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Tiegang Li

Atlas of Benthic Foraminifera from China Seas

The Bohai Sea and the Yellow Sea

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Preface

Systematic classification and accurate identification of benthic foraminifera has been a keystone for the reconstruction of paleoceanography. However, general identification books on benthic foraminifera from the China Seas are very limited. Many Chinese geologists of old generation, for example, Yan He, Yi Chun Hao, Pin Xian Wang, etc., had made great contributions to foraminiferal research on the China Seas. With the evolution of foraminiferal taxonomy and application of molecular studies, there is a need to summarize the characteristics of foraminiferal fauna from China Seas and to report to the world. The book series “Atlas of Benthic Foraminifera from China Seas” shouldered the burden of connecting research achievements from the old generation of Chinese geologists to the modern understanding of foraminiferal taxonomy. The present book concerning the Bohai Sea and the Yellow Sea fauna is the first part of this book series on the China Seas.

In this monograph, 183 species belonging to 92 genera, 51 families, and five orders are described. Among these species, one new genus and eight new species were established; one new combination and four new statements were reported; thirteen were new records to the China Seas and two were newly redescribed since the species were established half a century ago. We also try to present an up-to-date taxonomic status with morphological details for each species, and therefore we have made extensive use of micrographs.

“The more you know, the more you don’t know (from Aristotle, Greek)”, we certainly understand that the more problems we meet in foraminiferal taxonomy, the closer we are approaching to the truth. Although there are still a lot of shortcomings and deficiencies in this monograph, we try to introduce our understanding and share our experiences on benthic foraminifera from China Seas to the world. Your comments and criticism are greatly welcomed. Please contact to the following emails: tgli@fio.org.cn; leiyanli@qdio.ac.cn.

Qingdao, PR China — Tiegang Li
August 2016 — Yanli Lei

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We are indebted to many persons for assistance during the preparation of this monograph. First, the first author cannot ignore the preliminary education of foraminiferal taxonomy learnt from Prof. Shouyi Zheng and Zhaoxian Fu (Institute of Oceanology, Chinese Academy of Sciences). Next, we wish to thank Prof. Dr. Zhimin Jian (State Key Laboratory of Marine Geology, Tongji University, China) for many supports and instructions to the first author in foraminiferal research. We also want to thank Prof. Dr. Jan Pawlowski (Department of Genetics and Evolution, University of Geneva, Switzerland) for encouraging our foraminiferal studies in China. Special thanks are due to Dr. Rajiv Nigam for kind help in foraminiferal studies (National Institute of Oceanlography, Goa, India). We gratefully acknowledge technicians Xuejiao Wang, Mengmeng Zheng, and Lina Cao for sample treatments (Institute of Oceanology, Chinese Academy of Sciences). Of course we would not forget our two families for their support.

Finally, we thank several international scientists: Dr. Bruce W. Hayward (Geomarine Research, University of Auckland, New Zealand), Dr. Andrew J. Gooday (National Oceanography Centre, Southampton, UK), Dr. Tomas Cedhagen (Denmark), Dr. Peter Frenzel (Germany), Dr. Mike Kaminski (Saudi Arabia), Dr. Onno Gross and the "Foraminifera.eu Team" for providing selfless assistances in network resource of foraminiferal taxonomic studies.

Contents

Material and Methods

Study Sites and General Information

The Bohai Sea

The Bohai Sea is the innermost gulf of the North Yellow Sea of China with an area ~78,000 km^2 and high sediment loadings from river runoff. The Bohai Sea sediment samples were collected from nine stations (38°10′–39°00′ N, 119°30′–120°10 E) on December 18–19, 2011 (Fig. 1).

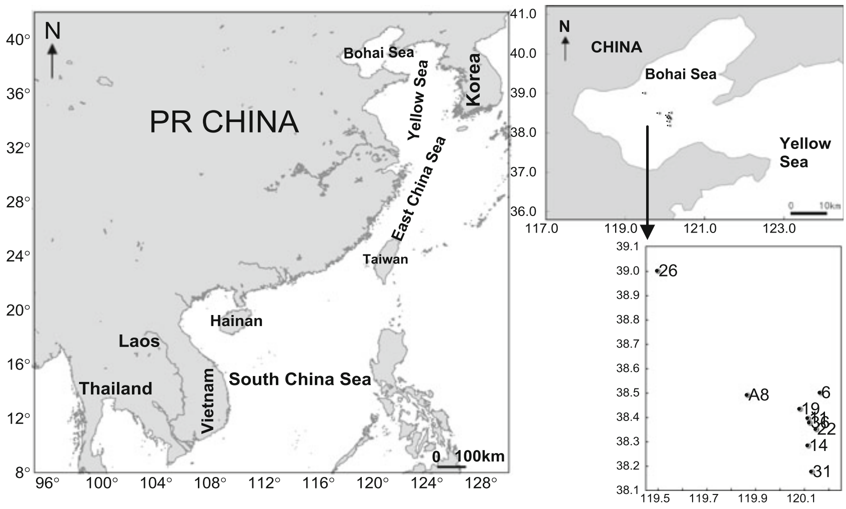

Fig. 1 Map of location and sampling stations in the Bohai Sea

The Yellow Sea

The Yellow Sea is a semi-enclosed shallow shelf sea (water depth <100 m) with an area of about 500,000 km^2. The average water depth is about 44 m. It is adjacent to the Bohai Sea in the northwest and to the East China Sea in the south, and geographically divided by the tip of the Shandong Peninsula into a northern and the southern parts (Fig. 2). A series of mud patches has developed under this circulation system, including the southeastern Yellow Sea mud area and the central Yellow Sea mud area, which formed the Yellow Sea Cold Water Mass. These mud deposits are valuable for high-resolution Holocene paleoenvironmental studies (Li et al. 2009).

The Yellow Sea sediment samples were collected based on several cruises from dozens of stations (31°15′ to 38°50′ N, 120°57′ to 124°30′ E) during 2008, 2009, 2012, and 2014 cruises (Fig. 2).

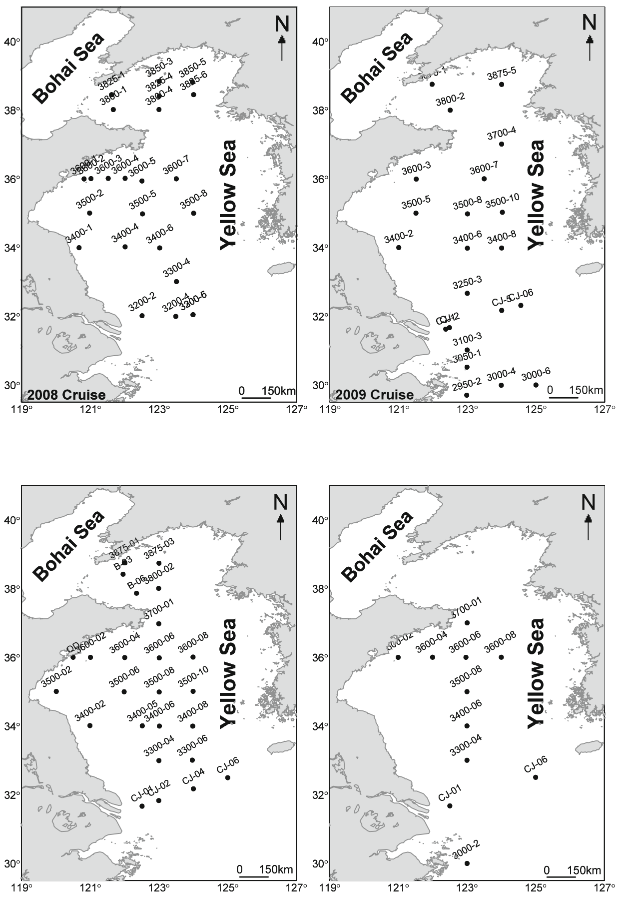

Fig. 2 Map of location and sampling stations in the Yellow Sea during 2008, 2009, 2012 and 2014 cruises

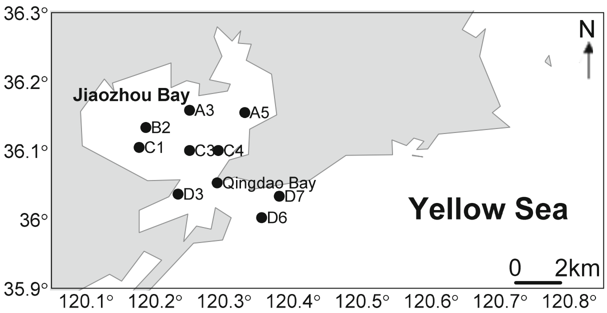

Fig. 3 Map of location and sampling stations in the Jiaozhou Bay and the Qingdao Bay

The Jiaozhou Bay and the Qingdao Bay

The Jiaozhou Bay is located on the southern coast of the Shandong Peninsula in the eastern China (Fig. 3). It is a semi-enclosed bay of the Yellow Sea that has undergone extensive environmental changes in recent years, due to natural factors such as sediment supplies and human activities such as farming and real estate development and operation of the city constructions.

The Qingdao Bay is an intertidal flat, located in the bay mouth of the Jiaozhou Bay. It is often severely affected by the local tourist industry and the blooming of drifting green tide, *Enteromorpha prolifera*, in the summer season. The sediment samples from the Jiaozhou Bay (36°00′ to 36°09′ N, 120°10′ to 120°22′ E) and the Qingdao Bay (36°00′ N, 120°30′ E) were collected during 2011 to 2014.

Sample Treatment

The sediments from the continental shelf region were taken using a 0.1 m^2 Gray–Ohara box corer. At each sampling station, environmental variables (water depth, temperature, salinity) were measured. The surface sediments were fixed using 95 % ethanol mixed with 1 g/L Rose Bengal such that live and dead specimens could be distinguished. In the laboratory, each sediment was dried in the oven below 50 °C for 24 h and weighed. The sediments were soaked in water and were sieved through 63 and 150 µm meshes. The foraminiferal specimens were concentrated by an isopycnic separation technique using tetrachloromethane (D = 1.59). For the ecological study, benthic foraminifera were counted in >150 µm size fraction. For the taxonomic study, foraminifera in both size fractions were observed.

Taxonomy

Foraminiferal specimens were isolated and mounted on slides, and were identified and enumerated under stereomicroscope Nikon SSZ1500, with continuous zooming to a maximum amplification of 225×. Specimens were studied and photographs were taken under the microscopes Nikon SSZ1500 and Nikon SMZ25 (with continuous zooming to a maximum amplification of 315×). Size measurements were taken during photographing.

Foraminifera were identified to species level based on the relevant literature. For better understanding of the ontogenetic process of complicated species and new species, some larval and juvenile specimens in small size fraction were studied and were microscopically photographed. When necessary, pouring chamber and grinding slice were done to reveal the internal structure of foraminifera.

In our book, "Foraminifera" as a Class-level taxonomic category, i.e., Class Foraminifera Lee, 1990, was affiliated with the Phylum Granuloreticulosa Lee, 1990, Kingdom PROTOZOA (Goldfuss, 1818) von Siebold, 1846. Foraminiferal classification systematics was based on those of Loeblich & Tappan (1987) and Lee (1990), as to the genus and the species levels we also referred to Hayward et al. (2015).

Order Astrorhizida Brady, 1881

Family Saccamminidae Brady, 1884

Genus *Lagenammina* Rhumbler, 1911

Lagenammina atlantica **(Cushman, 1944)** (Fig. 1)

Proteonina difflugiformis Cushman & Parker (non Brady), 1931, p. 2, pl. 1, Fig. 1.
Proteonina atlantica Cushman, 1944, p. 5, pl. 1, Fig. 4; Parker et al., 1953, p. 11, pl. 1, Fig. 4; Boltovskoy, 1959, p. 39, pl. 1, Fig. 1; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 68, pl. I, Figs. 1, 6; Wang et al., 1980, p. 197, pl. XI, Fig. 1; Zheng, 1988, p. 33, pl. IX, Fig. 2.
Proteonella atlantica (Cushman), Fursenko et al., 1979, p. 9, pl. 1, Figs. 7, 8; Zheng, 1988, p. 33, pl. 9, Fig. 2.
Lagenammina atlantica (Cushman, 1944), Lankford & Phleger, 1973, p. 123, pl. 1, Fig. 1; Snyder, 1990, p. 264, pl. 1, Fig. 4; Ujiie, 1995, p. 55, pl. 1, Fig. 16; Zheng & Fu, 2001, p. 235, pl. VI, Figs. 9, 10.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H30-01	451	250	250
H30-02	466	277	277
H30-03	523	323	323
H30-04	533	330	330

Occurrence and Ecology
The Yellow Sea (St CJ-04, St 3400-05, St 3500-02, St 3500-06, St 3500-10, St 3600-02, St 3600-04, St 3800-02, St 3875-01, St 3875-03, St B-03) (32°10′–38° 44′ N, 120°00′–127°00′ E), water depth 30.00–81.00 m, temperature 7.39–17.02 °C, salinity 30.82–33.39 ‰, abundance 0.08–33.84 ind./g sed.

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Lagenammina atlantica (Cushman, 1944)

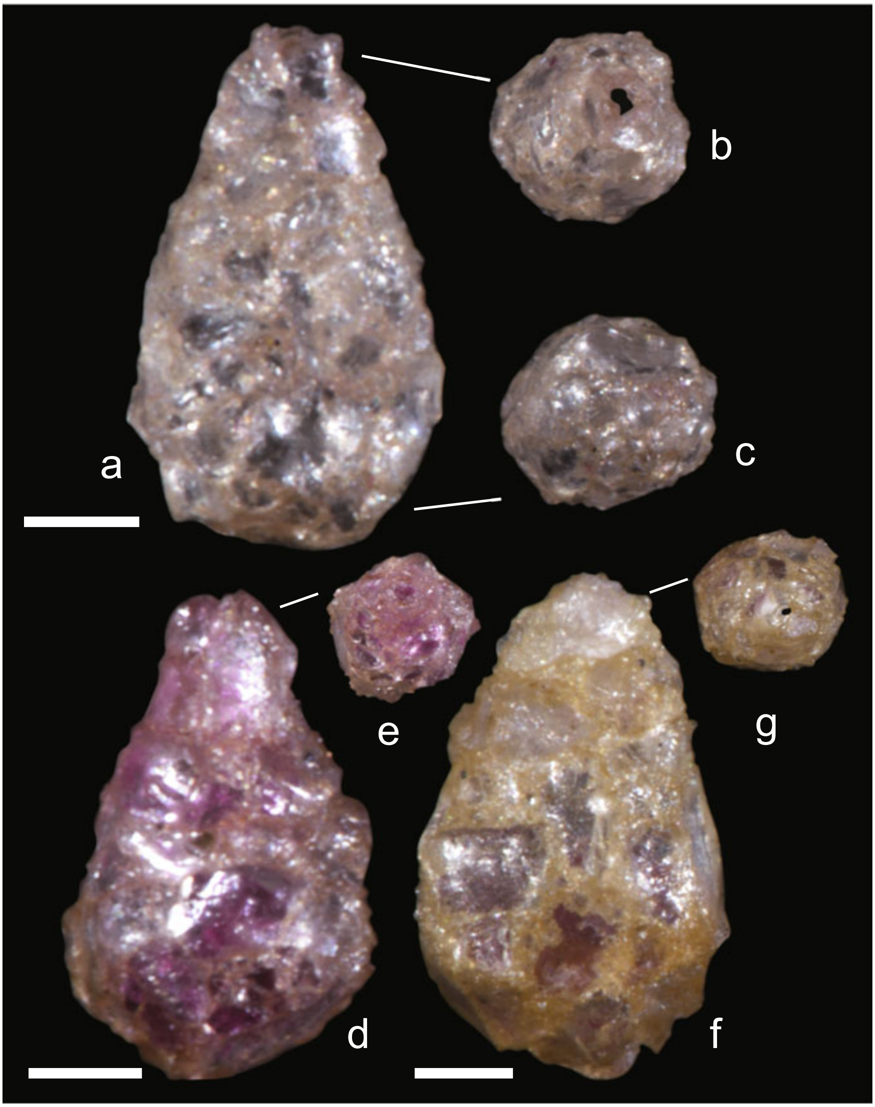

Fig. 1 **a–g** *Lagenammina atlantica* (Cushman, 1944), three specimens showing morphological variabilities. **a–c** The same specimen with apical (**b**) and antapical view (**c**). **d, e** Another specimen from the North Yellow Sea. **f, g** Specimen from the South Yellow Sea. Scale bars = 100 μm

Distribution

Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, Norway, the United States, Northeast U.S. Continental Shelf, Scotian Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description

Size about 500 μm in length. Test flask shaped and symmetrical, length:width ratio about 1.7:1. Neck elongate but sometimes indistinct. Wall covered by large quartz grains.

Remarks

Lagenammina atlantica has been identified as *Proteonina atlantica* in previous Chinese literature from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978). This species is a common species in the China Seas. Our specimens were slightly larger than that described from the South Yellow Sea.

***Lagenammina micacea* (Cushman, 1918)** (Fig. 2)

Proteonina micacea Cushman, 1918.

Reophax micaceus (Cushman, 1918).

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B22-01	608	350	350
B22-02	572	257	257

Occurrence and Ecology

The Bohai Sea (St 19) (38°25′ N, 120°04′ E), water depth 25.00 m, temperature 2.98 °C, salinity 30.53 ‰, abundance 0.08 ind./g sed.

Distribution

Bohai Sea.

Celtic Sea, North Atlantic Ocean, Norway.

Description

Size about 600 μm in length. Test flask shaped and somewhat asymmetrical, length:width ratio about 2:1. Neck distinct and elongate. Wall covered by large crystal particles. Aperture at the test terminal and produced on an elongate neck.

Remarks

Lagenammina micacea is a new record to China Seas. It occurred only in one station from the Bohai Sea and with low abundance.

Lagenammina micacea (Cushman, 1918)

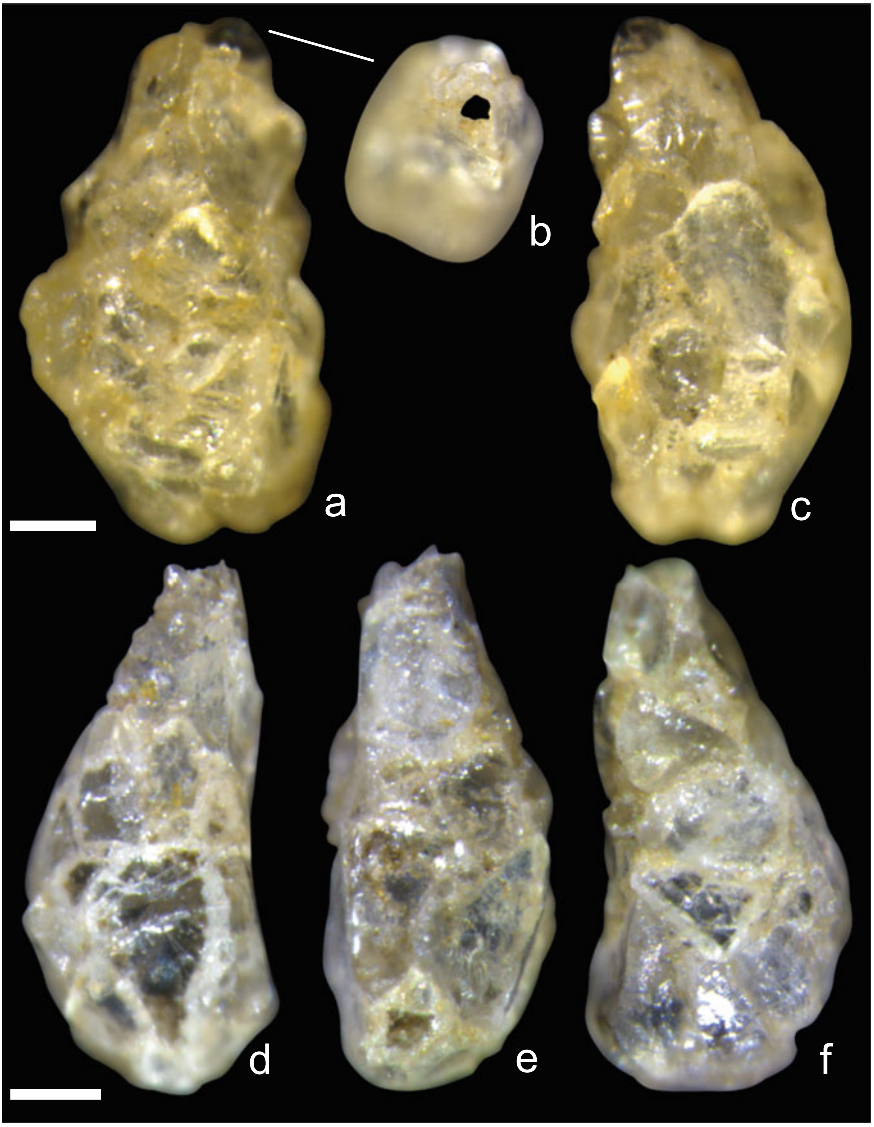

Fig. 2 **a–f** *Lagenammina micacea* (Cushman, 1918), two specimens showing morphological variabilities. **a–c** The same specimen from the Bohai Sea. **d–f** Another specimen with different side of views. Scale bars = 100 μm

Genus *Saccammina* Carpenter, 1869

***Saccammina hadai* (Saidova, 1975)** (Fig. 3)

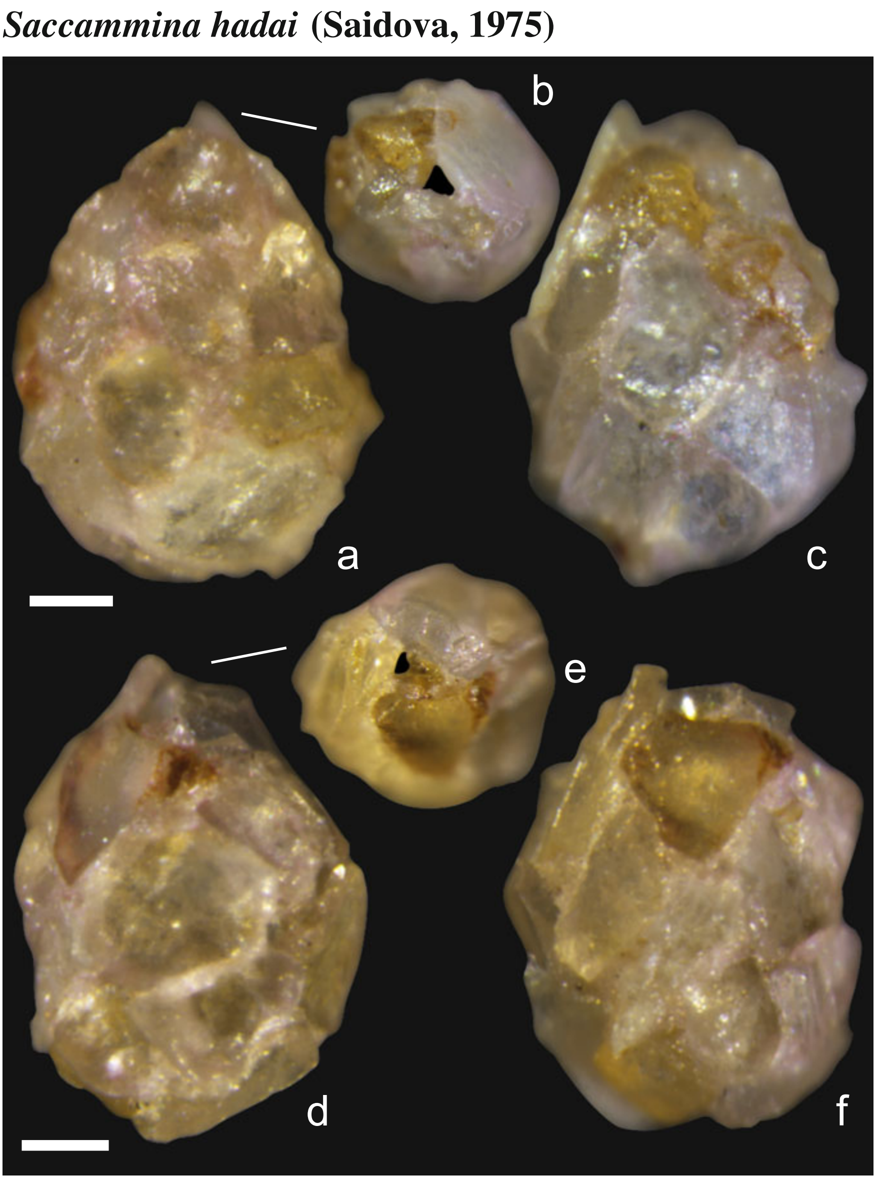

Fig. 3 **a–f** *Saccammina hadai* (Saidova, 1975), two specimens from the Bohai Sea. **a–c** The same specimen. **d–f** Another specimen. **b, e** Apical views showing cross section outline and apertures. Scale bars = 100 μm

Psammosphaera hadai Saidova, 1975, p. 42, pl. 8, Fig. 5.
Saccammina hadai (Saidova, 1975), Loeblich & Tappan, 1994, p. 13, pl. 3, Figs. 5, 6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B23-01	590	427	427
B23-02	557	406	406

Occurrence and Ecology
The Bohai Sea (St 26, St 6, St 19, St 11, St 36, St 31) (38°10′–39°00′ N, 119°30′–120°10′ E), water depth 24.00–27.00 m, temperature 2.25–4.25 °C, salinity 30.11–30.79 ‰, abundance 0.02–0.20 ind./g sed.

Distribution
Bohai Sea.
Timor Sea, Sri Lanka (Timbiri Ela).

Description
Size about 570 μm in length. Test a single globular chamber, length:width about 1.4:1. Wall covered by coarse quartz particles. Aperture triangular, terminally located.

Remarks
Saccammina hadai is a new record to China Seas. It is a common species in the Bohai Sea but occurred usually with low abundance. The Bohai population has a similar size with that from the Timor Sea, but much smaller than the holotype.

Genus *Thurammina* Brady, 1879

***Thurammina albicans* Brady, 1879** (Fig. 4)

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H74-01	353	337	337

Occurrence and Ecology
The Yellow Sea (St 3400-06) (33°59′ N, 123°00′ E), water depth 67.80 m, temperature 12.00 °C, salinity 31.91 ‰, abundance 0.24 ind./g sed.

Distribution
Yellow Sea.

Thurammina albicans Brady, 1879

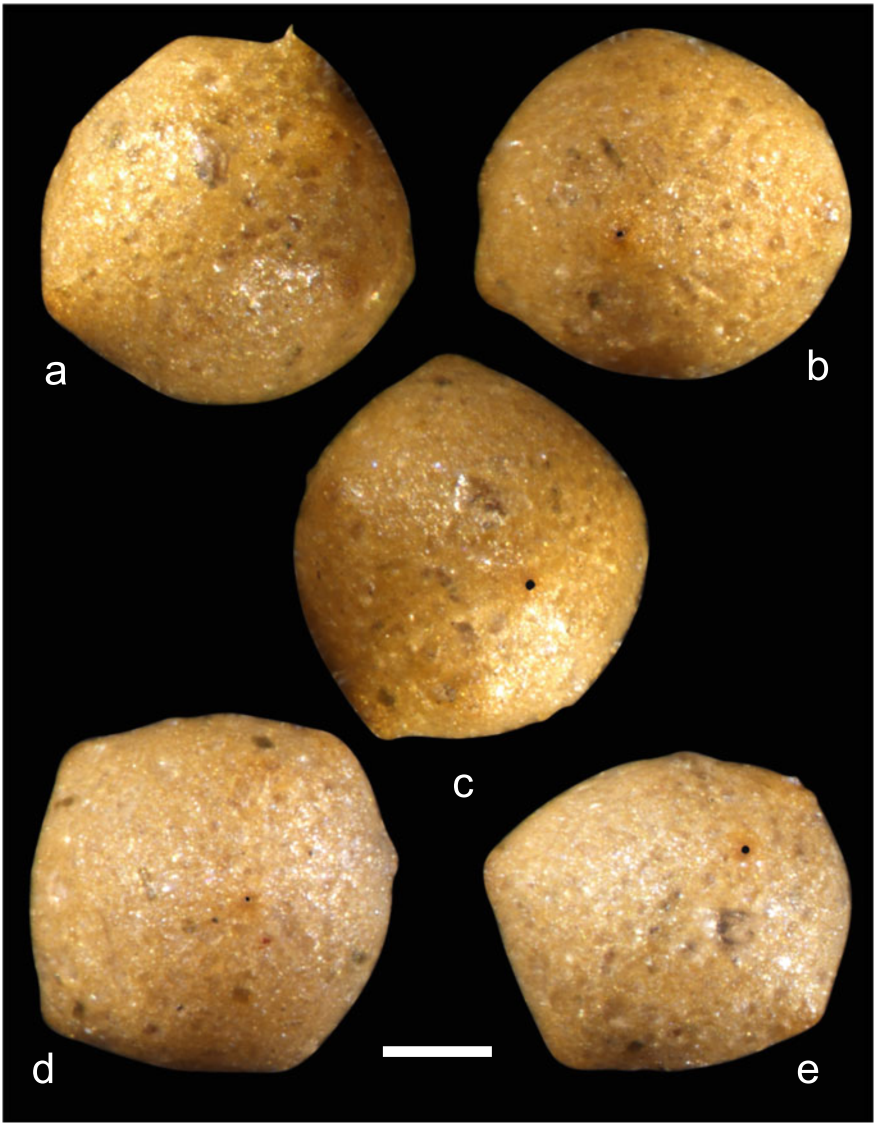

Fig. 4 a–e *Thurammina albicans* Brady, 1879, same specimen from the South Yellow Sea showing different side of views. Scale bar = 100 μm

Bay of Biscay, New Zealand (New Zealand Exclusive Economic Zone), North Atlantic Ocean.

Description
Size about 350 μm in length. Test globular to subglobular with many indistinct short protuberances. Wall agglutinated and covered by very thin quartz grains, brown in color. Aperture a small opening at the summit of each protuberance.

Remarks
Thurammina albicans is a new record to China Seas. It occurred usually infrequently and with low abundance in the Yellow Sea.

Family Ammodiscidae Reuss, 1862

Genus *Ammodiscus* Reuss, 1862

Ammodiscus gullmarensis **Höglund, 1948** (Fig. 5)

Ammodiscus planus Höglund, 1947, p. 127, pl. 28, Figs. 17, 18, text Figs. 99, 100, 105, 106, 108, 109.
Ammodiscus gullmarensis Höglund, 1948; Loeblich & Tappan, 1994, p. 14, pl. 3, Figs. 11–15; Wang et al., 1988, p. 117, pl. X, Fig. 8; Zheng, 1988, p. 36, pl. V, Fig. 3; pl. LI, Fig. 2; Zheng & Fu, 2001, p. 263, pl. X, Fig. 4; pl. XI, Figs. 3, 4; pl. CXVII, Fig. 3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D124-01	238	241	50
D124-02	263	233	63

Occurrence and Ecology
The Yellow Sea (St B-03) (38°25′ N, 121°57′ E), water depth 45.69 m, temperature 7.72 °C, salinity 31.67 ‰, abundance 0.02 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Gulf of Saint Lawrence, Japan, New Zealand, Norway, Southern Ocean, New Caledonia, Mediterranean Sea, North Atlantic Ocean.

Description
Size about 250 μm in diameter. Test planispirally enrolled with six to eight whorls, pie-like in shape. Proloculus globular. Second chamber an undivided tubular and tightly appressed against the preceding whorl. Wall agglutinated. Aperture at the open end of the tubular chamber.

Ammodiscus gullmarensis Höglund, 1948

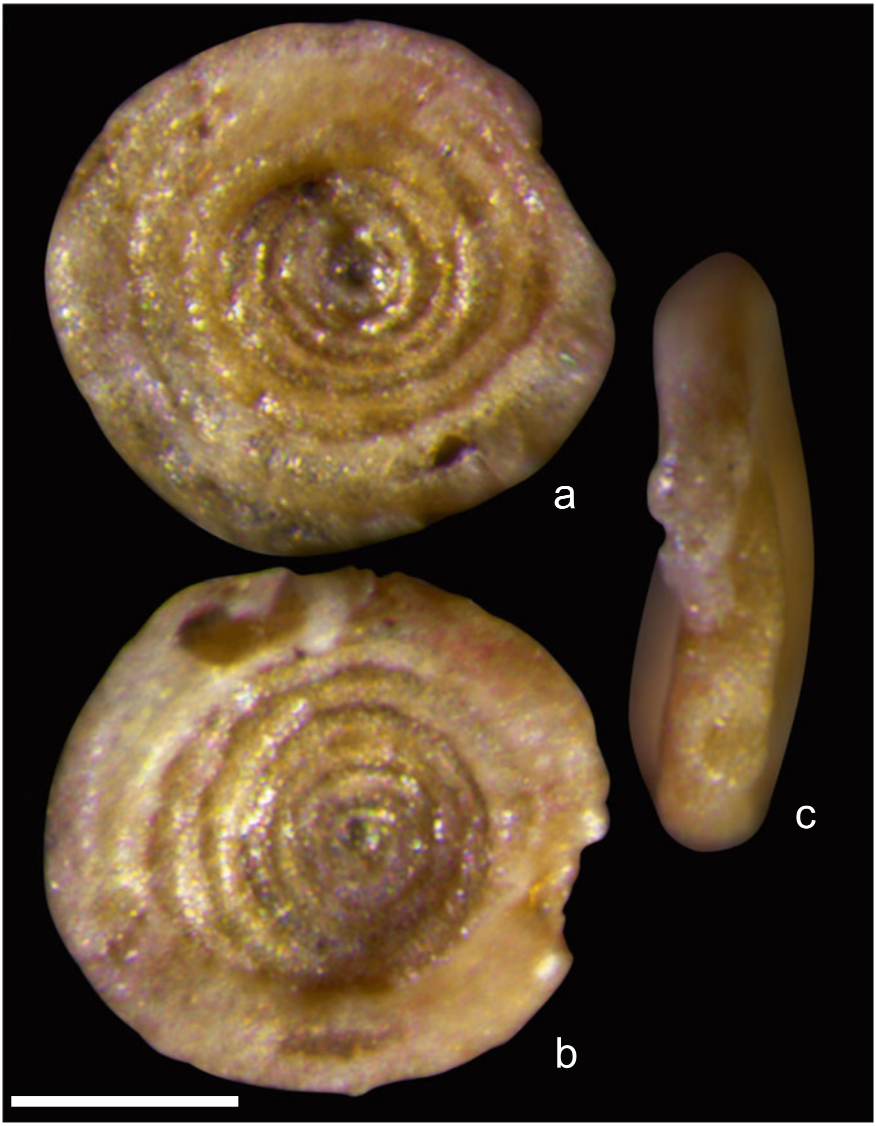

Fig. 5 **a–c** *Ammodiscus gullmarensis* Höglund, 1948, the same specimen from the North Yellow Sea showing different side of views. Scale bar = 100 μm

Remarks

Ammodiscus gullmarensis has been reported from the East China Sea by Wang et al., (1988). Our specimen was smaller than that described from the East China Sea. It occurred infrequently in North Yellow Sea sediments and with low abundance.

Order Textulariida Delage et Hérouard, 1896

Family Hormosinidae Haeckel, 1894

Genus *Reophax* de Montfort, 1808

Reophax curtus **Cushman, 1920** (Fig. 1)

Reophax curtus Cushman, 1920, p. 8, pl. 2, Figs. 2, 3; Hada, 1931, p. 57, Fig. 8; Cushman & McCulloch, 1939, p. 58, pl. 2, Fig. 12; Cushman, 1944a, p. 18, pl. 13, Fig. 21; 1944b, p. 10, pl. 1, Figs. 15, 16; 1948, p. 24, pl. 2, Figs. 13, 14; Parker, 1952, p. 395, pl. 1, Figs. 11–19; Asano, 1952, p. 2, Fig. 5; Sen Gupta, 1971, p. 84, pl. 1, Figs. 2–4; Kim & Han, 1972, pl. II-1, Fig. 2; Khoreva, 1974, p. 79, pl. 1, Fig. 3; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 68, pl. I, Figs. 2, 7; Fursenko et al., 1979, p. 15, pl. 3, Figs. 1–11, pl. 15, Fig. 1; Boltovskoy et al., 1980, p. 48, pl. 30, Figs. 5–7; McCulloch, 1981, p. 8, pl. 1, Figs. 6, 8; Nomura, 1986, p. 475, pl. 1, Fig. 10; Wang, et al., 1988, p. 117, pl. X, Figs. 4, 16; Bender, 1995, p. 48, pl. 3, Fig. 7; Zheng & Fu, 2001, p. 290, pl. XV, Figs. 9–11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H28-01	1000	579	579
H28-02	1177	586	586

Occurrence and Ecology
The Yellow Sea (St 3400-05, St 3400-06, St 3400-08, St 3500-08, St 3500-10, St 3600-02, St 3600-04, St 3875-01, St 3875-03, St B-03) and intertidal flat of the Qingdao Bay (33°59′–38°44′ N, 120°30′–127°00′ E), water depth 3.00–81.00 m, temperature 7.39–13.75 °C, salinity 31.11–33.39 ‰, abundance 0.02–7.52 ind./g sed.

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Reophax curtus Cushman, 1920

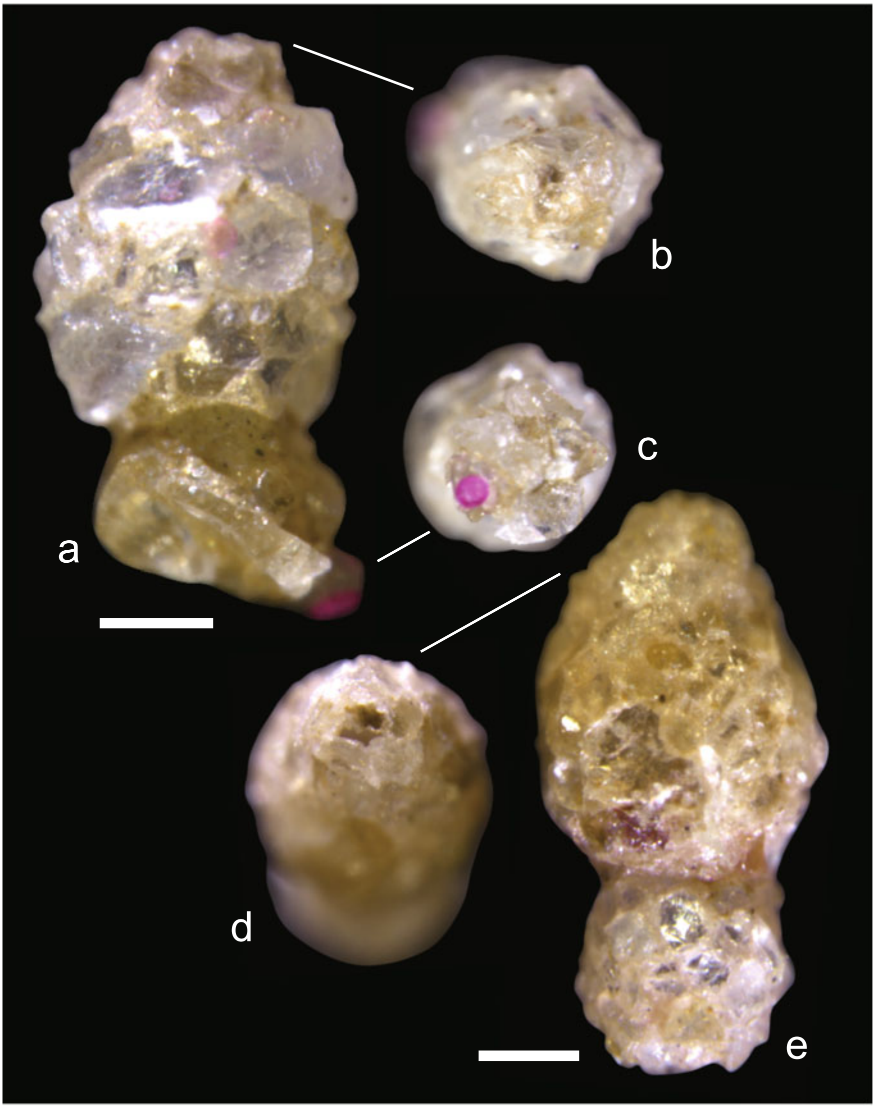

Fig. 1 **a–e** *Reophax curtus* Cushman, 1920, two specimens showing morphological variabilities. **a–c** From the same specimen. **d, e** Another specimen. Scale bars = 200 μm

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Bay of Biscay, Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, North Atlantic Ocean United States, Scotian Shelf, Southeast U.S. Continental Shelf.

Description
Size large, about 1100 μm in length. Test elongate, length:width ratio about 1.9:1, with 2–3 rounded to pyriform chambers in slightly arcuate series. Each succeeding chamber attached near the base of the apertural neck of the preceding chamber. Wall thin, agglutinated with large grains of quartz. Aperture terminal, rounded in shape, and produced on a slight neck.

Remarks
Reophax curtus has been reported by Micropaleontology Group in Marine Geology Department of Tongji University (1978) from the sediments of South Yellow Sea. It was also observed from the East China Sea (Wang et al., 1988) and the Bohai Sea (Zheng & Fu, 2001). Our specimens were mainly distributed in the stations within the Yellow Sea Cold Water Mass area

***Reophax regularis* Höglund, 1947** (Fig. 2)

Reophax regularis Höglund, 1947, p. 86, pl. 9, Figs. 11, 12; pl. 26, Figs. 37–43; pl. 27, Figs. 24–27; p. 89, text Fig. 53; Rosset–Moulinier, 1972, p. 117, pl. 3, Figs. 1, 2; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 68, pl. I, Figs. 11, 12; Hofker, 1983, p. 20, pl. 1, Figs. 5, 8; Zheng, 1988, p. 51, pl. 13, Fig. 1; Haas, 1997, p. 226; Zheng & Fu, 2001, p. 306, pl. XX, Figs. 6, 7; XXI, Figs. 11–15.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H34-01	951	503	503
H34-02	868	517	517

Occurrence and Ecology
The Yellow Sea (St 3400-05, St 3600-06) (34°00′–35°58′ N, 122°30′–123°00′ E), water depth 40.00–70.00 m, temperature 9.19–13.75 °C, salinity 31.12–32.98 ‰, abundance 0.04–0.34 ind./g sed.

Distribution
Yellow Sea, East China Sea, South China Sea, Xisha Islands.
New Zealand, Norway, North Atlantic Ocean.

Description
Size about 900 μm in length. Test elongate, length:width ratio about 1.8:1. Three pyriform chambers in slightly arcuate series, each succeeding chamber attached near the base of the apertural neck of the preceding chamber. Wall thin and agglutinated with grains of quartz. Aperture rounded and located terminally.

