanoma gracilenta* sp. nov.；4, 7–11. 大灯犬虫 *Lychnocanoma grande* (Campbell et Clark) group；12–14. 日本灯犬虫萨恺亚种 *Lychnocanoma nipponica sakaii* Morley et Nigrini

图版 70

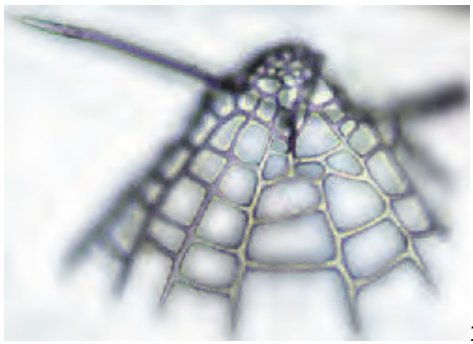


1, 2. 日本灯犬虫萨恺亚种 *Lychnocanoma nipponica sakaii* Morley et Nigrini；3. 日本灯犬虫大角亚种 *Lychnocanoma nipponica magnacornuta* Sakai；4. 新石囊虫 *Lithopera neotera* Sanfilippo et Riedel；5. 轮罩篮虫 *Sethophormis rotula* Haeckel；6–10. 多肋织锥虫 *Plectopyramis polypleura* Haeckel

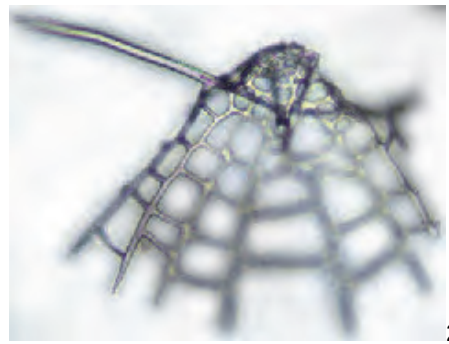


1. 方筛锥虫 *Sethopyramis quadrata* Haeckel；2. 十二眼织锥虫 *Plectopyramis dodecomma* Haeckel；3–8. 围裹锥虫 *Peripyramis circumtexta* Haeckel；9, 10. 间裂梯锥虫 *Bathropyramis interrupta* Haeckel；11. 伍德口梯锥虫 *Bathropyramis* (*Acropyramis*) *woodringi* Campbell et Clark