Remarks
Reophax regularis was observed from the continental shelf sediments of China Seas from the north to the south, from the Yellow Sea to the Xisha Islands

Reophax regularis Höglund, 1947

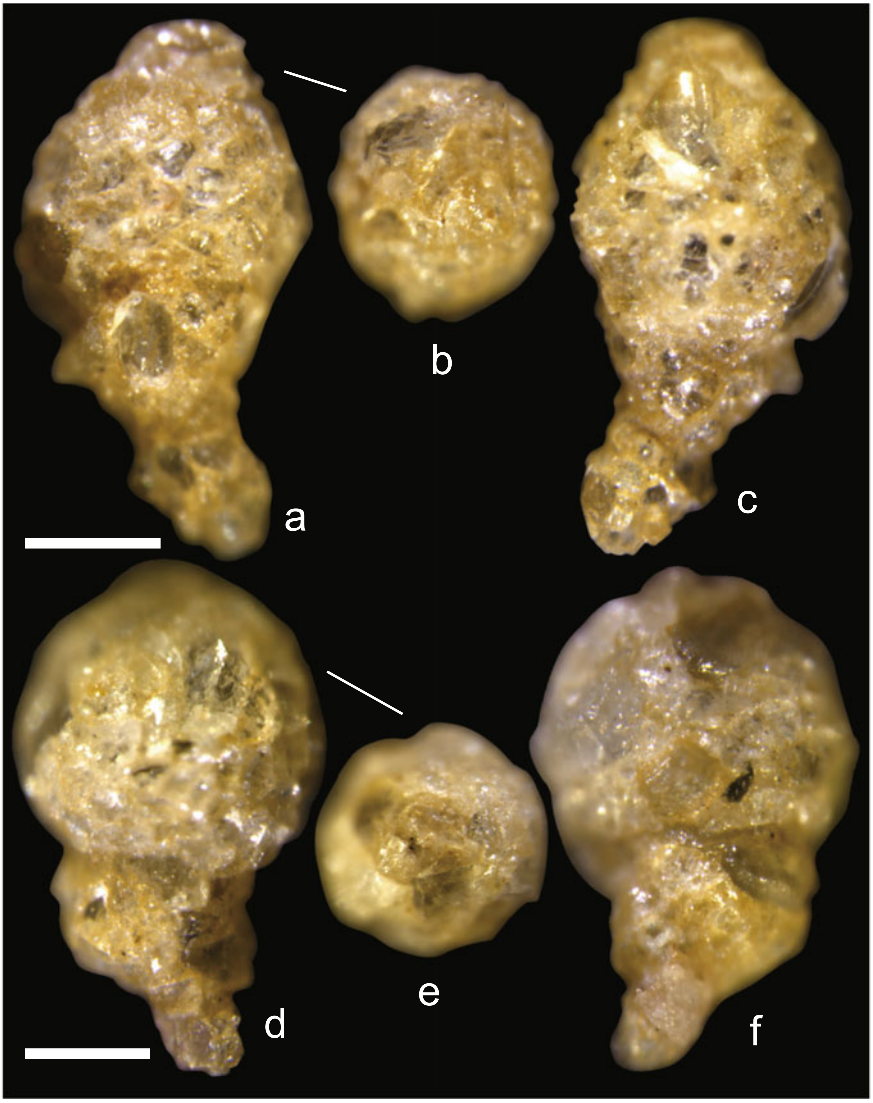

Fig. 2 **a–f** *Reophax regularis* Höglund, 1947, two specimens showing morphological variabilities. **a–c** From the same specimen. **d–f** Another specimen. Scale bars = 200 μm

(Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Zheng & Fu, 2001). It is a common species in the China Seas but abundance is usually low.

Reophax scorpiurus de Montfort, 1808 (Fig. 3)

Reophax scorpiurus de Montfort, 1808, p. 331 (fide Bronnimann & Whittaker, 1980b); Flint, 1899, p. 273, pl. 16, Fig. 3; Hofker, 1930, p. 120, pl. 47, Fig. 4; Hada, 1931, p. 55, Fig. 6; Loeblich & Tappan, 1953, p. 24, pl. 1, Figs. 7–10; Walton, 1955, p. 1013, pl. 99, Fig. 4; Bermudez & Seiglie, 1963, p. 147, pl. 2, Fig. 2; Phleger, 1964b, pl. 1, Fig. 6; Hofker, 1969, p. 14, Figs. 4–9; Bock, 1971, p. 6, pl. 1, Fig. 11; Lankford & Phleger, 1973, pl. 1, Fig. 2; Hofker, 1976, p. 4, Fig. 7; Albani, 1979, p. 13, Fig. 3-1; Brönnimann & Whittaker, 1980b, p. 261, Figs. 1–7, 12, 17; Haake, 1980, p. 4, pl. 1, Fig. 2; Resig, 1981, p. 662, pl. 9, Fig. 14; Schroeder, 1986, p. 42, pl. 14, Figs. 1–5; pl. 23; Wang et al., 1988, p. 117, pl. X, Fig. 2; Zheng, 1988, p. 51, pl. 13, Fig. 6; Schroeder et al., 1990, p. 35, pl. 1, Figs. 15, 16; Cimerman & Langer, 1991, p. 17, pl. 4, Figs. 1–4; Bender, 1995, p. 49, pl. 4, Fig. 5; Hess & Kuhnt, 1996, p. 187, pl. 1, Figs. 3, 5; Hald & Korsun, 1997, p. 119, pl. 1, Fig. 2; Zheng & Fu, 2001, p. 308, pl. XXII, Figs. 8–14.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H48-01	1121	306	306
H48-02	1289	327	327

Occurrence and Ecology

The Yellow Sea (St 3400-06, St 3500-06, St 3600-02, St 3800-02, St 3875-01) (33°59′–38°44′ N, 121°00′–123°00′ E), water depth 33.80–67.80 m, temperature 7.39–12.31 °C, salinity 31.11–31.96 ‰, abundance 0.24–11.48 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, United States, New Caledonia, Scotian Shelf, Vineyard Sound, North Western Weddell Sea, South Pacific Ocean, Southern Ocean, Arctic Ocean, Gulf of Mexico, Mediterranean Sea.

Description

Size about 1200 μm in length. Test elongate, length:width ratio about 4:1. About five rounded to pyriform chambers in somewhat arcuate series, looks slightly curved. Each succeeding chamber attached near the base of the apertural neck of the preceding chamber. Sutures depressed. Wall agglutinated with large and very coarse quartz grains. Aperture rounded and located terminally, produced on the neck.

Remarks

Reophax scorpiurus is widely distributed in the China Seas. It has been reported from the middle and outer continental shelf from the Yellow Sea, the East China Sea, and the South China Sea (Wang et al., 1988; Zheng & Fu, 2001). In our investigation it has rather high abundance in the Yellow Sea, especially in the Yellow Sea Cold Water Mass area.

Reophax scorpiurus de Montfort, 1808

Fig. 3 **a–e** *Reophax scorpiurus* de Montfort, 1808, two specimens showing morphological variabilities. **a** A live specimen. **b–e** Another live specimen with different side of views. Scale bars = 100 μm

Family Ammosphaeroidinidae Cushman, 1927

Genus *Cribrostomoides* Cushman, 1910

***Cribrostomoides subglobosa* (Cushman, 1910)** (Figs. 4, 5)

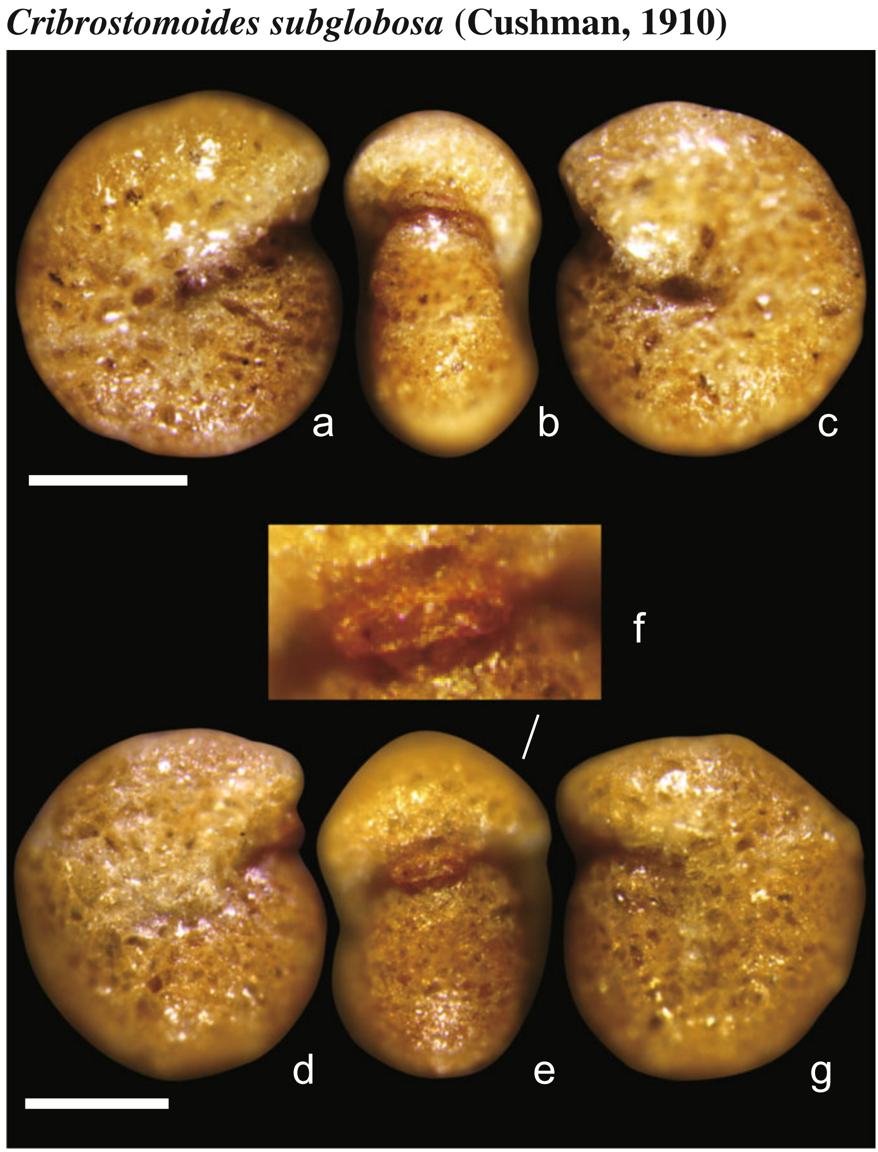

Fig. 4 **a–g** *Cribrostomoides subglobosa* (Cushman, 1910), two specimens showing morphological variabilities. **a–c** From the same specimen. **d–g** Another specimen. Scale bars = 200 µm

Cribrostomoides subglobosa (Cushman, 1910)

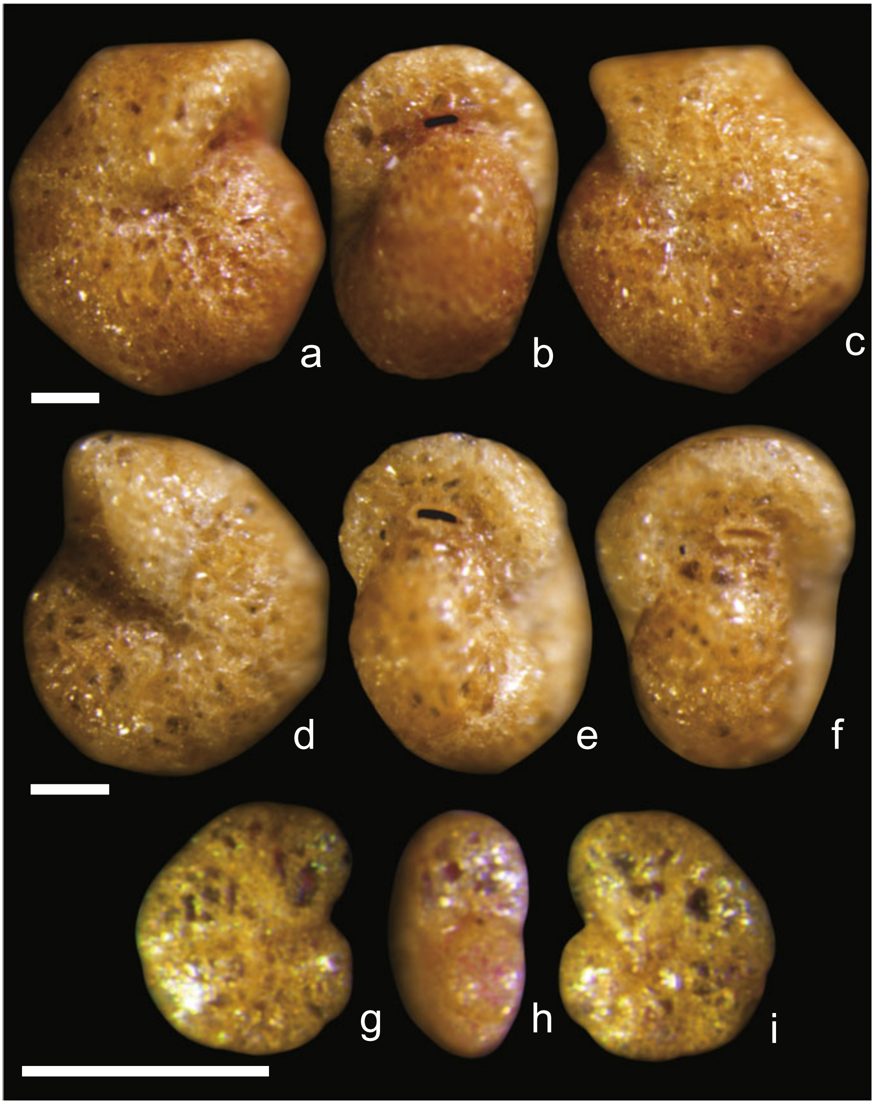

Fig. 5 **a–i** *Cribrostomoides subglobosa* (Cushman, 1910), three specimens showing morphological variabilities. **a–c** From the same specimen. **d–f** Another specimen. **g–i** A juvenile specimen. Scale bars = 100 μm

Haplophragmium latidorsatum Brady, 1884 (*pars*) (*non* Bornemann), 307, pl. 34, Fig. 7; Flint, 1899, p. 276, pl. 20, Fig. 1.

Haplophragmoides subglobosum (G.O. Sars) Cushman, 1910a, p. 105, text Fig. 102–104; 1920, pl. 8, Fig. 5; 1921, p. 81, pl. 15, Fig. 1a, b; Lacroix, 1930, p. 11, Fig. 13; Cushman & McCulloch, 1939, p. 80, pl. 6, Figs. 7, 8.

Labrospira subglobosa (G.O. Sars), Hoeglund, 1947, p. 144, pl. 11, Fig. 2; text Fig. 126.

Alveolophragmium subglobosum (G.O. Sars), Parker, 1954, p. 487, pl. 2, Figs. 1, 2; Ingle et al., 1980, p. 136, pl. 3, Fig. 10; Sejrup et al., 1981, p. 290, pl. 1, Fig. 1; Van Marle, 1988, p. 147, pl. 5, Fig. 26, 27.

Recurvoides subglobosus (G.O. Sars), Uchio, 1960, p. 52, pl. 1, Figs. 26, 27.

Cribrostomoides subglobosus (G.O. Sars), Vilks, 1969, p. 45, pl. 1, Fig. 18a, b; Podobina, 1974, p. 18, pl. 2, Figs. 1, 2; pl. 4, Figs. 1–3; LeRoy & Hodgkinson, 1975, p. 432, pl. 4, Figs. 2–4; Poag, 1981, p. 57, pl. 11, Fig. 2; pl. 12, Fig. 2a, b; Resig, 1981, p. 664, pl. 10, Fig. 7; Schroeder, 1986, p. 48, pl. 17, Figs. 15, 16; Schroeder et al., 1988, p. 32, pl. 6, Figs. 1, 2; Zheng, 1988, p. 62, pl. 17, Fig. 6; pl. 19, Figs. 3, 4; Thomas et al., 1990, p. 227, pl. 2, Fig. 8; Tu & Zheng, 1991, p. 166. pl. 1, Fig. 7; Murray & Alve, 1994, p. 50, pl. 1, Figs. 5, 6.

Cribrostomoides bradyi Cushman, 1910, p. 108, tfs. 167a-b; Research Party of Marine Geology, Ministry of Geology, and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 145, pl. 1, Fig. 2.

Cribrostomoides subglobosum forma subglobosum (Cushman), Jones et al., 1993, pp. 181–191, Figs. 1.1–1.3; pl. 1, Figs. 1–4; pl. 2, Figs. 6–8; pl. 3; Figs. 1–7.

Cribrostomoides subglobosus (Cushman), Zheng & Fu, 2001, p. 337, pl. XXXIV, Figs. 2–4.

Cribrostomoides subglobosa (Cushman, 1910), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D8-01	429	393	243
D8-02	457	439	337
D8-03	516	453	360
D8-04	429	381	300
D8-05 (juvenile)	103	87	55

Occurrence and Ecology

The Yellow Sea (St 3400-05, St 3400-06, St 3400-08, St 3500-06, St 3600-06, St 3875-01) (33°59′–38°44′ N, 121°59′–123°58′ E), water depth 40.00–80.00 m, temperature 7.39–13.75 °C, salinity 31.12–32.98 ‰, abundance 0.02–8.26 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, United States, New Caledonia, Northeast U.S. Continental

Shelf, Southeast U.S. Continental Shelf, North Western Weddell Sea, Arctic Ocean, Mediterranean Sea.

Description
Size about 450 μm in length. Test enrolled and involute, about seven chambers per whorl. Early stage slightly streptospiral, later becomes planispiral and symmetrical. Outline of the test sometimes slightly angulate and umbilical area distinctly depressed. Sutures indistinct. Wall agglutinated with fine grains. Aperture distinct, equatorial located, and with a narrow lip.

Remarks
Cribrostomoides subglobosa has been identified as *Cribrostomoides bradyi* Cushman, 1910 or *Cribrostomoides subglobosum* in previous Chinese literature (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988; Zheng & Fu, 2001). It is a common species in the Yellow Sea and the East China Sea.

Family Haplophragmoididae Maync, 1952

Genus *Haplophragmoides* Cushman, 1910

***Haplophragmoides applanata* [Wang, 1978] nov. stat.** (Fig. 6)

Haplophragmoides applanata sp. nov., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 71, pl. II, Figs. 3–5, 8–9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H70-01	595	450	175
H70-02	473	380	145

Nomenclature
Haplophragmoides applanata was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978) in a Chinese local publication. According to International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), Recommendation 51D in Article 51.2.1, "Author anonymous, or anonymous but know or inferred,… if the authorship is known or inferred from external evidence, the name of the author, if cited, should be enclosed in square brackets to show the original anonymity". Therefore, we assigned Dr. Pin Xian Wang as the author since he guided the book publication.

Haplophragmoides applanata [Wang, 1978] nov. stat

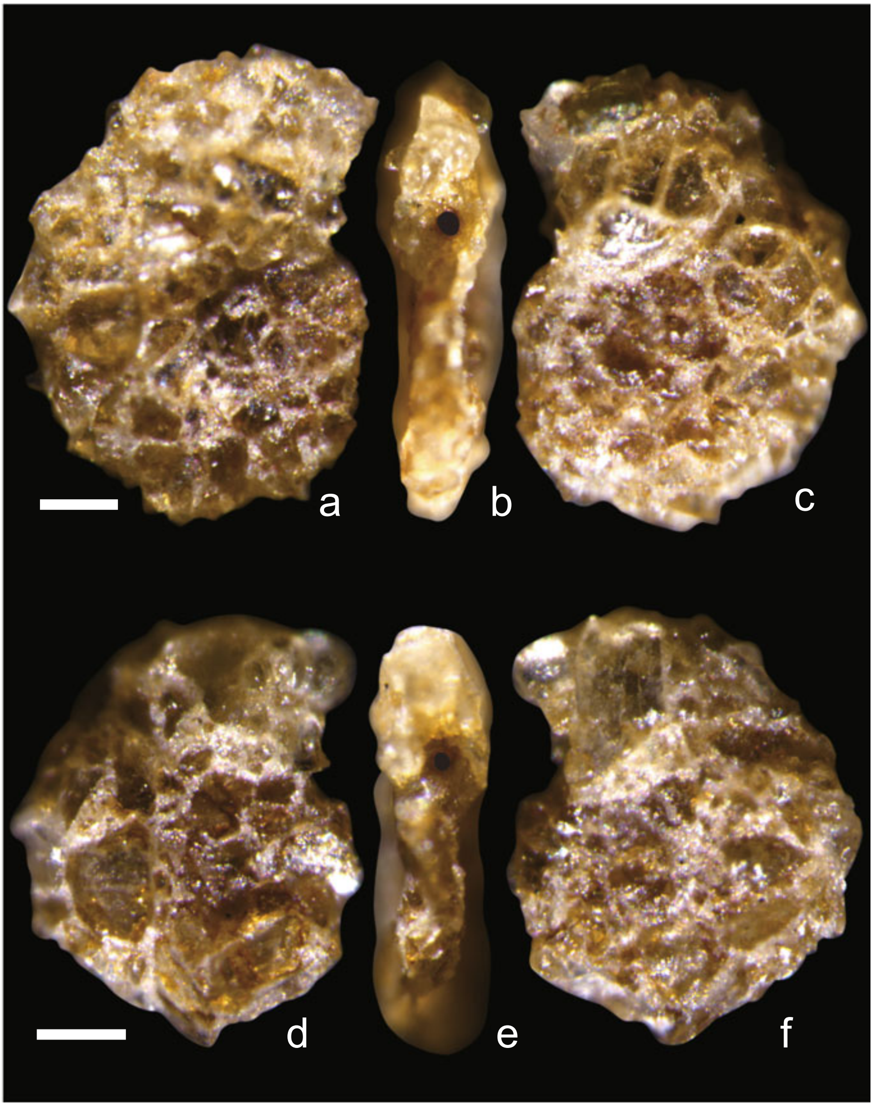

Fig. 6 **a–f** *Haplophragmoides applanata* [Wang, 1978]. **a–c** The same specimen with different side of views. **d–f** Another specimen. Scale bars = 100 μm

Occurrence and Ecology
The Bohai Sea (St 26, St A8, St 6, St 11, St 22) and the Yellow Sea (St 3600-08) (36°00′–39°00′ N, 119°30′–123°59′ E), water depth 25.00–78.00 m, temperature 2.25–9.12 °C, salinity 30.30–33.31 ‰, abundance 0.32 ind./g sed.

Distribution
Bohai Sea, Yellow Sea.

Description
Size about 550 μm in length, length:width ratio about 1.3:1. Test planispirally enrolled, involute to slightly evolute, 2.6:1 flattened laterally and slightly asymmetrical in side view, biumbilicate, and slightly depressed in each umbilical region. The final whorl with about seven to eight chambers, slightly inflated, and margin lobulated. Sutures indistinct. Wall rather thin and coarsely agglutinated with quartz grains. Aperture an elongate equatorial slit located at the base of the apertural face.

Remarks
Haplophragmoides applanata was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978). This species was discovered from the South Yellow Sea in 20–50 m water depth region. In our investigation this species often occurred in sediments of Bohai Sea and the Yellow Sea Cold Water Mass area. It might be an endemic species of the North Chinese Seas representing cold water environment.

***Haplophragmoides canariensis* (d'Orbigny, 1839)** (Fig. 7)

Alveolophragmium canariensis (d'Orbigny, 1839).

Cribrostomoides canariensis (d'Orbigny, 1839).

Nonionina canariensis d'Orbigny, 1839, p. 128, pl. 11, Figs. 33, 34.

Haplophragmoides canariensis (d'Orbigny), Cushman, 1910a, p. 101, Fig. 149; 1920, p. 38, pl. 8, Fig. 1; Loeblich & Tappan, 1964, p. C225, Fig. 135, 1; He et al., 1965, p. 57, pl. I, Fig. 2; Hedley et al., 1967. p. 18, pl. 5, Fig. 4; text Fig. 7; Towe, 1967, p. 147–151, pl. 12, pl. 13; Marszalek et al., 1969, p. 343; Matoba, 1970, p. 35, pl. 1, Fig. 6a, b; Echols, 1971, pl. 3, Fig. 2; Le Calvez, 1974, pp. 35, 36; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 72, pl. II, Figs. 14–16; Hao et al., 1980, p. 27, pl. 2, Fig. 8; Hong, 1985, p. 68; Schroeder, 1986, p. 46, pl. 18, Fig. 1; Bender, 1989, p. 297, pl. 16, Fig. 16; Zheng et al., 1988, p. 145, pl. 1, Fig. 3; Cimerman & Langer, 1991, p. 18, pl. 4, Figs. 7–9; Zheng & Fu, 2001, p. 341, pl. XXXV, Fig. 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H43-01	288	235	135
H43-02	251	221	193
H43-03	296	229	170

Occurrence and Ecology
The Yellow Sea (St CJ-06, St 3300-06, St 3400-05, St 3500-06, St 3500-08, St 3500-10, St 3600-02, St 3600-04, St 3800-02, St 3875-01, St B-06) (32°29′–38°44′ N, 121°00′–125°00′ E), water depth 33.80–81.00 m, temperature 7.39–18.08 °C, salinity 31.11–33.39 ‰, abundance 0.08–51.68 ind./g sed.

Haplophragmoides canariensis (d'Orbigny, 1839)

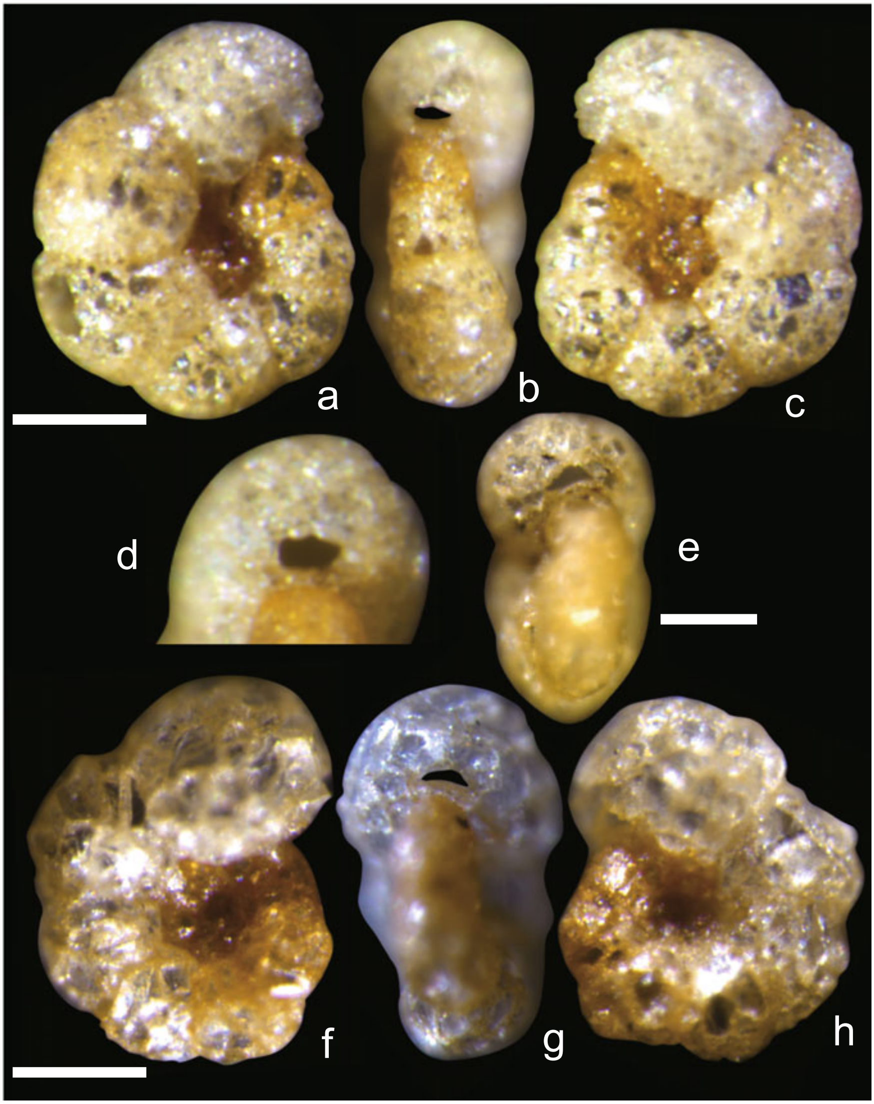

Fig. 7 a–h *Haplophragmoides canariensis* (d'Orbigny, 1839), three specimens showing morphological variabilities. **a–d** From the same specimen. **e** Another specimen. **f–h** The third specimen. Scale bars = 100 µm

Distribution

Yellow Sea, Okinawa Trough.

Gulf of Saint Lawrence, Japan, North Atlantic Ocean, United States, New Caledonia, Northeast U.S. Continental Shelf, Mediterranean Sea.

Description

Size about 280 μm in length, length:width ratio about 1.2:1. Test planispirally enrolled, involute to slightly evolute, about 1.4:1 flattened laterally. Umbilical region distinctly depressed. The final whorl with about seven chambers, inflated, and subglobose in shape. Sutures very distinct and depressed. Wall thin, agglutinated with coarsely particles. Aperture distinct, elongate or arch in shape, opening at the base of the apertural face.

Remarks

Haplophragmoides canariensis has been frequently reported from the Yellow Sea sediments by previous Chinese publications (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; He et al., 1965; Zheng & Fu, 2001). This species might be a cold water species from the North Temperate Zone.

Family Discamminidae Mikhalevich, 1980

Genus *Ammoscalaria* Höglund, 1947

***Ammoscalaria pseudospiralis* (Williamson, 1858)** (Figs. 8, 9)

Proteonina pseudospiralis Williamson, 1858, p. 2, Figs. 2, 3.

Haplophragmium pseudospirale (Williamson), Brady, 1884, p. 302, pl. 34, Figs. 1–4.

Ammobaculites pseudospiralis (Williamson), Cushman, 1920, p. 62, pl. 12, Fig. 4; 1921, p. 94, pl. 19, Figs. 1, 2; Lacroix, 1930, p. 12, Figs. 15, 16; Hada, 1931, p. 66, Fig. 18; Chapman & Parr, 1937, p. 143, pl. 10, Fig. 39.

Ammoscalaria pseudospiralis (Williamson), Hoeglund, 1947, pp. 159–162, pl. 31, Fig. 1; Phleger et al., 1953, p. 6, pl. 1, Figs. 29, 35; Boltovskoy, 1957, p. 19, pl. 3, Fig. 9; Phleger, 1964a, pl. 1, Figs. 10, 11; Voorthuysen, 1960, p. 243, pl. 10, Fig. 2; Brodniewicz, 1965, p. 186, pl. 8, Fig. 2; Matoba, 1970, p. 48, pl. 1, Fig. 9a, b; Murray, 1971, p. 29, pl. 7, Figs. 1–4; Bergen & O'Neil, 1979, pl. 5, Fig. 23; Boltovskoy et al., 1980, p. 54, pl. 35, Figs. 4–7; Alve & Nagy, 1986, p. 281, pl. 2, Figs. 6–8; Zheng, 1988, p. 68, text Fig. 11; Alve, 1990, pp. 185, 196; Zheng & Fu, 1990, p. 186, pl. 1, Fig. 32; 1990, pp. 546, 557, pl. 1, Fig. 3; Cimerman & Langer, 1991, p. 18, pl. 5, Figs. 4–6; Barmawidjaja et al., 1992, p. 309, pl. 1, Figs. 12, 13; Bender, 1995, p. 41, pl. 4, Fig. 15; pl. 11, Fig. 1; Zheng & Fu, 2001, p. 356, pl. XXXVI, Figs. 11–13; pl. XXXVII, Figs. 1–4; pl. CXVII, Fig. 10.

Ammoscalaria pseudospiralis (Williamson, 1858)

Fig. 8 a–c *Ammoscalaria pseudospiralis* (Williamson, 1858), same specimen with different side of views. Scale bar = 100 µm

Ammoscalaria pseudospiralis (Williamson, 1858)

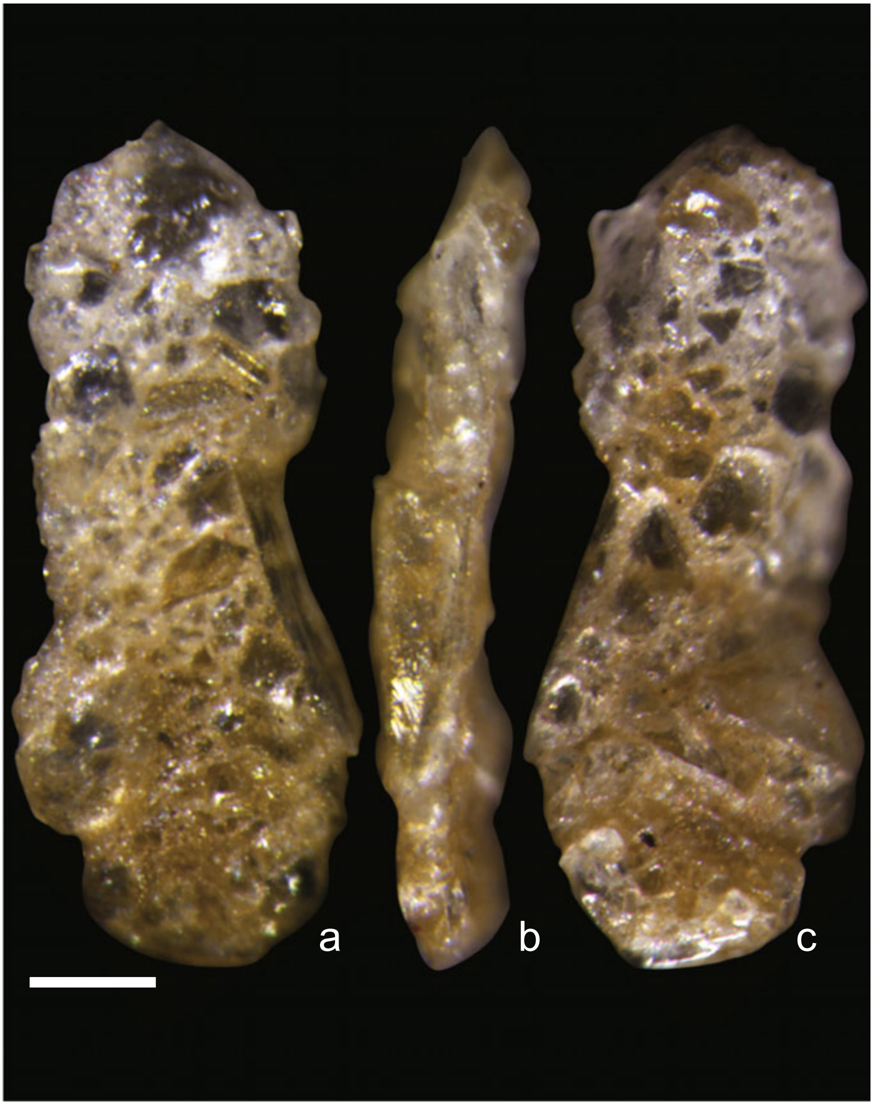

Fig. 9 a–c *Ammoscalaria pseudospiralis* (Williamson, 1858), another specimen with different side of views. Scale bar = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H150-01	798	207	105
H150-02	660	267	95

Occurrence and Ecology

The Yellow Sea (St 3600-02) (35°59′ N, 120°59′ E), water depth 33.00 m, temperature 18.30 °C, salinity 31.30 ‰, abundance 0.10 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea, Xisha Islands.

Bay of Biscay, Celtic Sea, English Channel, Japan, New Zealand, North Atlantic Ocean, Norway, Gulf of Mexico, Mediterranean Sea.

Description

Size about 750 μm in length. Test elongate, length:width ratio about 3:1, very thin, and flattened. Early portion with one to two planispiral whorls, comprising about five chambers. Later portion uncoiling and rectilinear, with about four to five short and broad chambers. Sutures unclear. Wall thick, agglutinated with very coarse and large quartz grains. Aperture an indistinct round opening located terminally.

Remarks

Ammoscalaria pseudospiralis is characterized by having a very thin and flattened test, and very obscure sutures. It is an inner continental shelf shallow water species. In the Yellow Sea it rarely occurred and with low abundance.

Family Lituolidae de Blainville, 1827

Genus *Ammobaculites* Cushman, 1910

***Ammobaculites agglutinans* (d'Orbigny, 1846)** (Fig. 10)

Spirolina agglutinans d'Orbigny, 1864, p. 137, pl. 7, Figs. 10–12; (*fide* Ellis & Messina, 1940).

Ammobaculites agglutinans (d'Orbigny), Cushman, 1910a, p. 115, Fig. 176; 1921, p. 89, pl. 17, Fig. 4; Hada, 1931, p. 65, Fig. 17; Braga, 1960, p. 27, pl. 2, Figs. 7, 8; Hedley et al., 1965, p. 11, pl. 1, Figs. 2, 3; Chiji & Lopez, 1968, p. 102, pl. 6, Fig. 3; Bock, 1971, p. 7, pl. 1, Fig. 15; Rosset–Moulinier, 1972, p. 119, pl. 3, Fig. 10; pl. 27, Fig. 6; Zheng, 1988, p. 66, pl. 23, Fig. 7; Bender, 1989, p. 297, pl. 16, Fig. 18; 1995, p. 40; Zheng & Fu, 2001, p. 366, pl. XXXIX, Figs. 3–7.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H9-01	527	153	153
H9-02	769	173	173

Ammobaculites agglutinans (d'Orbigny, 1846)

Fig. 10 **a–e** *Ammobaculites agglutinans* (d'Orbigny, 1846), two specimens showing morphological variabilities. **a–c** From the same specimen. **d, e** Another specimen. Scale bars = 50 μm

Occurrence and Ecology

The Bohai Sea (St 26, St 6, St 19, St 11, St 36, St 31), the Yellow Sea (St CJ-02, St CJ-04, St 3300-04, St 3500-02) and intertidal flat of the Qingdao Bay (31°49′–39°

00′ N, 119°30′–122°59′ E), water depth 3.00–42.00 m, temperature 2.25–17.54 °C, salinity 30.11–38.00 ‰, abundance 0.02–2.50 ind./g sed.

Distribution

Bohai Sea, Qingdao Bay of the Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Japan, New Zealand, North Atlantic Ocean, Norway, United States, New Caledonia, Northeast U.S. Continental Shelf, North Western Weddell Sea, Gulf of Mexico, Mediterranean Sea.

Description

Size about 650 µm in length. Test elongate, length:width ratio about 4:1. Early portion close coiled, having about six chambers. Later portion uncoiling and rectilinear, rounded in section, having about five to seven chambers. Sutures with distinct depressions. Wall coarsely agglutinated. Aperture terminal, rounded in shape.

Remarks

Ammobaculites agglutinans is widely distributed in the China Seas, from the shallow water to the deep water area in the continental shelf of China.

Family Haplophragmiidae Eimer & Fickert, 1899

Genus *Haplophragmium* Reuss, 1860

Haplophragmium bonplandi **Todd & Bronnimann, 1957** (Fig. 11)

Haplophragmium bonplandi Todd & Bronnimann, 1957, p. 23, pl. 2, Fig. 2; Scott & Medioli, 1980, p. 36, pl. 2, Figs. 4, 5; Levy et al., 1995a, p. 601, pl. 1, Fig. 1; Zheng & Fu, 2001, p. 340, pl. XXXV, Fig. 13.

Haplophragmoides cf. *bonplandi* Todd & Bronnimann, McCulloch, 1981, p. 11, pl. 2, Figs. 7, 8, 10, 11, 13.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H24-01	385	340	131
H24-02	366	295	111

Occurrence and Ecology

The Yellow Sea (St 3500-10) (35°00′ N, 123°59′ E), water depth 81.00 m, temperature 9.62 °C, salinity 33.39 ‰, abundance 1.42 ind./g sed.

Distribution

Yellow Sea.

Haplophragmium bonplandi Todd & Bronnimann, 1957

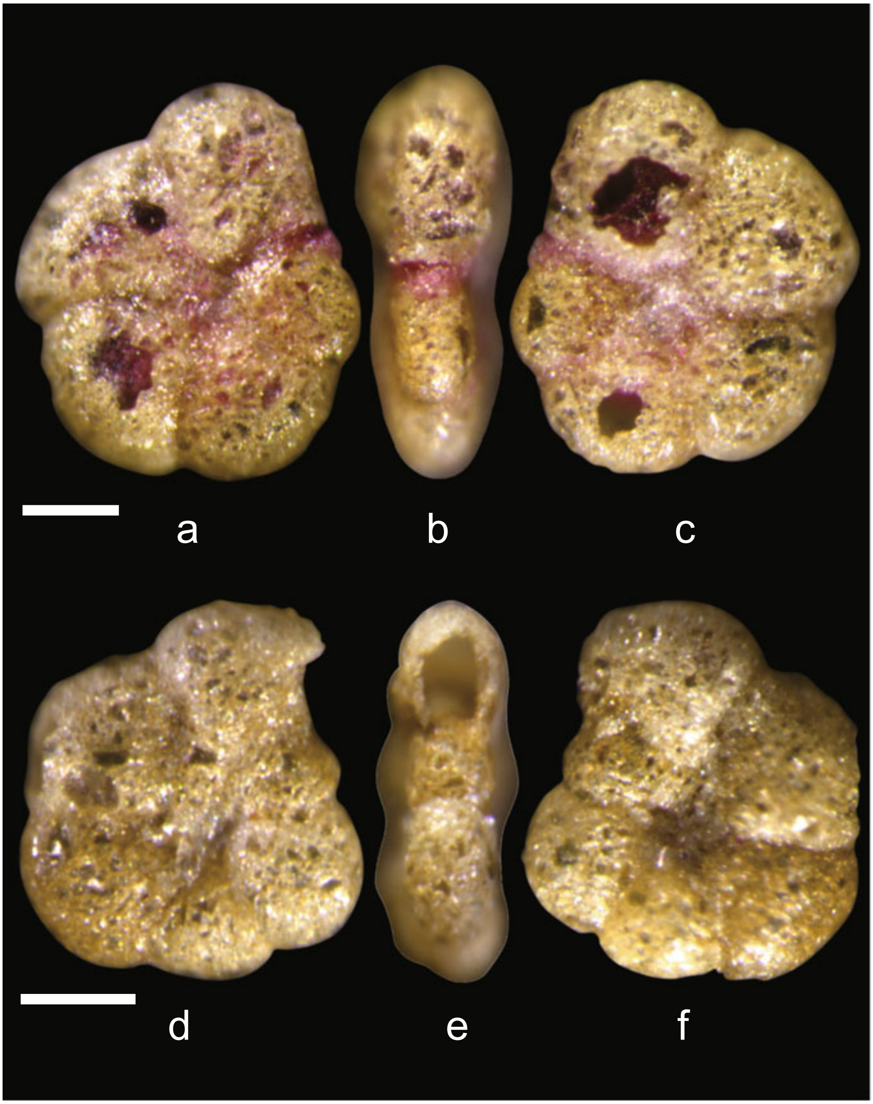

Fig. 11 a–f *Haplophragmium bonplandi* Todd & Bronnimann, 1957, two specimens showing morphological variabilities. **a–c** From the same specimen. **d–f** Another specimen. Note that the specimens were broken. Scale bars = 100 μm

Description

Size about 380 μm in length, length:width ratio about 1.1:1, about 2.6:1 flattened laterally. Test planispirally enrolled and slightly evolute, bilateral symmetrically;

side view distinctly flattened. Umbilical region distinctly depressed. The final whorl with about six chambers. Wall very thin, finely to coarsely agglutinated. Aperture an indistinct small slit at the base of the apertural face.

Remarks
Haplophragmium bonplandi is not a common species in China Seas. In our investigation it occurred at the Yellow Sea Cold Water Mass region and has a low abundance.

Family Spiroplectamminidae Cushman, 1927

Genus *Spiroplectammina* Cushman, 1927

***Spiroplectammina sagittula* (Defrance, 1824)** (Fig. 12)

Textularia sagittula Defrance, 1824, p. 177, pl. 13, Fig. 5; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 70, pl. I, Fig. 10; Wang et al., 1980, p. 33, pl. III, Fig. 1; Loeblich & Tappan, 1987, p. 173, pl. 193, Figs. 1-2; Research Party of Marine Geology, Ministry of Geology, and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 146, pl. I, Fig. 8; Lee et al., 1990, p. 899, Fig. 62.

Spiroplectammina sagittula (Defrance, 1824), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D47-01	435	307	131
D47-02	393	301	150

Occurrence and Ecology
The Yellow Sea (St CJ-01) (31°39′ N, 122°30′ E), water depth 26.90 m, temperature 14.03 °C, salinity 30.31 ‰, abundance 0.08 ind./g sed.

Distribution
Yellow Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea, and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, Southeast U.S. Continental Shelf, and Mediterranean Sea.

Description
Size about 400 μm in length, length:width ratio about 1.4:1. Test biserial, large early planispiral coil of few chambers followed by biserially arranged later chambers; about seven to nine chambers in each side. Sutures distinct. Wall agglutinated with fine quartz grains. Aperture an indistinct slit, located at the base of the apertural face.

Spiroplectammina sagittula (Defrance, 1824)

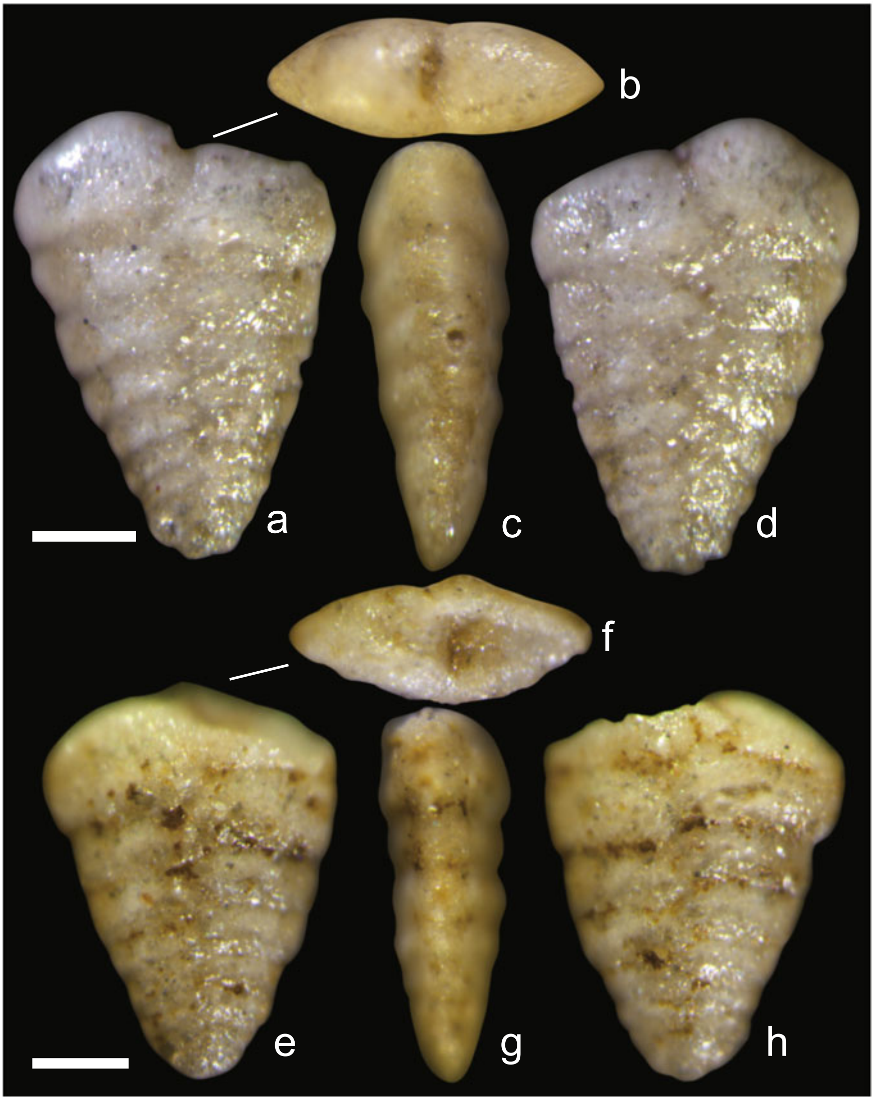

Fig. 12 **a–h** *Spiroplectammina sagittula* (Defrance, 1824), two specimens were sampled from the South Yellow Sea. **a–d** From the same specimen. **e–h** Another specimen. Scale bars = 100 μm

Remarks

Spiroplectammina sagittula has been identified as *Textularia sagittula* in previous Chinese literature. This species was assigned to *Spiroplectammina sagittula* by Hayward et al., (2015). It occurred in the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980) and the Okinawa Trough sediments (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988).

Genus *Spiroplectinella* Kisel'man, 1972

***Spiroplectinella pseudocarinata* (Cushman, 1921)** (Fig. 13)

Textularia carinata d'Orbigny, 1846, Cushman, 1911, p. 17, text Figs. 26, 27; Brady, 1884 (non d'Orbigny, 1826), p. 360, pl. 42, Figs. 15, 16.

Textularia Pseudocarinata Cushman, 1921, p. 121, pl. 22, Fig. 5; Wang et al., 1980, p. 12, pl. III Fig. 2; Wang et al., 1988, p. 122, pl. XI, Figs. 7, 13.

Spiroplectinella carinata (d'Orbigny, 1846), Loeblich & Tappan, 1987, p. 112, pl. 120, Figs. 11–15.

Spiroplectammina arenasuturata LeRoy, Inoue, 1989 (non LeRoy, 1939), pl. 19, Fig. 5.

Spiroplectinella pseudocarinata (Cushman, 1921), Loeblich & Tappan, 1994, p. 19, pl. 15, Figs. 1–14.

Spirorutilus carinatus (d'Orbigny, 1846), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H157-01	715	333	139
H157-02	475	275	169

Occurrence and Ecology

The Yellow Sea (St 3000-2) (29°59′ N, 123°00′ E), water depth 42.77 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 0.01 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, the Timor Sea, Mediterranean Sea, North Atlantic Ocean.

Description

Size about 600 μm in length, length:width ratio about 2:1. Test biserial, except to the slightly planispiral coiled early portion. Transverse section lozenge in shape and with marginal keels. Wall agglutinated with fine particles. Aperture an indistinct slit.

Remarks

Spiroplectinella pseudocarinata has been identified as *Textularia Pseudocarinata* in the previous Chinese literature from continental shelf sediments of the East China Sea (Wang et al., 1980, 1988). Our Yellow Sea population was slightly smaller than that described from the East China Sea; in addition, its marginal keels were less distinct.

Spiroplectinella pseudocarinata (Cushman, 1921)

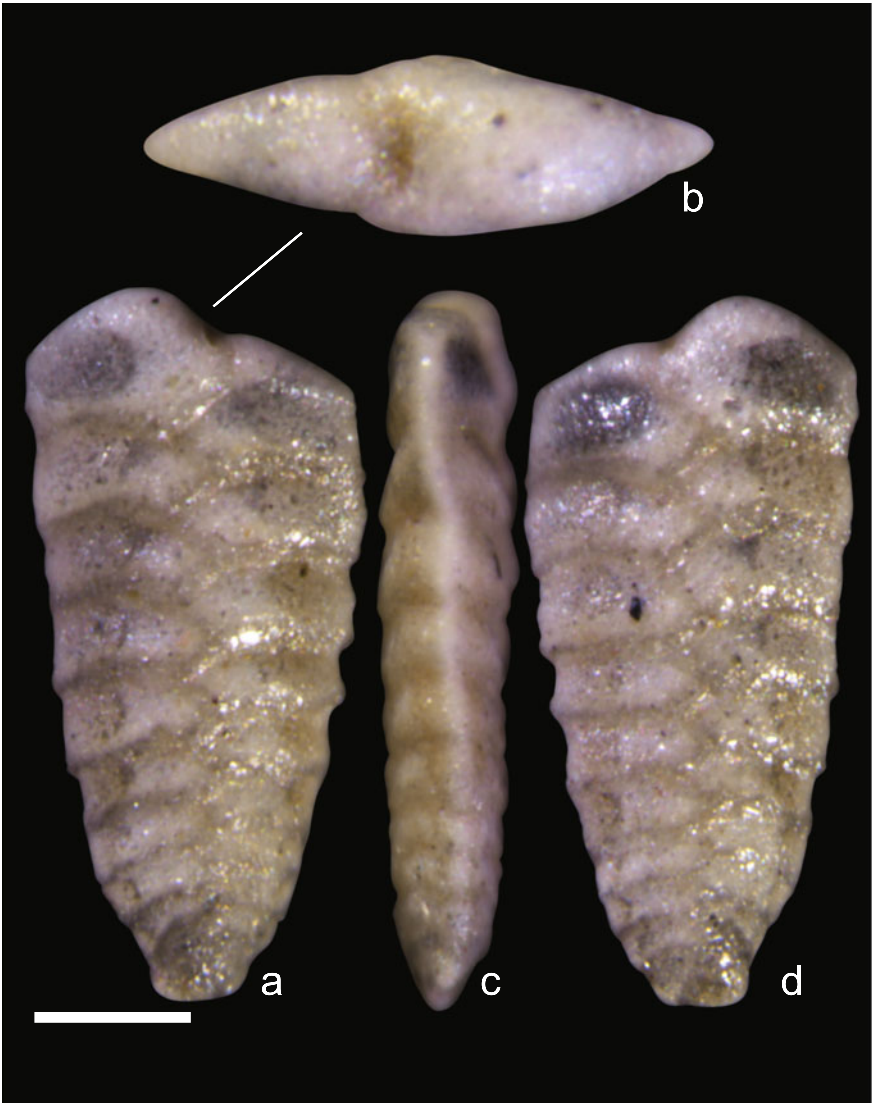

Fig. 13 a–d *Spiroplectinella pseudocarinata* (Cushman, 1921), same specimen showing different side of views. Scale bar = 150 µm

Family Nouriidae Chapman & Parr, 1936

Genus *Nouria* Heron–Allen & Earland, 1914

***Nouria polymorphinoides* Heron–Allen & Earland, 1914** (Fig. 14)

Nouria polymorphinoides Heron–Allen & Earland, 1914, p. 376, pl. 37, Figs. 1–15; Hada, 1931, p. 93, text Fig. 45; Cushman & McCulloch, 1939, p. 111, pl. 12, Figs. 5–10; Phleger et al., 1953, p. 11, pl. 3, Figs. 1, 2; Todd & Bronnimann, 1957, p. 30, pl. 4, Fig. 14; Uchio, 1960, pl. 3, Fig. 29; Bermudez & Seiglie, 1963, p. 110, pl. 4, Fig. 5; Lankford & Phleger, 1973, pl. 3, Fig. 1; Haake, 1977, p. 66, pl. 2, Fig. 5; Fursenko et al., 1979, p. 24, pl. 3, Fig. 15; Zheng, 1979, p. 112, pl. 1, Fig. 7; Loeblich & Tappan 1987, p. 32, pl. 123, Figs. 11–12; Zheng, 1988, p. 100, pl. 15, Figs. 5–8; Cimerman & Langer, 1991, p. 20, pl. 7, Figs. 1–3; Bender, 1995, p. 47, pl. 5, Fig. 9.

Nouria polymorphinoides Heron–Allen & Earland, Zheng & Fu, 2001, p. 413, pl. LVIII, Figs. 16, 17; pl. LIX, Figs. 1–6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H19-01	72	523	175
H19-02	821	529	219

Occurrence and Ecology

The Yellow Sea (St 3300-04, St 3400-06, St 3400-08, St 3500-06, St 3500-08, St 3600-02, St 3600-04, St 3600-06) (32°59′–35°59′ N, 121°00′–123°58′ E), water depth 32.90–80.00 m, temperature 9.19–15.61 °C, salinity 31.11–33.23 ‰, abundance 0.10–49.00 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea, Xisha Islands, Nansha Islands.

Bay of Biscay, Japan, New Zealand, North Atlantic Ocean, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 770 μm in length. Test elongate, oval in section, length:width ratio about 1.5:1, and very flattened in side view. Early stage polymorphine spiral, later biserial. Sutures obscure. Wall very thin and coarsely agglutinated with large mineral grains. Aperture terminally located.

Remarks

Nouria polymorphinoides is widely distributed in the China Seas but usually has low abundance. In the Yellow Sea it mainly distributed in the Yellow Sea Cold Water Mass area.

Nouria polymorphinoides Heron-Allen & Earland, 1914

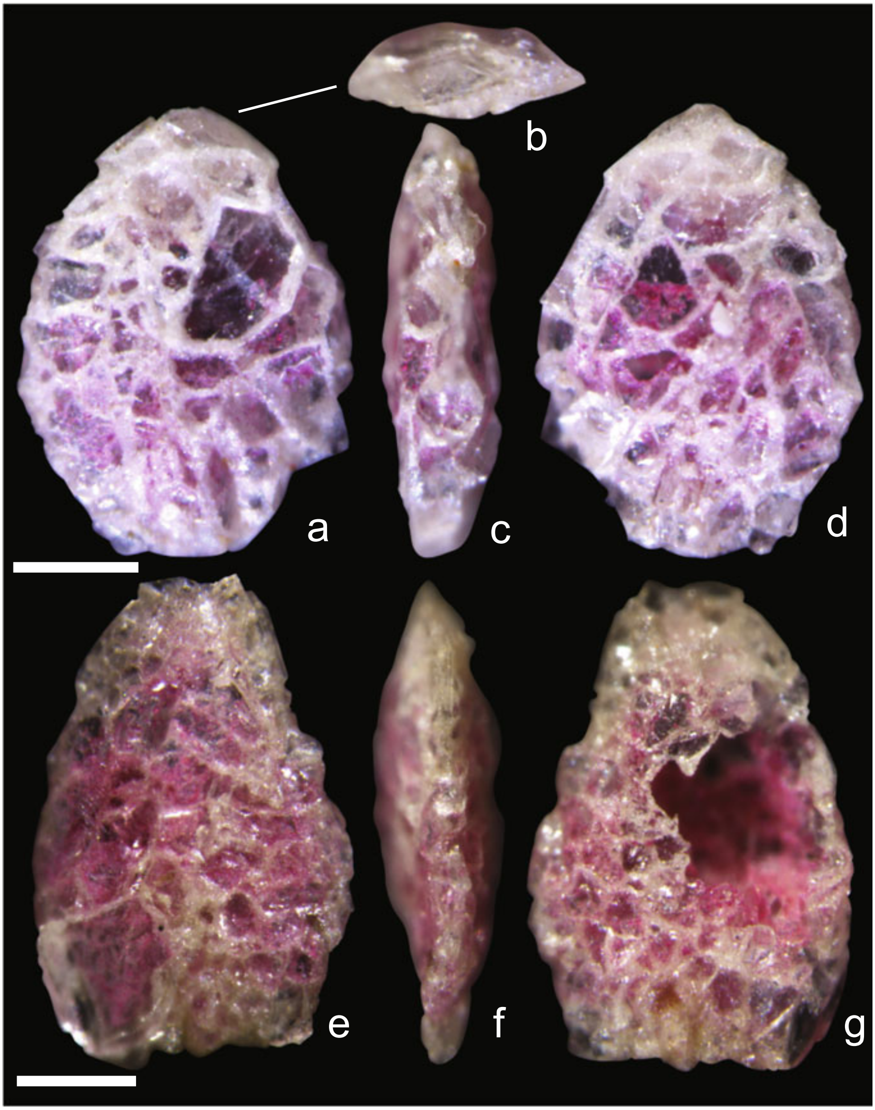

Fig. 14 a–g *Nouria polymorphinoides* Heron–Allen & Earland, 1914. **a–d** The same specimen showing different side of views. **e–g** Another specimen (one side was broken). Scale bars = 200 μm

Family Trochamminidae Schwager, 1877

Genus *Ammoglobigerina* Eimer & Fickert, 1899

***Ammoglobigerina globigeriniformis* (Park & Jones, 1865)** (Fig. 15)

Lituola nautiloidea var. *globigeriniformis* Parker & Jones, 1865, p. 407, pl. 15, Figs. 46, 47.

Haplophragmium globigeriniforme (Parker & Jones), Brady, 1884, p. 312, pl. 35, Figs. 10, 11; Flint, 1899, p. 277, pl. 21, Fig. 1.

Trochammina globigeriniformis (Parker & Jones), Cushman, 1911, p. 124, Figs. 193, 194; 1921, p. 96, pl. 11, Figs. 4, 5; Phillips, 1977, p. 22, pl. 2, Fig. 4; Ingle et al., 1980, p. 140, pl. 5, Figs. 12, 13; Haake, 1980, p. 7, pl. 1, Fig. 18; Resig, 1981, p. 654, pl. 5, Fig. 4; Hughes, 1988, p. 305, pl. 3, Figs. 4–8; Tu & Zheng, 1991, p. 168, pl. 1, Fig. 1.

Trochammina ex. gr. globigeriniformis (Parker & Jones), Saidova, 1961, pl. 12, Fig. 71.

Ammoglobigerina trochamminiforme Galloway, 1933, p. 182, pl. 10, Figs. 3–4; Loeblich & Tappan, 1987, p. 33, pl. 128, Figs. 9–10.

Trochammina cf. *globigeriniformis* (Parker & Jones), Schroeder, 1986, p. 52, pl. 19, Figs. 5–8.

Ammoglobigerina globigeriniformis (Parker & Jones), Wang et al., 1988, p. 123, pl. XI, Fig. 15; Zheng & Fu, 2001, p. 418, pl. LXI, Figs. 1–3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B1-01	605	493	370
B1-02	378	301	209

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-02, St 3400-05, St 3400-06, St 3500-10, St 3600-02, St 3875-01, St B-06) and intertidal flat of the Qingdao Bay (31°49′–39°00′ N, 119°30′–123° 59′ E), water depth 0.00–81.00 m, temperature 1.50–26.50 °C, salinity 30.11–38.00 ‰, abundance 0.04–5.70 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, United States, Grand Bank, Northeast U.S. Continental Shelf, Mediterranean Sea.

Description

Size about 500 μm in length. Test trochospiral, length:width ratio about 1.2:1, with subglobular chambers increasing rapidly in size as added. Final whorl with about

Ammoglobigerina globigeriniformis (Park & Jones, 1865)

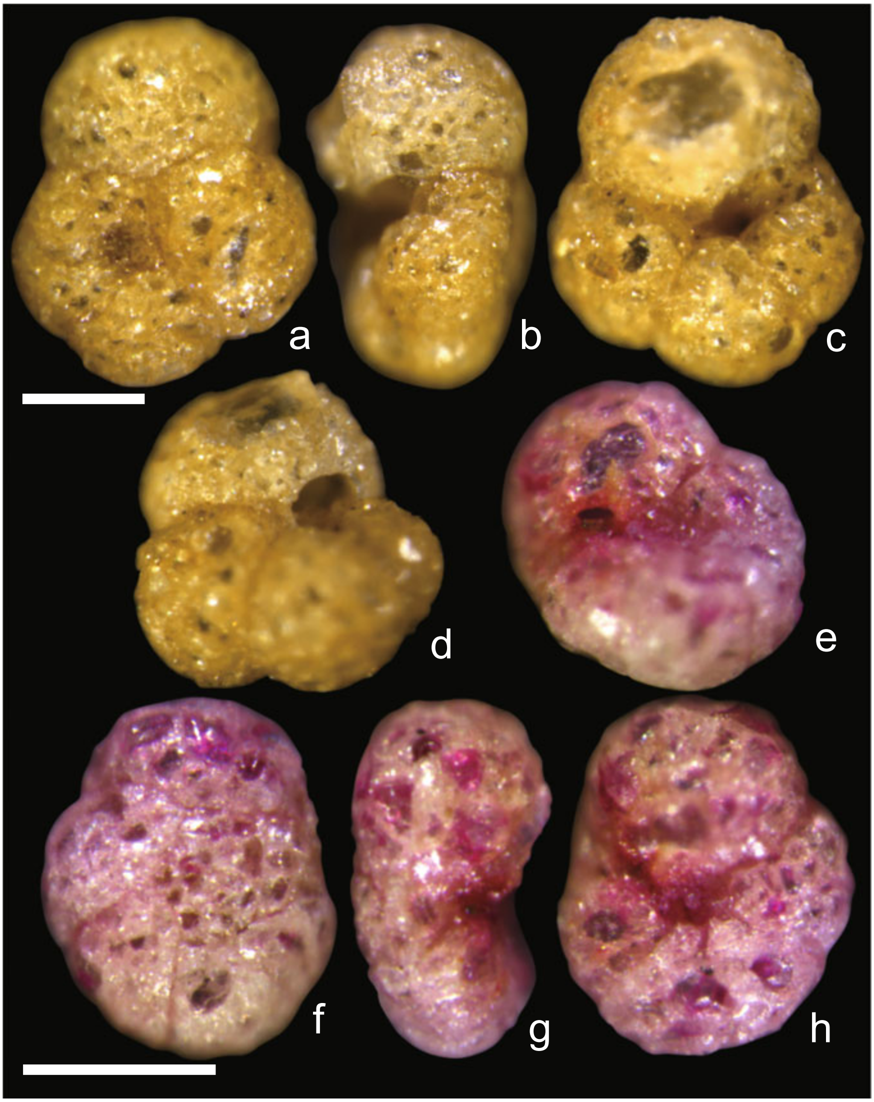

Fig. 15 **a–h** *Ammoglobigerina globigeriniformis* (Park & Jones, 1865), two specimens showing morphological variabilities. **a–d** From the same specimen. **e–h** Another specimen. Scale bars = 200 μm

four chambers. Sutures distinct. Wall thin and finely to moderately coarse agglutinated with sand grains. Aperture a distinct interiomarginal slit on the umbilical side.

Remarks

Ammoglobigerina globigeriniformis has been identified as *Trochammina globigeriniformis* in Chinese previous literature (Wang et al., 1988). It is a common species and widely distributed in the China Seas.

Genus *Paratrochammina* Brönnimann, 1979

***Paratrochammina simplissima* (Cushman & McCulloch, 1948)** (Fig. 16)

Trochammina pacifica Cushman var. *simplex* Cushman & McCulloch, 1939, p. 104, pl. 11, Fig. 4.

Trochammina pacifica Cushman var. *simplissima* Cushman & McCulloch, 1948, p. 76.

Trochammina pacifica Cushman, Uchio, 1960, p. 59, pl. 3, Figs. 26, 27; Phleger, 1964b, p. 383, pl. 1, Figs. 22, 23.

Paratrochammina simplissima (Cushman & McCulloch), Bronnimann, 1979, p. 10, Figs. 2, 3; 6A-I; 8A-H; Bronnimann & Zaninetti, 1984, p. 68, pl. 6, Fig. 7; Zheng, 1988, p. 84, pl. 38, Fig. 7; Loeblich & Tappan, 1994, p. 23, pl. 24, Figs. 1–12; Ujiie, 1995, p. 57, pl. 2, Fig. 7a–c; Zheng & Fu, 2001, p. 425, pl. LIX, Fig. 13; pl. LXI, Fig. 10; pl. LXIV, Figs. 10, 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H53-01	295	215	131
H53-02	443	348	165

Occurrence and Ecology

The Yellow Sea (St 3500-06, St 3875-01) (34°59′–38°44′ N, 121°59′–121°59′ E), water depth 51.00–52.00 m, temperature 7.39–12.31 °C, salinity 31.14–31.62 ‰, abundance 0.16–0.60 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan, New Zealand, New Caledonia, Gulf of Mexico.

Description

Size about 370 μm in length, length:width ratio about 1.3:1. Test trochospiral, about six chambers per whorl, very convex at the dorsal side, nearly conical in the lateral view. Sutures distinct. Wall finely agglutinated with sand grains. Aperture an interiomarginal, umbilical–extraumbilical arch.

Paratrochammina simplissima (Cushman & McCulloch, 1948)

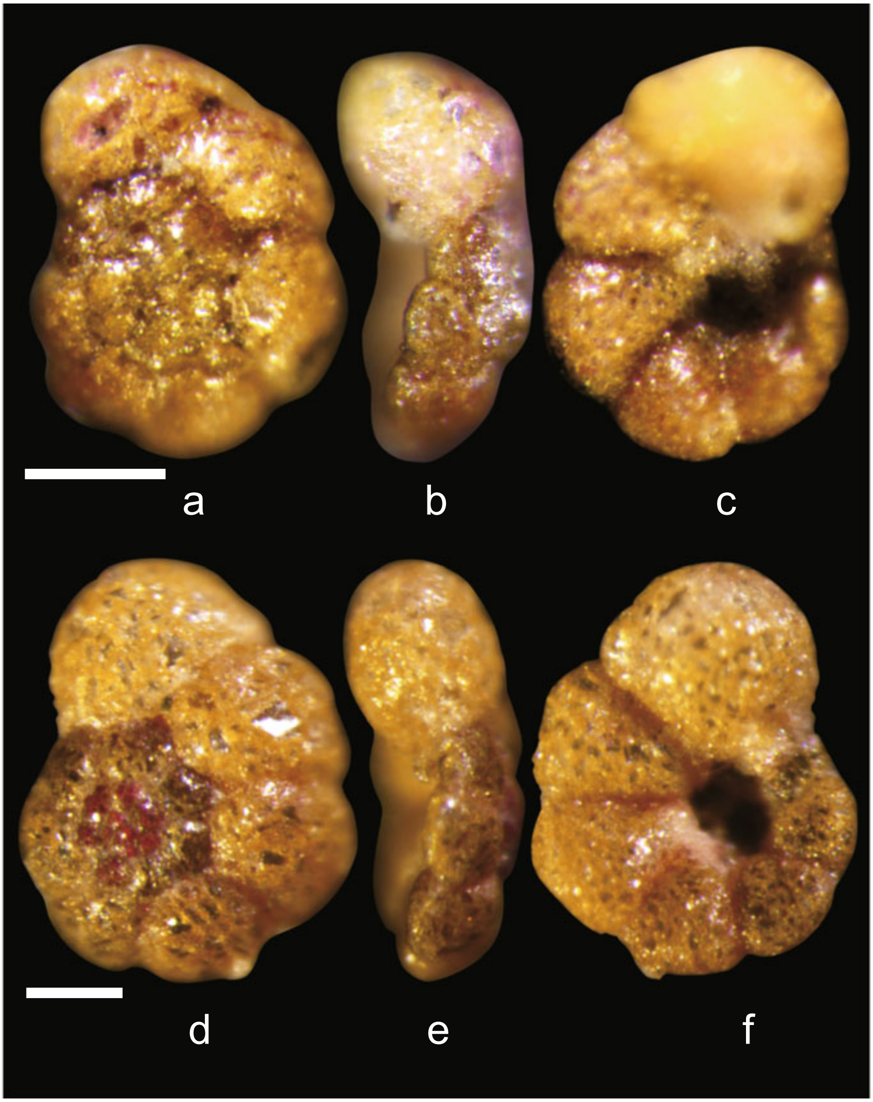

Fig. 16 a–f *Paratrochammina simplissima* (Cushman & McCulloch, 1948), two specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d–f** From another specimen. Scale bars = 100 μm

Remarks

Paratrochammina simplissima occurred in the Bohai Sea, the Yellow Sea, and the East China Sea but with low abundance. It resembles *Trochammina squamata* in the general test shape at the first glance, but differs by a conical convex dorsal side view and more chamber numbers (6 vs. 5).

Genus *Trochammina* Parker & Jones, 1859

Trochammina hadai **Uchio, 1962** (Fig. 17)

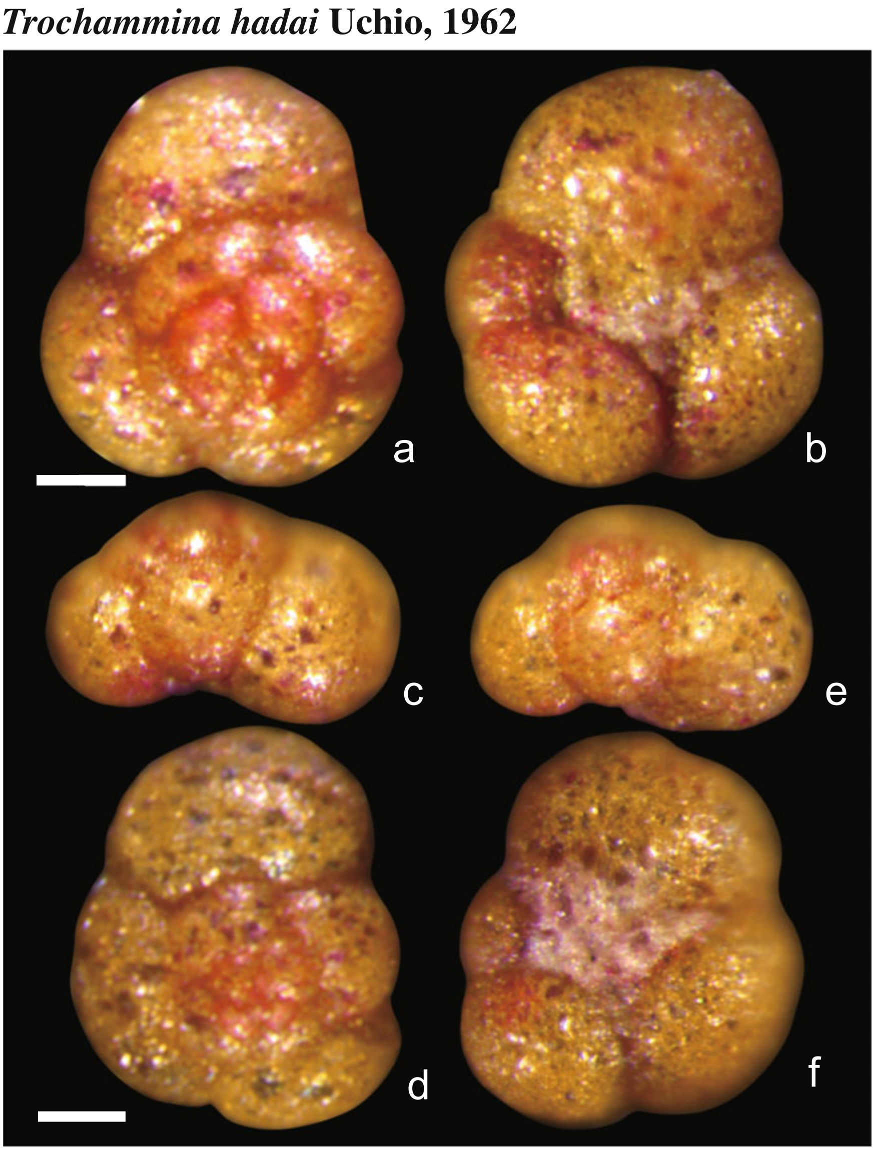

Fig. 17 **a–f** *Trochammina hadai* Uchio, 1962, two specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d–f** Another specimen. Scale bars = 50 µm

Trochammina globigeriniformis Hada, 1931 (non Parker & Jones), p. 91, text Fig. 44a–c; Takayanagi, 1955, p. 42, pl. 1, Fig. 17a–c.

Trochammina hadai Uchio, 1962, p. 387, pl. 18, Fig. 9a–c; Matoba, 1970, p. 62, pl. 1, Figs. 14a–c, 15a–c; Seibold, 1976, p. 180, pl. 1, Fig. 2a, b; Ujiie et al., 1983, p. 53, pl. 1, Figs. 11–13; Shchedrina & Lukina, 1984, p. 17, pl. 111, Fig. 19a, b; Zheng & Fu, 1990, p. 196, pl. 1, Fig. 3; Loeblich & Tappan, 1994, p. 24, pl. 26, Figs. 1–9; Zheng & Fu, 2001, p. 434, pl. LXIII, Figs. 5–9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H152-01	229	203	139
H152-02	223	190	128

Occurrence and Ecology

The Yellow Sea (St 3400-06) (33°59′ N, 123°00′ E), water depth 68.10 m, temperature 10.50 °C, salinity 31.14–31.62 ‰, abundance 0.08 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Gulf of Alaska, Japan, United States.

Description

Size about 225 μm in length, length:width ratio about 1.2:1. Test trochospiral, chambers increasing gradually in size as added. Final whorl with about four chambers. Umbilical area depressed but often blocked by its own secretion. Sutures radial and distinct. Wall agglutinated with fine sand grains. Aperture indistinct.

Remarks

Trochammina hadai is a common species in the Bohai Sea and the Yellow Sea, usually occurred in high abundance.

***Trochammina squamata* Jones & Parker, 1860** (Fig. 18)

Trochammina squamata Jones & Parker, 1860, p. 407, pl. 15, Fig. 30; Hedley et al., 1964, Figs. 1, 1a–b; 3; 1a–b; 3, 3a–c; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 72, pl. 2, Figs. 11–13; Wang et al., 1988, p. 123, pl. 11, Fig. 14; Scott & Leckie, 1990, p. 263; Zheng & Fu, 2001, p. 439, pl. LXIV, Fig. 1.

Tritaxis squamata (Jones & Parker, 1860), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H44-01	277	225	85
H44-02	367	297	120
H44-03	356	283	157

Trochammina squamata Jones & Parker, 1860

Fig. 18 **a–e** *Trochammina squamata* Jones & Parker, 1860, two specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d, e** Another specimen. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St CJ-04, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-06, St 3600-02, St 3800-02, St 3875-01, St 3875-03, St B-03) and intertidal flat of the Qingdao Bay (32°10′–38°44′ N, 121°00′–127°00′ E), water depth 0.00–80.00 m, temperature 2.50–23.50 °C, salinity 31.65–38.00 ‰, abundance 0.10–6.42 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Qingdao Bay, East China Sea.

Bay of Fundy, Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, United States, Chesapeake Bay, Gulf of Mexico, Mediterranean Sea.

Description

Size about 350 μm in length. Test trochospiral, length:width ratio about 1.2:1, rather flatted in side view. Final whorl with about five chambers increasing gradually in size as added, the last chamber inflated and obviously larger than the others. Umbilical area concave in one side. Sutures distinct. Wall finely agglutinated with sand grains. Aperture an interiomarginal, umbilical–extraumbilical slit with a lip.

Remarks

Trochammina squamata is widely distributed from the Bohai Sea to the East China Sea, from intertidal flat to the continental shelf sediments, especially in the nearshore area. This species has been synonymized as *Tritaxis squamata* (Jones & Parker, 1860) by Hayward et al., (2015). However, the Genus *Tritaxis* usually contains species with three chambers per whorl, and our specimens do not match this feature. Therefore we remain its original taxonomic classification.

***Trochammina inflata* (Montagu, 1808)** (Fig. 19)

Nautilus inflatus Montagu, 1808, p. 81, Fig. 3.

Rotalina inflata (Montagu), Williamson, 1858, p. 50, pl. 4, Figs. 93, 94.

Trochammina inflata (Montagu), Brady 1884, p. 338, pl. 41, Fig. 4a–c; He et al., 1964, p. 58, pl. 1, Fig. 4; He et al., 1965, p. 58, pl. I, Fig. 4; Knudsen, 1971, p. 190, pl. 1, Figs. 1–12; Murray, 1971, p. 35, pl. 10, Figs. 3–6; Haynes, 1973, pl. 37, pl. 4, Figs. 15–17, pl. 6, Fig. 3; Resig, 1974, p. 76, pl. 1, Fig. 1; Zaninetti et al., 1977, pl. 1, Figs. 1, 2; Zheng et al., 1978, p. 31, pl. 1, Fig. 2; Fursenko et al., 1979, p. 54, pl. 11, Figs. 1–3; Murray, 1980, p. 99, pl. 2, Figs. 12, 13; Hao et al., 1980, p. 209, pl. 3, Fig. 4; Li & He, 1983, p. 66, pl. 1, Fig. 1; Boltovskoy, 1984b, p. 5, Fig. 13; Bronnimann & Whittaker, 1984b, pp. 311–315, Figs. 1–11; Lin & Zhu, 1986, p. 71; Loeblich & Tappan, 1987, p. 122, pl. 129, Figs. 20–23; Wu & Wang, 1989, p. 924; Angell, 1990, pp. 246–247, pl. 1, Figs. 1–6; Schroeder–Adams, 1990, p. 36, pl. 3, Figs. 9, 10; pl. 9, Figs. 24–26; Patterson, 1990, p. 240, pl. 1, Figs. 8–10; Scott et al., 1991, p. 388, pl. 2, Figs. 7, 8; Cimerman & Langer, 1991, p. 20, pl. 7, Figs. 7–9; Jonasson & Patterson, 1992, p. 297, pl. 2, Figs. 1, 2; Hayward & Triggs, 1994, p. 115, pl. 1, Figs. 7, 8; Alve & Murray, 1994, p. 20, pl. 1, Figs. 17, 18; de Rijk, 1995, pl. 1, Fig. 9; Stigter et al., 1998, pl. 3, Fig. 10; Zheng & Fu, 2001, p. 435, pl. LXVI, Fig. 13.

Trochammina inflata (Montagu, 1808)

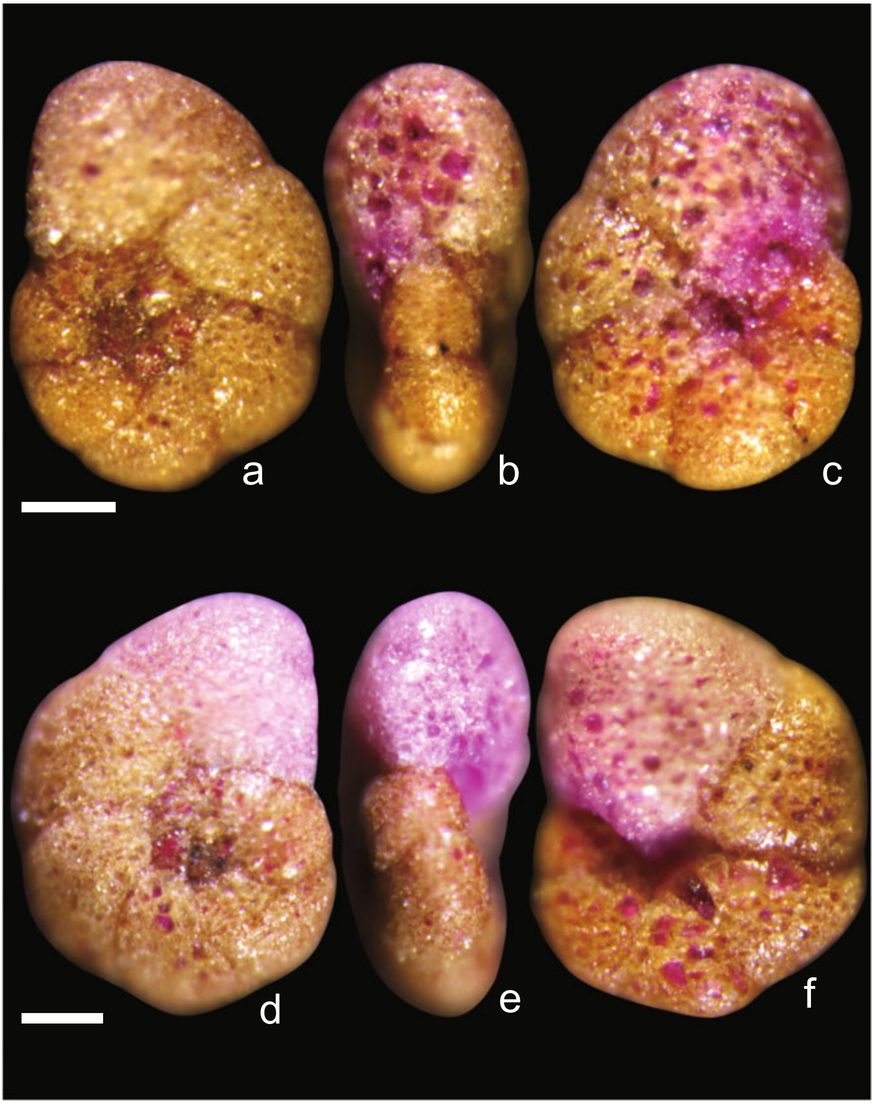

Fig. 19 **a–f** *Trochammina inflata* (Montagu, 1808), two specimens showing morphological variabilities. **a–c** From the same specimen. **d–f** Another specimen. Scale bars = 100 µm

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H118-01	442	328	210
H118-02	480	396	219

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 1.50–18.00 °C, salinity 32.00–36.00 ‰, abundance 0.21–2.99 ind./g sed.

Distribution

Bohai Sea, Qingdao Bay of the Yellow Sea, East China Sea.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea, and St. George's Channel, Japan, Malaysia, New Zealand, North Atlantic Ocean, Norway, Southern Ocean, United States, Chesapeake Bay, New Caledonia, Vineyard Sound, Black Sea, Gulf of Mexico, Mediterranean Sea.

Description

Size about 450 μm in length. Test trochospiral, length:width about 1.3:1, about 1.6:1 flattened laterally. Final whorl with about six chambers increasing gradually in size as added; the last chamber triangular in shape, inflated, and larger than the others. Umbilical area concave in one side. Sutures distinct and radial to slightly curved. Wall finely agglutinated with sand grains. Aperture an interiomarginal, umbilical–extraumbilical arched slit.

Remarks

Trochammina inflata is a common species in the China Seas, occurring from tidal flat to the continental shelf sediments.

Genus *Arenoparrella* Andersen, 1951

***Arenoparrella asiatica* Polski, 1959** (Figs. 20, 21)

Arenoparrella mexicana asiatica Polski, 1959, p. 585, pl. 78, Fig. 1; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 72, pl. II, Figs. 19–21; Wang et al., 1988, p. 123, pl. XI, Fig. 16.

Polskiammina asiatica (Polski, 1959), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B7=D50-01	590	475	278
B7=D50-02	489	402	222
B7=D50-03	417	332	247
D50=B7-01	467	463	267
D50=B7-02	338	273	155

Arenoparrella asiatica Polski, 1959

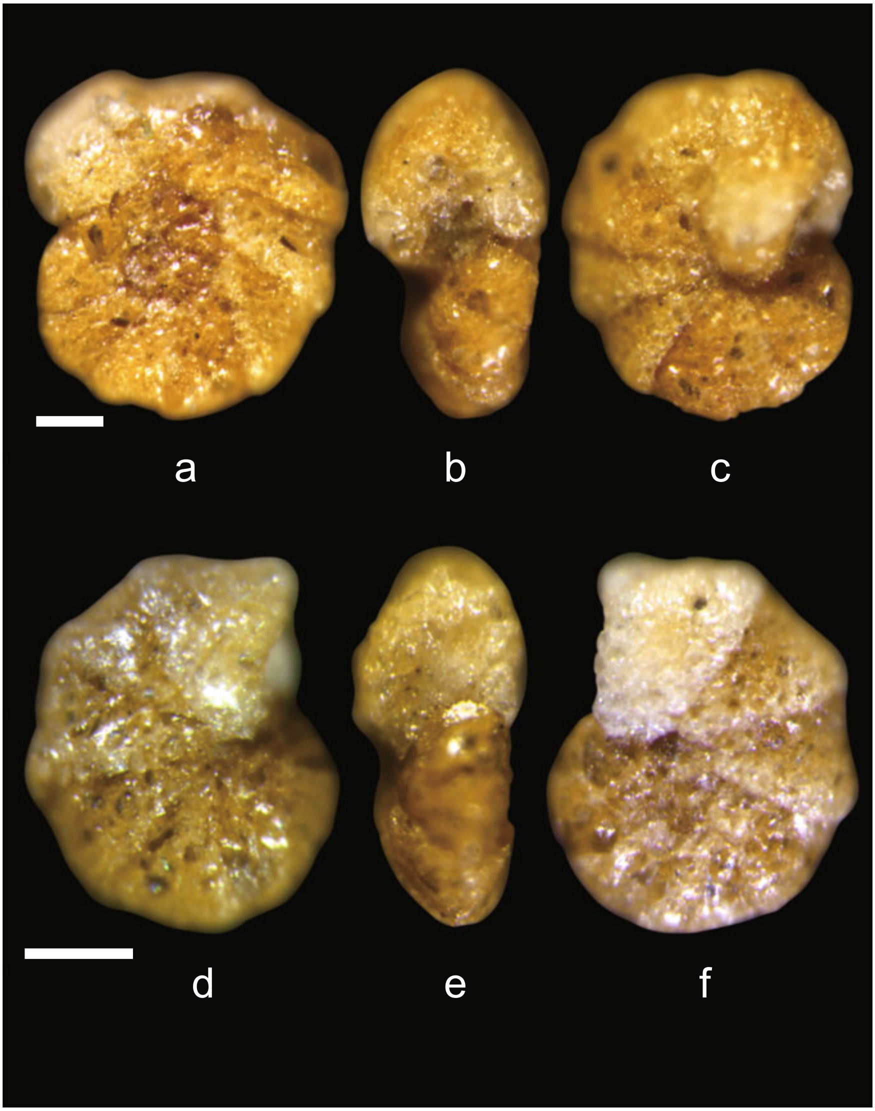

Fig. 20 a–f *Arenoparrella asiatica* Polski, 1959, two specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d–f** Another specimen. Scale bars = 100 μm

Occurrence and Ecology

The Bohai Sea (St 19, St 14) (38°16′–38°25′ N, 120°04′–120°06′ E), water depth 24.00–25.00 m, temperature 2.98–3.30 °C, salinity 30.53–30.70 ‰, abundance 0.02–0.08 ind./g sed.