图版 72



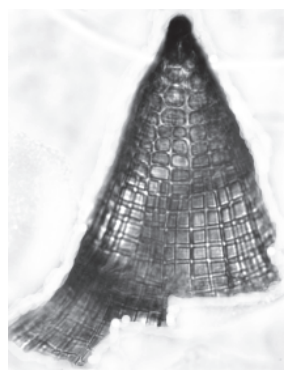
1



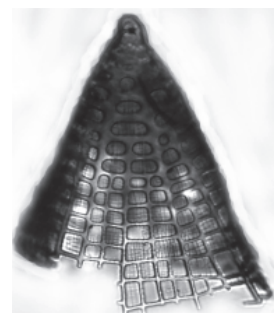
2

50 μm

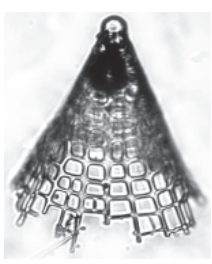
3



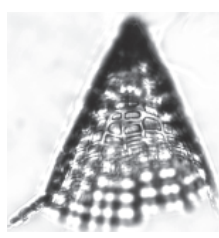
4



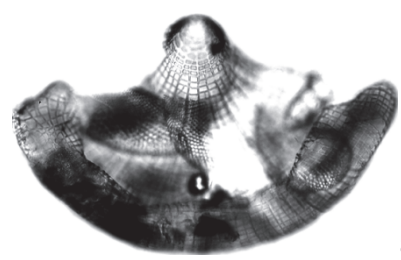
5



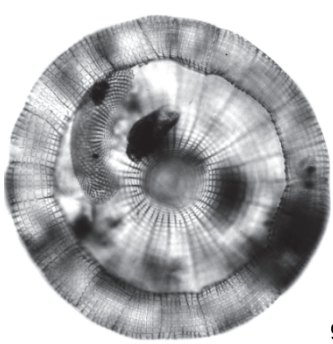
6



7



8



9

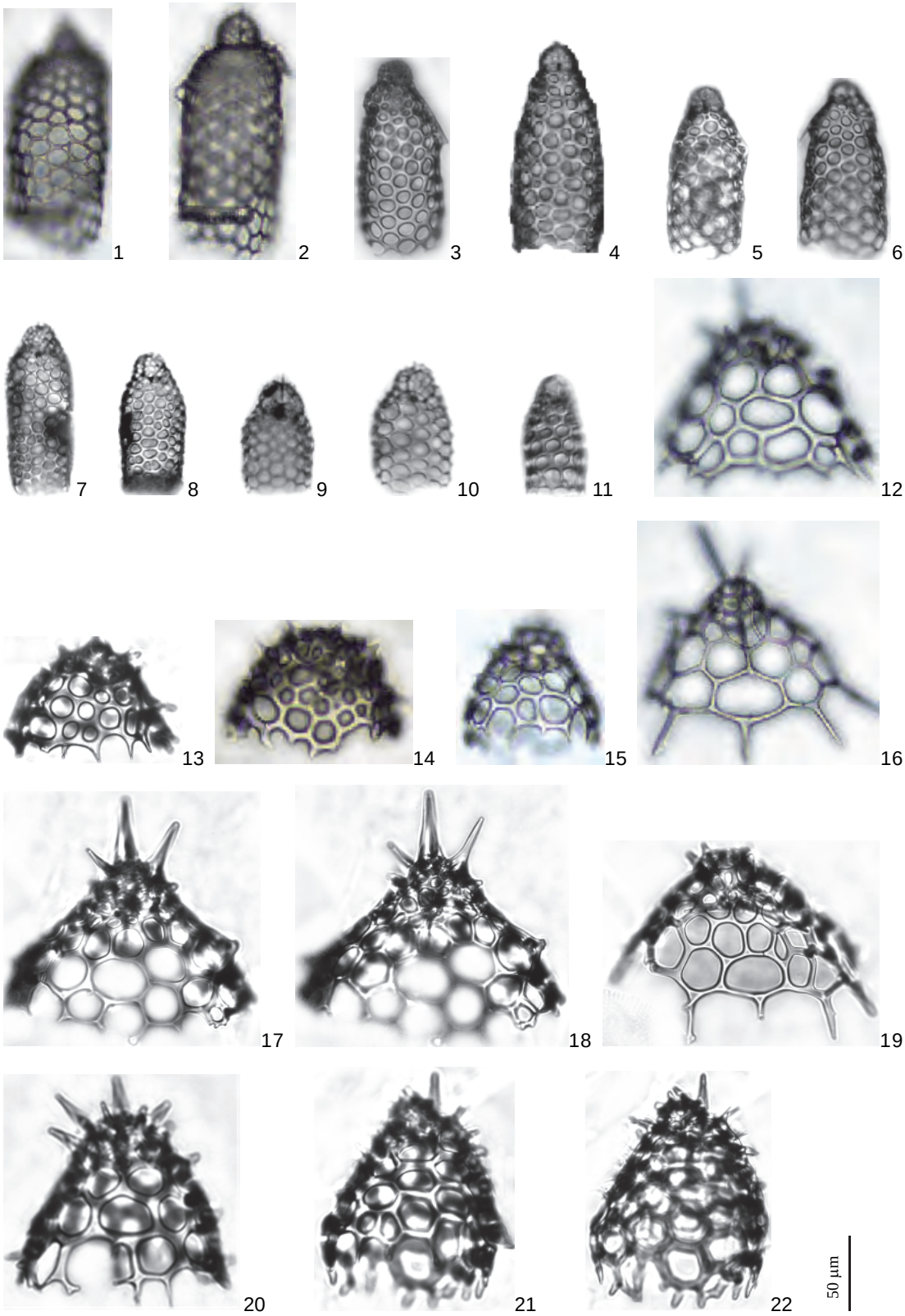
10

11

12

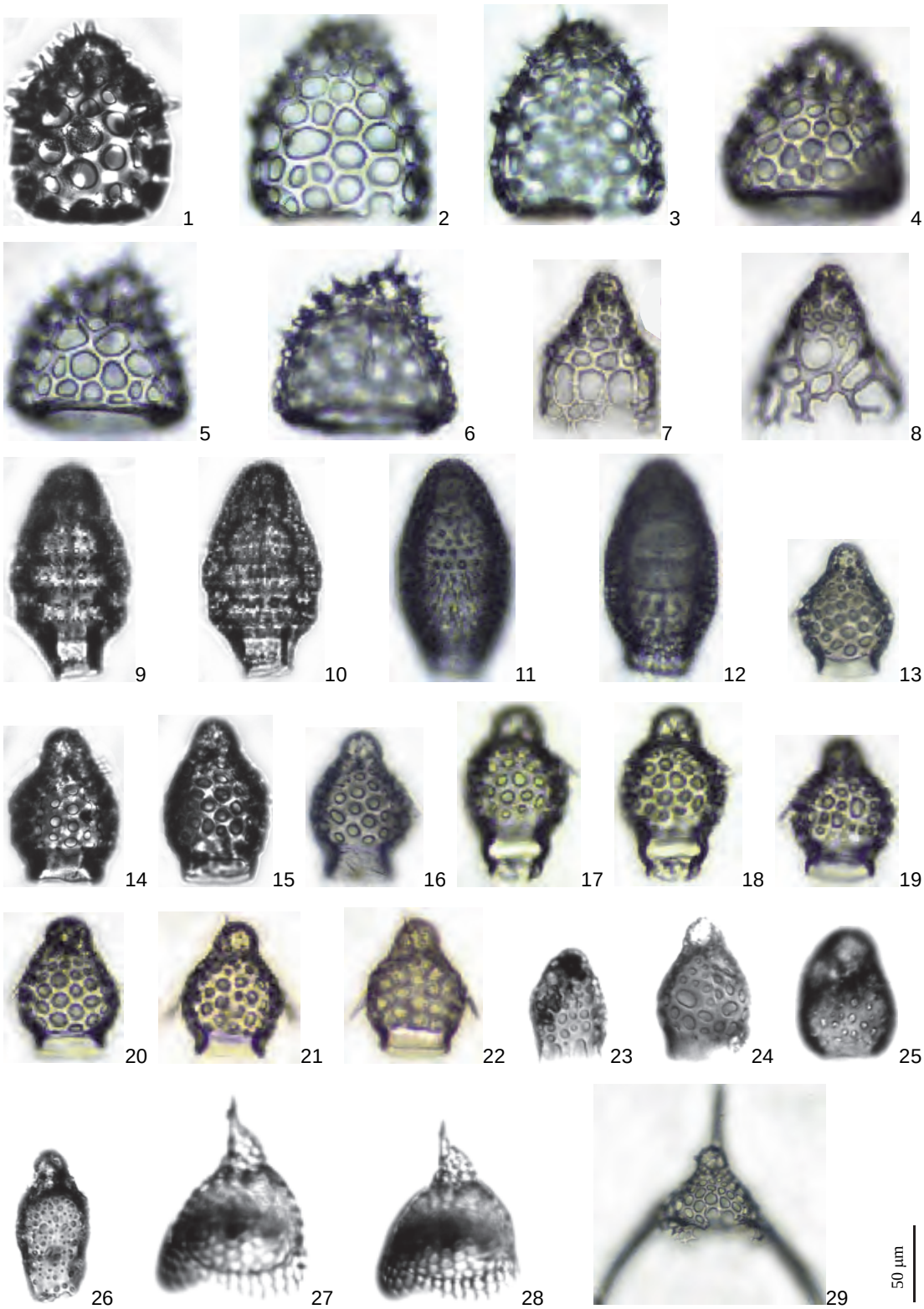
13

1, 2. 梯锥虫（未定种） *Bathropyramis* sp.；3. 大格锥虫 *Cinclopyramis gigantea* Haecker；4–7. 格锥虫（未定种）*Cinclopyramis* sp.；8, 9. 帐篷石网虫? *Litharachnium tentorium* Haeckel？；10, 11. 佐贞筛圆锥虫 *Sethoconus joergenseni* (Petrushevskaya)；12, 13. 四孔筛圆锥虫 *Sethoconus quadriporus* (Bjorklund)

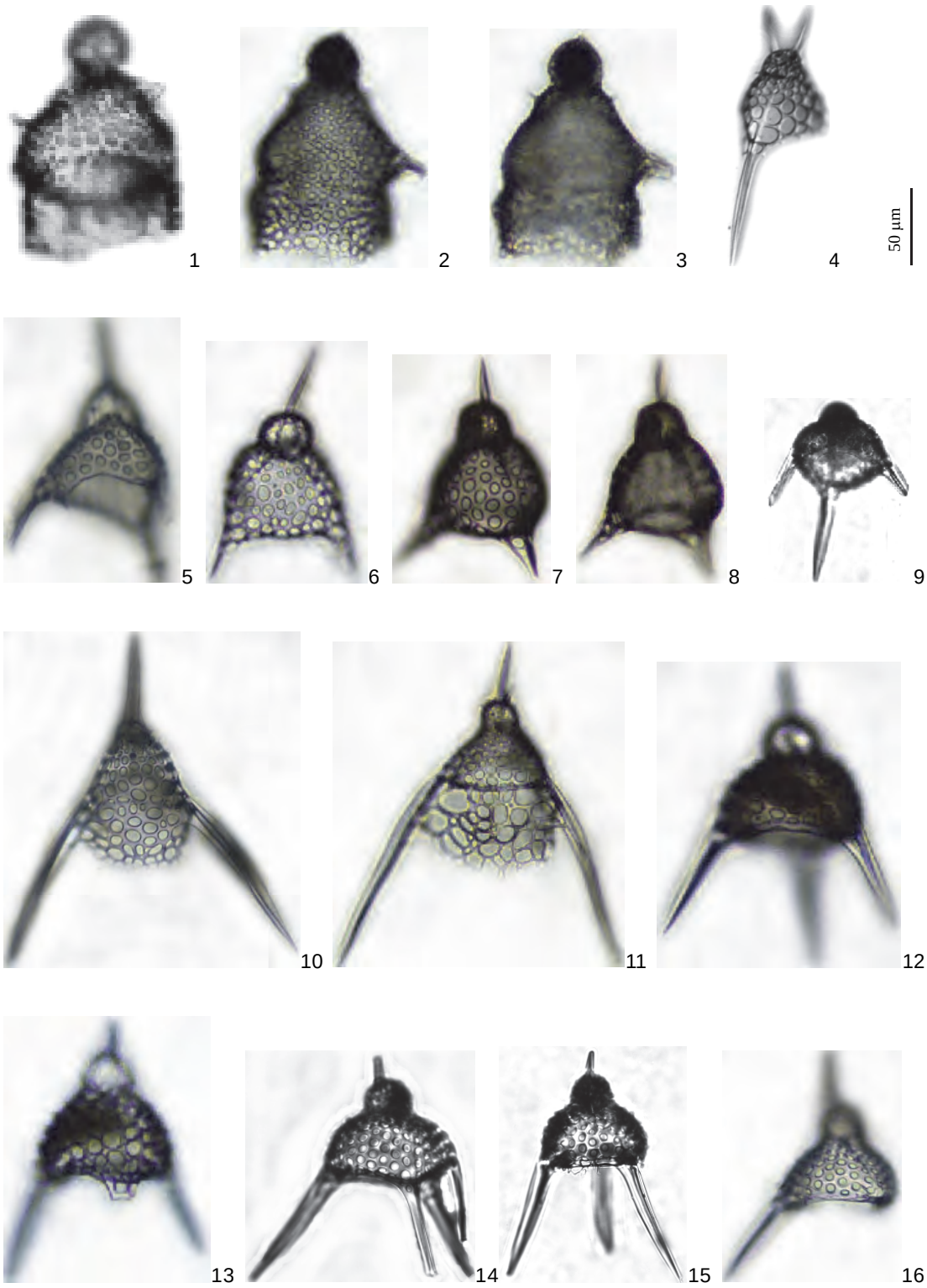


1–10. 板筛圆锥虫 *Sethoconus tabulata* (Ehrenberg)；11. 筛圆锥虫（未定种）*Sethoconus* sp.；12–15. 扩角笼虫 *Ceratocyrtis amplus* (Popofsky)；16–19. 盔角笼虫 *Ceratocyrtis galeus* (Cleve)；20–22. 强壮角笼虫 *Ceratocyrtis robustus* Bjorklund