Arenoparrella asiatica Polski, 1959

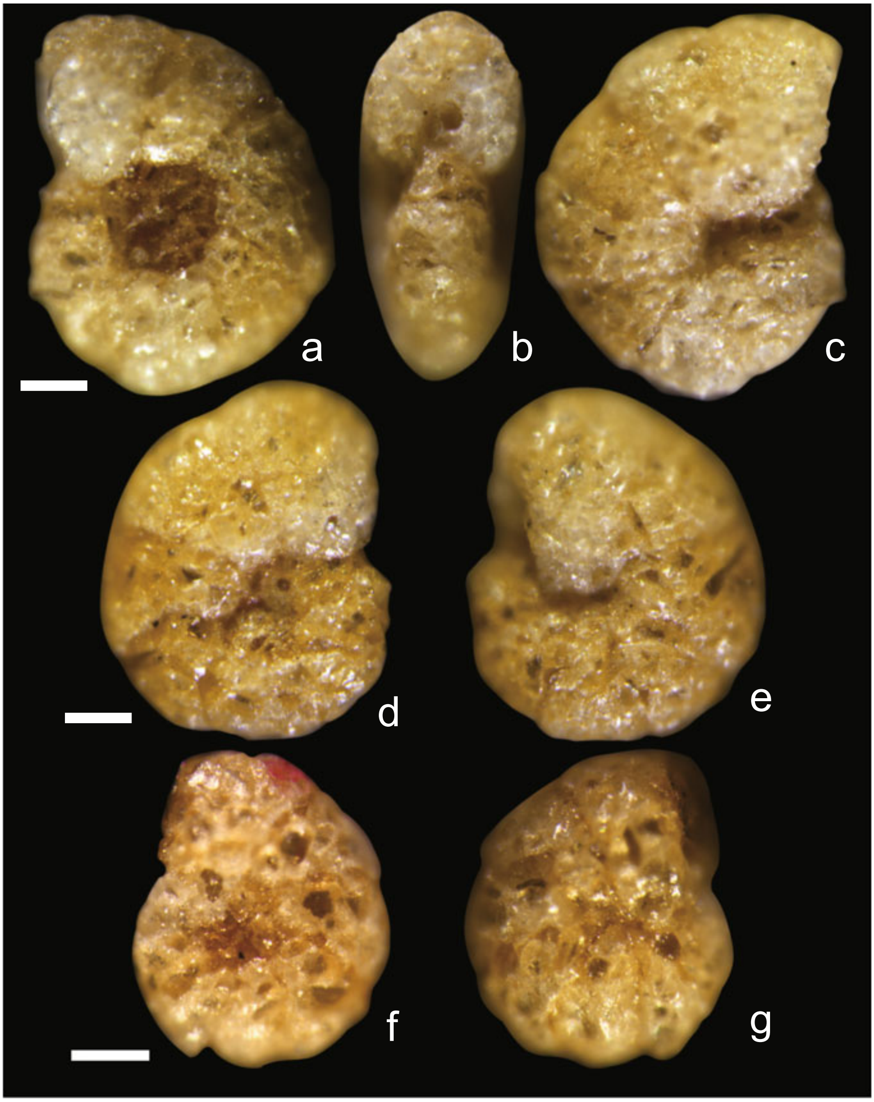

Fig. 21 a–g *Arenoparrella asiatica* Polski, 1959, three specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d, e** Another specimen. **f, g** A small specimen. Scale bars = 100 µm

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Description
Size about 450 μm in length. Test in a low trochospiral coil, length:width ratio about 1.2:1. Chambers increasing gradually in size, about eight chambers in final

Siphogaudryina stephensoni (Cushman, 1928)

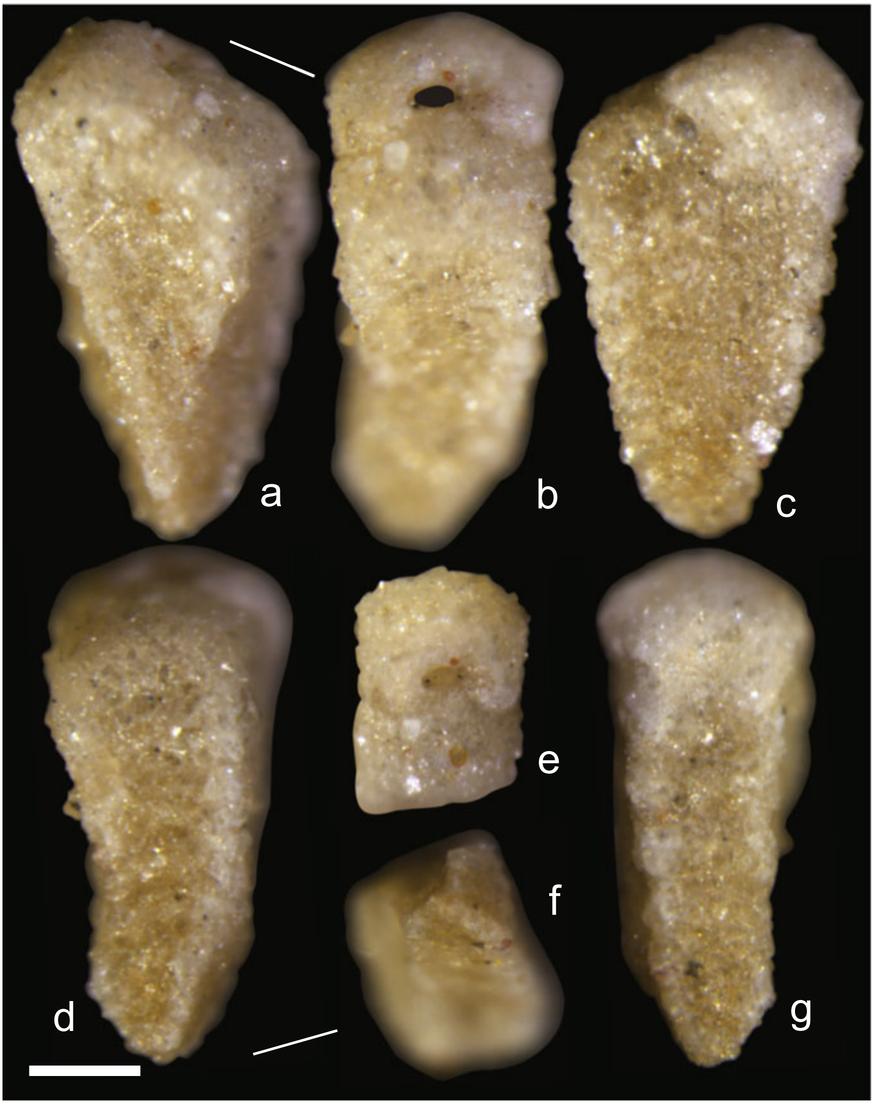

Fig. 22 **a–g** *Siphogaudryina stephensoni* (Cushman, 1928), the same specimen showing different side of views. **e** Aperture face. **f** Antapical view. Scale bar = 150 μm

whorl. Final whorl with about seven to eight chambers. Sutures distinct. Wall agglutinated with fine sand grains. Aperture a distinct opening without lip.

Remarks
Arenoparrella asiatica has been reported from sediments of the Yellow Sea and the East China Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988). Brönnimann et al., (1987) established the genus of *Polskiammina* and made a combination as *Polskiammina asiatica* (Polski, 1959) (Hayward et al., 2015). But we adopted the system of Loeblich & Tappan (1987) and ranked it within the Genus *Arenoparrella*. This species distributed in the Bohai Sea, the Yellow Sea, and the East China Sea with low abundance.

Family Verneuilinidae Cushman, 1911

Genus *Siphogaudryina* Cushman, 1935

***Siphogaudryina stephensoni* (Cushman, 1928)** (Figs. 22, 23)

Siphogaudryina stephensoni (Cushman, 1928), Cushman, 1946; Loeblich & Tappan, 1987, p. 137, pl. 144, Figs. 4–8.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H160-01	718	401	310
H160-02	655	386	313
H160-03	546	350	318
H160-04	531	318	258

Occurrence and Ecology
The Yellow Sea (St 3600-05) (35°59′ N, 122°29′ E), water depth 59.00 m, temperature 8.50 °C, salinity 32.60 ‰, abundance 0.16 ind./g sed.

Distribution
Yellow Sea.
U. Cretaceous, U.S.A.

Description
Size about 600 μm in length. Test elongate, increasing gradually in breadth, length: width ratio about 1.7:1. Early stage with about three to four chambers, very short in length, triserially arranged, and triangular in section. Later stage with about five to six chambers, biserial, with flattened sides and quadrangular section. Marginal angles produced and subcarinate in both triserial and biserial parts. Sutures indictinct. Wall agglutinated with fine quartz grains. Aperture disticnt interiomarginal arch.

Siphogaudryina stephensoni (Cushman, 1928)

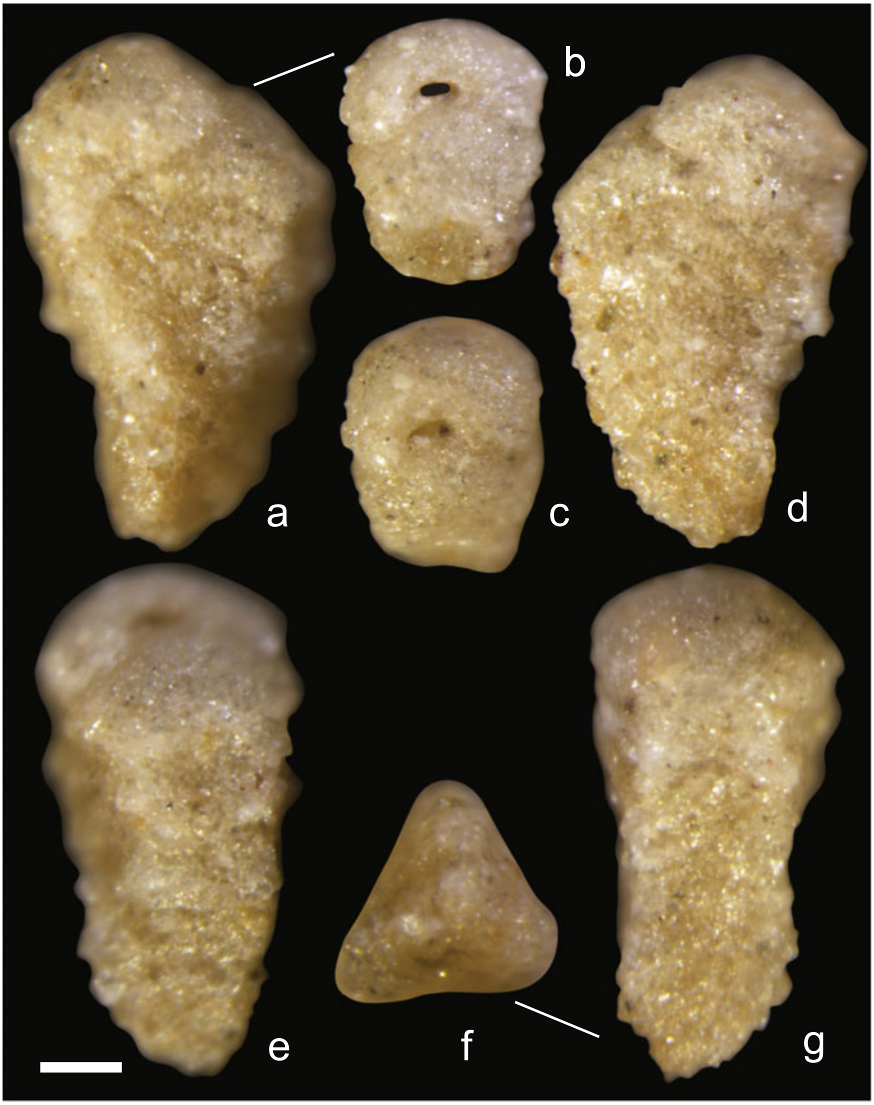

Fig. 23 **a–g** *Siphogaudryina stephensoni* (Cushman, 1928), another specimen with different side views. **b, c** Aperture face. **f** Antapical view. Scale bar = 100 μm

Remarks

Siphogaudryina stephensoni was established by Cushman (1946). It was discovered from Maastrichtian, Ripley Formation, McNairy County, Tennessee. The taxonomic feature of the Yellow Sea specimens basically matched the figures of *S.*

stephensoni in Cushman (1946) in a side view, but the body size is shorter and sutures are much vaguer than the paratypes, which was described by Loeblich & Tappan (1964) from Wolfe City Sand. This species is a new record to China Seas.

Family Globotextulariidae Cushman, 1927

Genus *Verneuilinulla* Saidova, 1975

***Verneuilinulla advena* (Cushman, 1922)** (Fig. 24)

Verneuilina advena Cushman, 1922a, p. 57, pl. 9, Figs. 7–9; Earland, 1933, p. 99, pl. 3, Figs. 43–46.

Eggerella advena (Cushman), Cushman, 1937b, p. 51, pl. 5, Figs. 12–15; Cushman & McCulloch, 1939, p. 95, pl. 10, Fig. 1; Cushman, 1948, p. 32, pl. 3, Fig. 12; Loeblich & Tappan, 1953, p. 36, pl. 3, Figs. 8–10; Uchio, 1960, p. 19, pl. 2, Fig. 18; Resig, 1963, p. 121–126; Phleger, 1964b, p. 378, pl. 1, Fig. 9; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 71, pl. I, Figs. 21–23; Fursenko et al., 1979, p. 67, pl. 13, Fig. 3; Scott & Medioli, 1980, p. 40, pl. 2, Fig. 7; Shchedrina & Lukina, 1984, p. 24, pl. 4, Fig. 26; Wang et al., 1988, p. 125, pl. 12, Fig. 10; Oki, 1988, p. 83, pl. 4, Fig. 5; Zheng et al., 1989, pl. 1, Figs. 5, 6; Schroeder–Adams et al., 1990, p. 33, pl. 2, Fig. 8; Snyder et al., 1990, p. 251, 264; Blais–Steves & Patterson, 1988, p. 214, pl. 1, Fig. 3.

Verneuilinulla advena (Cushman) Loeblich & Tappan, 1987, p. 144, pl. 151, Figs. 7–10; 1994, p. 22, pl. 19, Figs. 8, 9; Zheng & Fu, 2001, p. 484, pl. LXXIII, Figs. 12, 13.

Eggerelloides advenus (Cushman), Cimerman & Langer, 1991, p. 20, pl. 8, Figs. 5, 6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B11-01	436	183	183
B11-02	350	150	150

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31) (38°10′–39°00′ N, 119°30′–120°10′ E), water depth 24.00–27.00 m, temperature 2.25–4.25 °C, salinity 30.11–30.79 ‰, abundance 0.16–0.72 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Verneuilinulla advena (Cushman, 1922)

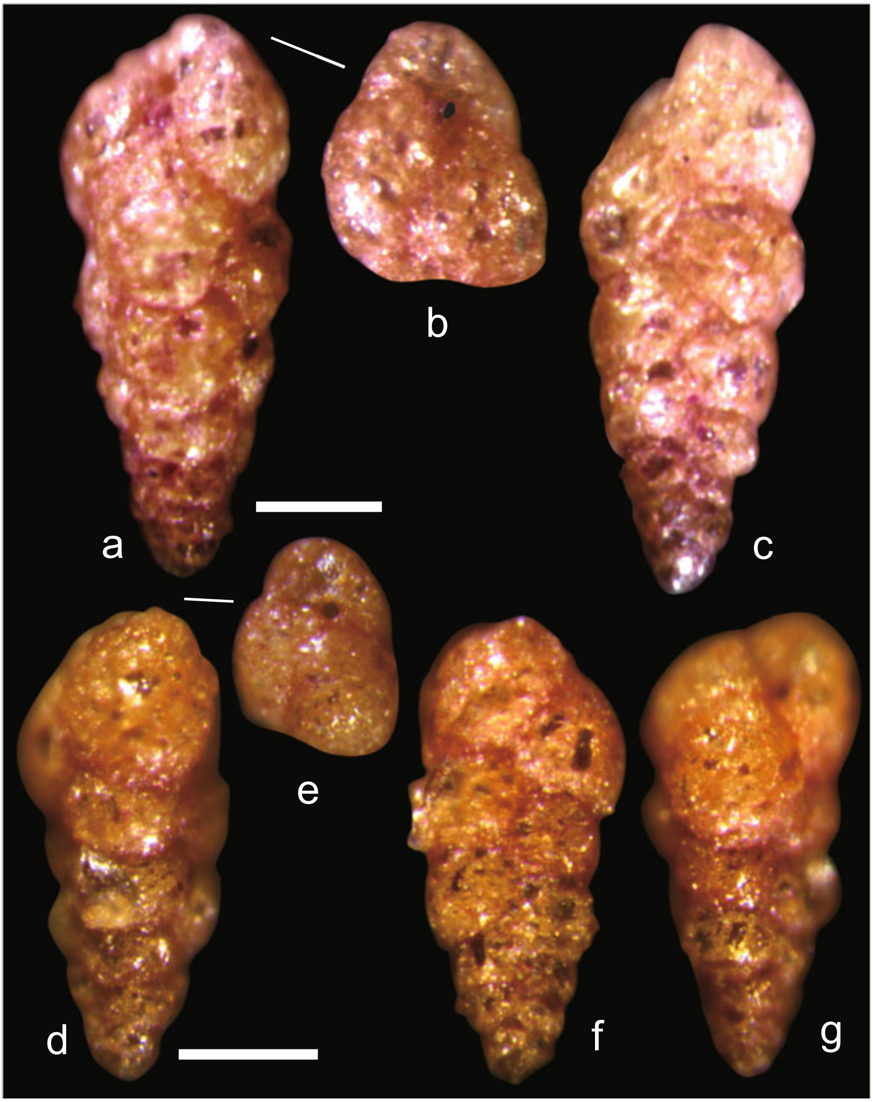

Fig. 24 a–g *Verneuilinulla advena* (Cushman, 1922), two specimens showing morphological variabilities. **a–c** From the same specimen. **d–g** Another specimen. **b, e** Apical views. Scale bars = 100 μm

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, United States, Chesapeake Bay, Scotian Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Arctic Ocean, Gulf of Mexico, Mediterranean Sea.

Description

Size about 400 µm in length. Test elongate and usually slender, length:width ratio about 2.4:1. Early stage trochospiral, with four to five chambers per whorl, later reduced to three per whorl. Sutures distinct. Wall coarsely agglutinated with sand grains. Aperture interiomarginal.

Remarks

Verneuilinulla advena is a common and abundant species in the Bohai Sea. It also occurred in the Yellow Sea and the East China Sea but with low abundance (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988).

***Verneuilinulla propinqua* (Brady, 1884)** (Fig. 25)

Verneuilina propinqua Brady, 1884, (*pars*), p. 387, pl. 47, Figs. 8–12; Cushman, 1911, p. 53, text Fig. 86.

Eggerella propinqua (Brady), Cushman, 1937b, p. 53, pl. 5, Figs. 21, 22; Takayanagi, 1955, pl. 1, Fig. 8; Matoba, 1970, p. 51, pl. 1, Fig. 20; McLauglin & Gupta, 1994, p. 86, pl. 1, 4.

Verneuilinulla propinqua (Brady), Zheng & Fu, 2001, p. 485, pl. LXXIV, Fig. 3.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H26-01	577	268	268
H26-02	476	267	267

Occurrence and Ecology

The Yellow Sea (St 3300-06, St 3400-06, St 3400-08, St 3500-08, St 3500-10, St 3600-06, St 3600-08, St 3875-03, St B-03) (33°00′–38°44′ N, 121°57′–127°00′ E), water depth 50.00–81.00 m, temperature 7.72–17.00 °C, salinity 31.67–33.39 ‰, abundance 0.08–15.34 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, New Zealand, North Atlantic Ocean, Gulf of Mexico.

Description

Size about 530 µm in length. Test elongate and subconical to conical in shape, length:width ratio about 2:1. Early stage trochospiral and later reduced to three per whorl. Sutures moderate distinct to indistinct. Wall coarsely agglutinated with sand grains. Aperture an interiomarginal opening.

Remarks

Verneuilinulla propinqua is a common and abundant species in the Yellow Sea. It occurred also in the East China Sea but usually with low abundance.

Verneuilinulla propinqua (Brady, 1884)

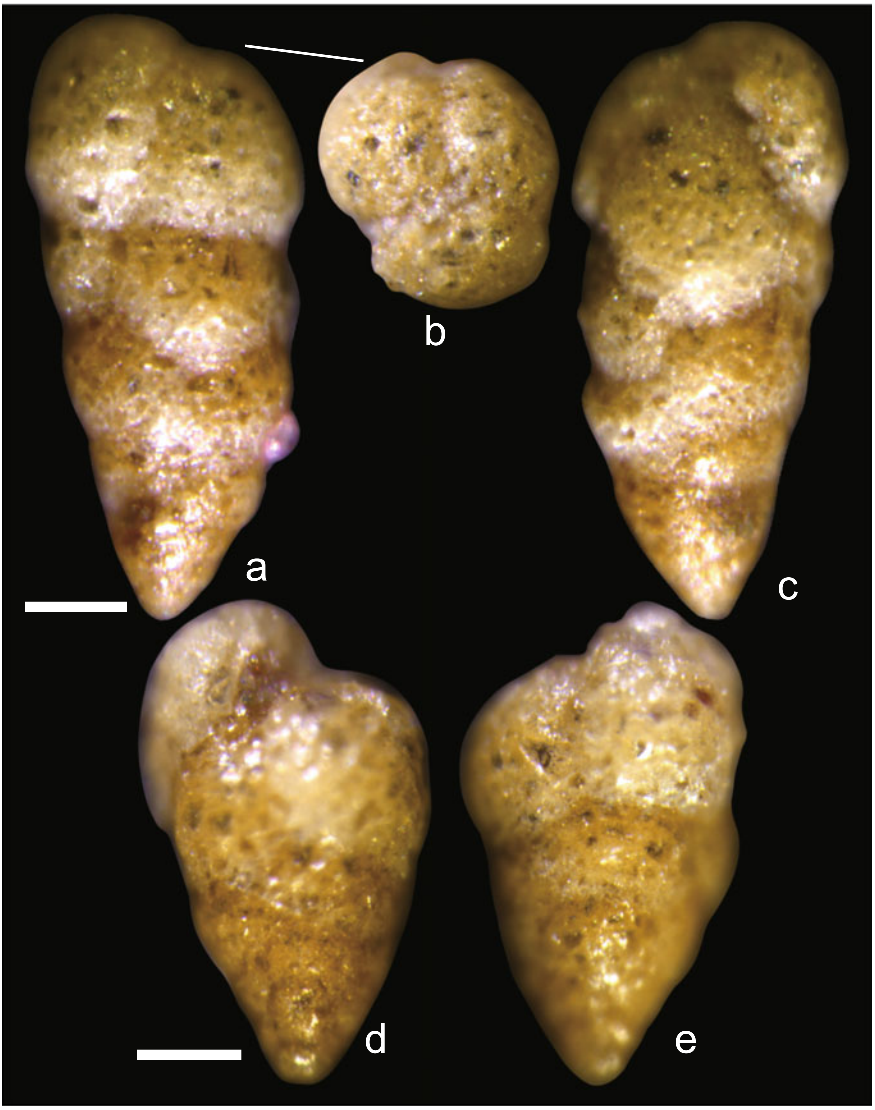

Fig. 25 a–e *Verneuilinulla propinqua* (Brady, 1884), two specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d, e** From another specimen. **b** Apical view. Scale bars = 100 μm

Family Eggerellidae Cushman, 1937

Genus *Eggerelloides* Haynes, 1973

***Eggerelloides scaber* (Williamson, 1858)** (Fig. 26)

Bulimina scabra Williamson, 1858, p. 65, pl. 5, Figs. 136, 137.

Verneuilina scabra (Williamson), Cushman, 1922a, p. 55, pl. 10, Figs. 5, 6.

Eggerella scabra (Williamson), Cushman, 1937b, p. 50, pl. 5, Figs. 10, 11; Hoeglund, 1947, p. 191, pl. 13, Figs. 12–14, text Figs. 162–165; Hofker, 1960, p. 236, Figs. 11, 12; Hansen, 1965, p. 330, Fig. 1; Murray, 1968, p. 94, pl. 1, Fig. 1; 1971, p. 45, pl. 15, Fig. 6; Matoba, 1970, p. 51, pl. 1, Figs. 21, 22; Knudsen, 1971, p. 192, pl. 1, Fig. 13; pl. 15, Figs. 5–7; Voorthuysen, 1973, p. 45, pl. 4, Fig. 3; Hansen & Hanzlikova, 1974, pp. 447, 456, pl. 3, Fig. 1; Alve & Nagy, 1986, p. 282, pl. 4, Figs. 4, 5; Hermelin, 1987, p. 71, pl. 1, Fig. 9; Oki, 1989, pp. 84, 169, pl. 4, Fig. 7; Stigter et al., 1998, pl. 2, Fig. 2.

Eggerelloides scabrum (Williamson), Haynes, 1973, p. 44, pl. 2, Figs. 7, 8; pl. 19, Figs. 10, 11, text Fig. 8, nos. 1–4.

Eggerella polita Zheng, 1988 (*non* Collins), p. 94, pl. 45, Figs. 5, 6.

Eggerelloides scabrus (Williamson), Alve, 1990, pp. 185, 186; 1991a, pl. 16, Figs. 6–8; Cimerman & Langer, 1991, p. 21, pl. 8, Fig. 7; Alve & Murray, 1994, p. 20, pl. 1, Fig. 12; Zheng & Fu, 2001, p. 493, pl. LXXIV, Figs. 1, 2.

Eggerelloides scabra (Williamson), Hohennegger et al., 1993, p. 81, pl. 1, Fig. 3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H25-01	509	250	250
H25-02	422	253	253

Occurrence and Ecology

The Yellow Sea (St CJ-04, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-06, St 3500-08, St 3500-10, St 3600-02, St 3600-04, St 3600-06, St 3600-08, St 3700-01, St 3800-02, St 3875-01, St 3875-03, St B-03, St B-06) (32° 10′–38°44′ N, 121°00′–127°00′ E), water depth 29.00–81.00 m, temperature 7.39–17.02 °C, salinity 30.31–33.39 ‰, abundance 0.16–122.66 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea, and St. George’s Channel, Japan, New Zealand, North Atlantic Ocean, Norway, Vineyard Sound, Black Sea, Mediterranean Sea.

Description

Size about 470 μm in length, length:width ratio about 1.9:1. Test subfusiform, with the bluntly rounded initial portion, length:width ratio about 1.9:1. Early stage

Eggerelloides scaber (Williamson, 1858)

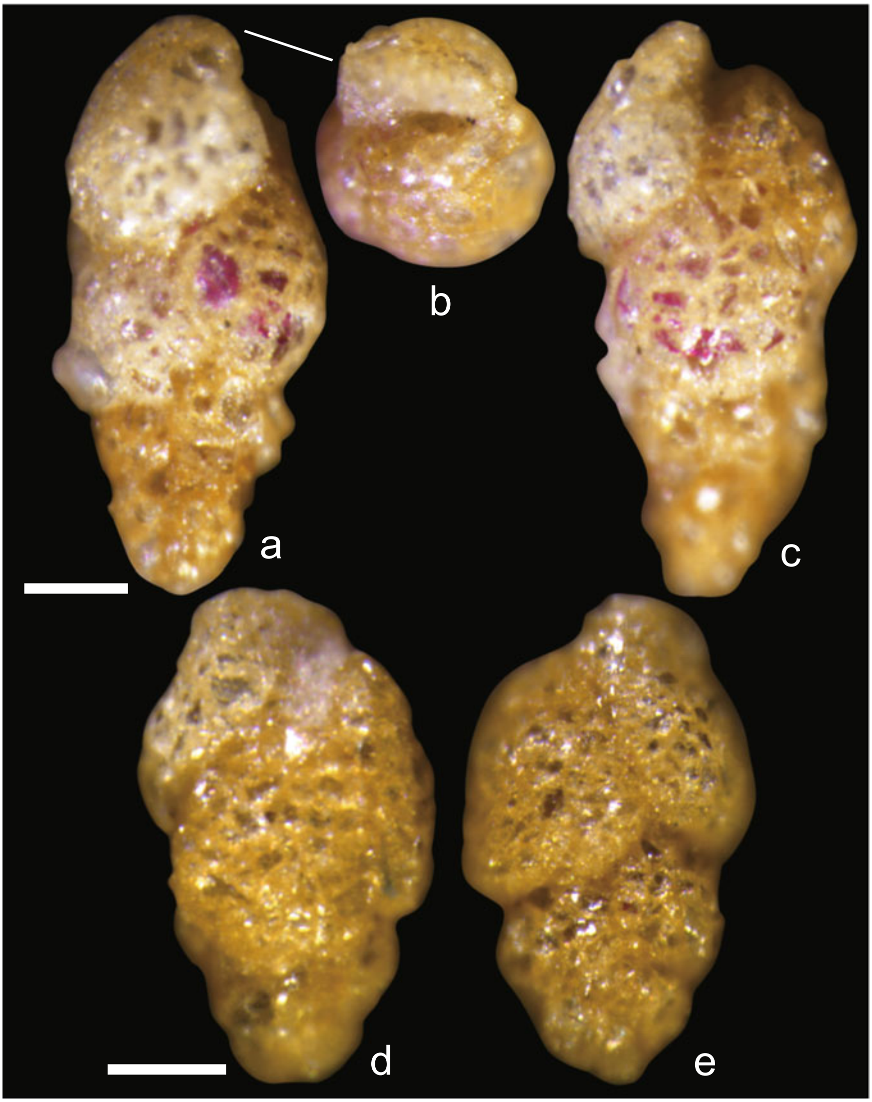

Fig. 26 a–e *Eggerelloides scaber* (Williamson, 1858), two specimens showing morphological variabilities. **a–c** From the same specimen. **b** Apical view. **d, e** From another specimen. Scale bars = 100 μm trochospiral and later becomes triserial. Sutures distinct. Wall coarsely to finely agglutinated with sand grains. Aperture a distinct high interiomarginal arch.

Remarks
Eggerelloides scaber is a common and abundant species in the Yellow Sea, distributing from the sediments of offshore to the Yellow Sea Cold Water Mass area. It also occurred in the East China Sea but with low abundance.

Family Textulariidae Ehrenberg, 1838

Genus *Sahulia* Loeblich & Tappan, 1985

***Sahulia conica* (d'Orbigny, 1839)** (Fig. 27)

Siphotextularia conica (d'Orbigny, 1839).

Textularia conica d'Orbigny, 1839, He et al., 1965, p. 57, pl. I, Fig. 1; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 70, pl. I, Figs. 27–29; Wang et al., 1988, p. 121, pl. XI, Fig. 5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H155-01	586	1036	785
H155-02	495	875	628

Occurrence and Ecology
The Jiaozhou Bay (St D1) (36°04′ N, 120°14′ E), water depth 10.00 m, temperature 25.85 °C, salinity 29.78 ‰, abundance 0.04 ind./g sed.

Distribution
Yellow Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, Micronesia, North Atlantic Ocean, United States, New Caledonia, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description
Size about 550 μm in length, length:width ratio about 0.6:1. Test biserial throughout and forming a typical conical shape with circular outline. Each side with five to six chambers, chambers broad and low. Sutures distinct and nearly horizontal arranged. Aperture located at the base of the apertural face, forming a straight slit across the center of the flattened terminal face. Lip distinct and flap-like, apertural reentrant present at the ends of the lip.

Remarks
Sahulia conica is a common species in the Yellow Sea and the East China Sea (Micropaleontology Group in Marine Geology Department of Tongji University,

Sahulia conica (d'Orbigny, 1839)

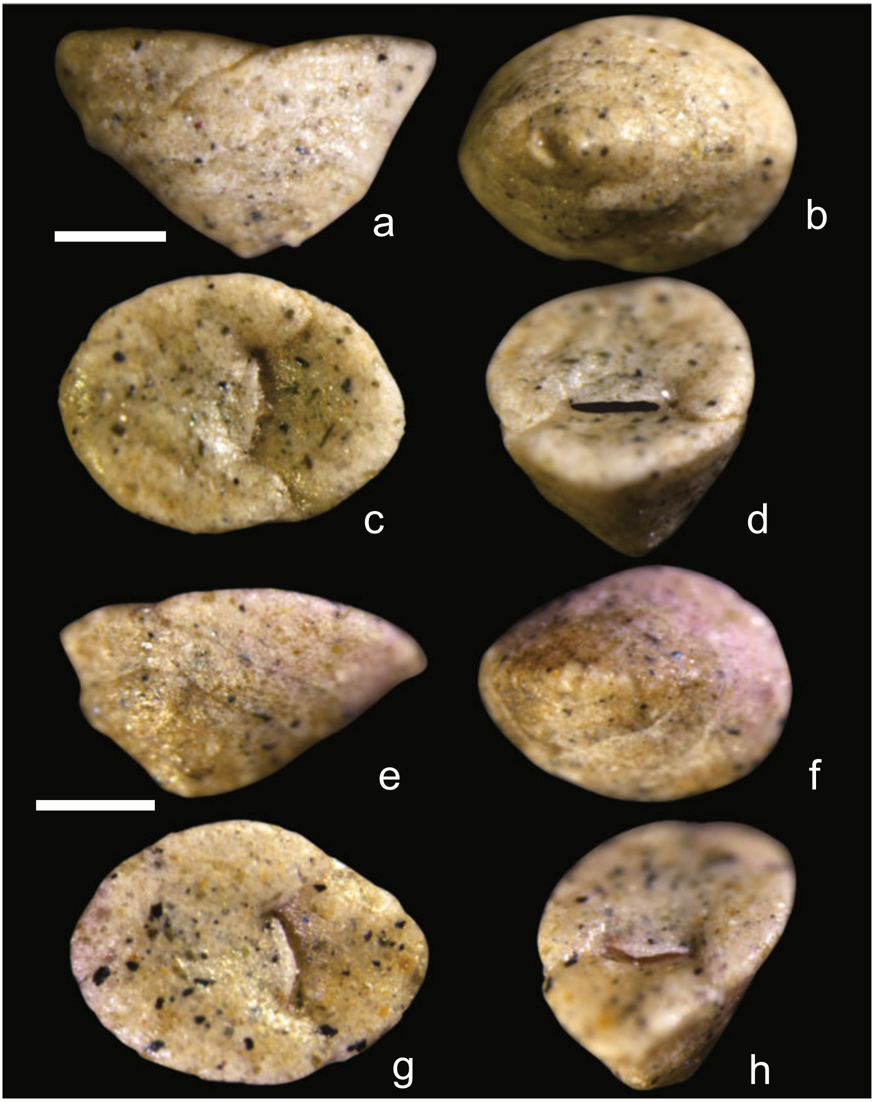

Fig. 27 a–h *Sahulia conica* (d'Orbigny, 1839), two specimens were sampled from the Jiaozhou Bay of the Yellow Sea. **a–d** The same specimen with different side of views. **e–h** Another specimen with different side profiles. Scale bars = 300 μm

1978; Wang et al., 1988). The Yellow Sea population was slightly smaller than that described from the East China Sea (Wang et al., 1988). In May this species reproduced and formed high abundance in the Jiaozhou Bay sediments.

***Sahulia kerimbaensis* (Said, 1949)** (Fig. 28)

Textularia kerimbaensis Said, 1949, p. 6, pl. 1, Fig. 8; Chushman, Todd & Post, 1954, p. 329, pl. 83, Fig. 11; Graham & Militante, 1959, p. 28, pl. 2, Figs. 5, 6;

***Sahulia kerimbaensis* (Said, 1949)**

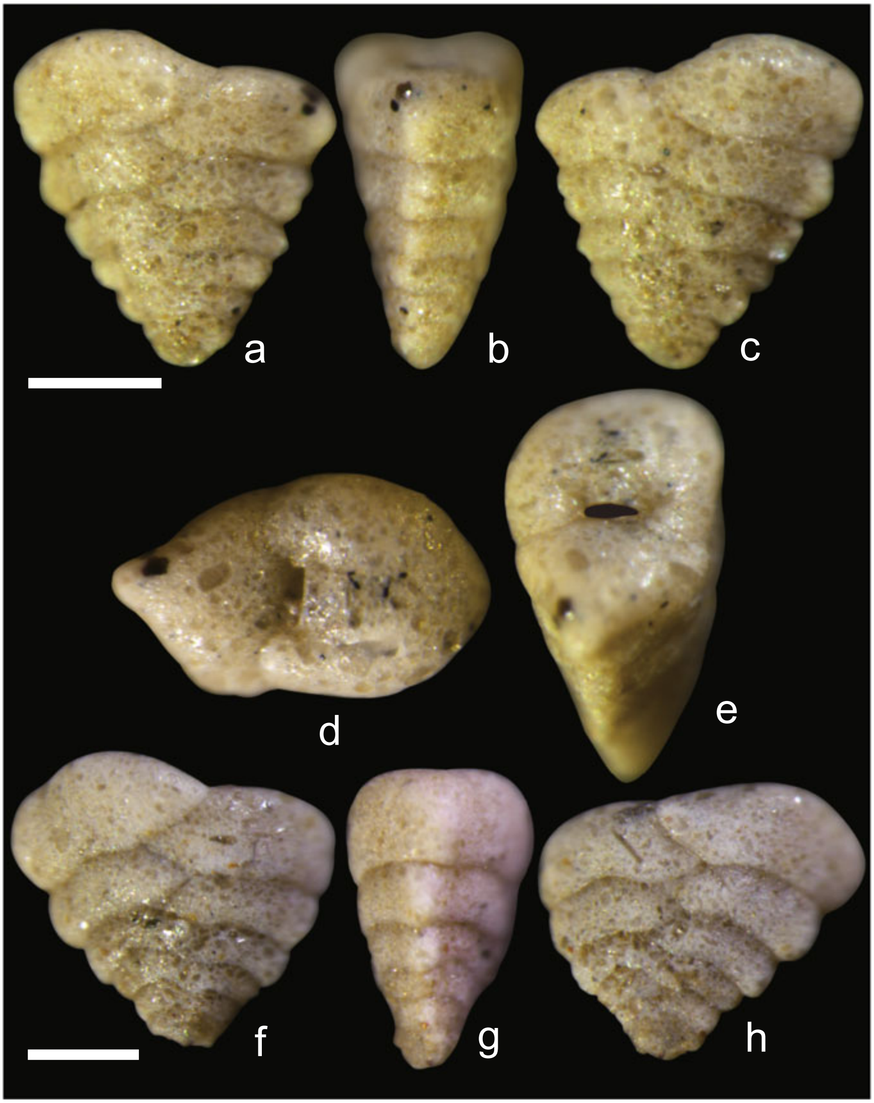

Fig. 28 a–h *Sahulia kerimbaensis* (Said, 1949), two specimens showing morphological variabilities. **a–e** Same specimen with different side of views. **f–h** Another specimen. Scale bars = 200 µm

Hofker, 1968, p. 15, pl. 1, Figs. 21, 22; Research Party of Marine Geology, Ministry of Geology, and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 146, pl. I, Fig. 7.

Spiroplectammina kerimbaensis (Said, 1949), Halicz & Reiss, 1979, p. 306, pl. 3, Figs. 9, 13, 15–21.

Spiroplectinella kerimbaensis (Said, 1949), Loeblich & Tappan, 1994, p. 19, pl. 14, Figs. 9–14.

Sahulia kerimbaensis (Said, 1949), Hayward et al., 2011.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D26-01	532	502	295
D26-02	517	580	343

Occurrence and Ecology

The Yellow Sea (St 3800-02) (38°00′ N, 122°59′ E), water depth 59.00 m, temperature 8.35 °C, salinity 31.96 ‰, abundance 0.64 ind./g sed.

Distribution

Yellow Sea.

Gulf of Aqaba, Japan, Micronesia, Timor Sea, New Caledonia.

Description

Size about 520 μm in length, length:width ratio about 1:1. Test biserial. Chambers increased rapidly in breadth. Body thickness about half of the width. Sutures rather distinct and nearly horizontal arranged. Wall agglutinated with fine grain particle. Aperture a slit at the base of the apertural face with a distinct flap-like lip.

Remarks

Sahulia kerimbaensis has been identified as *Textularia kerimbaensis* in previous Chinese literature (Research Party of Marine Geology, Ministry of Geology, and Mineral Resources & Chinese University of Geosciences (Beijing, 1988). Later, it was assigned to *Spiroplectinella kerimbaensis* by Loeblich & Tappan (1994) and to *Sahulia kerimbaensis* by Hayward et al., (2011). The taxonomic features of Yellow Sea population match well with those of the genus *Sahulia* by having a conical-like test and a distinct lip. We therefore followed the taxonomic category of Hayward et al., (2011) and assigned it to *Sahulia kerimbaensis*.

Genus *Textularia* Defrance, 1824

***Textularia earlandi* Parker, 1952** (Fig. 29)

Textularia elegans Lacroix, 1931, p. 8, Figs. 4, 6.

Textularia tenuissima Earland, 1933, p. 95, pl. 3, Figs. 21–30.

Textularia earlandi Parker, 1952

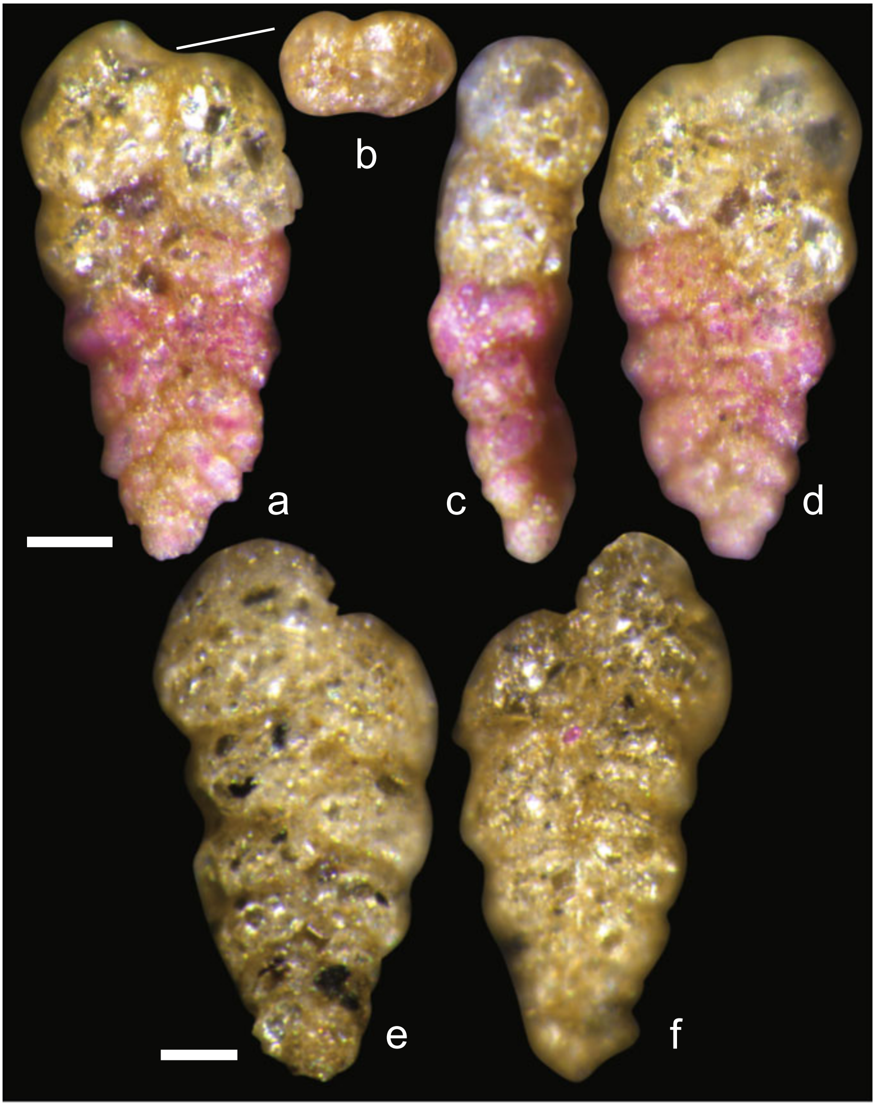

Fig. 29 a–f *Textularia earlandi* Parker, 1952, two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e, f** Another specimen. Scale bars = 50 μm

Textularia earlandi Parker, 1952, p. 458; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 70, pl. I, Fig. 24.

Prolixoplecta earlandi (Parker, 1952).

Spiroplectammina earlandi (Parker, 1952).
Spiroplectinella earlandi (Parker, 1952).

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H42-01	304	156	87
H42-02	380	185	143

Occurrence and Ecology

The Yellow Sea (St CJ-02, St 3875-01, St B-03) (31°49′–38°44′ N, 121°57′–122° 59′ E), water depth 40.00–51.00 m, temperature 7.39–17.54 °C, salinity 31.59–31.67 ‰, abundance 0.18–0.24 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Bay of Biscay, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea, and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Pacific Ocean, Southern Ocean, United States, West Weddell Sea, Arctic Ocean, Gulf of Mexico.

Description

Size about 350 μm in length, length:width ratio about 2:1. Test biserial, with seven to nine chambers in each side. Lateral view compressed and may slightly curved in some specimens. Sutures distinct. Wall agglutinated with fine particles. Apical face dumbbell-shaped but aperture indistinct.

Remarks

Textularia earlandi was reported by Micropaleontology Group in Marine Geology Department of Tongji University (1978) from sediment of the South Yellow Sea. It frequently occurred in the Yellow Sea in our investigation but usually has low abundance.

Textularia foliacea **Heron–Allen & Earland, 1915** (Fig. 30)

Textularia foliacea Heron–Allen & Earland, 1915, p. 638, pl. 47, Figs. 17–20; Cushman, 1921, p. 117, pl. 19, Fig. 7; Lalicker & McCulloch, 1940, p. 128, pl. 14, Fig. II; Asano, 1950a, p. 5, text Figs. 19, 20; Graham & Militante, 1959, p. 28, pl. 2, Fig. 3; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 69, pl. I, Figs. 4, 9; Halicz & Reiss, 1979, p. 301, pl. 2, Figs. 4–9, 12, 13; Wang et al., 1980, p. 195, pl. VIII, Fig. 2; Banner & Pereira, 1981, p. 94, pl. 2, Fig. 8; pl. 3, Figs. 2–4; Wang et al., 1988, p. 121, pl. XI, Fig. 9; Zheng, 1988, p. 109, pl. 28, Figs. 1–4; pl. 52, Figs. 11, 12, text Fig. 26; Hatta & Ujiié, 1992a, p. 59, pl. 2, Fig. 7; Loeblich & Tappan, 1994, p. 28, pl. 34, Figs. 6–14; Zheng & Fu, 2001, p. 532, pl. LXXXVI, Figs. 5–9; pl. XCII, Figs. 3–6; pl. LXXXVII, Figs. 1–11.

Textularia foliacea Heron-Allen & Earland, 1915

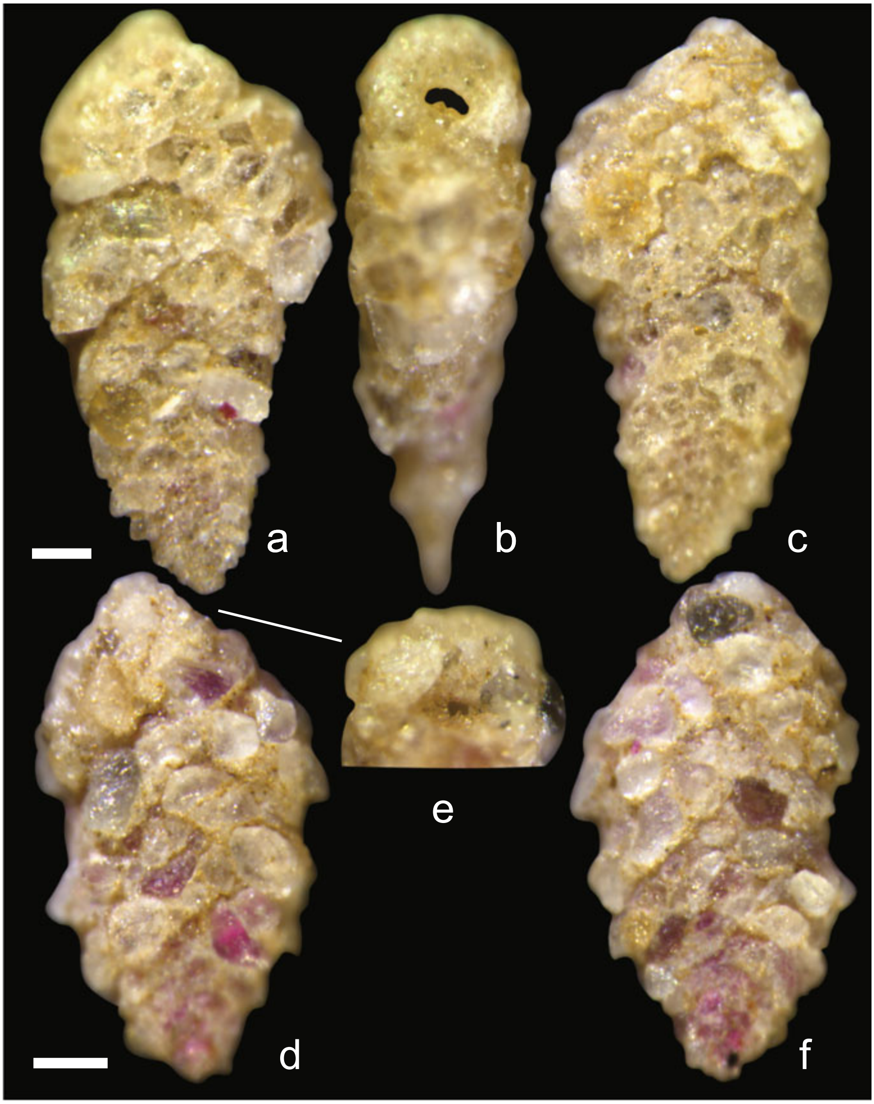

Fig. 30 **a–f** *Textularia foliacea* Heron–Allen & Earland, 1915, two specimens were sampled from the South Yellow Sea. **a–c** The same specimen with different side of views. **d–f** Another specimen. Scale bars = 100 μm

Textularia sica Lalicker & Bernudez, 1941, p. 16, pl. 4, Fig. 6.
Valvotextularia foliacea (Heron–Allen & Earland), Hofker, 1968, p. 16, pl. 2, Figs. 7–14.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B35-01	863	460	262
B35-02	695	383	137

Occurrence and Ecology

The Bohai Sea (St A8, St 22, St 14, St 31) (38°10′–38°29′ N, 119°52′–120°08′ E), water depth 24.00–27.00 m, temperature 2.36–4.25 °C, salinity 30.11–30.70 ‰, abundance 0.02–0.18 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Xisha Islands.

Gulf of Aqaba, Japan, Maldives, Micronesia, North Pacific Ocean.

Description

Size about 800 μm in length, length:width ratio about 1.8:1. Test biserial throughout, with about ten chambers in each line. Lateral view wedge-shaped with a slender tip end. Sutures distinct. Wall agglutinated with large and coarse quartz grains. Aperture a distinct arch at the base of the apertural face.

Remarks

Textularia foliacea is a very common and usually a dominant species in continental shelf of the China Seas. It has been reported by pervious Chinese literature from the Bohai Sea, the Yellow Sea, the East China Sea, and the Xisha Islands (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980; Wang et al., 1988; Zheng & Fu, 2001).

***Textularia lancea* Lalicker & McCulloch, 1940** (Figs. 31, 32)

Textularia lancea Lalicker & McCulloch, 1940, p. 130, pl. 14, Fig. 14; Loeblich & Tappan, 1994, p. 28, pl. 40, Figs. 1–5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D9=B26-01	658	358	238
D9=B26-02	848	487	309

Occurrence and Ecology

The Bohai Sea (St 26, St 6) and the Yellow Sea (St CJ-02, St CJ-06, St 3500-02, St 3600-02, St 3600-04, St 3700-01) (31°49′–39°00′ N, 119°30′–125°00′ E), water depth 25.00–55.20 m, temperature 2.25–18.08 °C, salinity 30.31–32.74 ‰, abundance 0.02–15.28 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Timor Sea.

Textularia lancea Lalicker & McCulloch, 1940

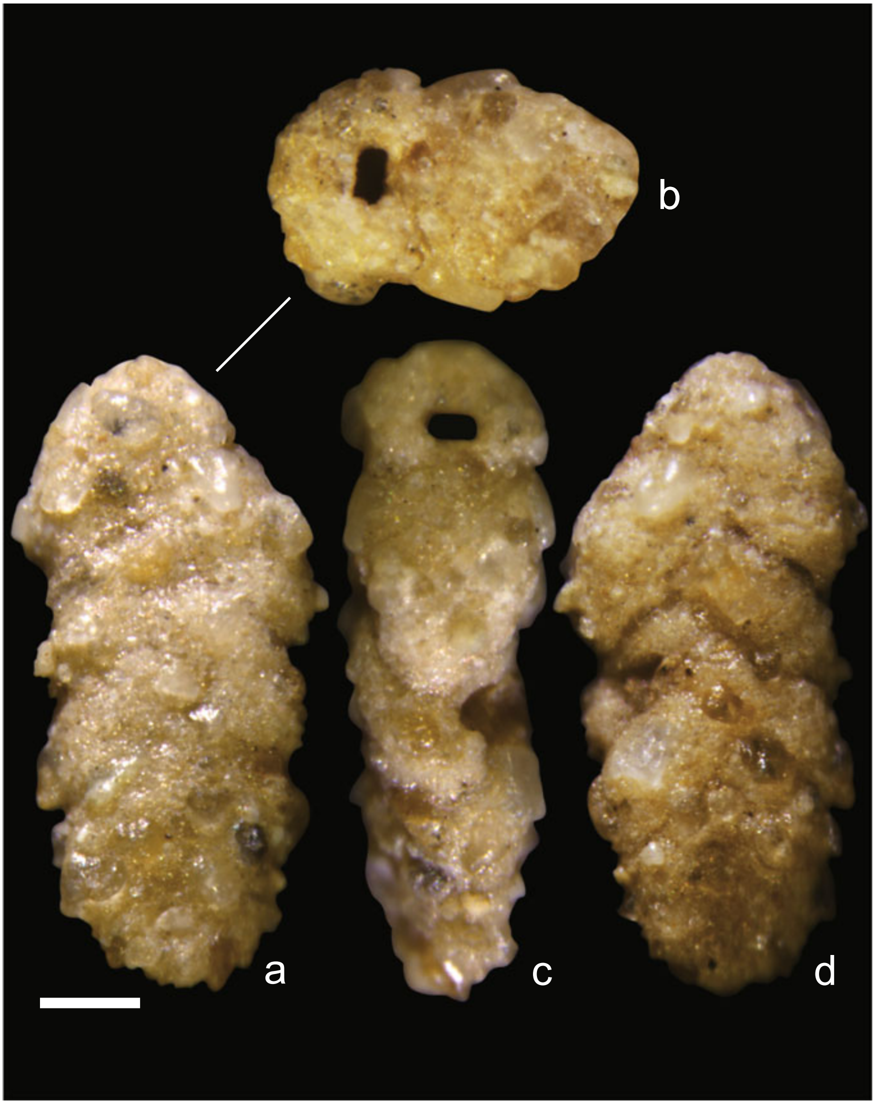

Fig. 31 **a–d** *Textularia lancea* Lalicker & McCulloch, 1940, same specimen with different side of views. **b** Aperture face. Scale bar = 200 μm

Description

Size about 750 μm in length, length:width ratio about 1.8:1. Test biserial, with five to six chambers in each side, the terminal end of the early portion bluntly rounded.

Textularia lancea Lalicker & McCulloch, 1940

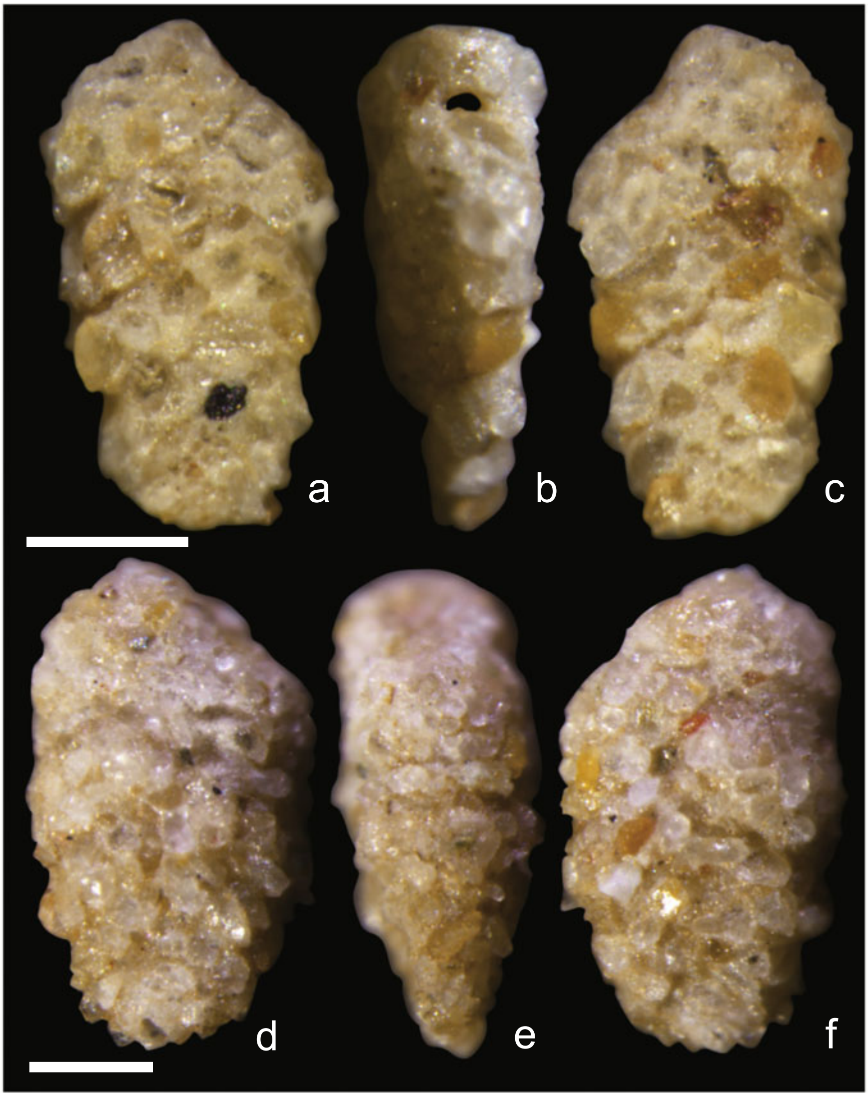

Fig. 32 **a–f** *Textularia lancea* Lalicker & McCulloch, 1940, two specimens sampled from the South Yellow Sea. **a–c** From the same specimen. **d–f** Another specimen. Scale bars = 200 μm

Sutures distinct and incline downwards. Wall rather thick and agglutinated by coarse alternating with fine quartz grains, sometimes colorful. Aperture narrowly elliptical to a low arch-shaped slit at the base of the apertural face.

Remarks

Textularia lancea is a new record to China Seas. It is a common species in the Yellow Sea. Loeblich & Tappan (1994) described a Timor population, which was relatively smaller in size than the Yellow Sea one.

Textularia subantarctica **Vella, 1957** (Fig. 33)

Textularia subantarctica Vella, 1957, p. 16, pl. 3, Figs. 49–51; Saisova, 1975, pl. 35, Fig. 8; Loeblich & Tappan, 1994, p. 30, pl. 39, Figs. 1–5.

Textularia cf. *lata* Germeraad, Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 70, pl. I, Figs. 25–26.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H61-01	261	280	166
H61-02	348	477	313

Occurrence and Ecology

The Yellow Sea (St CJ-06, St 3500-02) (32°29′–35°00′ N, 120°00′–125°00′ E), water depth 30.00–55.20 m, temperature 10.68–18.08 °C, salinity 30.82–32.74 ‰, abundance 0.16–1.86 ind./g sed.

Distribution

Yellow Sea.

New Zealand, New Caledonia.

Description

Size about 300 μm in length, length:width ratio about 0.8:1. Test biserial throughout, about six to seven chambers in each side. Chambers increase rapidly in breadth from the early portion to the terminal face of adult stage. Sutures indistinct. Wall agglutinated with fine grains. Aperture indistinct arch at the base of the apertural face.

Remarks

Textularia subantarctica is a common species in the Yellow Sea sediments. It differs from *Sahulia kerimbaensis* by smaller body size and indistinct aperture. *T. subantarctica* has been reported by several studies (Vella, 1957; Saisova, 1975; Loeblich & Tappan, 1994). This species has been regarded as a synonym of *T. truncata* Höglund, 1947 (Hayward et al., 2015), however, the main difference between *T. subantarctica* and *T. truncate* is that the sutures and aperture of later species are both very distinct. Therefore, *T. subantarctica* should be existed as a substantial species.

Textularia subantarctica Vella, 1957

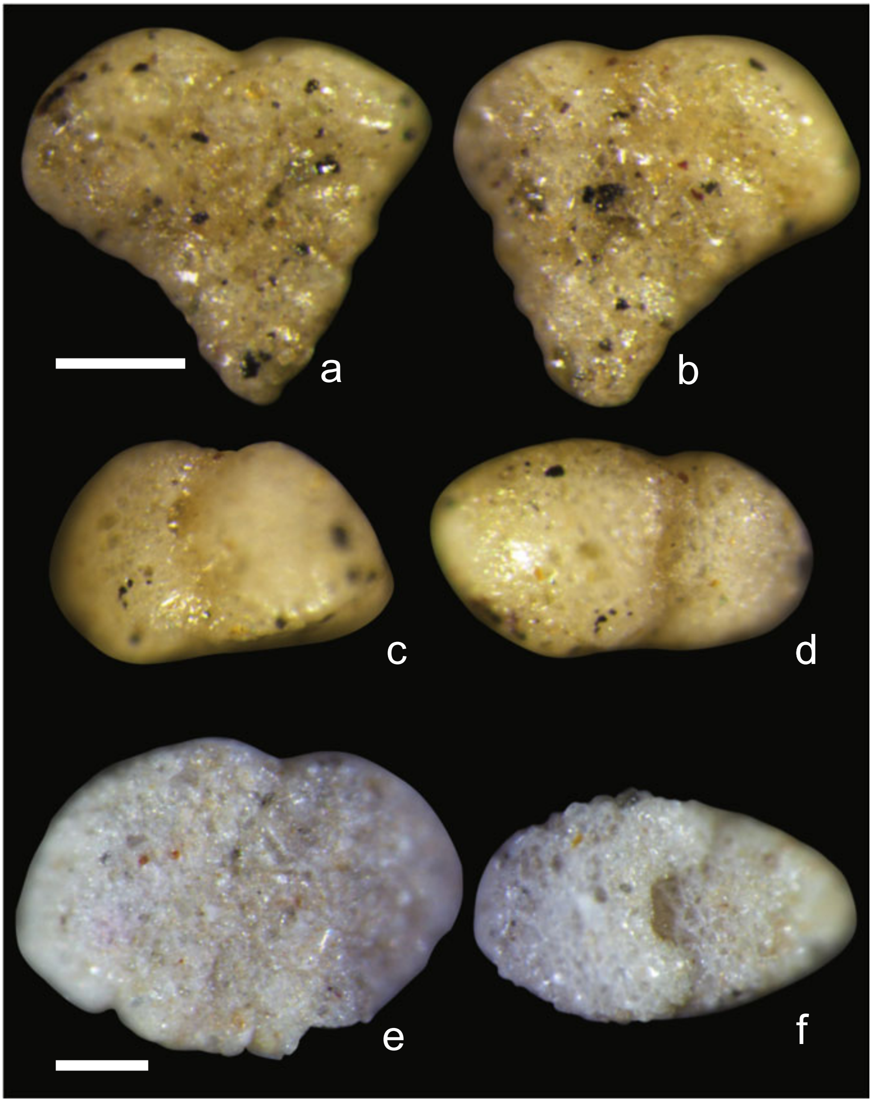

Fig. 33 a–f *Textularia subantarctica* Vella, 1957, two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e, f** Another specimen. Scale bars = 100 μm

Genus *Siphotextularia* Finlay, 1939

Siphotextularia wairoana **Finlay, 1939** (Fig. 34)

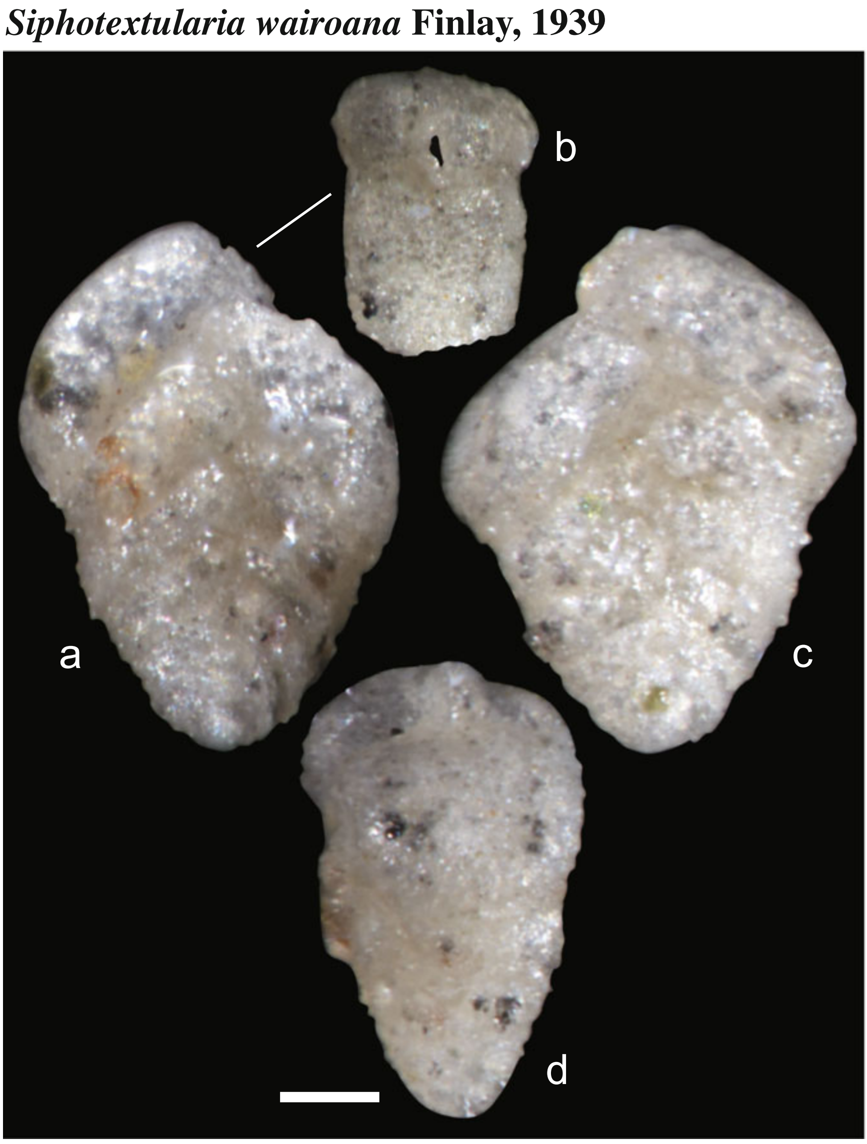

Fig. 34 a–d *Siphotextularia wairoana* Finlay, 1939, the same specimen with different side of views. **b** Aperture face view showing the typical quadrangular shape. **d** Lateral view. Scale bar = 50 μm

Siphotextularia wairoana Finlay, 1939a, p. 511, pl. 68, Fig. 2; Wang et al., 1988, p. 122, pl. XI, Fig. 12; Loeblich & Tappan, 1987, p. 175, pl. 193, Figs. 5–6; Loeblich & Tappan, 1994, p. 31, pl. 43, Figs. 3–8.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B96=D89-01	266	192	125

Occurrence and Ecology

The Bohai Sea (St 22) and the Yellow Sea (St CJ-04, St 3300-06) (32°10′–38° 21′ N, 120°08′–124°00′ E), water depth 26.00–50.00 m, temperature 2.36–17.02 °C, salinity 30.30–32.41 ‰, abundance 0.08–0.64 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.

New Zealand, Sahul Shelf.

Description

Size about 260 μm in length, length:width ratio about 1.4:1. Test biserial throughout, about six chambers in each side. Apical view quadrangular in shape. Sutures moderately distinct. Wall finely agglutinated with sand grains. Aperture an areal slit, produced on a tubular neck.

Remarks

Siphotextularia wairoana has been reported by Wang et al., (1988). It is a common species and usually distributed in the middle and out continental shelf sediments of the China Seas.

Family Pseudogaudryinidae Loeblich & Tappan, 1985

Genus *Pseudoclavulina* Cushman, 1936

Pseudoclavulina juncea **Cushman, 1936** (Fig. 35)

Pseudoclavulina juncea Cushman, 1936, p. 19, Fig. 8a, b; Collins, 1958, p. 356; Braga, 1961, p. 45, pl. 4, Fig. 4; Ishiwada, 1964, p. 205, p. 35, pl. 1, Fig. 11; Zheng, 1988, p. 104, pl. 47, Figs. 5–7; Loeblich & Tappan, 1994, p. 32, pl. 45, Figs. 1–7; Zheng & Fu, 2001, p. 581, pl. CVII, Figs. 4, 5, 10, 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D40-01	910	307	307
D40-02	797	280	280

Pseudoclavulina juncea Cushman, 1936

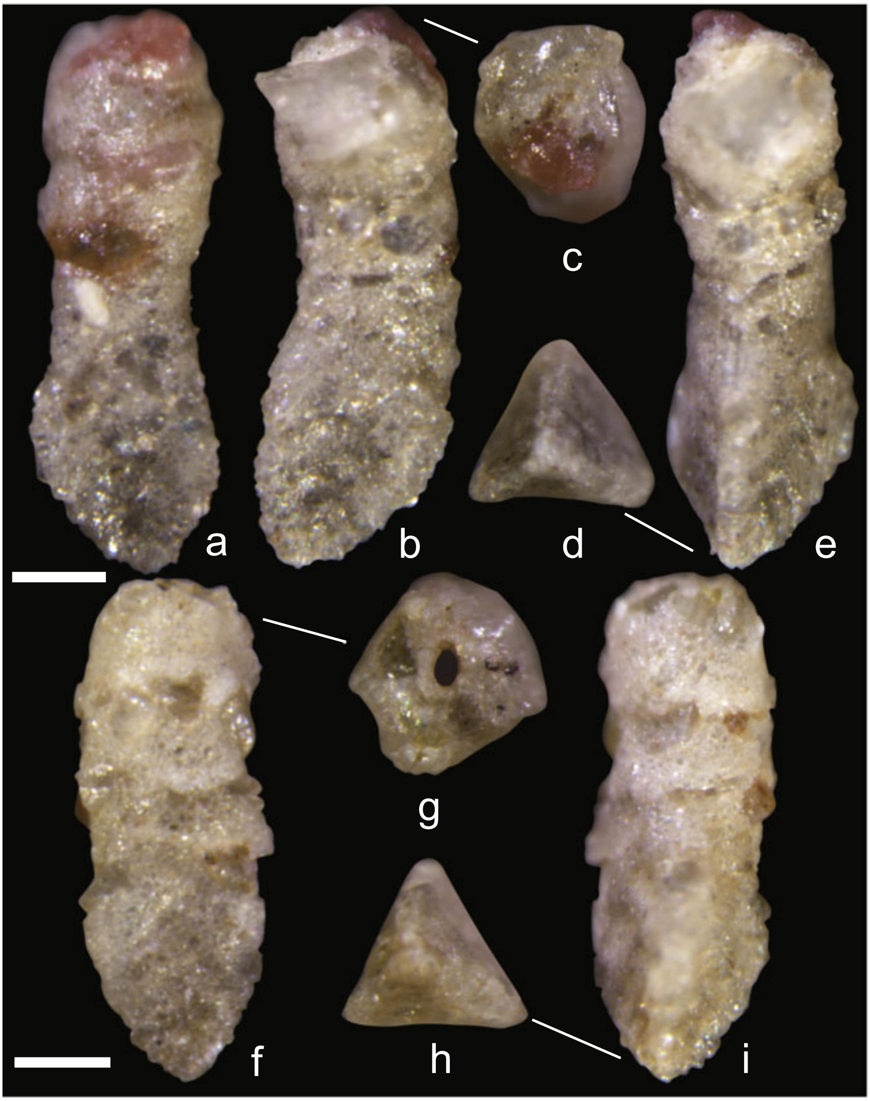

Fig. 35 a–i *Pseudoclavulina juncea* Cushman, 1936, two specimens were sampled from the sediments of Yellow Sea Cold Water Mass area. **a–e** The same specimen with different side of views. **f–i** Another specimen. Scale bars = 150 µm

Occurrence and Ecology

The Yellow Sea (St 3400-08) and intertidal flat of the Qingdao Bay (33°59′–36° 00′ N, 120°30′–123°58′ E), water depth 3.00–80.00 m, temperature 3.00–10.01 °C, salinity 32.94–38.00 ‰, abundance 0.12–0.42 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.
Japan, Sahul Shelf.

Description

Size about 850 μm in length, length:width ratio about 2.9:1. Test elongate. Early stage triserial and triangular, carinate in the margine, about six chambers in each side, occupying about 1/3 of the body length. Adult stage about four uniserial and cylindrical chambers, gradually slightly increased in the width. Wall agglutinated with coarse quartz grains. Aperture elliptical in shape, without any tooth, located in the center of the terminal chamber.

Remarks

Pseudoclavulina juncea was discovered by Cushman (1936). The Yellow Sea specimens matched the original description in main taxonomic characters. This species was also occurred in the East China Sea and the South China Sea (Zheng & Fu, 2001). Our specimens were sampled from the sediments of Yellow Sea Cold Water Mass area.

Genus *Pseudogaudryina* Cushman, 1936

***Pseudogaudryina atlantica* (Bailey, 1851)** (Fig. 36)

Textularia atlantica Bailey, 1851.
Gaudryina atlantica (Bailey, 1851).
Pseudogaudryina atlantica (Bailey, 1851), Loeblich & Tappan, 1987, p. 50, pl. 197, Figs. 5–9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H161-01	772	439	335

Occurrence and Ecology

The Yellow Sea (St 3600-05) (35°59′ N, 122°29′ E), water depth 59.00 m, temperature 8.50 °C, salinity 32.60 ‰, abundance 0.16 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.
Japan, North Atlantic Ocean, United States, Southeast U.S. Continental Shelf, Gulf of Mexico.

Pseudogaudryina atlantica (Bailey, 1851)

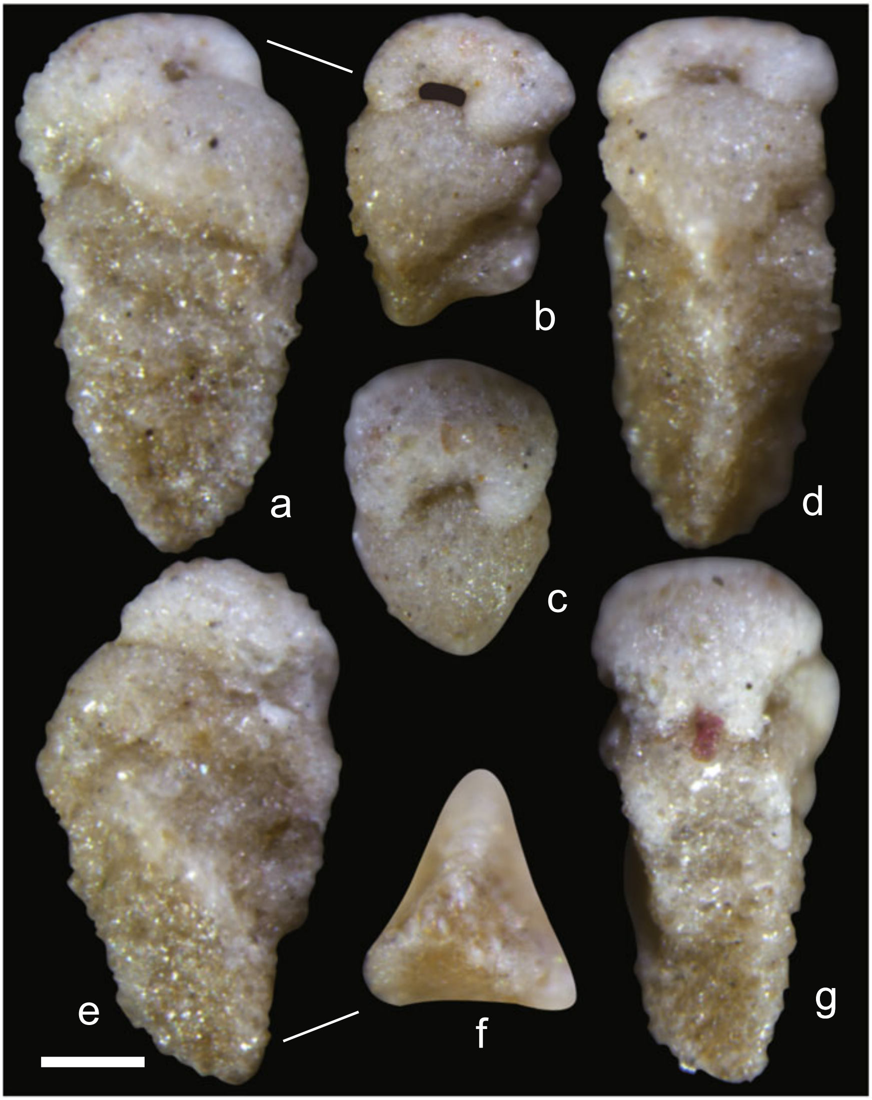

Fig. 36 **a–g** *Pseudogaudryina atlantica* (Bailey, 1851), the same specimen showing different side of views. **b, c** Aperture face. **f** Antapical view showing early portion. Scale bar = 150 μm

Description

Size 772 μm in length, length:width ratio about 1.8:1. Test triangular. Early stage triserial and triangular in section, about four chambers in each side. Later becoming biserial but triangular in section, about four to five chambers in each side. Distinctly twisted from triserial to biserial transformation. Sutures indistinct in the early stage, but more and more distinct in the late stage. Wall agglutinated with fine quartz grains. Aperture arch shape, located at the final chamber base.

Remarks
The Yellow Sea specimen matched well with the taxonomic features of original description of *Pseudogaudryina atlantica*. This species differs from *P. pacifica* by having a distinct torsion in the test. In our investigation it occured only in the sediment of Yellow Sea Cold Water Mass area.

***Pseudogaudryina pacifica* (Cushman & McCulloch, 1939)** (Fig. 37)

Gaudryina (*Pseudogaudryina*) *atlantica* (Bailey) var. *pacifica* Cushman & McCulloch, 1939, p. 94, pl. 9, Figs. 1, 2; Cushman, 1946, p. 24, pl. 8, Figs. 9, 10.

Gaudryina (*Pseudogaudryina*) *pacifica* Cushman & McCulloch, Zheng, 1988, p. 91, pl. 43, Figs. 2, 3; Zheng & Fu, 1990, pp. 548, 556, 557, pl. 1, Fig. 11; Tu & Zheng 1991, p. 168, pl. 1, Fig. 12.

Pseudogaudryina pacifica (Cushman & McCulloch), Loeblich & Tappan, 1994, p. 33, pl. 45, Figs. 20–23; Debenay, 2012, p. 89.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H159-01	832	443	325
H159-02	771	413	313

Occurrence and Ecology
The Yellow Sea (St 3600-05) (35°59′ N, 122°29′ E), water depth 59.00 m, temperature 8.50 °C, salinity 32.60 ‰, abundance 0.08 ind./g sed.

Distribution
Yellow Sea, East China Sea, South China Sea.
New Caledonia, Sahul Shelf.

Description
Size about 800 μm in length, length:width ratio about 1.9:1. Test elongate triangular. Early stage triserial and triangular in section, with about four chambers in each side. Later becoming biserial but triangular in section, with about four chambers (range: three to five chambers) in each side. Sutures moderate distinct among chambers. Wall agglutinated with fine quartz grains. Aperture a distinct arch at the final chamber.

Remarks
Pseudogaudryina pacifica was established as *Gaudryina* (*Pseudogaudryina*) *atlantica* (Bailey) var. *pacifica* by Cushman & McCulloch (1939). The taxonomic feature of the Yellow Sea population matches well with that of the Southwestern

Pseudogaudryina pacifica (Cushman & McCulloch, 1939)

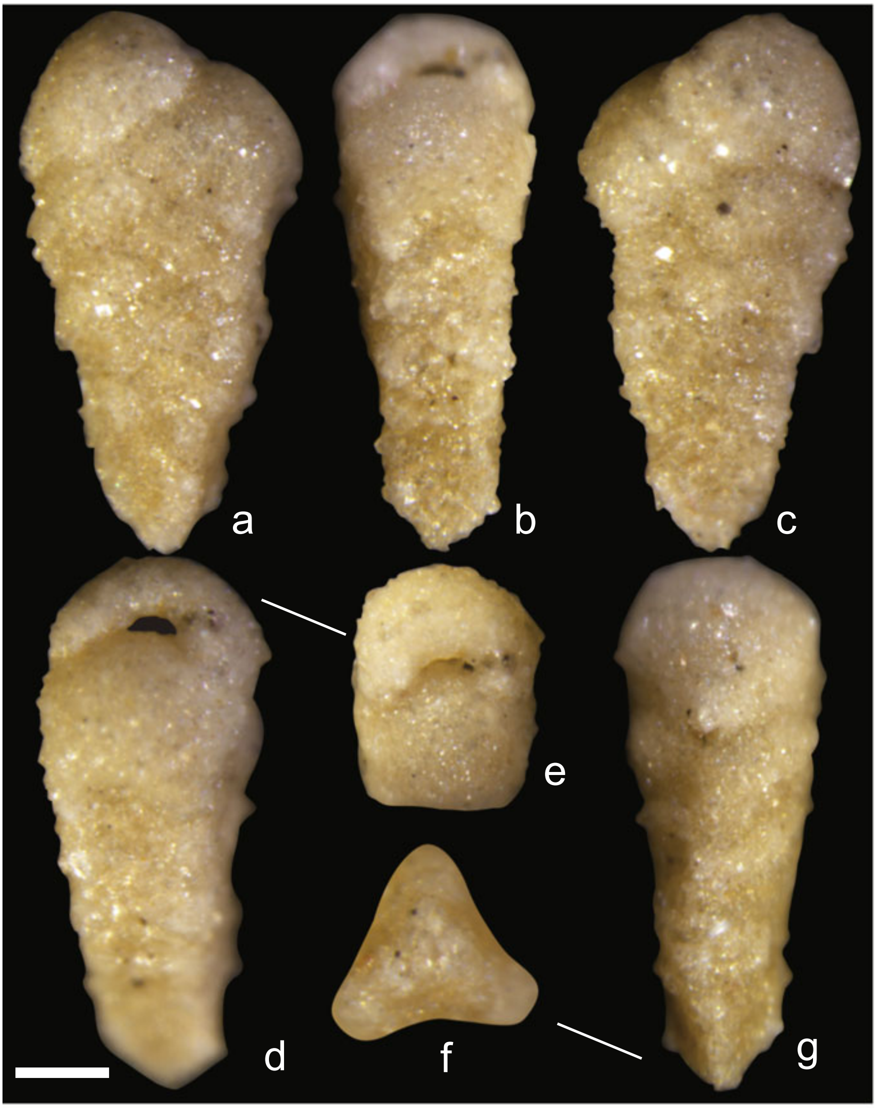

Fig. 37 **a–g** *Pseudogaudryina pacifica* (Cushman & McCulloch, 1939), the same specimen with different side of views. **e** Aperture face. **f** Antapical view showing early portion. Scale bar = 150 μm

Pacific one (Debenay, 2012). In the Yellow Sea, *P. pacifica* occurred only in the sediment of Yellow Sea Cold Water Mass region, but it is more abundant in the East China Sea and the South China Sea.