图版 74

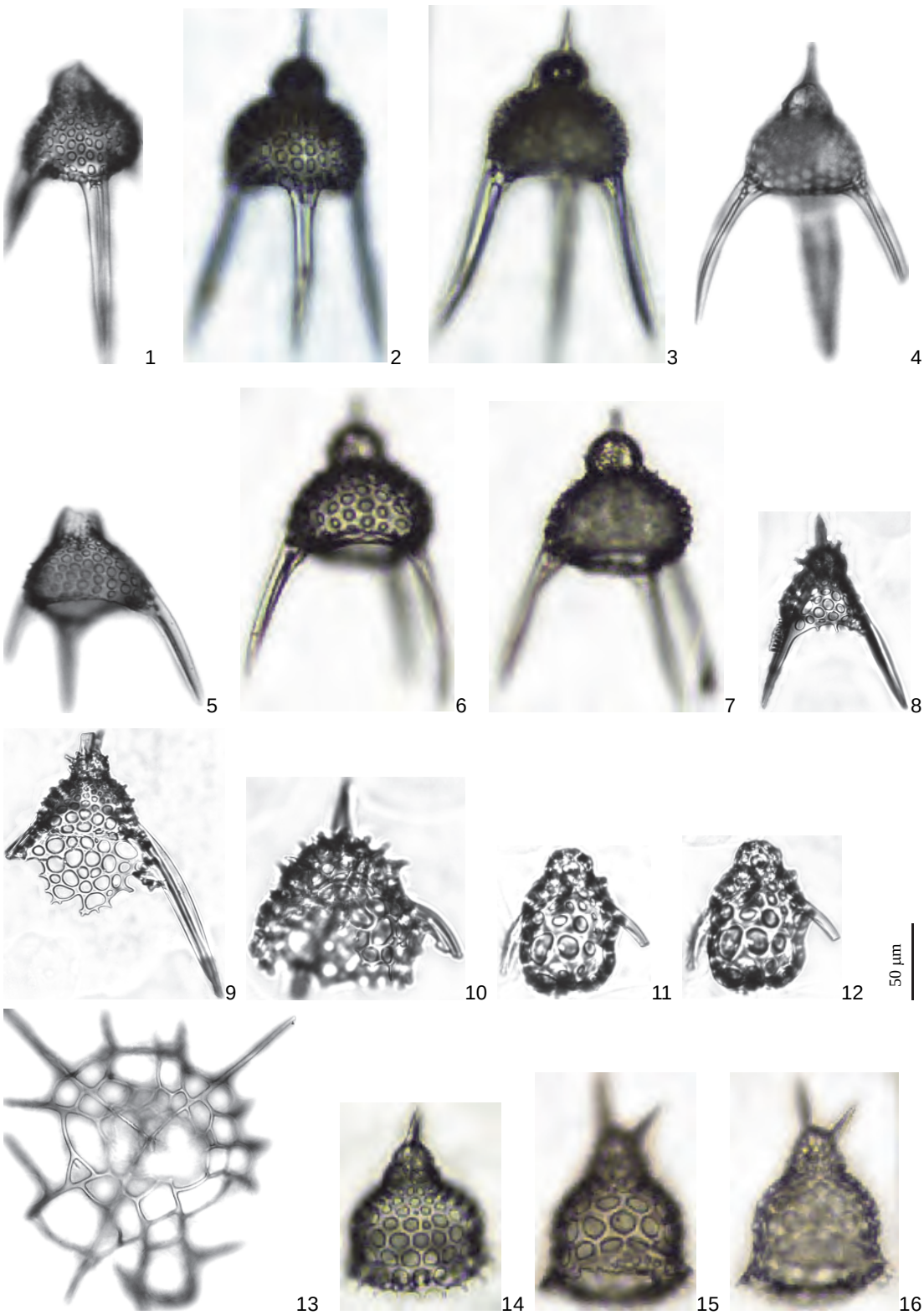


1–6. 思都角笼虫 *Ceratocyrtis stoermeri* Goll et Bjørklund；7, 8. 角笼虫（未定种）*Ceratocyrtis* sp.；9–12. 黎明格头虫 *Dictyocephalus* (*Dictyoprora*) *eos* Clark et Campbell；13–22. 乳格头虫 *Dictyocephalus papillosus* (Ehrenberg)；23. 格头虫（未定种 1）*Dictyocephalus* sp. 1；24, 25. 格头虫（未定种 2）*Dictyocephalus* sp. 2；26. 格头虫（未定种 3）*Dictyocephalus* sp. 3；27, 28. 铃翼盔虫 *Pterocorys campanula* Haeckel；29. 神脚虫（未定种）*Theopodium* sp.