***Pseudogaudryina triangulata* nov. spec.** (Figs. 38, 39, 40)

Diagnosis

Size about 320 μm in length. Test a typical triangular in shape thoroughly. Early stage triserial and later biserial. The chambers increased rapidly in width, with

***Pseudogaudryina triangulata* nov. spec.**

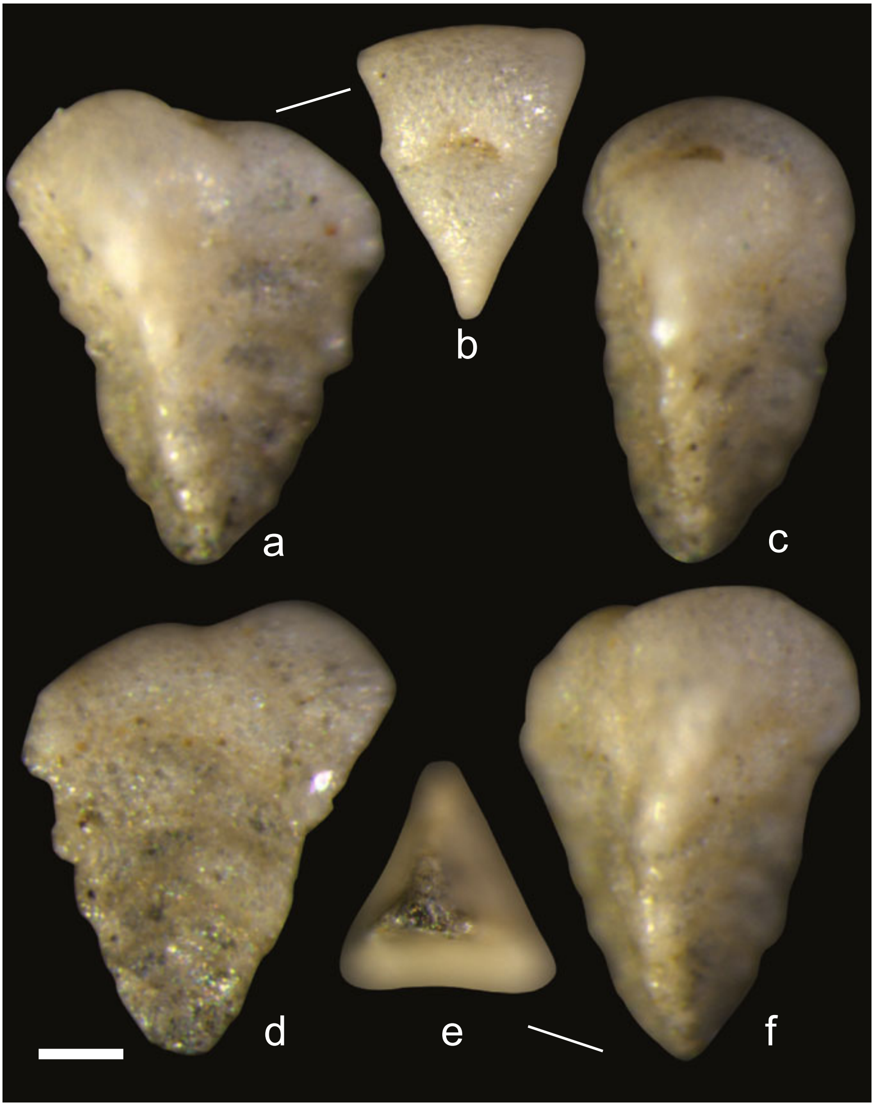

Fig. 38 **a–f** *Pseudogaudryina triangulata* nov. spec., the holotype specimen showing different side of view. **b** Apical view. **e** Antapical view showing the triangular profiles. Scale bar = 50 μm

Pseudogaudryina triangulata nov. spec.

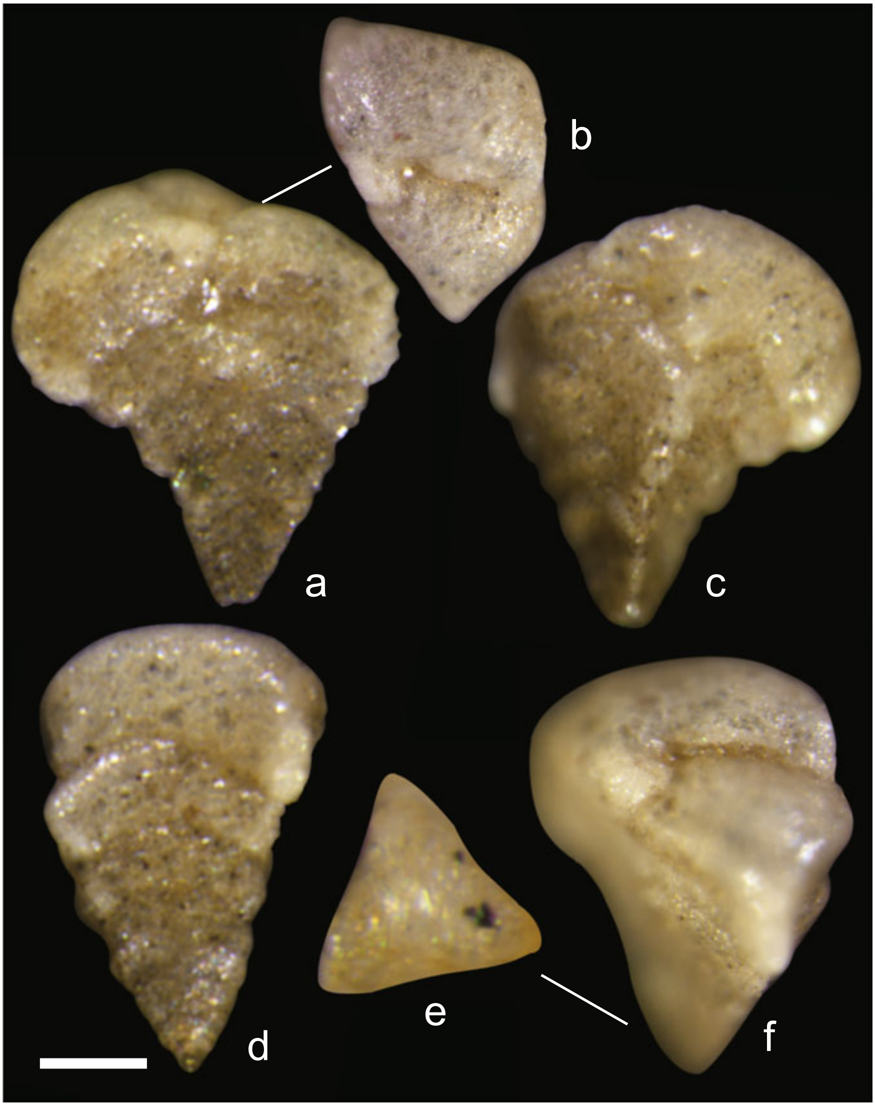

Fig. 39 a–f *Pseudogaudryina triangulata* nov. spec., the paratype-01 specimen showing different side of views. Scale bar = 100 µm

about seven chambers in each side. Marginal keels distinct and rather sharp, slightly carinate, and dentate. Sutures moderately distinct. Wall agglutinated with very fine grains. Aperture an indistinct interiomarginal slit.

Pseudogaudryina triangulata nov. spec.

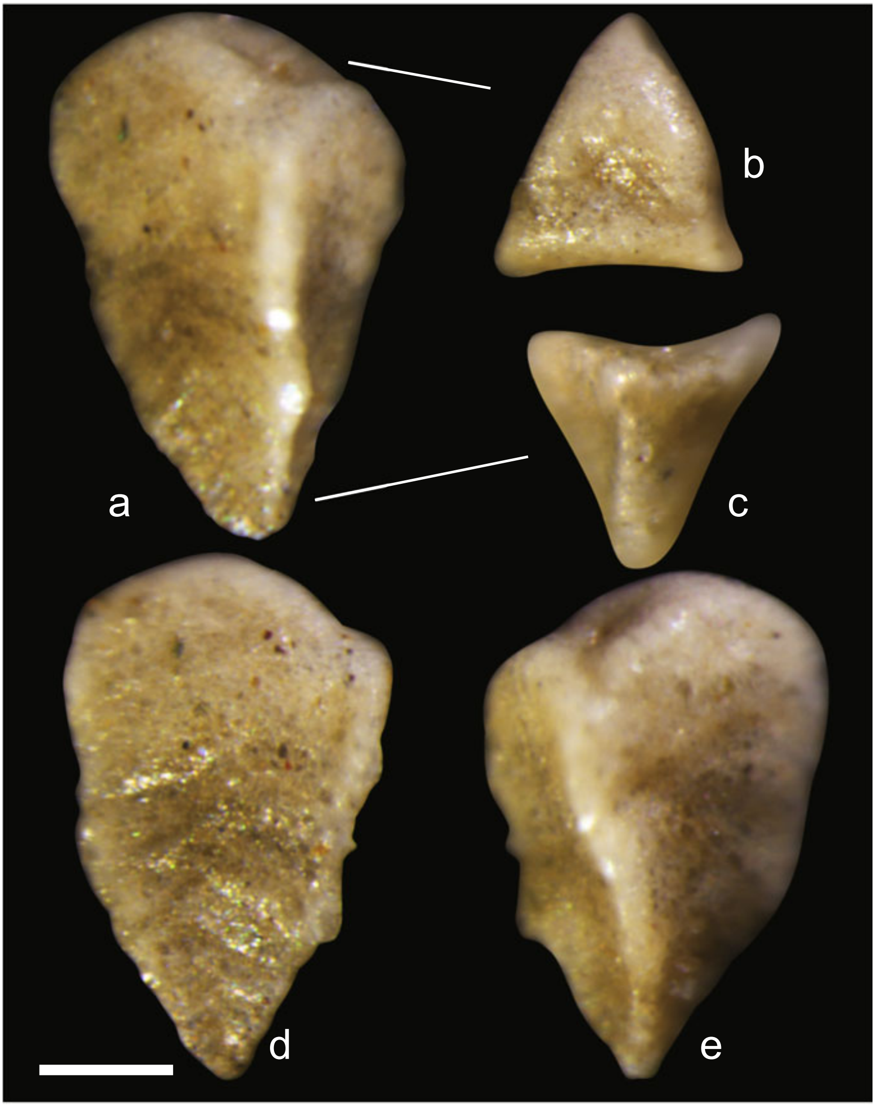

Fig. 40 a–e *Pseudogaudryina triangulata* nov. spec., the paratype-02 specimen showing different side of views. Scale bar = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D10=B74 Holotype	290	219	168
D10=B74 Paratype-01	418	363	257
D10=B74 Paratype-02	355	241	211
D10=B74 Paratype-03	257	206	183
D10=B74 Paratype-04	261	205	195

Etymology

The Latin adjective *triangulate* refers to the typically triangular test shape.

Type Material

Holotype (IOCA D10=B74 Holotype) and two paratypes (IOCAS D10=B74 Paratype-01; IOCAS D10=B74 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). In addition, 35 Paratype specimens are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-06, St 3300-04, St 3300-06, St 3400-06, St 3400-08, St 3500-06, St 3600-08) (31°49′–36°00′ N, 121°59′–125°00′ E), water depth 32.90–80.00 m, temperature 9.12–18.08 °C, salinity 31.14–33.31 ‰, abundance 0.04–3.62 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Description

Size about 320 μm in length, length:width ratio about 1.3:1. Test typically triangular in shape. Early stage triserial and later biserial. The chambers increased rather rapidly in width, with about seven chambers (range: six to eight chambers) in each side. Marginal keels of the three-dimensional test sides rather sharp, slightly carinate, and dentate. The two series of angular biserial chambers dissimilar, one series being roughly triangular in section and the other quadrangular in section, maintaining the triangular test shape. Sutures moderately distinct. Wall agglutinated with fine quartz grains. Aperture indistinct small arch interiomarginal slit, horizontally located in the central of the aperture face.

Remarks

Pseudogaudryina triangulata is rather distinct from most of the congeners by having a short triangular body shape, in addition, the rapidly increased chamber width and the sharp marginal keels are also its special characteristics.

Only a few species have been established within this genus. *P. triangulata* is easily to be distinguished from *P. atlantica* by different test shape, in addition, the latter species is much bigger in size (∼1 mm in length) (Loeblich & Tappan, 1987). Although *P. triangulata* resembles *P. padifica* in the chamber numbers at first glance, the latter is comparatively rounded and plumped in the test shape and without sharp marginal keels (Loeblich & Tappan, 1994), thus could be easily distinguished.

***Pseudogaudryina wangi* nov. spec.** (Figs. 41, 42)

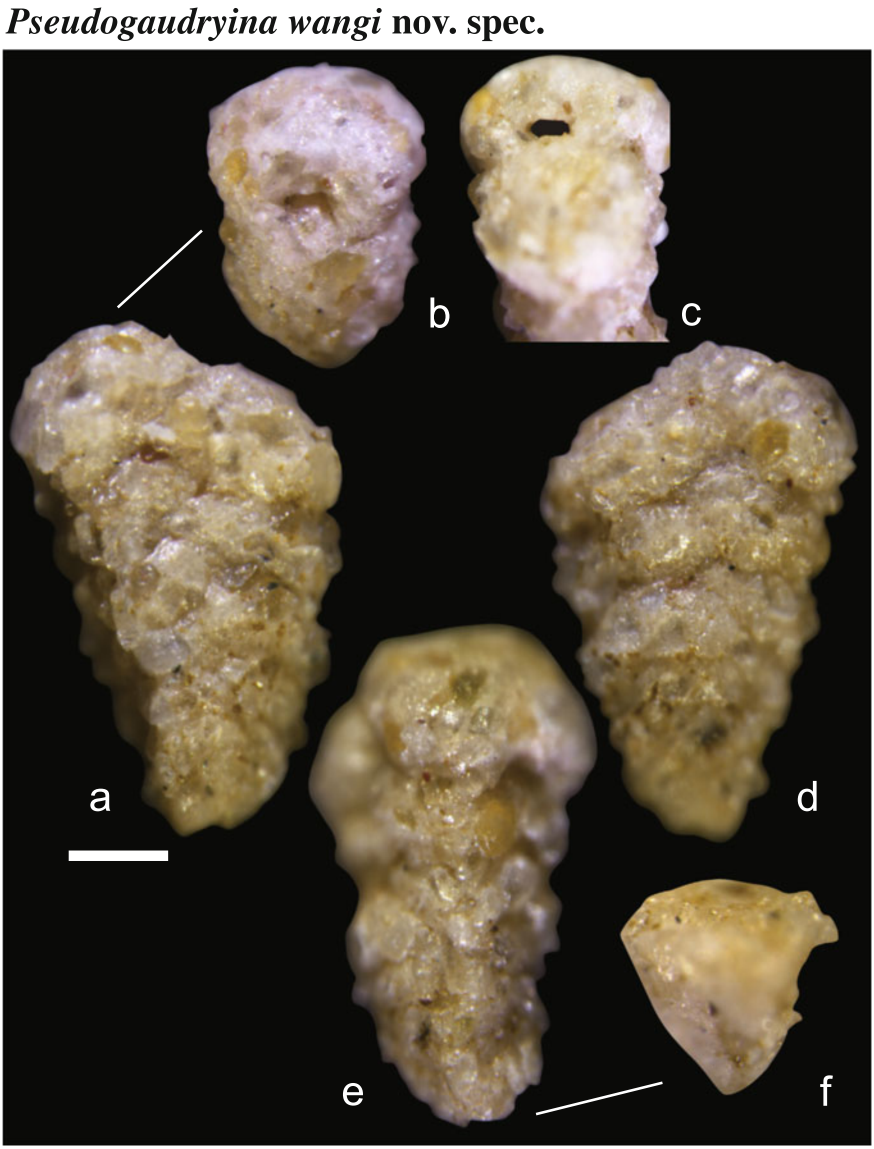

Fig. 41 **a–f** *Pseudogaudryina wangi* nov. spec., the holotype specimen showing different side of views. Scale bar = 200 µm

Pseudogaudryina wangi nov. spec.

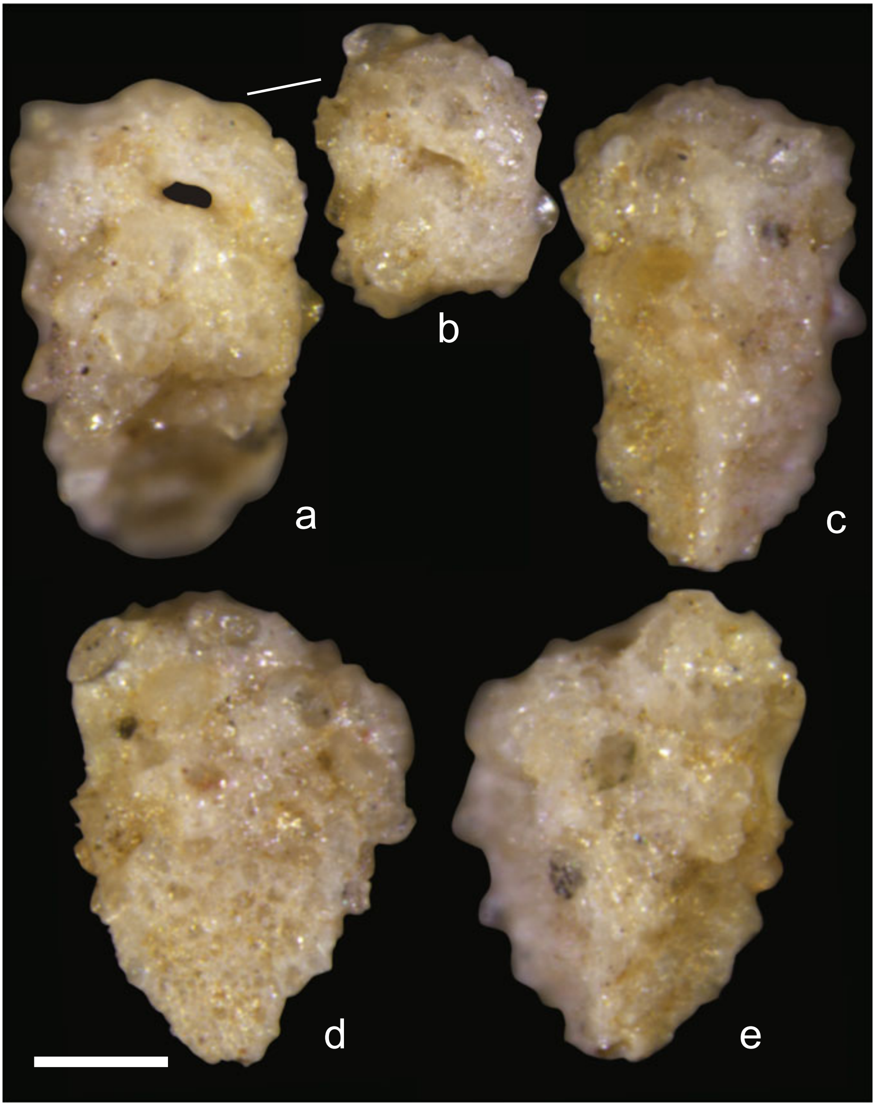

Fig. 42 a–e *Pseudogaudryina wangi* nov. spec., the paratype-01 specimen showing different side of views. Scale bar = 150 µm

Gaudryina cf. *guanajayensis* Bermúdez, Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 71, pl. II, Figs. 1, 2.

Diagnosis

Size about 750 μm in length. Test roughly triangular in shape. Early stage triserial and triangular in section and later become biserial, about 7 chambers from the initial to the terminal end in each side. One series of the chambers roughly triangular in section and the other quadrangular in section. Sutures distinct and inclined downwards. Wall agglutinated with large and coarse grains mixed with fine particles. Aperture distinct, oblong in shape, at the inner margin of the final chamber.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H22 Holotype	980	656	573
H22 Paratype-01	560	403	342
H22 Paratype-02	713	433	300

Etymology

Named in honor of Professor Dr. Pin Xian Wang (School of Ocean and Earth Science, Tongji University, China), who firstly discovered this species but identified it as *Gaudryina* cf. *guanajayensis* from the South Yellow Sea sediment. The species is dedicated to Pin Xian Wang is also due to his huge contributions to foraminiferal research and the Chinese marine geological sciences for decades.

Type Material

Holotype (IOCA H22 Holotype) and two paratypes (IOCAS H22 Paratype-01; IOCAS H22 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). Five paratype specimens are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Occurrence and Ecology

The Yellow Sea (St 3400-08, St 3500-06, St 3500-08, St 3600-04) and intertidal flat of the Qingdao Bay (33°59′–36°00′ N, 120°30′–123°58′ E), water depth 44.00–80.00 m, temperature 9.25–12.31 °C, salinity 31.13–34.00 ‰, abundance 0.12–7.86 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 750 μm in length, length:width ratio about 1.5:1. Test elongate and roughly triangular in shape. Early stage very short, triserial, and triangular in section, with two to three chambers, later biserial and with about four to six chambers, therefore the total chambers from the initial to the terminal end with on average seven chambers (range: five to nine chambers) in each side. One series of the chambers roughly triangular in section and the other quadrangular in section. Sutures distinct and inclined downwards. Wall agglutinated with very large and coarse grains mixed with fine particles. Aperture distinct, oblong in shape, and located at the inner margin of the final chamber.

Remarks

Micropaleontology Group in Marine Geology Department of Tongji University (1978) reported this species from the South Yellow Sea sediment and identified it as *Gaudryina* cf. *guanajayensis*. But the authors mentioned that their specimens were rather different from the original description of *G. guanajayensis*, which was discovered from an Eocene stratum of Cuba by Bermúdez by have a distinctly smaller size and lacking of gridding structures on the last chambers. However, the taxonomic feature of Micropaleontology Group in Marine Geology Department of Tongji University (1978)'s specimen matched well with the characters within the genus *Pseudogaudryina* in the test shape and construction, and also the arrangement of the two series chambers. Therefore it should be a different species from *Gaudryina guanajayensis* and be attributed to the genus of *Pseudogaudryina.*

Within the genus of *Pseudogaudryina*, only a few species were described in detail, including *P. atlantica* (Bailey, 1851), *P. concava* (Collins, 1958), and *P. pacifica* (Cushman & McCulloch, 1939). Comparing to the other congeners, *P. wangi* has a triangular body shape with a plumped outline, in addition, the rather coarse wall texture and the distinct aperture are also easily to identify and to differentiate from the other congeners. Among the three species, *P. atlantica* may resemble *P. wangi* in the shape of the terminal face, however, it has relatively larger test size (2.5 mm vs. 1 mm) and an elongate shape and marginal keels (Loeblich & Tappan, 1987), thus is also easily to be distinguished.

Family Valvulinidae Berthelin, 1880

Genus *Clavulina* d'Orbigny, 1826

***Clavulina huanghaiensis* nov. spec.** (Figs. 43, 44)

Diagnosis

Test about 1200 μm in length. Early stage triserial and triangular, margins not carinate. The triangular portion with about five chambers in each side, occupying 1/2–2/3 of the body length. Adult stage with about two uniserial cylindrical chambers equally in width. Sutures moderately distinct. Wall agglutinated with coarse particles. Aperture with a distinct flake shaped toothplate.

Clavulina huanghaiensis nov. spec.

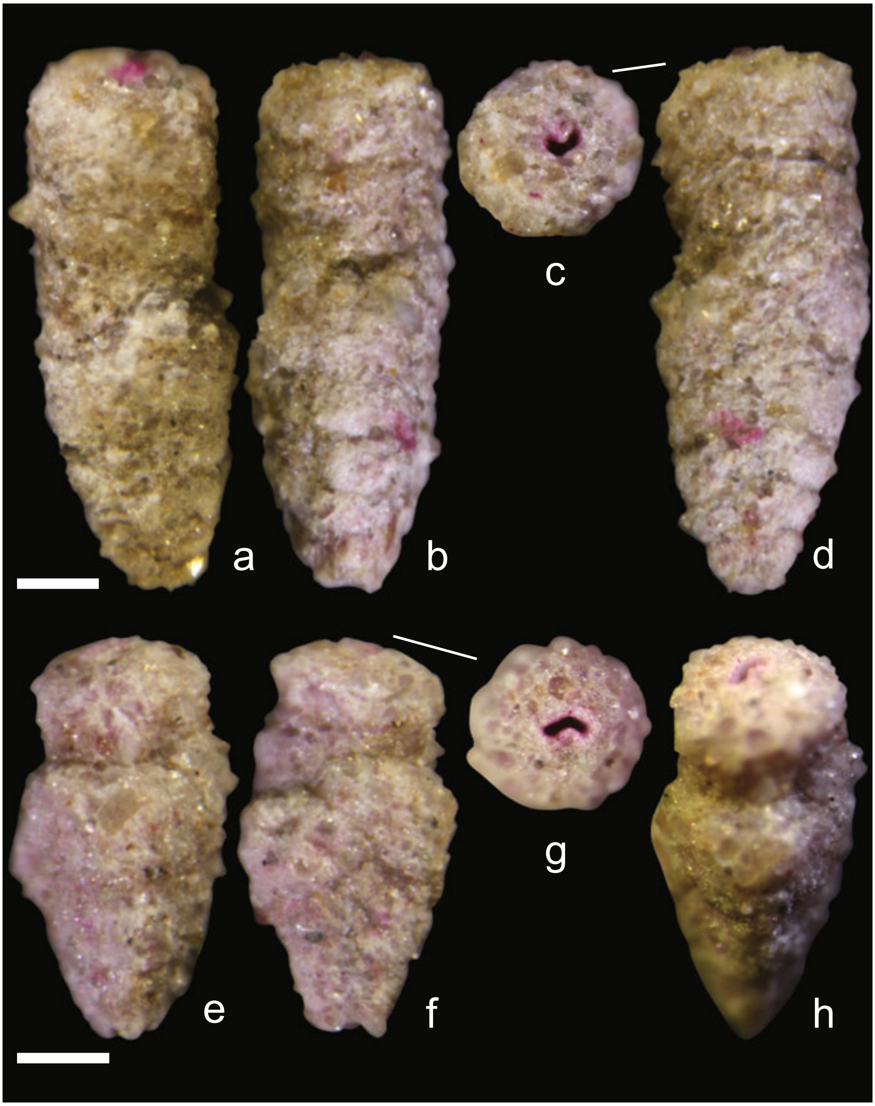

Fig. 43 **a–h** *Clavulina huanghaiensis* nov. spec., two specimen were sampled from the sediments of Yellow Sea Cold Water Mass area. **a–d** Holotype specimen. **e–h** Paratype-01 specimen. Scale bars = 200 μm

Clavulina huanghaiensis nov. spec.

Fig. 44 a–h *Clavulina huanghaiensis* nov. spec. **a–d** Paratype-02 specimen. **e–h** Paratype-03 specimen. **c** Aperture face. **g** Antapical view showing triangular early portion. Scale bars = 200 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H158 Holotype	1305	497	497
H158 Paratype-01	859	446	446
H158 Paratype-02	1198	476	476
H158 Paratype-03	1184	610	610
H158 Paratype-04	888	525	525
H158 Paratype-05	742	496	496

Etymology
Named after the sea area where the species was discovered.

Type Material
Holotype (IOCA H158 Holotype) and two paratypes (IOCAS H158 Paratype-01; IOCAS H158 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). The other 35 paratypes specimens are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Type Locality
The Yellow Sea (St 3400-06) (33°59′ N, 123°00′ E), water depth 67.80 m, temperature 12.00 °C, salinity 31.91 ‰, abundance 0.72 ind./g sed.

Distribution
Yellow Sea, East China Sea, South China Sea.

Description
Size about 1200 μm in length, length:width ratio about 2:1. Test elongate and robust. Early stage triserial and triangular, margins not carinate. Each triangular portion with about five chambers (range: five to six chambers; 13 specimens) in each side, occupying about 1/2–2/3 of the body length. Most of the adult stage with about two uniserial cylindrical chambers (rang: one to three chambers; 13 specimens) equally in width. Sutures moderately distinct both in early portion and in adult portion. Wall agglutinated with coarse particles. Aperture with a distinct flake shaped toothplate, located in the center of the terminal chamber in the adult portion of the terminal end.

Remarks
Clavulina huanghaiensis differs from most congeners by having the unique body shape, a long triserial portion followed by a very short uniserial chambers, and its triangular margins are mellow, not carinate; in addition, this species has a flake-like toothplate. The most similar species can be compared is *C. subangularis* Ishizaki, 1939, which also has a flak like toothplate, but has distinctly smaller triserial portion and with carinate margins. Therefore they are easy to be distinguished each other from the general test outline (Loeblich & Tappan, 1994). At the first glance, *C. huanghaiensis* might somewhat resemble *Goesella rotundata* (Cushman, 1913)

in the test shape, however, the later species has trochospirally coiled chambers in the early stage (Loeblich & Tappan, 1987) and thus is differ from *C. huanghaiensis*.

Clavulina huanghaiensis is only observed in the stations within the Yellow Sea Cold Water Mass area in several sampling cruises (e.g., in 2009 cruise and in 2012 cruise). The Yellow Sea Cold Water Mass area is located in the central of the Yellow Sea and characterized by low temperature and high salinity. We supposed it might be an endemic species of this area.

Order Miliolida Delage et Hérouard, 1896

Family Cornuspiridae Schultze, 1854

Genus *Cornuspira* Schultze, 1854

***Cornuspira involvens* (Reuss, 1850)** (Fig. 1)

Operculina involvens Reuss, 1850, p. 370, pl. 46, Fig. 30.

Cornuspira involvens (Reuss), Reuss, 1864, p. 39, pl. 1, Fig. 2; Brady, 1884, p. 200, pl. 11, Figs. 1–3; Cushman, 1917a, p. 25, pl. 1, Fig. 2; pl. 2, Fig. 2; Cushman, 1921, p. 389, pl. 77, Figs. 3, 4; Cushman, 1940, pl. 16, Fig. 2; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 8, pl. 1, Fig. 3; Tappan & Loeblich, 1982, pl. 48, Fig. 1; Hatta & Ujiié, 1992a, p. 61, pl. 4, Fig. 1; Loeblich & Tappan, 1994, p. 36. pl. 56, Figs. 15, 16.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H156-01	954	865	259

Occurrence and Ecology

The Jiaozhou Bay (St D1) (36°04′ N, 120°14′ E), water depth 10.00 m, temperature 25.85 °C, salinity 29.78 ‰, abundance 0.02 ind./g sed.

Distribution

Bohai Sea, Jiaozhou Bay of the Yellow Sea.

Bay of Biscay, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, Norway, South Pacific Ocean, Southern Ocean, United States, New Caledonia, Southeast U.S. Continental Shelf, Vineyard Sound, North Western Weddell Sea, Gulf of Mexico, Mediterranean Sea.

Y. Lei and T. Li, *Atlas of Benthic Foraminifera from China Seas*,
Springer Geology, DOI 10.1007/978-3-662-53878-4_3

Cornuspira involvens (Reuss, 1850)

Fig. 1 a–d *Cornuspira involvens* (Reuss, 1850), the same specimen showing different side of views. Scale bar = 200 µm

Description

Size about 1000 µm in length, length:width ratio about 1.1:1. Test discoidal, with a globular proloculus and undivided planispirally enrolled tubular second chamber.

Wall calcareous, porcelaneous, and imperforate with slight transverse growth lines. Aperture at open end of tube.

Remarks

Cornuspira involvens has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978). The Yellow Sea population is distinctly larger than that from the Bohai Sea.

Family Miliamminidae Saidova, 1981

Genus *Miliammina* Heron-Allen & Earland, 1930

***Miliammina fusca* (Brady, 1870)** (Fig. 2)

Quinqueloculina fusca Brady, 1870, p. 286, pl. 11, Figs. 2, 3; Hada, 1936, p. 853, Fig. 5; Murray, 1971, p. 21, pl. 3, Figs. 1–6.

Miliammina fusca (Brady, 1870), Wang et al., 1988, p. 118, pl. X, Fig. 18; Debenay, 2012, pp. 86, 254.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H130-01	433	235	177
H130-02	382	178	150
H130-03	243	112	73

Occurrence and Ecology

The Yellow Sea (St 3300-04, St 3000-02) (29°59′–33°00′ N, 122°59′–123°00′ E), water depth 33.00–50.00 m, temperature 20.60–22.59 °C, salinity 30.87–34.29 ‰, abundance 0.05–0.27 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George’s Channel, Japan, Malaysia, New Zealand, North Atlantic Ocean, Norway, Southern Ocean, United States, Chesapeake Bay, New Caledonia, Scotian Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description

Size about 350 μm in length, length:width ratio about 2:1. Test elongated ovate in shape. Chambers in *quinqueloculine* arrangement, narrow and one-half coil in length. Wall moderately thick and agglutinated with fine sand grains. Aperture at the end of the chamber, rounded with a T-shape tooth produced on a short neck.

Miliammina fusca (Brady, 1870)

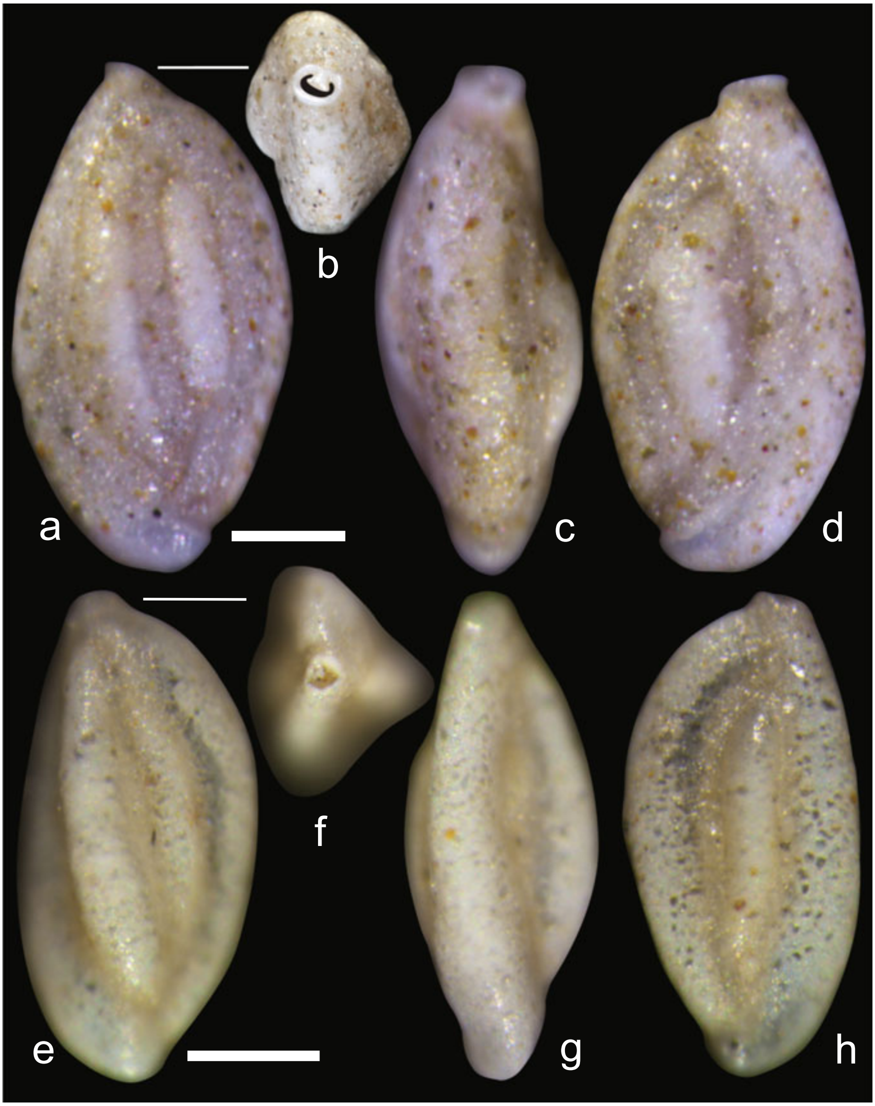

Fig. 2 **a–h** *Miliammina fusca* (Brady, 1870). **a–d** The same specimen. **e–h** From another specimen. **b, f** Apical views. Scale bars = 100 μm

Remarks

The Genus *Miliammina* Heron-Allen & Earland, 1930 was affiliated to the Family Rzehakinidae Cushman, 1933 of the Order Textulariida Delage et Hérouard, 1896 by Loeblich & Tappan (1987). But Hayward et al. (2015) assigned this genus into the Family Miliamminidae Saidova, 1981 of the Order Miliolida Delage et Hérouard, 1896. Here we adopted the later classification for the Genus *Miliammina*.

Miliammina fusca was reported from the Yellow Sea and the East China Sea by Wang et al. (1988). It is a common species but usually occurred in low abundance in shallow water area from the continental shelf of the China Seas.

Family Spiroloculinidae Wiesner, 1920

Genus *Spiroloculina* d'Orbigny, 1826

Spiroloculina communis **Cushman & Todd, 1944** (Figs. 3, 4)

Spiroloculina excavate Brady (not d'Orbigny) 1884, p. 151, pl. 9, Figs. 5, 6.

Spiroloculina grateloupi Cushman (not d'Orbigny) 1917, p. 31, pl. 4, Figs. 4, 5; 1929, p. 40, pl. 8, Fig. 1; 1932, p. 34, pl. 8, Figs. 10, 11.

Spiroloculina communis Cushman & Todd, 1944, p. 63, pl. 9, Figs. 4, 5, 7, 8; Asano, 1951, p. 13, Figs. 87, 88; 1956, p. 67, pl. 7, Figs. 2, 3; Cushma, Todd & Post, 1954, p. 335, pl. 84, Fig. 13; Braga, 1961, p. 70, Fig. 7; Albani, 1965, p. 61, Fig. 6; Hedley, Hurdle & Burdeet, 1965, p. 13, pl. 9a, b; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 75, pl. III, Figs. 24, 28; Albani, 1979, p. 17, Figs. 14, 15; Wang et al., 1988, p. 126, pl. XII, Fig. 13; Zheng, 1988, p. 237, pl. II, Figs. 15, 16; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 149, pl. 2, Figs. 17–18; Hatta & Ujiié, 1992a, p. 63, pl. 5, Fig. 4; Hayward et al., 1999, p. 108, pl. 6, Figs. 8–9; Debenay, 2012, p. 133.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D92-01	963	565	220
B56=D92-01	787	493	260
D92-01	963	565	220

Occurrence and Ecology

The Bohai Sea (St 26, St A8), the Yellow Sea (St CJ-04, St 3400-05, St 3500-02) and intertidal flat of the Qingdao Bay (32°10′–39°00′ N, 119°30′–124°00′ E), water depth 3.00–42.00 m, temperature 2.86–17.02 °C, salinity 30.68–38.00 ‰, abundance 0.02–2.24 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Japan, Micronesia, New Zealand, North Atlantic Ocean, North Pacific Ocean, United States, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Spiroloculina communis Cushman & Todd, 1944

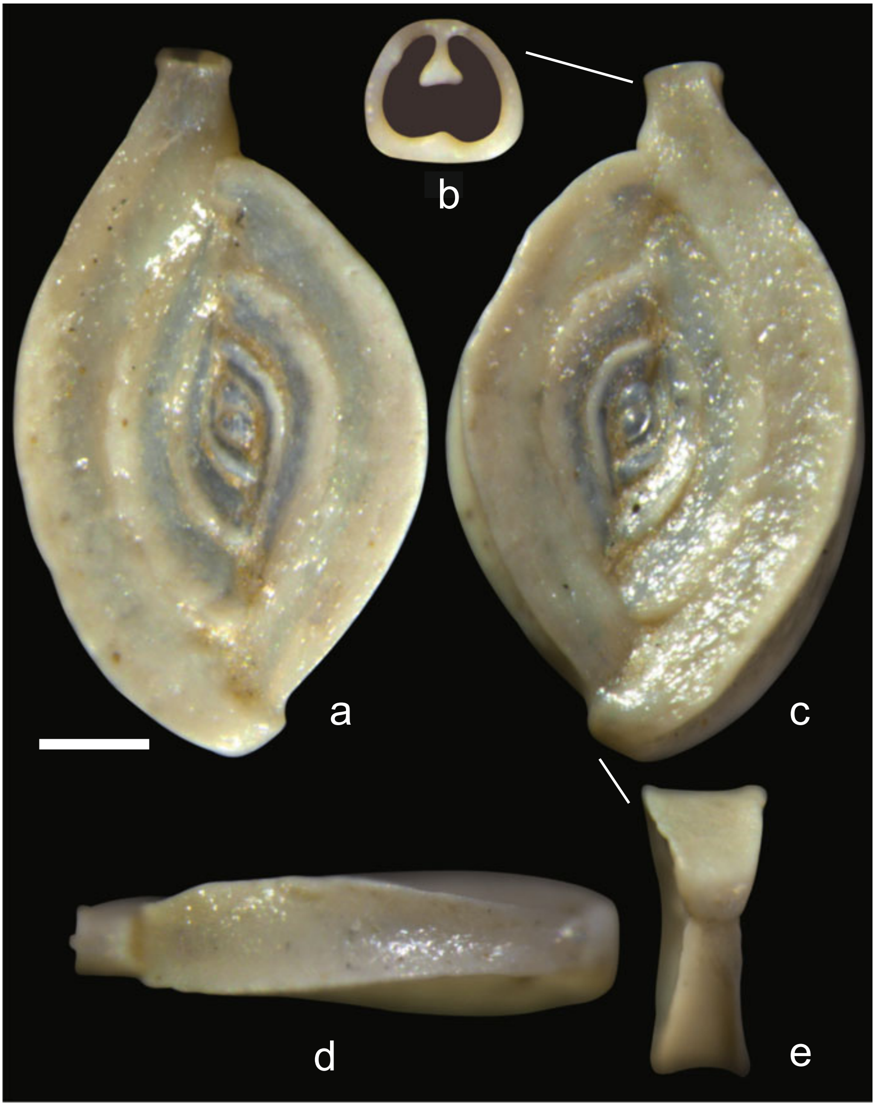

Fig. 3 a–e *Spiroloculina communis* Cushman & Todd, 1944, the same specimen showing different side of views. Scale bar = 150 μm

Spiroloculina communis Cushman & Todd, 1944

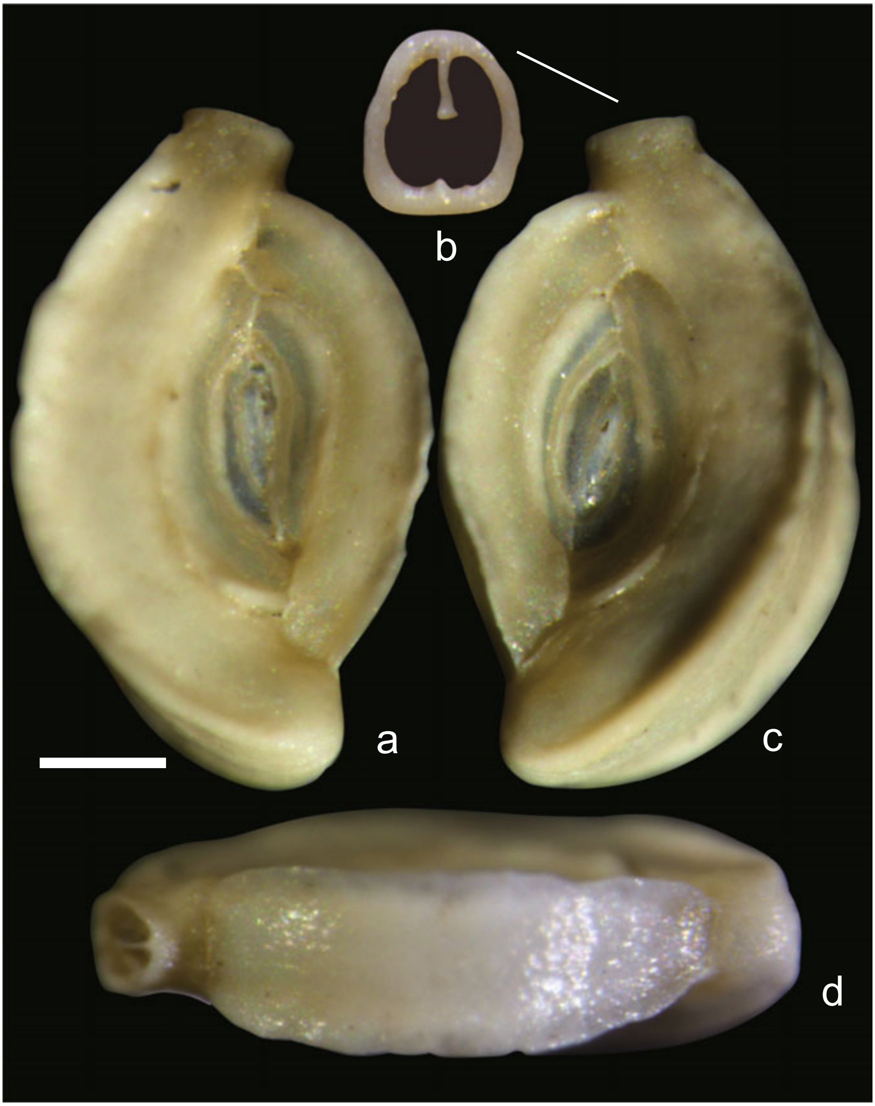

Fig. 4 a–d *Spiroloculina communis* Cushman & Todd, 1944, another specimen showing different side of views. Scale bar = 150 µm

Description
Size about 880 μm in length, length:width ratio about 1.6:1. Test fusiform in outline, very flattened in side view and distinct concave in the central part. Chambers one-half coil in length, rapidly increased their thickness and added in a single plane. Chamber periphery rather sharp, carinate in some specimens. Wall calcareous, imperforate and porcelaneous. Aperture at the open end of the final chamber, produced on a distinct neck. Tooth bifid.