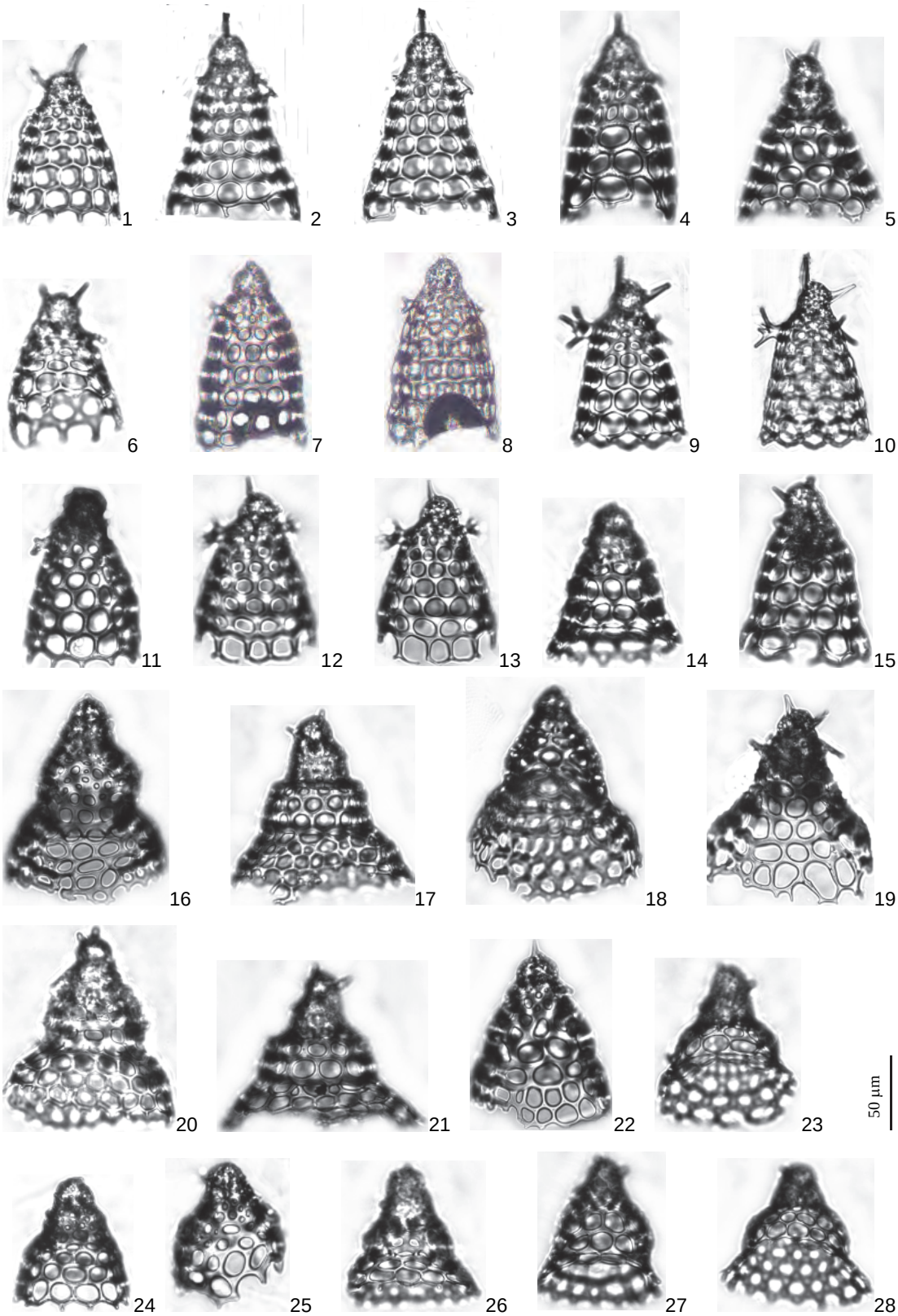


1–3. 小角里曼虫 *Lipmanella dictyoceras* (Haeckel)；4. 双角翼篮虫 *Pterocanium bicorne* Haeckel；5–8. 短脚翼篮虫（新种）*Pterocanium brachypodium* sp. nov.；10, 11. 大孔翼篮虫 *Pterocanium grandiporus* Nigrini；9, 12–16. 寇咯翼篮虫 *Pterocanium korotnevi* (Dogiel)

图版 76

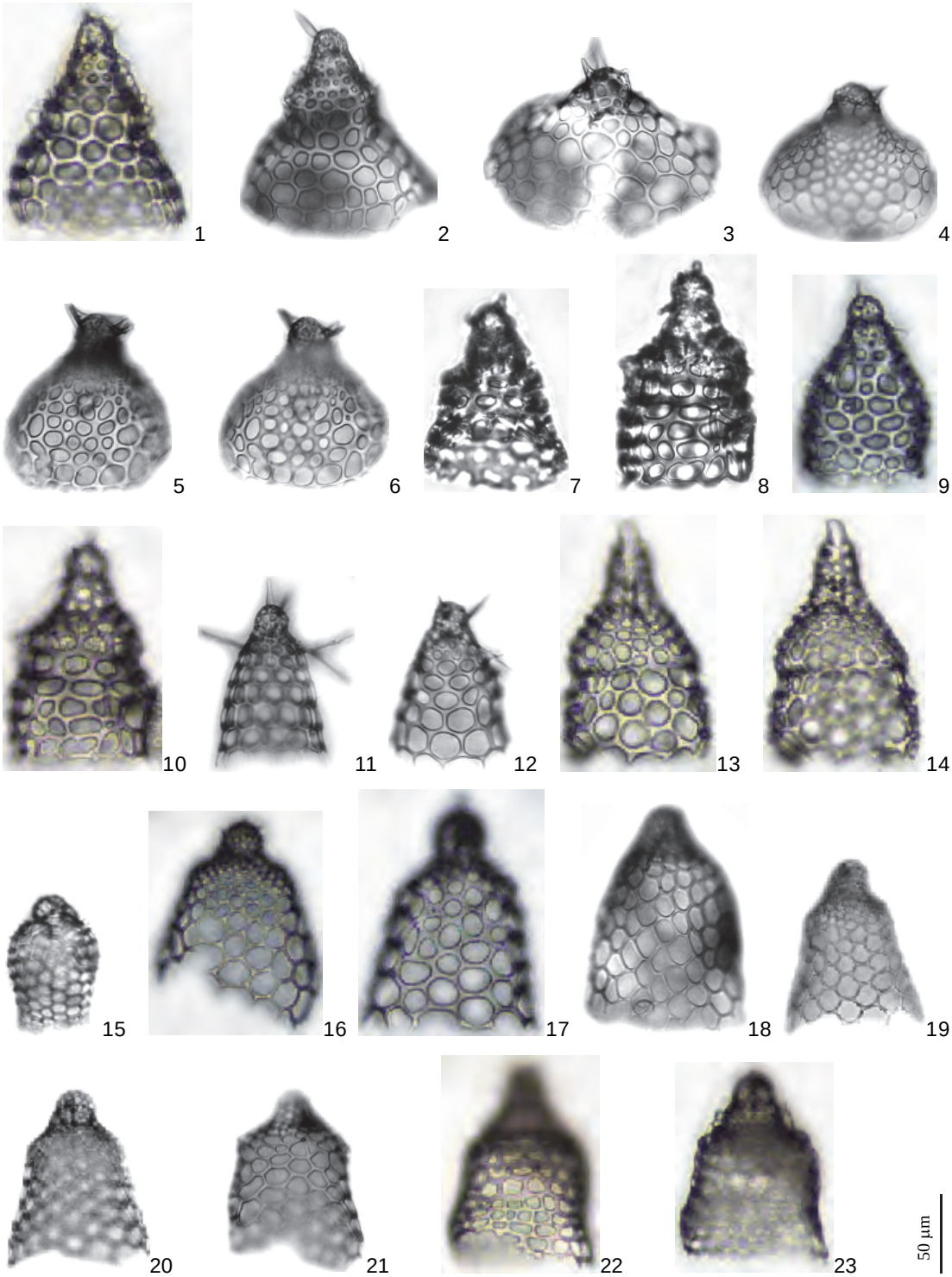


1–3. 长脚翼篮虫亚种 *Pterocanium praetextum praetextum* (Ehrenberg)；4–7. 三叶翼篮虫 *Pterocanium trilobum* (Haeckel)；8. 翼篮虫（未定种）*Pterocanium* sp.；9, 10. 洁假网杯虫 *Pseudodictyophimus amundseni* Goll et Bjørklund；11, 12. 假网杯虫?（未定种）*Pseudodictyophimus* sp.?；13. 美毛神编虫 *Theophormis callipilium* Haeckel；14–16. 双角圆蜂虫 *Cycladophora bicornis* (Hays)