Remarks
Spiroloculina communis is a common species occurring from the Bohai Sea to the East China Sea, and also in the Okinawa Trough (Micropaleontology Group in Marine Geology Department of Tongji University, 1978, Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). Its abundance was not high in the inner continental shelf of the Bohai Sea and the Yellow Sea, but is high in the outer continental shelf of the East China Sea (Wang et al., 1988).

***Spiroloculina jucunda* Cushman & Ellisor, 1944** (Fig. 5)

Spiroloculina jucunda Cushman & Ellisor, 1944, p. 51, pl. 8, Figs. 16–18; Wang et al., 1988, p. 126, pl. XII, Fig. 12.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D100-01	787	542	188
D100-02	777	413	286
D100-01	787	542	188

Occurrence and Ecology
The Yellow Sea (St CJ-02, St CJ-04, St 3500-02) and intertidal flat of the Qingdao Bay (31°49′–36°00′ N, 120°00′–124°00′ E), water depth 3.00–42.00 m, temperature 1.50–17.54 °C, salinity 30.82–36.00 ‰, abundance 0.06–0.72 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Description
Size about 780 μm in length, length:width ratio about 1.5:1. Test ovate in outline, with flattened sides and truncate periphery. Chambers one-half coil in length and added in a single plane. Periphery margin sharp. Wall calcareous, imperforate, and porcelaneous. Aperture at the open end of the final chamber, with simple tooth, produced on a short neck.

Remarks
Spiroloculina jucunda has been reported from the East China Sea sediments occurring in low abundance (Wang et al., 1988). The neck in the Yellow Sea population is relatively shorter than that described in the East China.

Spiroloculina jucunda Cushman & Ellisor, 1944

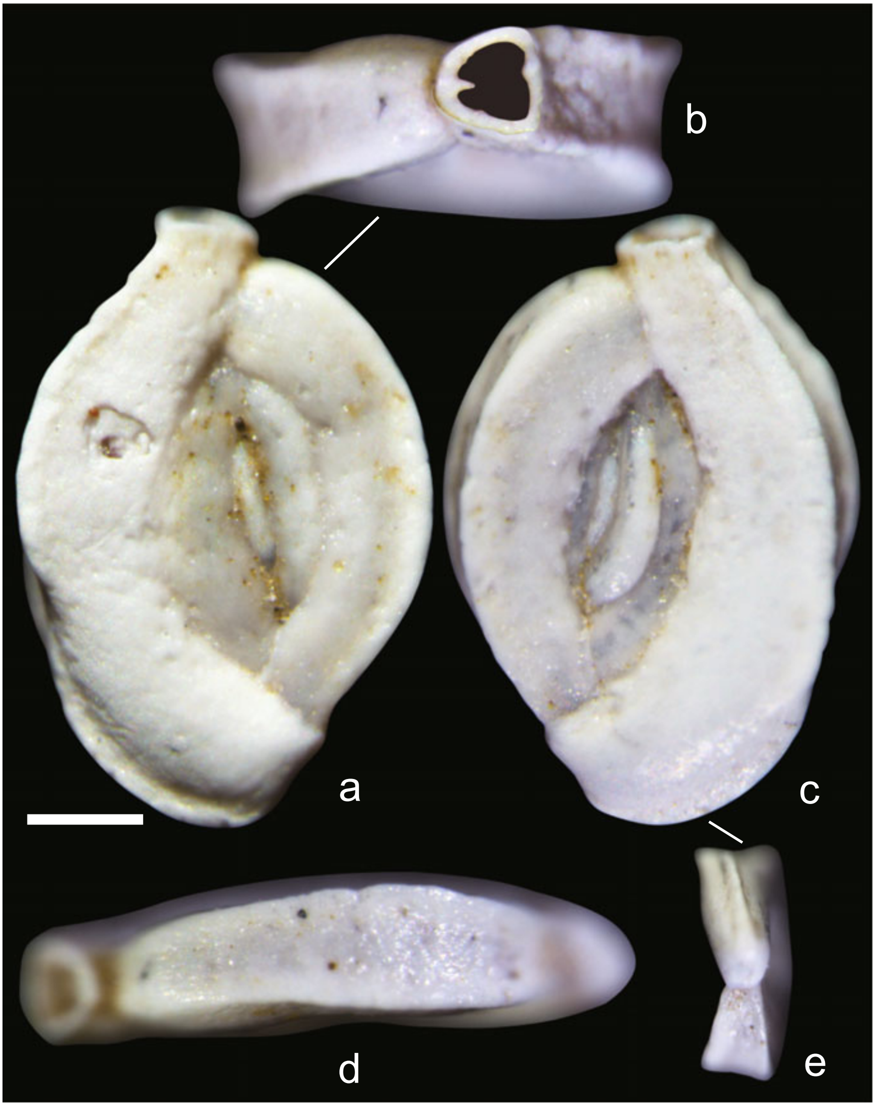

Fig. 5 **a–e** *Spiroloculina jucunda* Cushman & Ellisor, 1944, the same specimen of different side of views. **b** Apical view. **e** Antapical view. Scale bar = 150 μm

Family Hauerinidae Schwager, 1876

Genus *Cycloforina* Luczkowska, 1972

Cycloforina contorta **(d'Orbigny, 1839)** (Fig. 6)

Cycloforina contorta **(d'Orbigny, 1839)**

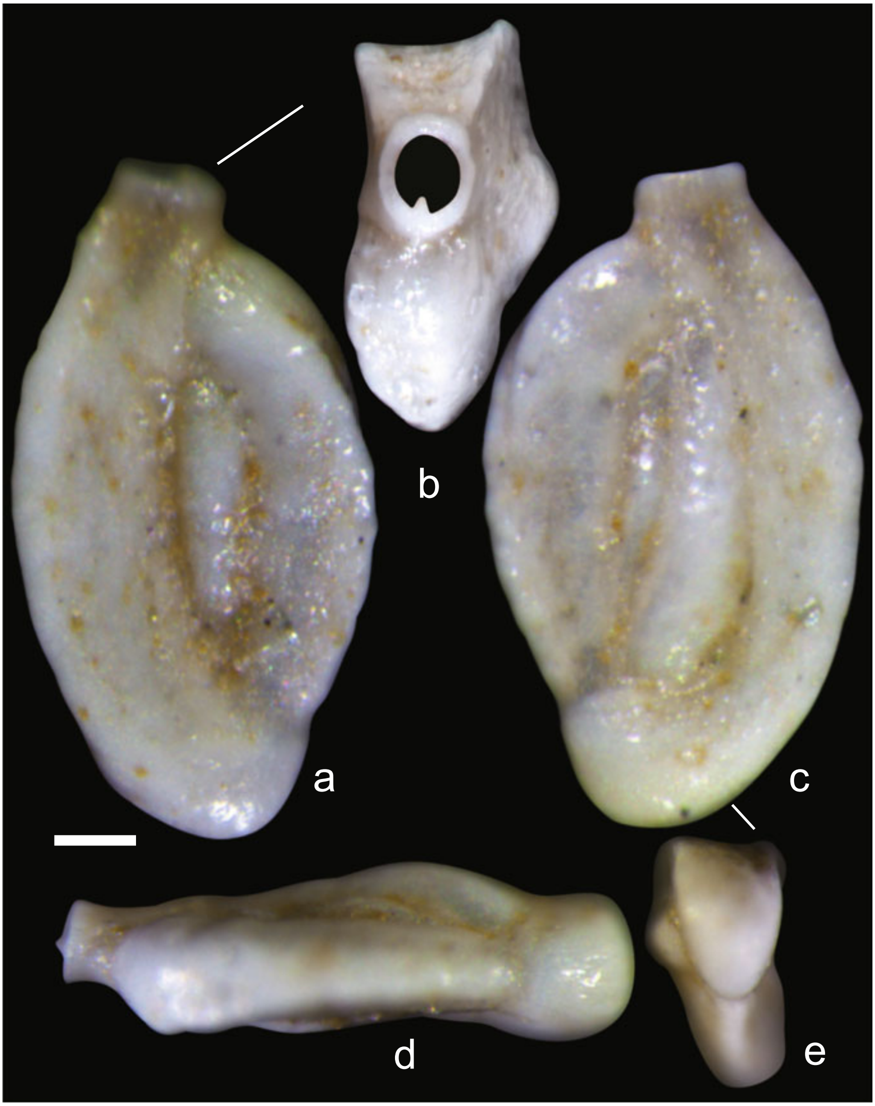

Fig. 6 **a–e** *Cycloforina contorta* (d'Orbigny, 1839), the same specimen of different side of views. **b** Apical view. **e** Antapical view. Scale bar = 50 μm

Quinqueloculina contorta d'Orbigny, 1839.

Quinqueloculina contorta d'Orbigny, 1846, Foram. Foss. Bassin Ter tiaire Vienne, p. 298, pl. 20, Figs. 4–6; Cushman, 1929, p. 29, pl. 3, Fig. 5; Cushman & Cahill, 1932, U.S. Geol. Surv. Prof. Paper, 175, p. 9, pl. 2, Fig. 3; Asano, 1951a, p. 3, Figs. 11, 12; 1956, p. 58, pl. 7, Fig. 12; Le Calvez & Le Calvez, 1958, p. 171, pl. 12, Figs. 140–142; Matsunaga, 1963, pl. 27, Fig. 9; He et al., 1965, p. 64, pl. II, Fig. 7; Matoba, 1970, Sci. Rep. Tohoku Univ. Geol., Vol. 42, no. 1, p. 59, pl. 2, Fig. 6; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 11, pl. I, Figs. 4, 5; Zheng et al., 1978, p. 37, pl. II, Fig. 6; Wang et al., 1988, p. 128, pl. XIII, Figs. 4–6.

Cycloforina contorta (d'Orbigny), Loeblich & Tappan, 1987, p. 342, pl. 342, Figs. 4–9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H164-01	383	220	105

Occurrence and Ecology

The Yellow Sea (St CJ-01) (31°40′ N, 122°29′ E), water depth 29.40 m, temperature 21.60 °C, salinity 31.73 ‰, abundance 0.02 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, Mediterranean Sea, New Zealand, North Atlantic Ocean, United States.

Description

Size about 400 μm in length, length:width ratio about 1.7:1. Test fusiform in outline. Chambers in *quinqueloculine* arranged, with five chambers visible from the exterior. Wall calcareous, imperforate and porcelaneous, surface slightly coarse. Aperture circular, at the produced end of the final chamber, with a short simple tooth.

Remarks

Cycloforina contorta has been identified as *Quinqueloculina contorta* in precious Chinese literature (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978; Wang et al., 1988). It is a rare species and usually distributed with low abundance in inner continental shelf of China Seas.

Genus *Massilina* Schlumberger, 1893

***Massilina laevigata* (Cushman & Todd, 1944)** (Fig. 7)

Spiroloculina laevigata Cushman & Todd, 1944, p. 67, pl. 9, Figs. 26–29; Asano, 1956, p. 69, pl. 7, Fig. 6; He et al., 1965, p. 72, pl. 4, Fig. 7; Haake, 1975, p. 20, pl.

Massilina laevigata (Cushman & Todd, 1944)

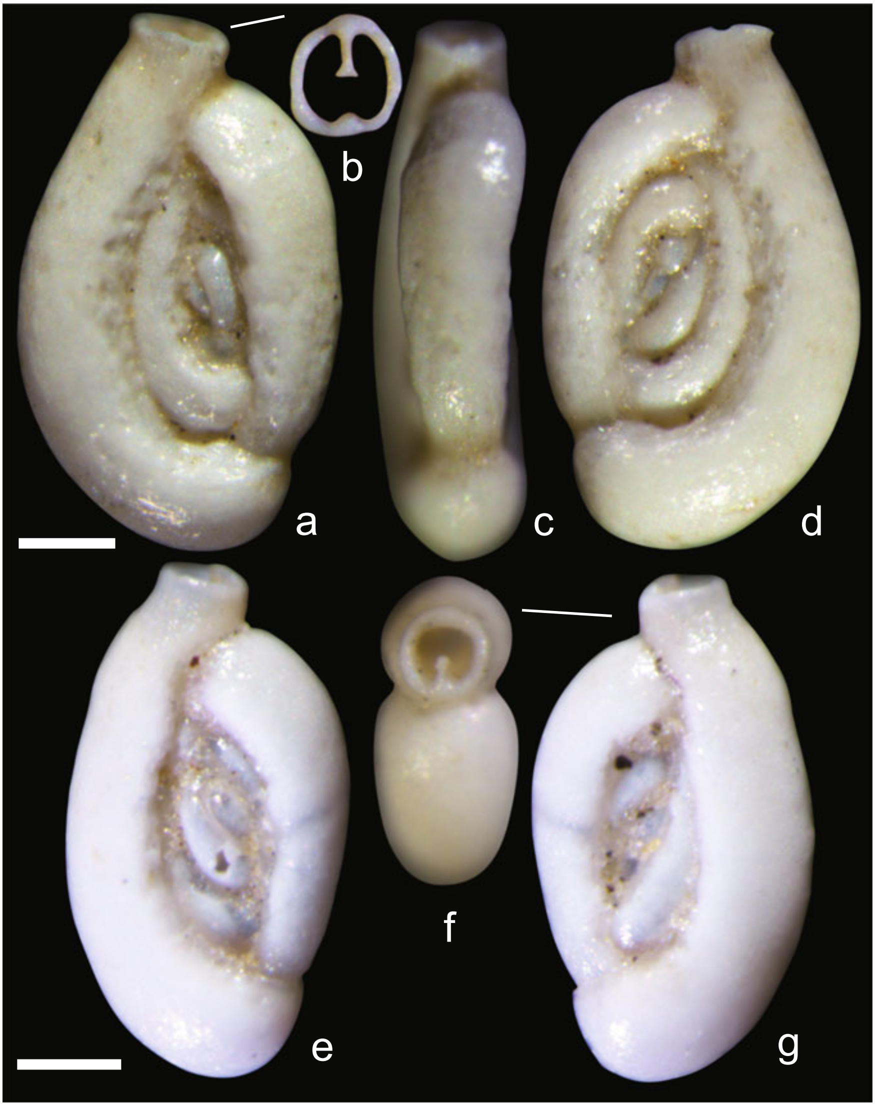

Fig. 7 **a–g** *Massilina laevigata* (Cushman & Todd, 1944), two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e–g** Another specimen. **f** Apical view. Scale bars = 100 μm

1, Figs. 11, 12; Zheng, 1978, p. 35, pl. I, Fig. 7; Wang et al., 1988, p. 126, pl. XII, Fig. 17.

Spiroloculina limbata Heron-Allen & Earland (not d'Orbigny), 1915, p. 553, pl. 40, Figs. 14–17.

Massilina laevigata Zheng, 1988, p. 221, pl. X, Figs. 6, 7.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H11-01	530	326	149
H11-02	474	262	140

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-04, St 3400-02, St 3400-05, St 3500-02) (31°49′–35°00′ N, 120°00′–124°00′ E), water depth 17.60–42.00 m, temperature 10.68–17.54 °C, salinity 29.15–32.08 ‰, abundance 0.04–1.86 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, Southeast Asia, Indian Ocean.

Description

Size about 500 μm in length, length:width ratio about 1.7:1. Test ovate in outline, slightly flattened and fusiform in section. Early chambers *quinqueloculine*, later added in a single plane on alternate sides as in *Spiroloculina*. Chamber periphery smoothly rounded. Wall calcareous, imperforate and porcelaneous, fine and smooth. Aperture rounded. Tooth elongate and bifid in the tip.

Remarks

Massilina laevigata has been identified as *Spiroloculina laevigata* in previous Chinese literature (He et al., 1965; Wang et al., 1988). It is a common species occurring in shallow water region of the continental shelf in China Seas, especially in the South Yellow Sea.

***Massilina secans* (d'Orbigny, 1826)** (Fig. 8)

Quinqueloculina secans d'Orbigny, 1826, Ann. Sci. Nat., Vol. 7, p. 303.

Massilina secans (d'Orbigny), Schlumberger, 1893, p. 218, pl. 4, Figs. 82, 83, text Figs. 31–33; Heron-Allen & Earland, 1915, p. 582, pl. 44, Figs. 24–27; Cushman, 1940, p. 178, pl. 14, Figs. 8, 9; Le Calvez & Le Calvez, 1958, p. 104, pl. 7, Fig. 66; He et al., 1965, no. 4, p. 71, pl. IV, Fig. 4; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 74, pl. III, Figs. 4, 9; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 14, pl. 2, Fig. 9; Zheng & Zheng, 1978, p. 179, pl. VI, Figs. 8, 9; Loeblich & Tappan, 1987, p. 335, pl. 344, Figs. 1–3; Wang et al., 1988, p. 130, pl. XIV, Figs. 16–17; Goës, 1894, Kongl. Svensk Vet. Akad. Handl. Band. 25, no. 9, p. 112, pl. 20, Fig. 856.

Massilina secans (d'Orbigny, 1826)

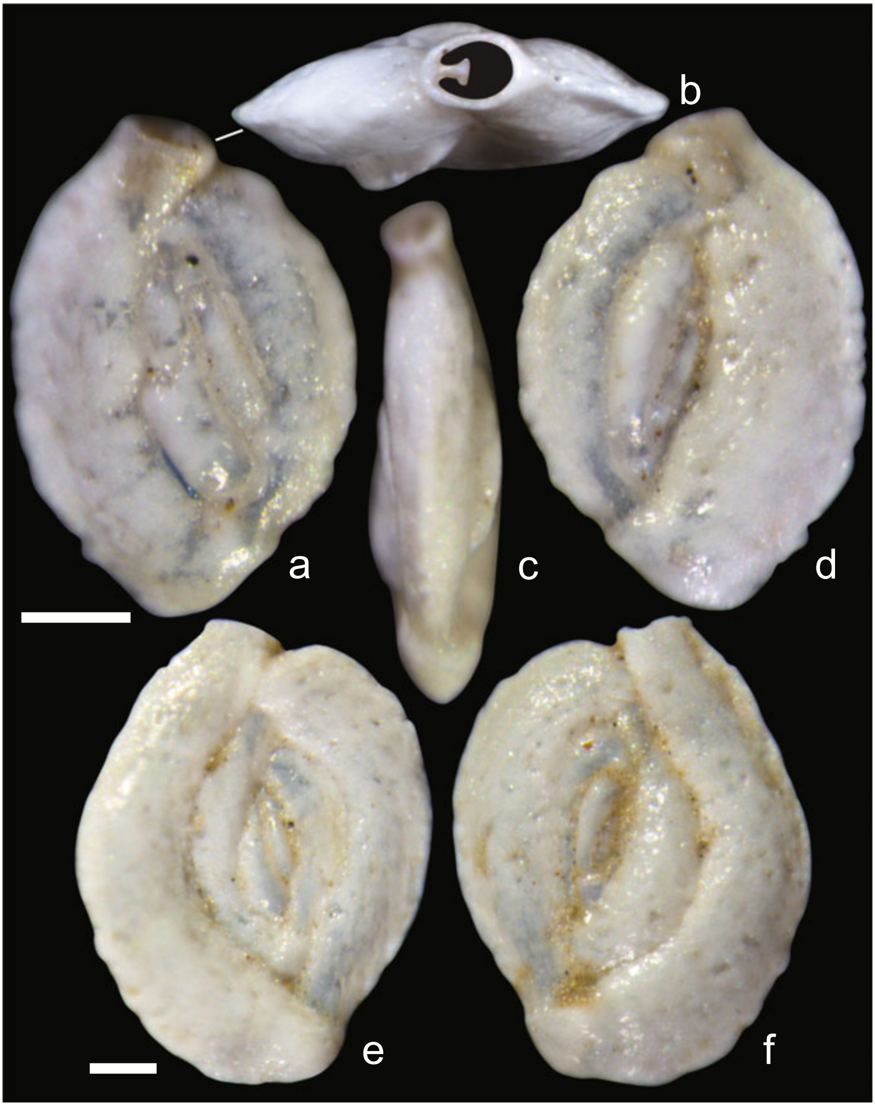

Fig. 8 a–f *Massilina secans* (d'Orbigny, 1826), two specimens showing morphological variabilities. **a–d** From the same specimen. **e, f** From another specimen. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D49-01	442	309	126
D49-02	663	511	135

Occurrence and Ecology
The Yellow Sea (St CJ-02) and intertidal flat of the Qingdao Bay (31°49′–36°00′ N, 120°30′–122°59′ E), water depth 3.00–40.00 m, temperature 8.00–17.54 °C, salinity 31.59–38.00 ‰, abundance 0.04–0.22 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Bay of Biscay, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, Micronesia, New Zealand, North Atlantic Ocean, United States, Vineyard Sound, Gulf of Mexico.

Description
Size about 550 μm in length, length:width ratio about 1.4:1. Test ovate in outline, rather flattened and fusiform in section. Early chambers *quinqueloculine*, later added in a single plane on alternate sides as in *Spiroloculina*. Periphery margin sharp and somewhat carinate. Wall calcareous, imperforate and porcelaneous, surface fairly coarse. Aperture terminal, ovate in shape, produced on a short neck. Tooth simple with bifid at the tip.

Remarks
Massilina secans has been frequently reported as a common species occurring in sediments of the South Yellow Sea and the East China Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978; Wang et al., 1988). In the Yellow Sea it distributed only in the south part and usually occurred in low abundance.

Genus *Quinqueloculina* d'Orbigny, 1826

***Quinqueloculina argunica* (Gerke, 1938)** (Fig. 9)

Miliolina akneriana (d'Orbigny) var. *longa* Gerke f. *argunica*, 1938.

Miliolina akneriana (d'Orbigny) var. *argunica*, 1950.

Quinqueloculina argunica He et al., 1965, p. 65, pl. III, Fig. 2; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 9, pl. 1, Fig. 13; Zheng et al., 1978, p. 36, pl. III, Fig. 5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H94-01	622	283	197
H94-02	579	266	147

Quinqueloculina argunica (Gerke, 1938)

Fig. 9 **a–f** *Quinqueloculina argunica* (Gerke, 1938), two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e, f** From another specimen. Scale bars = 100 μm

Occurrence and Ecology

Intertidal flat of the Qingdao Bay of the Yellow Sea (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 3.00–8.00 °C, salinity 38.00 ‰, abundance 0.04 ind./g sed.

Distribution
Bohai Sea, Qingdao Bay of the Yellow Sea.
Russia.

Description
Size about 600 μm in length, length:width ratio about 2.2:1. Test elongated ovate, flattened in side view. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Wall calcareous, imperforate, and porcelaneous, somewhat coarse in surface. Aperture ovate, produced on a short neck. Tooth simple but bifid at the tip.

Remarks
Quinqueloculina argunica was observed from the intertidal sediment of Qingdao Bay in our investigation. It has been reported from the sediments of Yellow Sea with low abundance in previous Chinese literature (He et al., 1965; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978).

***Quinqueloculina costata* d'Orbigny, 1878** (Fig. 10)

Quinqueloculina costata d'Orbigny, 1878, p. 63; Fornasini, 1905, pl. 2, Figs. 6, 6a, 6b; Cushman, 1929, pl. 3, Fig. 7; Cushman, 1932a (non d'Orbigny in Terquem, 1878), p. 20, pl. 5, Figs. 6, 7; Cushman, 1940, p. 177, pl. 14, Fig. 5; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 153, pl. 4, Figs. 5, 10.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D132-01	455	205	162

Occurrence and Ecology
Sediment core from the Qingdao Bay of the Yellow Sea, the East Sea (St DH5-3) (28°38′–36°00′ N, 120°30′–123°16′ E), water depth 3.00–75.00 m, temperature 3.00–20.16 °C, salinity 34.40–38.00 ‰, abundance 0.02–0.92 ind./g sed.

Distribution
Qingdao Bay of the Yellow Sea, East China Sea, Okinawa Trough.
Bay of Biscay, Japan, North Atlantic Ocean, United States.

Description
Size about 450 μm in length, length:width ratio about 2.2:1. Test elongated ovate. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Wall thick, calcareous, imperforate and porcelaneous, with longitudinal stripes in the surface. Aperture ovate, provided with a bifid tooth.

Quinqueloculina costata d'Orbigny, 1878

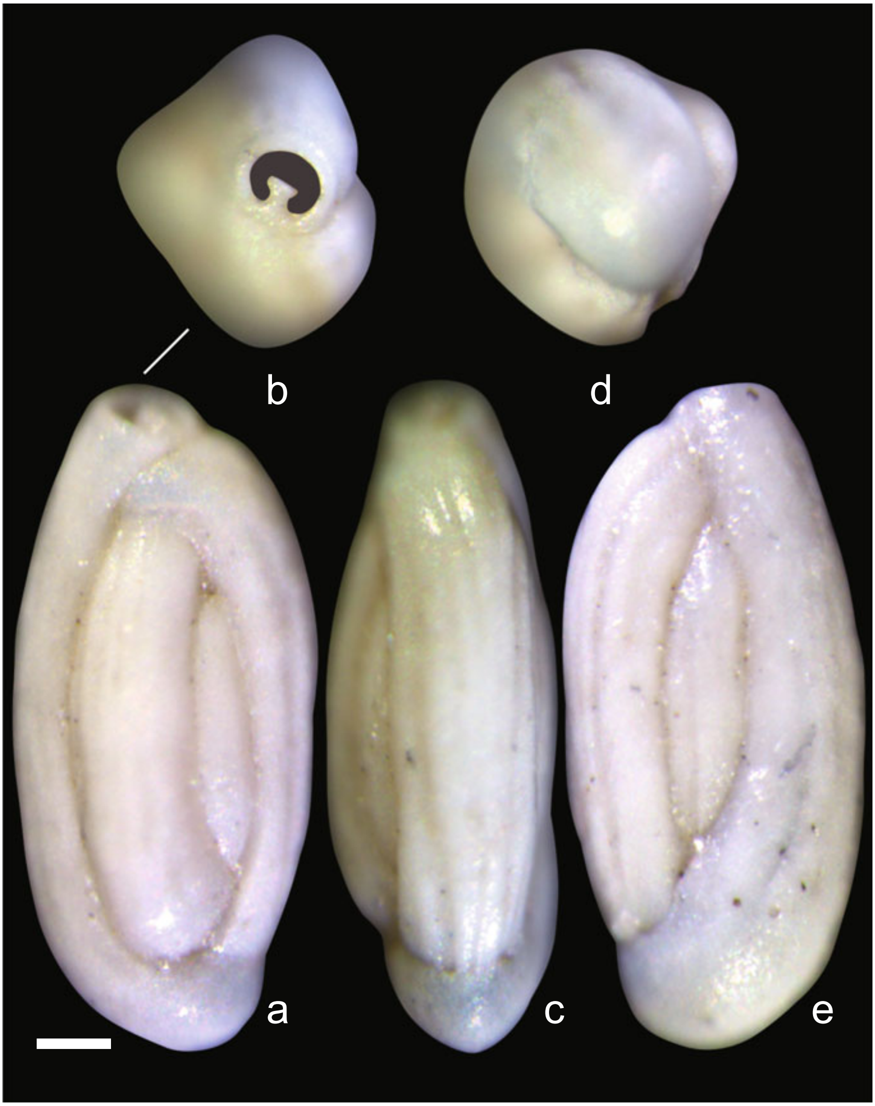

Fig. 10 **a–e** *Quinqueloculina costata* d'Orbigny, 1878, the same specimen showing different side of views. **b** Apical view. **d** Antapical view. Scale bar = 50 μm

Remarks

Quinqueloculina costata has been reported from the Okinawa Trough sediments (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). This specimen was isolated from the intertidal sediment of Qingdao bay. It also distributed in continental shelf of the East China Sea about 75 m water depth in our investigation.

***Quinqueloculina lamarckiana* d'Orbigny, 1839** (Fig. 11)

Quinqueloculina lamarckiana d'Orbigny, 1839, Foram. Cuba, p. 189, pl. 11, Figs. 14, 15; Cushman, 1921, U.S. Nat. Mus. Bull. 100, Vol. 4, p. 418, pl. 87, Fig. 20; Hada, 1931, Sci. Rept. Tohoku Univ. ser. 4, Vol. 6, No. 1, p. 79, text Fig. 32; He et al., 1965, p. 61, pl. 2, Fig. 1; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978, p. 9, pl. I, Figs. 9, 14; Wang et al., 1988, p. 127, pl. XIII, Figs. 10–12; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 153, pl. 4, Figs. 8, 9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B8-01	1037	880	498
B8-02	1019	843	511

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-02, St 3500-06, St 3500-08, St 3600-04, St 3700-01) and intertidal flat of the Qingdao Bay (31°39′–39°00′ N, 119°30′–124°00′ E), water depth 0.00–80.00 m, temperature 1.50–18.08 °C, salinity 30.11–38.00 ‰, abundance 0.58–2.29 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, Japan, Micronesia, North Atlantic Ocean, Southern Ocean, United States, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description

Size about 1000 μm in length, length:width ratio about 1.2:1. Test ovate to round in outline, triangularly in cross section. Outside surface of the test with five distinct ridges. Chambers one-half coil in length. Only three chambers visible at the exterior in outside view, three chambers visible from one side and two from that opposite. However, inner construction of transverse section in *quinqueloculine* arranged. Wall calcareous, imperforate and porcelaneous, smooth in surface. Aperture ovate, provided with a simple tooth.

Remarks

Quinqueloculina lamarckiana is a common species widely distributed in shallow water sediments of the continental shelf of the China Seas (He et al., 1965; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978; Wang et al., 1988). The Yellow

Quinqueloculina lamarckiana d'Orbigny, 1839

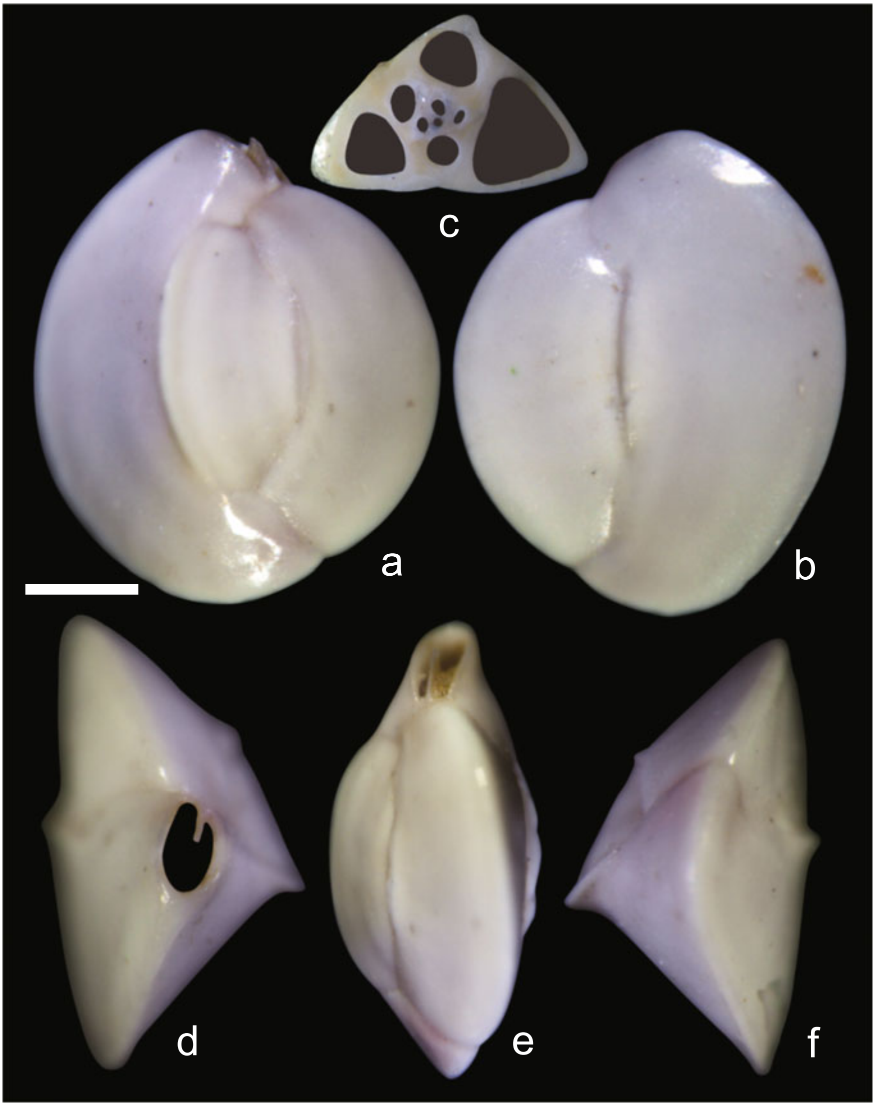

Fig. 11 a–f *Quinqueloculina lamarckiana* (d'Orbigny, 1839), the same specimen showing different side of views. **c** Grinding slide of transverse section showing inner structure of chambers. Scale bar = 250 μm

Sea population has only three chambers visible in outside view, but its inner construction in transverse section is still in *quinqueloculine* arranged. Considering the highly similarities of the test feature between the Yellow Sea population and the original description of *Quinqueloculina lamarckiana*, we identified this species as the same taxon.

***Quinqueloculina pseudoproxima* Zhang, 1988** (Fig. 12)

Quinqueloculina pseudoproxima Zhang, 1988, Wang et al., 1988, p. 129, pl. XIV, Figs. 1–3.

***Quinqueloculina pseudoproxima* Zhang, 1988**

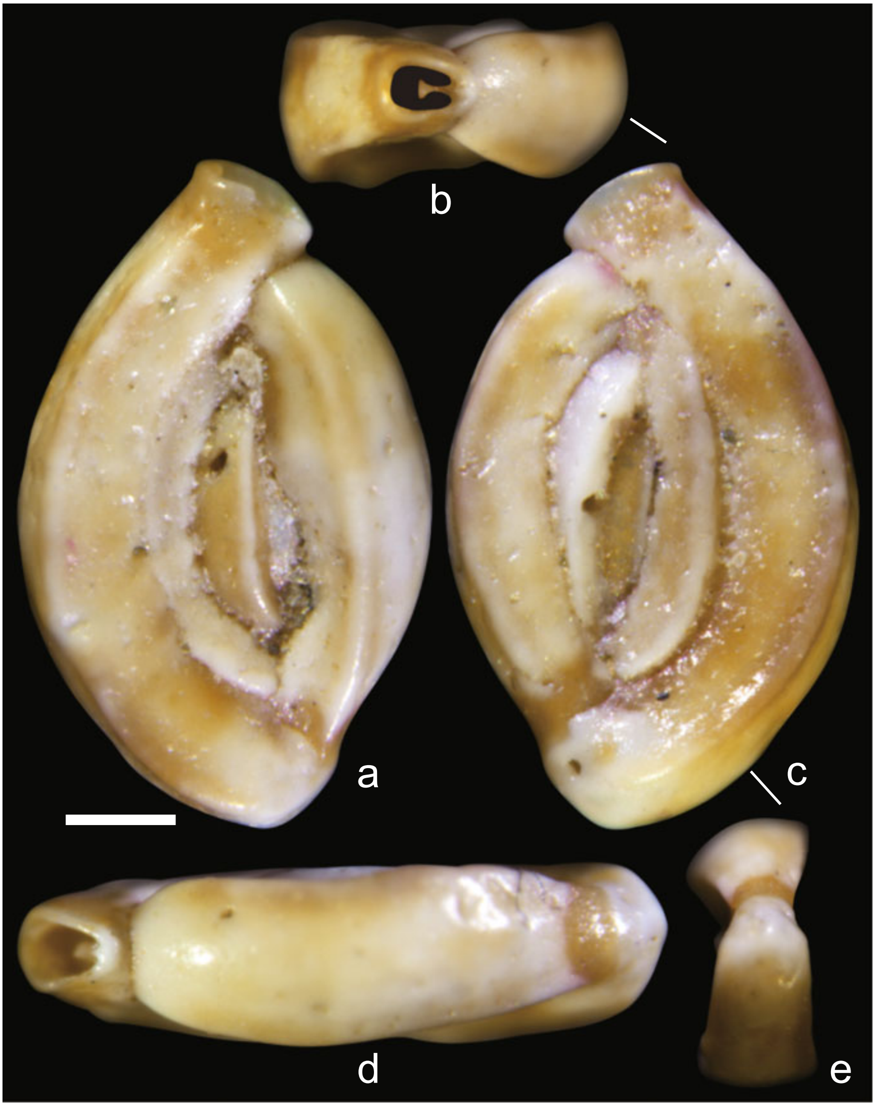

Fig. 12 **a–e** *Quinqueloculina pseudoproxima* Zhang, 1988, the same specimen showing different side of views. **b** Apical view. **e** Antapical view. Scale bar = 200 µm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H165-01	1160	741	340

Occurrence and Ecology

Intertidal flat of the Qingdao Bay, the Yellow Sea (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 24.50 °C, salinity 31.00 ‰, abundance 0.02 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea, East China Sea.

Description

Test large, size about 1000 μm in length, length:width ratio about 1.6:1. Test ovate in outline, distinctly flattened. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Chamber periphery somewhat carinate. Wall calcareous, imperforate, porcelaneous and thick, slightly coarse in surface. Aperture ovate, flush with the surface, produced on a distinct neck. Tooth bifid.

Remarks

Quinqueloculina pseudoproxima was discovered from middle to outer continental shelf sediments of the East China Sea (Wang et al., 1988). It was a common and abundant species in this sea area. In the Yellow Sea this species is rare and has low abundance in our investigation. *Q. pseudoproxima* has never been reported from other place of the world, suggesting an endemic species of the China Seas.

***Quinqueloculina seminula* (Linnaeus, 1758)** (Fig. 13)

Serpula seminulum Linné, 1767, Syst., Nat., 12th ed., No. 791, p. 1264.

Miliolina seminula Brady, 1884, Rep. Voy. Challenger, Zool., Vol. 9, p. 157, pl. V, Fig. 6.

Quinqueloculina seminula Cushman, 1929, Contr. Cushman Lab. Foram. Res. Vol. 5, p. 59, pl. 9, Figs. 16, 18; He et al., 1965, p. 63, pl. II, Fig. 5; Zheng et al., 1978, p. 37, pl. 3, Fig. 2; Wang et al., 1988, p. 129, pl. XIV, Figs. 12, 13.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D6-01	529	360	241

Occurrence and Ecology

The Yellow Sea (St 3300-06, St 3400-02, St 3400-05, St 3400-06, St 3400-08, St 3500-08, St 3600-04, St 3600-06) and intertidal flat of the Qingdao Bay (33°00′–36°00′ N, 120°30′–123°58′ E), water depth 0.00–80.00 m, temperature 1.50–26.50 °C, salinity 29.15–38.00 ‰, abundance 0.02–16.74 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Quinqueloculina seminula (Linnaeus, 1758)

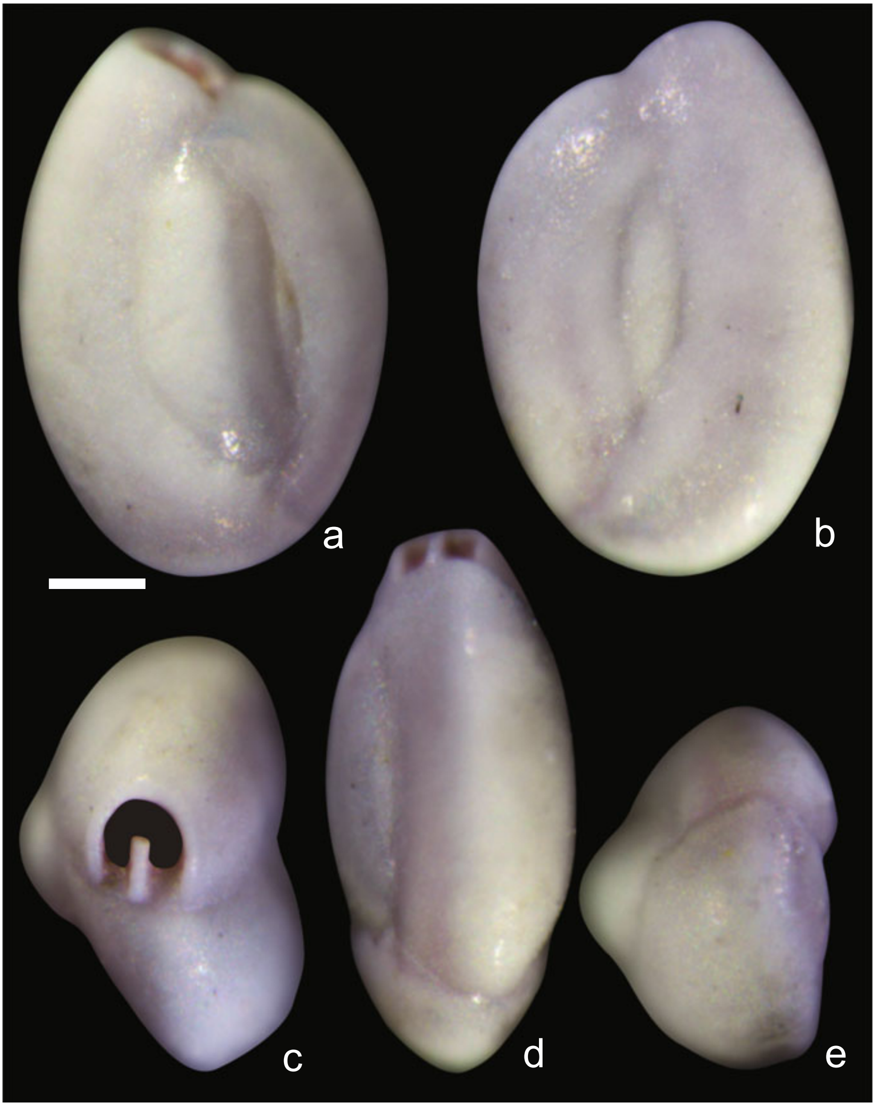

Fig. 13 **a–e** *Quinqueloculina seminula* (Linnaeus, 1758), the same specimen showing different side of views. **c** Apical view. **d** Lateral view. **e** Antapical view. Scale bar = 100 μm

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, Southern Ocean, United States, Grand Bank, New Caledonia, Northeast U.S. Continental Shelf, Scotian Shelf, Southeast U.S.