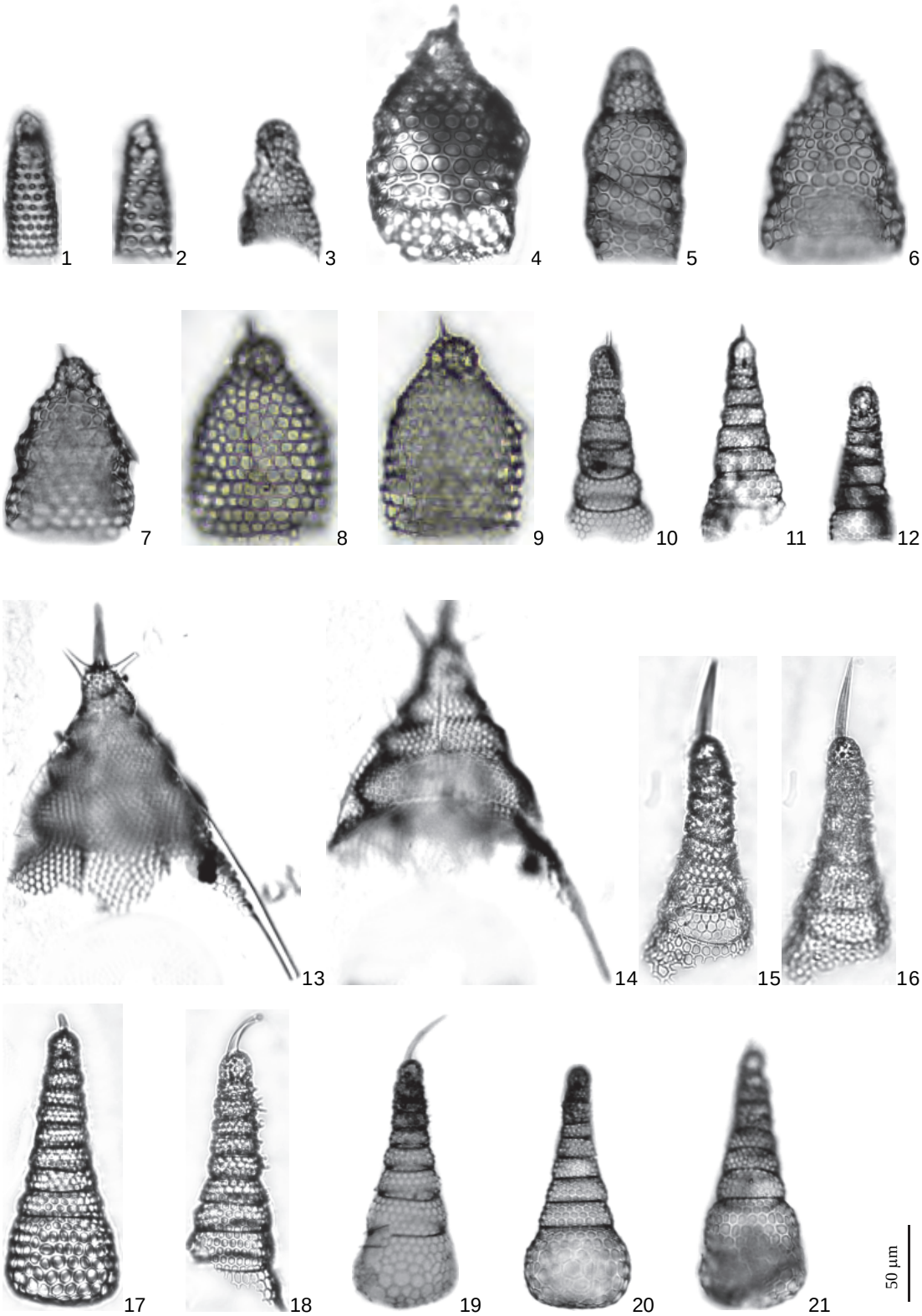


1–6. 乌塔角圆蜂虫 *Cycladophora cornuta* (Bailey)；7–13. 似角圆蜂虫 *Cycladophora cornutoides* (Petrushevskaya)；14, 15. 宙圆蜂虫宙亚种 *Cycladophora cosma cosma* Lombari et Lazarus；16–28. 戴维斯圆蜂虫 *Cycladophora davisiana* Ehrenberg group

图版 78

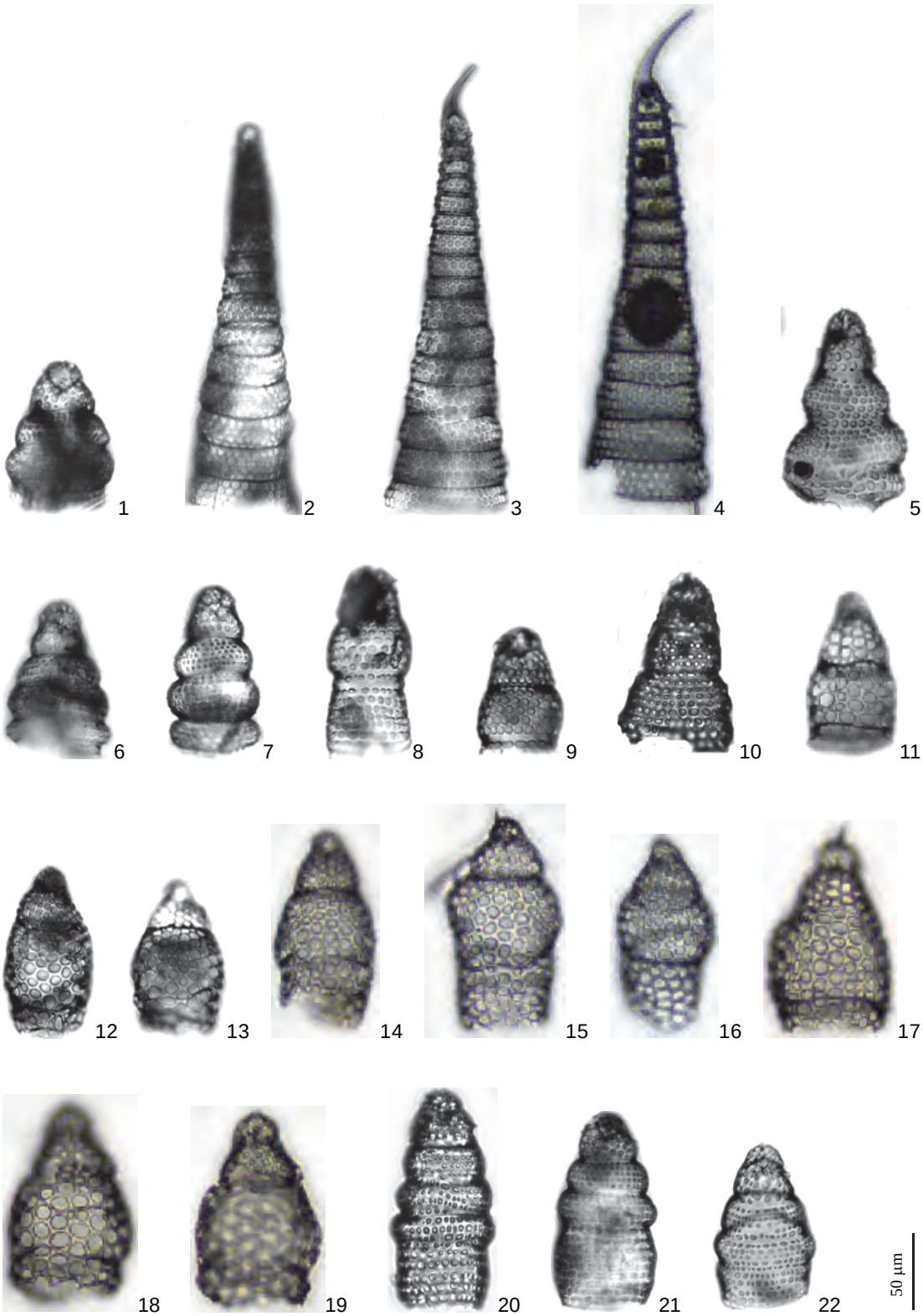


1, 2. 壮圆蜂虫 *Cycladophora robusta* Lombari et Lazarus；3–6. 缘窗袍虫 *Clathrocyclas craspedota* (Jørgensen)；7. 小窗袍虫 *Clathrocyclas lepta* Foreman；8–10. 单变窗袍虫筒亚种 *Clathrocyclas universa cylindrica* Clark et Campbell；11, 12. 贫瘤窗袍虫 *Clathrocycloma parcum* Foreman；13, 14. 棍爪丽篮虫 *Lamprocyrtis gamphonycha* (Jørgensen)；15. 盔冠虫（未定种）*Lophocorys* sp.；16–23. 多吉冈瓦纳虫 *Gondwanaria dogieli* (Petrushevskaya)

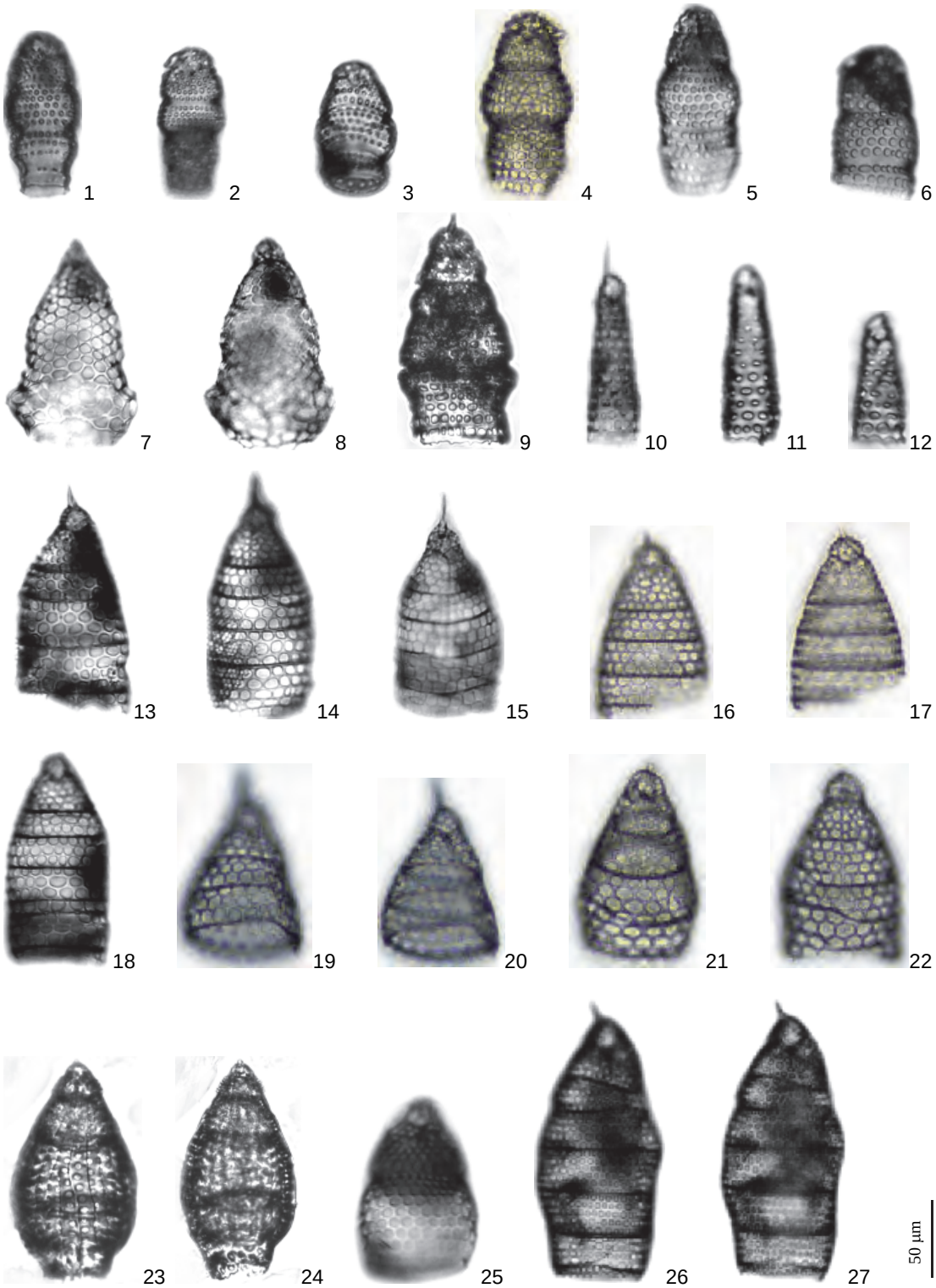


1, 2. 筒三居虫 *Tricolocampe cylindrica* Haeckel；3. 高节帽虫? *Stichopilium anocor* Renz?；4. 斜节帽虫 *Stichopilium obliqum* Tan et Su；5. 苍节帽虫 *Stichopilium phthinados* Tan et Chen；6, 7. 节帽虫（未定种 1）*Stichopilium* sp. 1；8, 9. 节帽虫（未定种 2）*Stichopilium* sp. 2；13, 14. 锯多节虫 *Stichocampe bironec* Renz；10–12, 15—21. 小壶篮袋虫 *Cyrtopera laguncula* Haeckel

图版 80

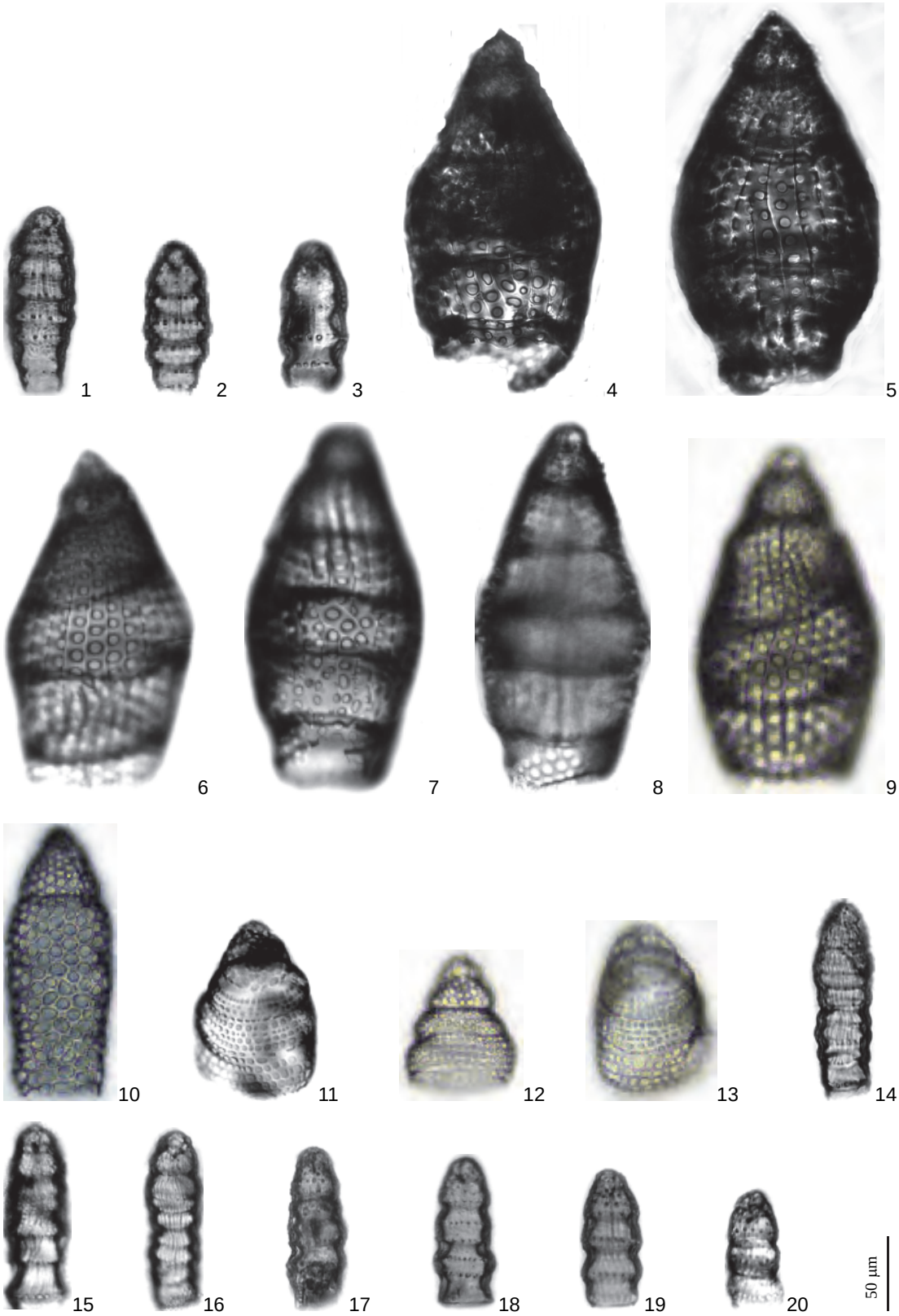


1. 串笼石螺旋虫 *lithostrobus botryocyrtis* Haeckel；2–4. 卡斯匹石螺旋虫 *Lithostrobus cuspidatus* (Bailey)；5–7. 串石螺旋虫 *Lithostrobus lithobotrys* Haeckel；8. 丽高网帽虫? *Dictyomitra caltanisettae* Dreyer?；9. 费民网帽虫 *Dictyomitra ferminensis* Campbell et Clark；10. 网帽虫（未定种）*Dictyomitra* sp.；11–19. 明山列盔虫 *Stichocorys delmontensis* Campbell et Clark；20–22. 排串列盔虫 *Stichocorys seriata* (Jørgensen)

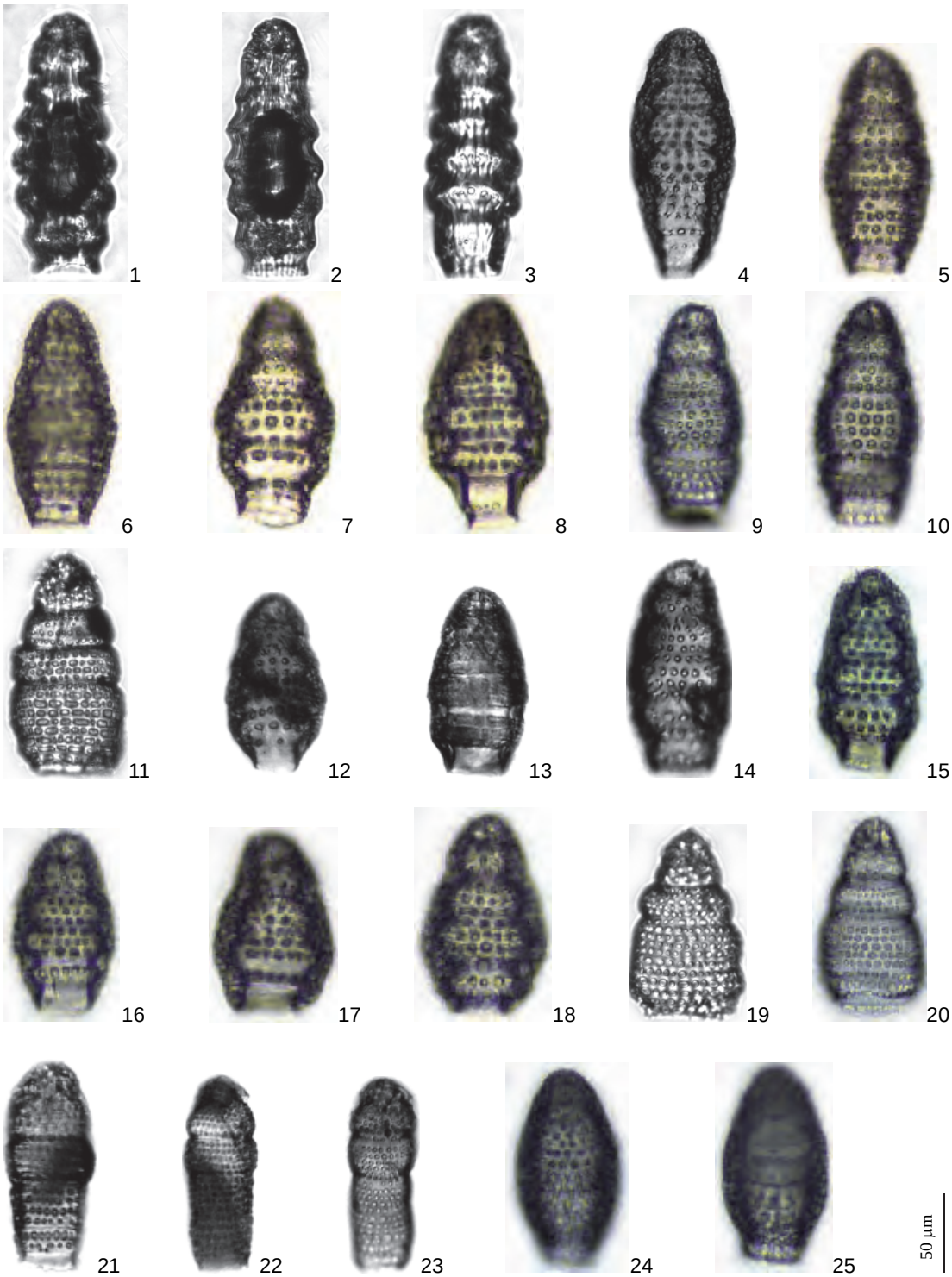


1–4. 列盔虫（未定种 1）*Stichocorys* sp. 1；5, 6. 列盔虫（未定种 2）*Stichocorys* sp. 2；7, 8. 列盔虫（未定种 3）*Stichocorys* sp. 3；9. 列盔虫（未定种 4）*Stichocorys* sp. 4；10–12. 环窄旋虫 *Artostrobus annulatus* (Bailey)；13–22. 环节细篮虫 *Eucyrtidium annulatum* (Popofsky)；23, 24. 丽转细篮虫 *Eucyrtidium calvertense* Martin；25. 克里特细篮虫 *Eucyrtidium creticum* Ehrenberg；26, 27. 六列细篮虫 *Eucyrtidium hexastichum* (Haeckel)

图版 82

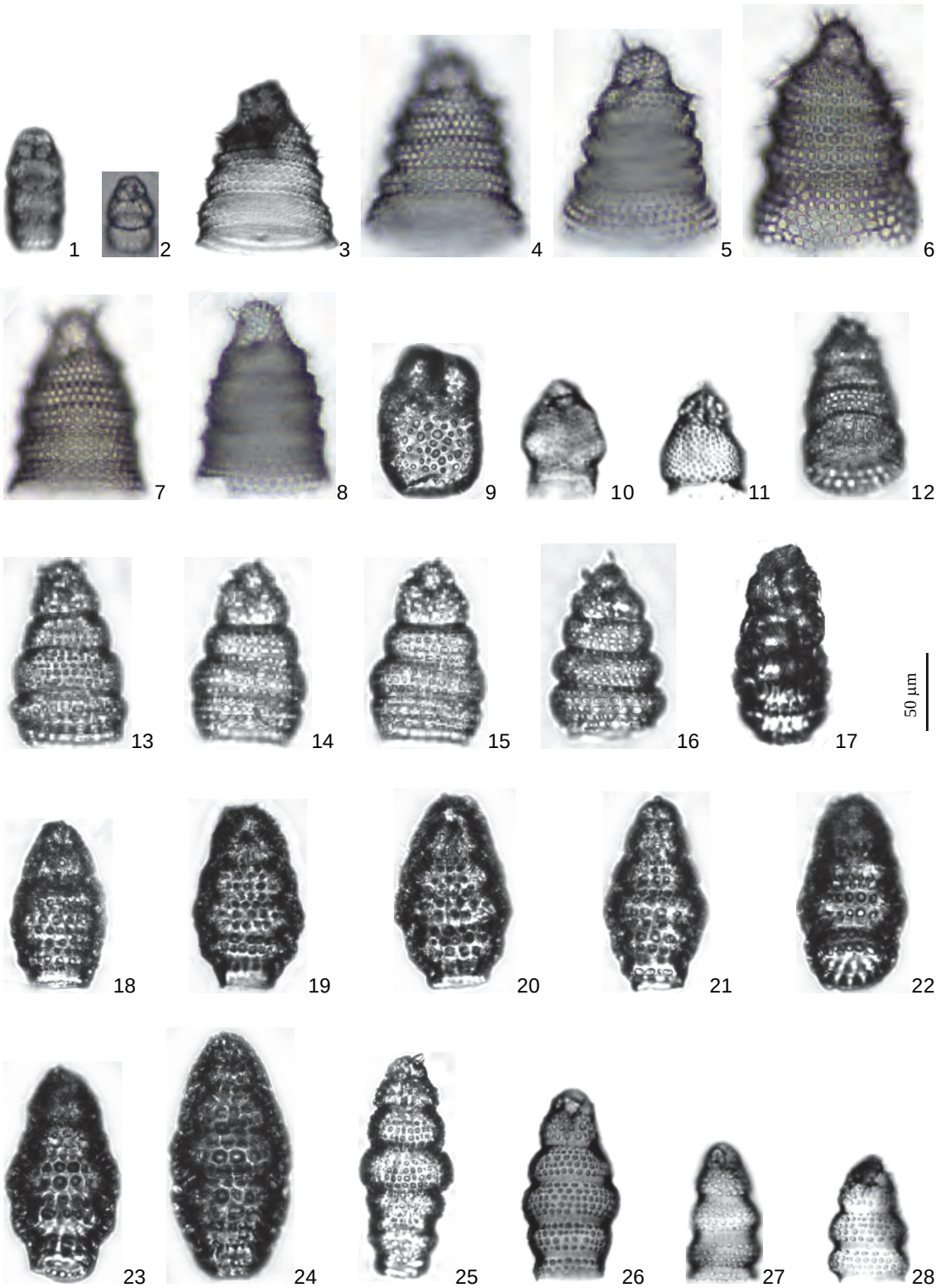


1–3. 北杵细篮虫 *Eucyrtidium hyperboreum* Bailey；4–9. 玛图雅细篮虫 *Eucyrtidium matuyamai* Hays；10. 托伊舍细篮虫 *Eucyrtidium teuscheri* Haeckel；11–13. 细篮虫（未定种）*Eucyrtidium* sp.；14–20. 线石帽虫 *Lithomitra lineata* (Ehrenberg)

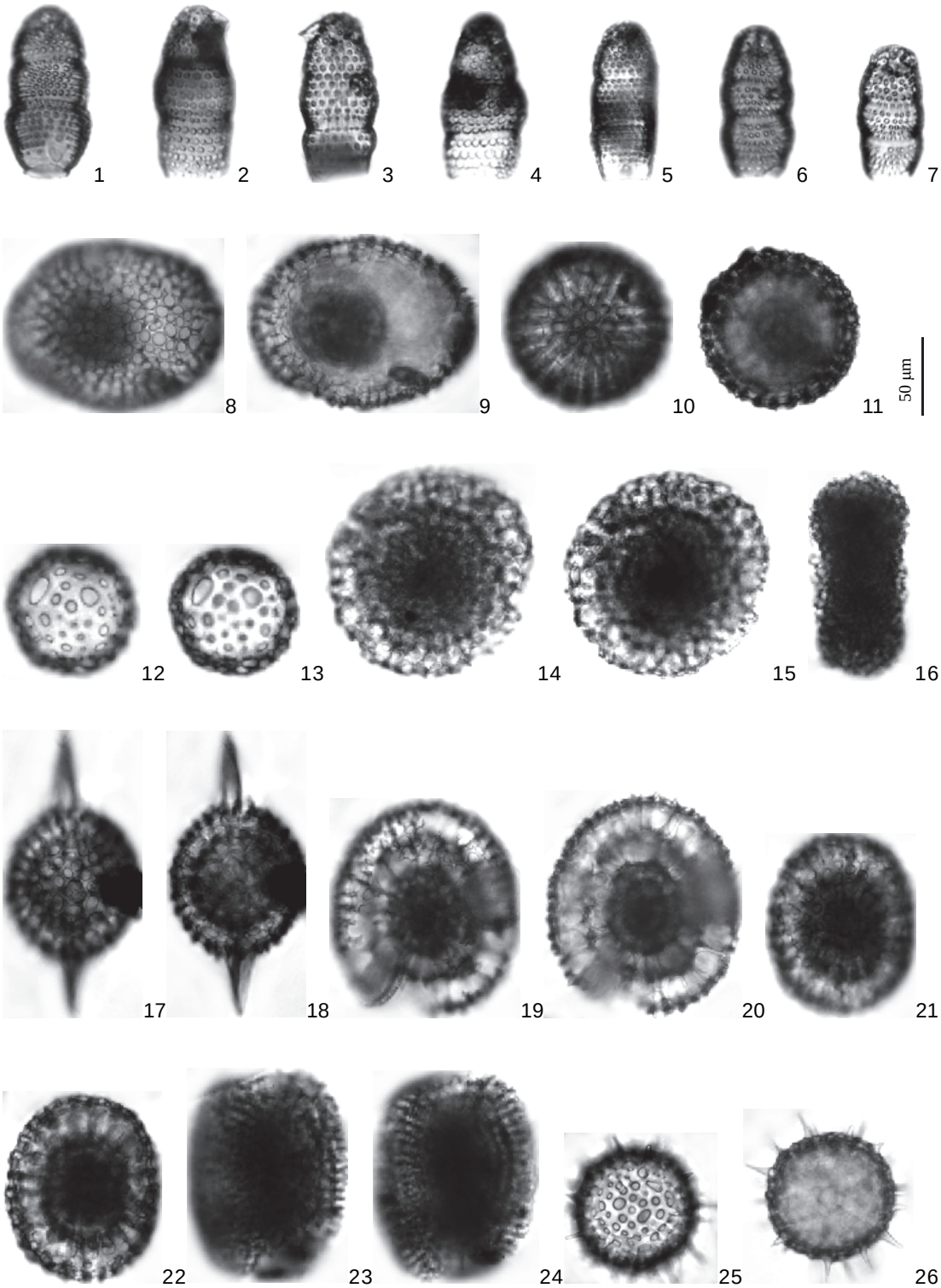


1–3. 蛛管毛虫 *Siphocampe arachnea* (Ehrenberg)；4–10. 烟囱管毛虫 *Siphocampe caminosa* Haeckel；11. 筐管毛虫 *Siphocampe corbula* (Harting)；12–18. 蠋管毛虫 *Siphocampe erucosa* Heackel；19, 20. 管毛虫（未定种）*Siphocampe* sp.；21–23. 莫德石毛虫长亚种？*Lithocampe* (*Lithocampium*) *modeloensis longa* Campbell et Clark?；24, 25. 八宿石毛虫 *Lithocampe octocola* Haeckel

图版 84



1, 2. 石毛虫（未定种）*Lithocampe* sp.；3–8. 梯盘旋篮虫 *Spirocyrtis scalaris* Haeckel；9. 南极囊篮虫 *Saccospyris antarctica* Haecker；10, 11. 北方吊葡萄虫 *Artobotrys borealis* (Cleve)；12–17. 耳陀螺虫 *Artostrobium auritum* (Ehrenberg) group；18–24. 阿吉旋葡萄虫 *Botryostrobus aquilonaris* (Bailey)；25–28. 布拉旋葡萄虫 *Botryostrobus bramlettei* (Campbell et Clark)



1–7. 匹形筐列虫 *Phormostichoartus pitomorphus* Caulet；8, 9. 空椭球虫（未定种，卵形）*Cenellipsis* sp.；10, 11. 日本荚球虫 *Thecosphaera japonica* Nakaseko；12, 13. 胶球虫（未定种 3，厚壁）*Collosphaera* sp. 3；14, 15. 编膜包虫 *Perichlamydium praetextum* (Ehrenberg)；16. 双腕虫（未定种）*Amphibrachium* sp.；17, 18. 针球虫（未定种 2，双皮壳，无髓壳）*Stylosphaera* sp. 2；19–22. 葱皮虫（未定种 2）*Cromyocarpus* sp. 2；23, 24. 巨人石果虫 *Lithocarpium titan* (Campbell et Clark)；25, 26. 空球虫（未定种）*Cenosphaera* sp.

(Q-3986.01)

www.sciencep.com

ISBN 978-7-03-052641-0

9 787030 526410 >

定价：198.00 元

科学出版社　地质分社
E-mail: earthscience@mail.sciencep.com
销售分类建议：古生物