Continental Shelf, Vineyard Sound, North Western Weddell Sea, Mediterranean Sea, United Kingdom.

Description
Size about 500 μm in length, length:width ratio about 1.5:1. Test ovate in outline. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Chamber periphery smooth. Wall calcareous, imperforate, porcelaneous, smooth in surface. Aperture ovate, provided with a simply tooth.

Remarks
Quinqueloculina seminula is a widely distributed species in the China Seas. Its abundance was usually high in inner continental shelf sediments, especially in the sediments of intertidal or neritic areas.

***Quinqueloculina subungeriana* Serova, 1960** (Fig. 14)

Quinqueloculina subungeriana Serova, 1960; He et al., 1965, p. 60, pl. I, Fig. 6; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 10, pl. 1, Fig. 7.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D48-01	653	429	288
D48-02	550	385	240

Occurrence and Ecology
The Yellow Sea (St 3300-04) (33°00′ N, 122°59′ E), water depth 33.00 m, temperature 20.60 °C, salinity 30.87 ‰, abundance 0.06–3.06 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Description
Size about 600 μm in length, length:width ratio about 1.5:1. Test ovate in outline. Cross section triangular, with three marginal uplifts in the three angles. Chambers one-half coil in length. Three chambers visible at the exterior of which three visible from one side and two from that opposite in outside view. Inner structure of transverse section in *quinqueloculine* arranged. Wall calcareous, imperforate, and porcelaneous, smooth surface. Aperture ovate, provided with a tooth.

Remarks
Quinqueloculina subungeriana has been reported from the Bohai Sea and the Yellow Sea sediments (He et al., 1965; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, 1978). It usually occurred in shallow water sediments of the continental shelf area with low abundance.

Quinqueloculina subungeriana Serova, 1960

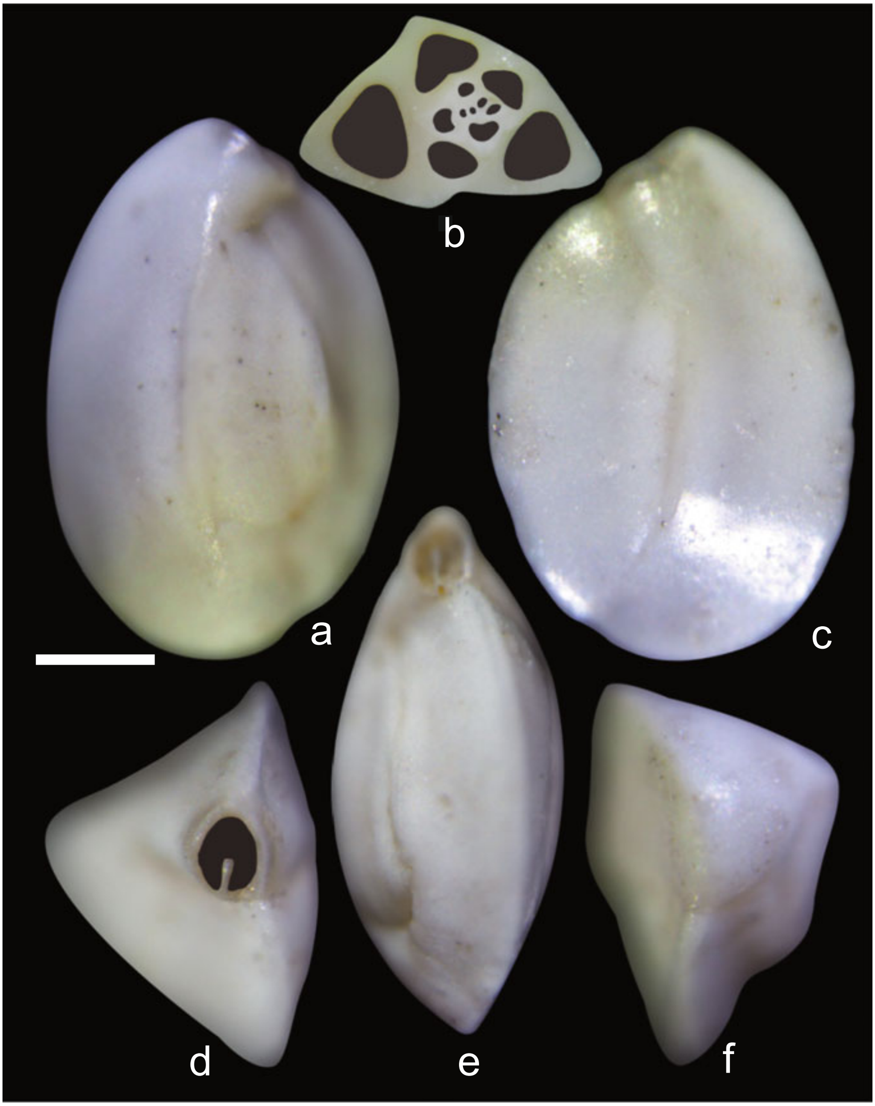

Fig. 14 a–f *Quinqueloculina subungeriana* Serova, 1960, the same specimen showing different side of views. **b** Grinding slide of transverse section showing inner structure of chambers. **d** Apical view. **e** Lateral view. **f** Antapical view. Scale bar = 150 μm

Quinqueloculina tikutoensis **Nakamura, 1937** (Fig. 15)

Quinqueloculina tikutoensis Nakamura, 1937, p. 136, pl. 10, Fig. 11; Wang et al., 1988, p. 127, pl. XIII, Figs. 7–9, 17–18.

Quinqueloculina tikutoensis Nakamura, 1937

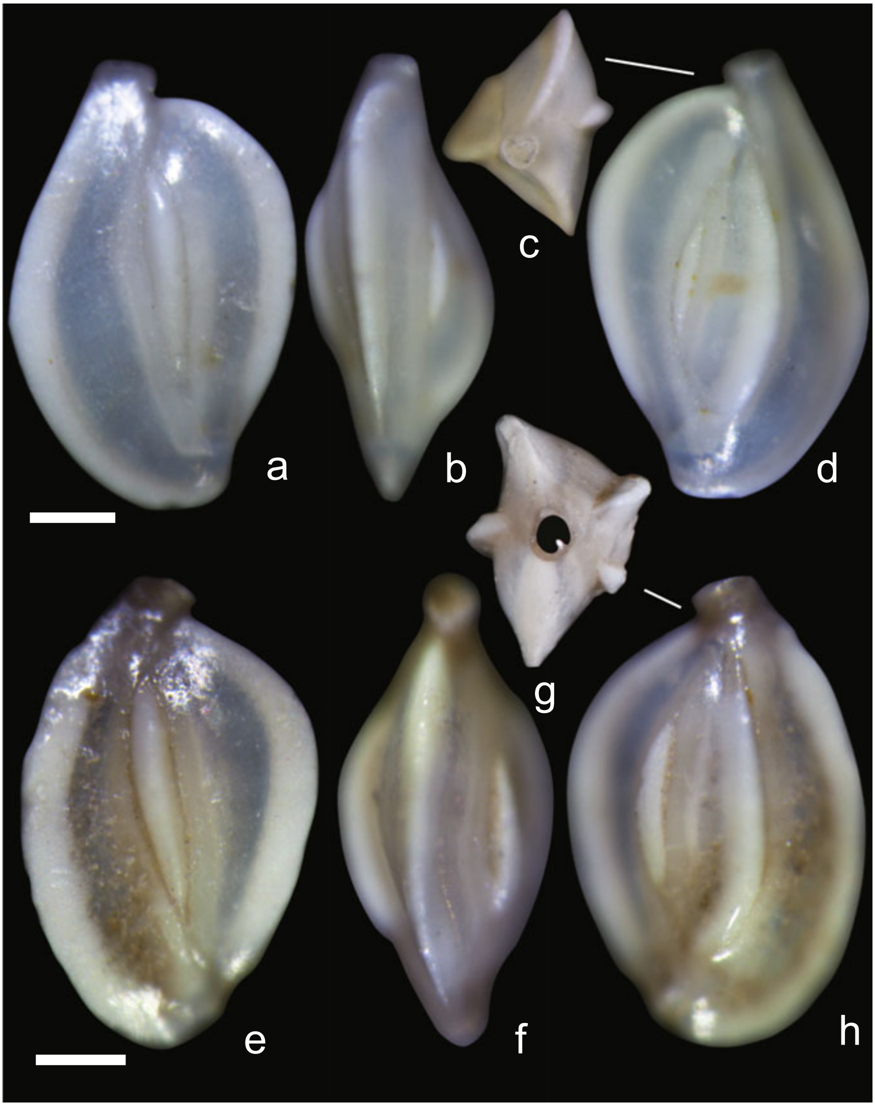

Fig. 15 **a–h** *Quinqueloculina tikutoensis* Nakamura, 1937, two specimens showing morphological variabilities. **a–d** From the same specimen. **e–h** From another specimen. **c, g** Apical views. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H83-01	503	330	216
H83-02	510	323	223

Occurrence and Ecology

The Yellow Sea (St CJ-02) (31°49′ N, 122°59′ E), water depth 40.00 m, temperature 17.54 °C, salinity 31.59 ‰, abundance 0.04 ind./g sed.

Distribution

Yellow Sea, East China Sea, Taiwan Strait.

Description

Size about 500 µm in length, length:width ratio about 1.5:1. Test ovate in outline. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Chamber periphery carinate with five ridges. Wall calcareous, imperforate, porcelaneous, smooth in surface. Aperture ovate, produced on a short neck. Tooth simple.

Remarks

Quinqueloculina tikutoensis has been considered as a warm water species. It is usually abundant in the south part of the continental shelf of the East China Sea (Wang et al., 1988). This species rarely occurs in the Yellow Sea.

Quinqueloculina tropicalis **Cushman, 1924** (Fig. 16)

Miliolina gracilis d'Orbigny, Brady, 1884 (non *Triloculina gracilis* d'Orbigny, 1839a), p. 160, pl. 5, Fig. 3.

Quinqueloculina laevigata Graham & Militante (not d'Orbigny), 1959, pl. 5, Fig. 13 (not 12).

Quinqueloculina tropicalis Cushman, 1924, p. 63, pl. 23, Figs. 9, 10; Barker, 1960, p. 10, pl. 5, Fig. 3; Albani, 1978, p. 368, Figs. 6I, J; Zheng, 1988, p. 214, pl. 6, Figs. 5, 6; pl. 24, Fig. 2; pl. 31, Fig. 4, text Fig. 32; Wang et al., 1988, p. 129, pl. XIV, Figs. 4–6; Loeblich & Tappan, 1994, p. 50, pl. 78, Figs. 13–15; Yassini & Jones, 1995, p. 85, Figs. 170–171, 174–175; Debenay, 2012, p. 127.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H163-01	520	333	145

Occurrence and Ecology

The Yellow Sea (St CJ-01) (31°40′ N, 122°29′ E), water depth 29.40 m, temperature 22.40 °C, salinity 31.73 ‰, abundance 0.02 ind./g sed.

Distribution

Yellow Sea.

Japan, North Pacific Ocean, New Caledonia, Gulf of Mexico.

Description

Size about 500 µm in length, length:width ratio about 1.6:1. Test ovate in outline and distinctly flattened in sides. Chambers one-half coil in length, with five chambers visible at the exterior, of which four visible from one side and three from that opposite. Wall calcareous, imperforate and porcelaneous, slightly brown and coarse in surface. Aperture ovate, and produced on a short neck. Tooth simply.

Quinqueloculina tropicalis Cushman, 1924

Fig. 16 a–e *Quinqueloculina tropicalis* Cushman, 1924, the same specimen showing different side of views. **c** Apical view. **d** Lateral view. **e** Antapical view. Scale bar = 100 μm

Remarks

Quinqueloculina tropicalis was reported by Wang et al. (1988) from sediments of the East China Sea. It is abundant in the inner continental shelf of the East China Sea but is rare in the Yellow Sea. Comparing to the holotype of *Q. tropicalis*, both populations from the Yellow Sea and the East China Sea were slightly shorter and wider in the test outline.

Genus *Biloculinella* Wiesner, 1931

***Biloculinella delphinoides* nov. spec.** (Figs. 17, 18, 19, 20)

Diagnosis
Test about 350 μm in length, length:width ratio about 1.3:1. Ovate in outline, lenticular in section, embraced by a thin, slight waved and fin-like chamber periphery. Chambers one-half coil in length. Chamber periphery broad, thin and usually slightly waved and protruding from the main body test. Sutures distinct. Wall calcareous, imperforate, porcelaneous, fine and smooth. Aperture terminal, covered by a broad apertural flap, leaving only a thin crescentic opening.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H133 Holotype	360	283	225
H133 Paratype-01	279	221	179
H133 Paratype-02	346	253	220
H133 Paratype-03	370	262	229
H133-05 (juvenile)	254	163	163
H133-06 (juvenile)	194	151	151
H133-07 (juvenile)	175	127	127
H133-08 (juvenile)	167	129	129

Etymology
The Greek *delphinoides* (dolphin-like) refers to the dolphin-like test shape.

Type Material
Holotype (IOCA H133 Holotype) and two paratypes (IOCAS H133 Paratype-01; IOCAS H133 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). The other 3 paratypes specimens are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Type Locality
The Yellow Sea (St 3400-06) (33°59′ N, 123°00′ E), water depth 67.80 m, temperature 12.00 °C, salinity 31.91 ‰, abundance 0.24 ind./g sed.

Distribution
Yellow Sea.

Biloculinella delphinoides nov. spec.

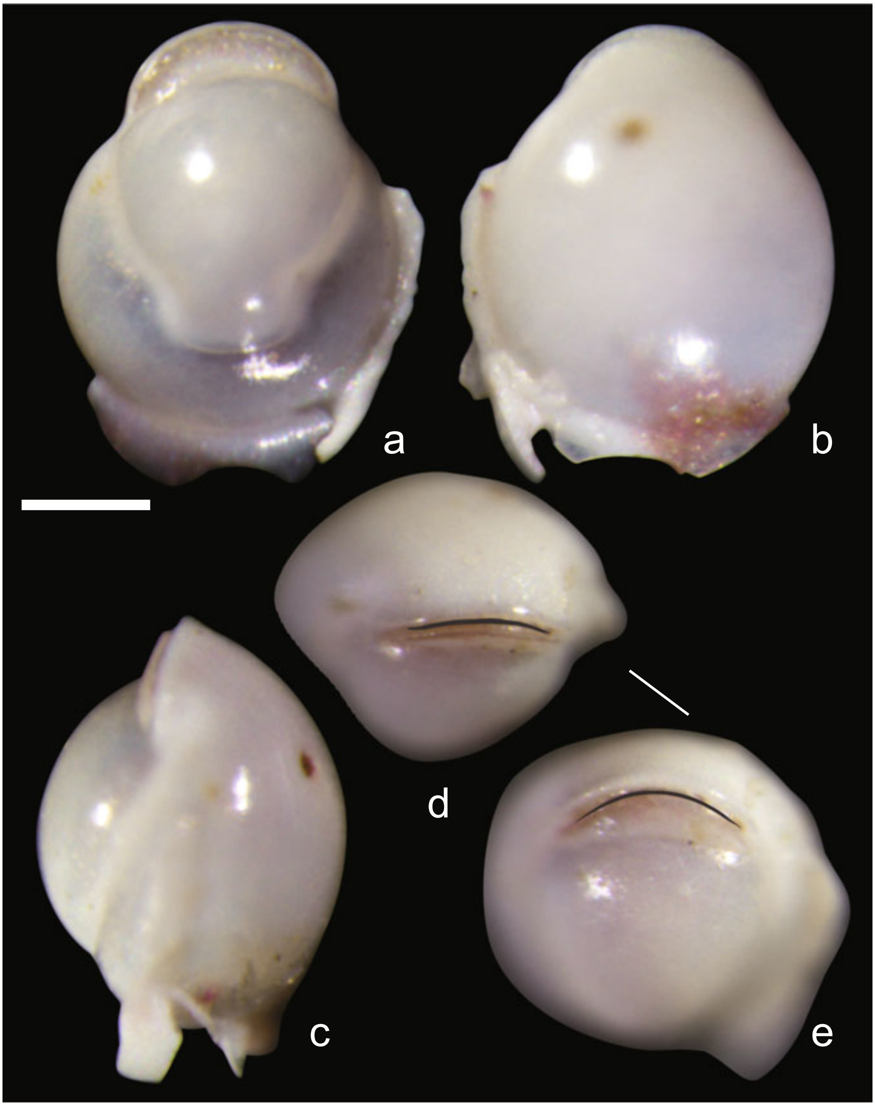

Fig. 17 **a–e** *Biloculinella delphinoides* nov. spec., the holotype specimen showing different side of views. **d, e** Apical views showing aperture. Scale bar = 100 μm

Description

Size about 350 μm in length, length:width ratio about 1.3:1. Test ovate in outline, lenticular in section, embraced by a thin and usually fin-like and waved chamber periphery, protuberant from the main body test. Lateral view dolphin-liking.

Biloculinella delphinoides nov. spec.

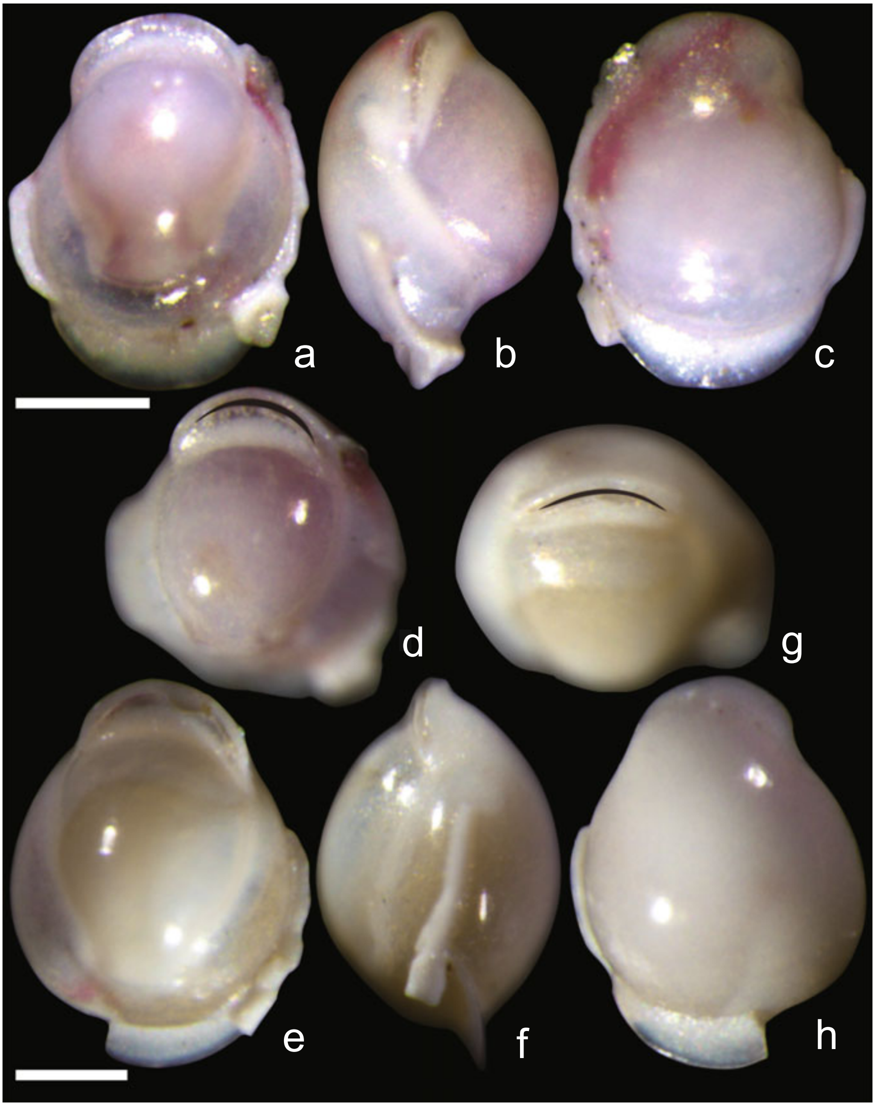

Fig. 18 a–h *Biloculinella delphinoides* nov. spec. **a–d** The paratype-01 specimen. **e–h** The paratype-02 specimen. Scale bars = 100 μm

Chambers one-half coil in length. Chambers wide and shallow. Chamber periphery broad, thin and waved, somewhat fin-like. Sutures distinct. Wall calcareous, imperforate, porcelaneous, fine, and smooth. Aperture terminal, covered by a broad apertural flap, leaving only a thin crescentic opening.

Biloculinella delphinoides nov. spec.

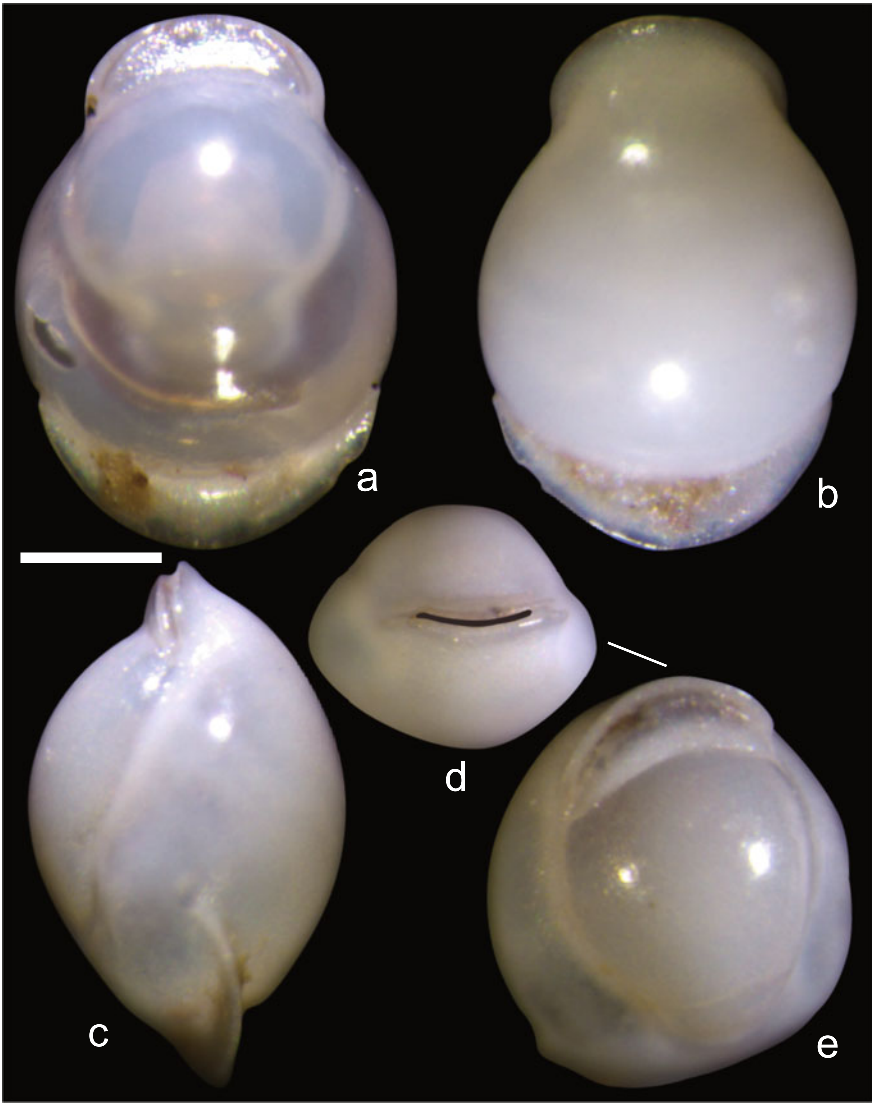

Fig. 19 **a–e** *Biloculinella delphinoides* nov. spec., the paratype-03 specimen showing different side of views. Scale bar = 100 μm

Remarks

The Genus *Biloculinella* contains only about 15 valid species according to Hayward et al. (2015). *B. delphinoides* is a very distinct species among all congeners by have a dolphin-like test shape and possessing the thin, slightly waved and fin-like chamber periphery. Four juvenile specimens of *B. delphinoides* were found from

Biloculinella delphinoides nov. spec.

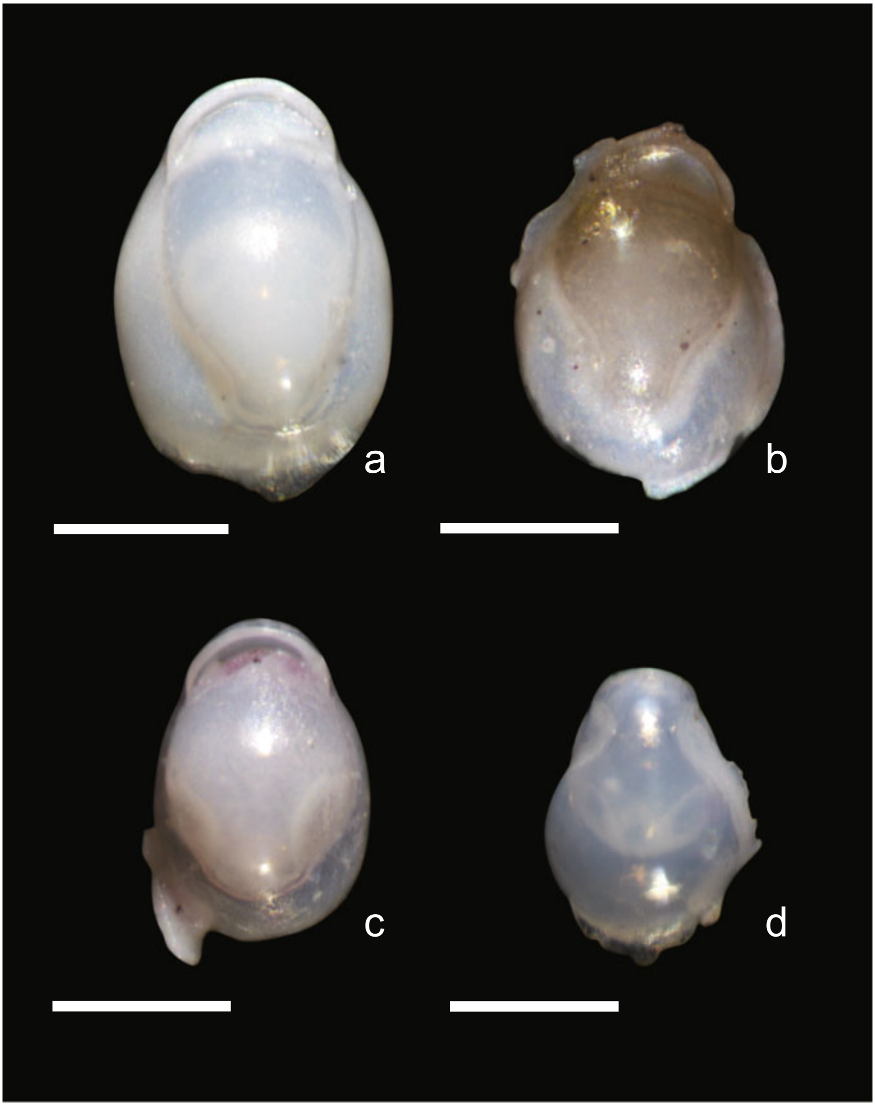

Fig. 20 a–d *Biloculinella delphinoides* nov. spec., four different juvenile specimens showing morphological variabilities. Scale bars = 100 µm

the population (Fig. 20a–d), and the fin-like chamber periphery could be seen growing from the larval stage. Only *B. depressa* is somewhat similar in anterior view (Loeblich & Tappan, 1994), however, is lacking of the fin-like chamber periphery. *B. delphinoides* was found in two different cruises, but it occurred only in the station of the Yellow Sea Cold Water Mass area, suggesting an endemic species of this region.

***Biloculinella globula* (Bornemann, 1855)** (Fig. 21)

Biloculina globules Bornemann, 1855, p. 349, pl. 19, Fig. 3; Cushman, 1917, p. 78, pl. 31, Fig. 2; Cushman, 1921, p. 474, pl. 95, Fig. 2; Wang et al., 1988, p. 133, pl. XVI, Fig. 5.

***Biloculinella globula* (Bornemann, 1855)**

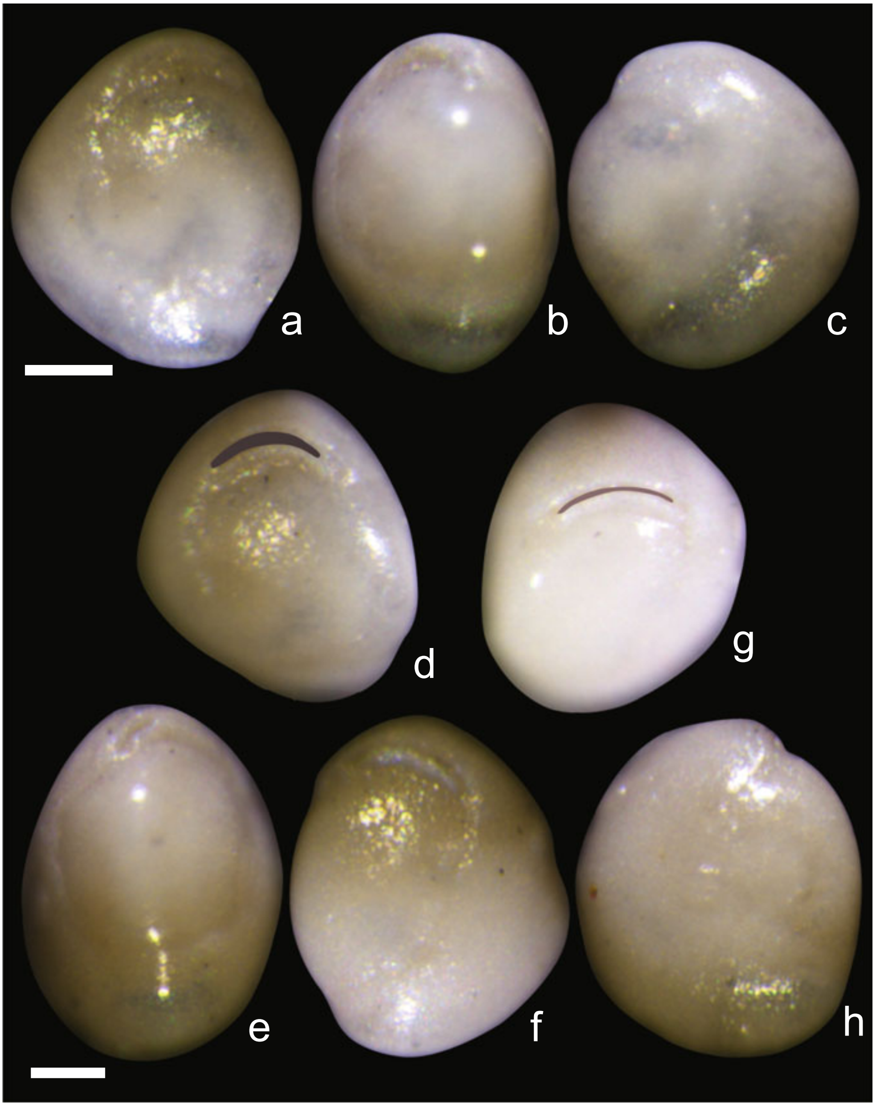

Fig. 21 **a–h** *Biloculinella globula* (Bornemann, 1855), two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e–h** From another specimen. Scale bars = 50 μm

Biloculinella globula Cushman, 1940, pl. 15, Fig. 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H134-01	180	160	135
H134-02	196	170	143

Occurrence and Ecology

The sediment core of 10 cm depth from the Qingdao Bay of the Yellow Sea (36° 00′ N, 120°30′ E), abundance 0.07 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, Micronesia, North Atlantic Ocean, New Caledonia, Mediterranean Sea.

Description

Size about 190 μm in length, length:width ratio about 1.1:1. Test nearly globular in contour, with a lenticular outline in section. Chambers one-half coil in length, wide and shallow, smooth in outline. Sutures indistinct. Wall calcareous, imperforate, porcelaneous and smooth. Aperture terminal, covered by a broad apertural flap, leaving only a thin crescentic opening.

Remarks

Biloculinella globula was reported by Wang et al. (1988) from the continental shelf of the East China Sea. It is a rare species in the China Seas. Our specimens were sampled from the sediment core in 10 cm depth of the Qingdao Bay. We did not found it from the continental shelf sediments of the Yellow Sea within our investigations. The core specimens from the Qingdao Bay might be immigrated by storm surge from the East China Sea.

Genus *Triloculina* d'Orbigny, 1826

***Triloculina inflata* d'Orbigny, 1826** (Fig. 22)

Triloculina inflata d'Orbigny, 1826, Ann. Sci. Nat. set. 1, Vol. 7, p. 300; d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne p. 278, pl. 17, Figs. 13–15; Kruit, 1955, Verh. Kon. Ned. Geol. Mijubk. serie Deel. 15, No. 3, p. 469, pl. 11, Fig. 3; He et al., 1965, p. 67, pl. III, Fig. 7; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 12, pl. 2, Fig. 11.

Miliolina inflata (d'Orbigny, 1826), Hayward et al., 2015.

Triloculina inflata d'Orbigny, 1826

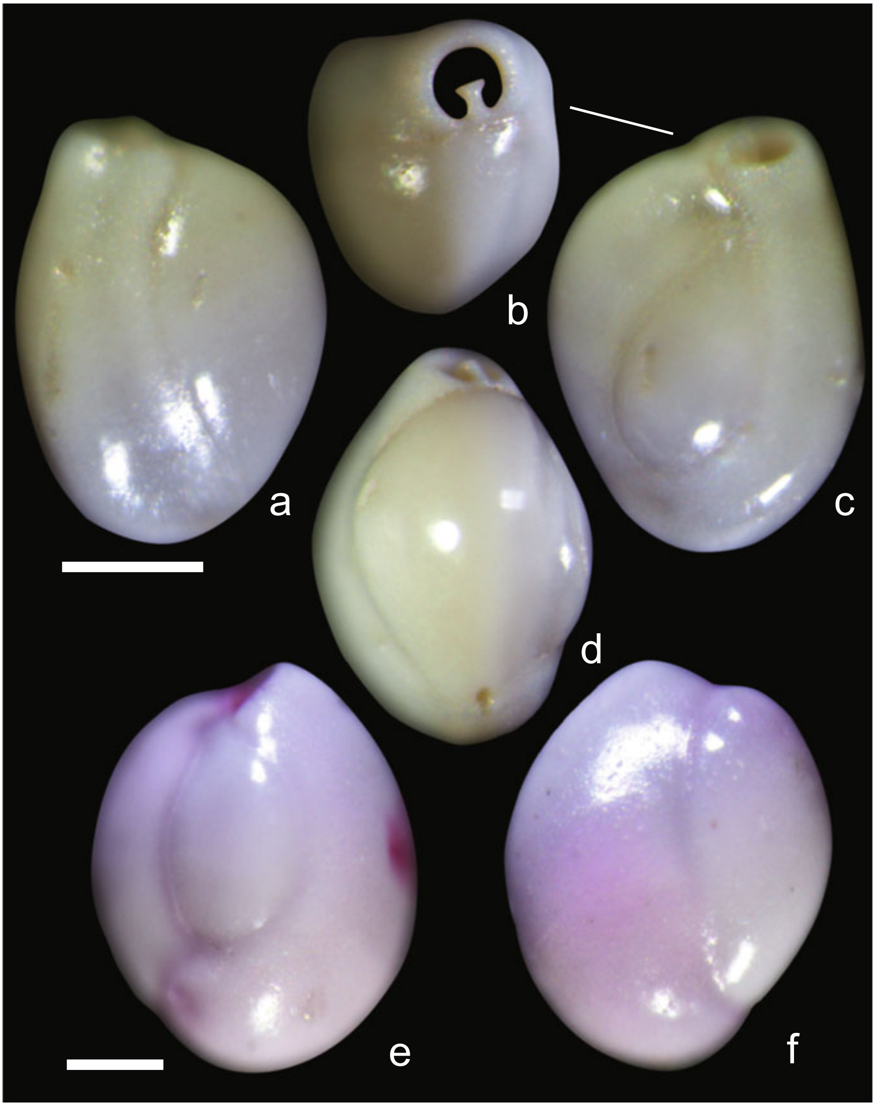

Fig. 22 a–f *Triloculina inflata* d'Orbigny, 1826, two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e, f** From another specimen. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H78-01	307	215	210
H78-02	422	327	222

Occurrence and Ecology
The Yellow Sea (St CJ-02, St 3500-02) (31°49′–35°00′ N, 120°00′–122°59′ E), water depth 30.00–40.00 m, temperature 10.68–17.54 °C, salinity 30.82–31.59 ‰, abundance 0.18–11.92 ind./g sed.

Distribution
Yellow Sea.
Ukraine, Austria.

Description
Size about 360 μm in length, length:width ratio about 1.4:1. Test ovate in outline, nearly equilaterally triangular in section. Chambers one-half coil in length, only three chambers visible from the exterior. Wall calcareous, imperforate and porcelaneous, thick, surface smooth. Aperture rounded, at the end of the final chamber. Tooth T-shaped.

Remarks
Triloculina inflata has been reported from quaternary sediment cores in Liaoning (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) and from the South Yellow Sea sediments (He et al., 1965). Our investigation also showed that this species usually occurred in inner continental shelf sediments of the South Yellow Sea with high abundance.

***Triloculina pentagonalis* [Wang, 1978] nov. stat.** (Fig. 23)

Triloculina pentagonalis sp. nov., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 77, pl. IV, Figs. 13–15, text Fig. 102; Wang et al., 1980, p. 195, pl. 8, Figs. 11–12, 17; Wang et al., 1988, p. 132, pl. XV, Figs. 15–16; Zheng, 1988, p. 243, pl. XIX, Figs. 1, 6; pl. XXXII, Figs. 23, 24; pl. XXXIII, Fig. 1.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D53-01	488	425	319
D53-02	473	422	342
D53-03	327	305	228

Nomenclature
Triloculina pentagonalis was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978) in a Chinese local publication. According to International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), Recommendation 51D in Article 51.2.1, "Author anonymous, or anonymous but know or inferred,… if the authorship

Triloculina pentagonalis [Wang, 1978] nov. stat.

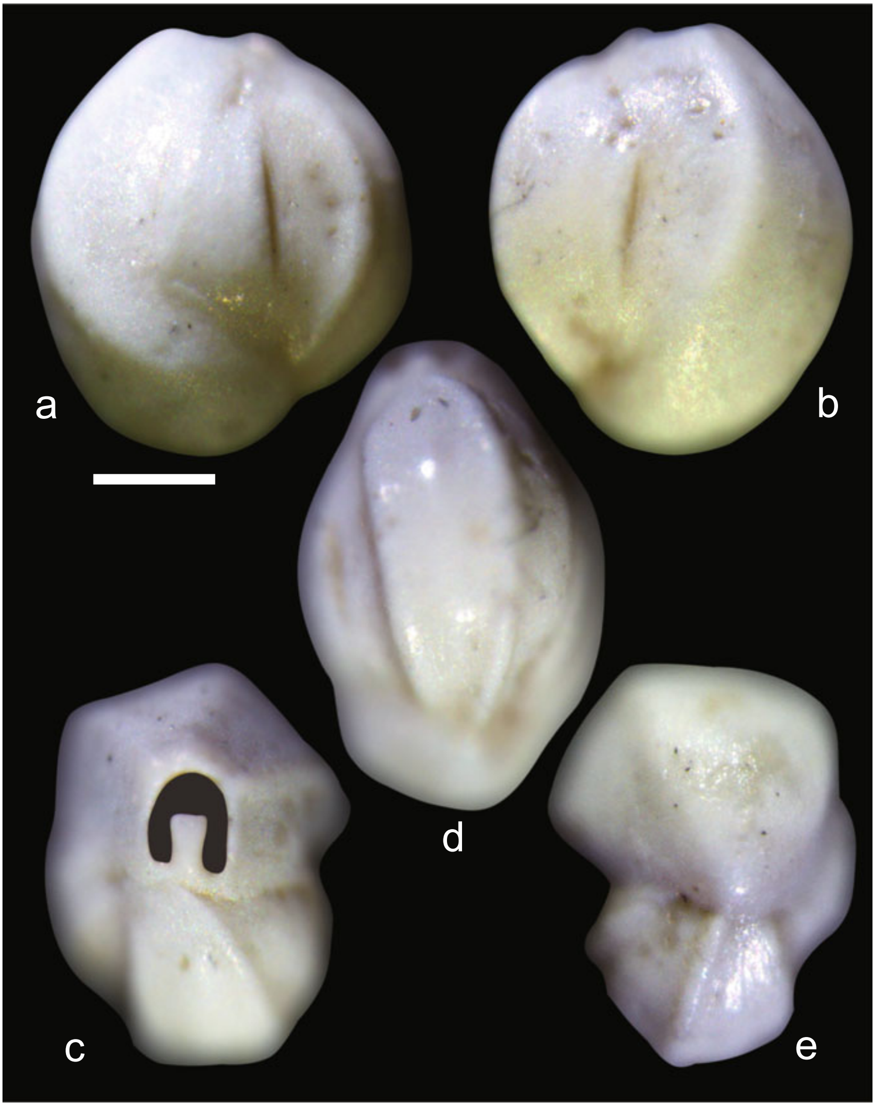

Fig. 23 **a–e** *Triloculina pentagonalis* [Wang, 1978], the same specimen showing different side of views. **c** Apical view. **d** Lateral view. **e** Antapical view. Scale bar = 150 μm

is known or inferred from external evidence, the name of the author, if cited, should be enclosed in square brackets to show the original anonymity". Therefore, we assigned Dr. Pin Xian Wang as the author since he guided the book publication.

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St 3500-02) (31°39′–35°00′ N, 120°00′–122° 59′ E), water depth 26.90–40.00 m, temperature 10.68–17.54 °C, salinity 30.31–31.59 ‰, abundance 0.08–2.98 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 500 μm in length, length:width ratio about 1.1:1. Test ovate in outline, subtriangular and somewhat angularly in section. Chambers one-half coil in length, only three chambers visible from the exterior. Chamber periphery uplifted. Wall calcareous, imperforate, porcelaneous, fairly thick. Aperture rounded, at the end of the final chamber, with a simple tooth.

Remarks

Triloculina pentagonalis was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978). This species was discovered from sediments of the South Yellow Sea, 20–30 m water depth. Later it was reported again in Wang et al. (1980) but without description. So far *Triloculina pentagonalis* has never been reported from the other sea area outside of China Seas, suggesting an endemic species of this sea area. In our investigation, it distributed in the South Yellow Sea and the East China Sea, especially in the North of Yangtze Estuary area, where its abundance was usually high.

***Triloculina sommeri* Tinoco, 1955** (Fig. 24)

Triloculina sommeri Tinoco, 1955, p. 24, pl. 2, Figs. 8, 9; Loeblich & Tappan, 1994, p. 56, pl. 84, Figs. 1–12.

Quinqueloculina akneriana d'Orbigny, 1846; Zheng, 1988 (non *Q. akneriana* d'Orbigny, 1846), p. 192, pl. 3, Figs. 12, 13; pl. 4, Figs. 1–3; pl. 6, Fig. 4; pl. 23, Figs. 7, 8; pl. 30, Figs. 1, 2; text Fig. 9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D96-01	293	239	171
D96-02	465	425	295

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 1.50 °C, salinity 36.00 ‰, abundance 0.36 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea, East China Sea.

Sahul Shelf.

Triloculina sommeri Tinoco, 1955

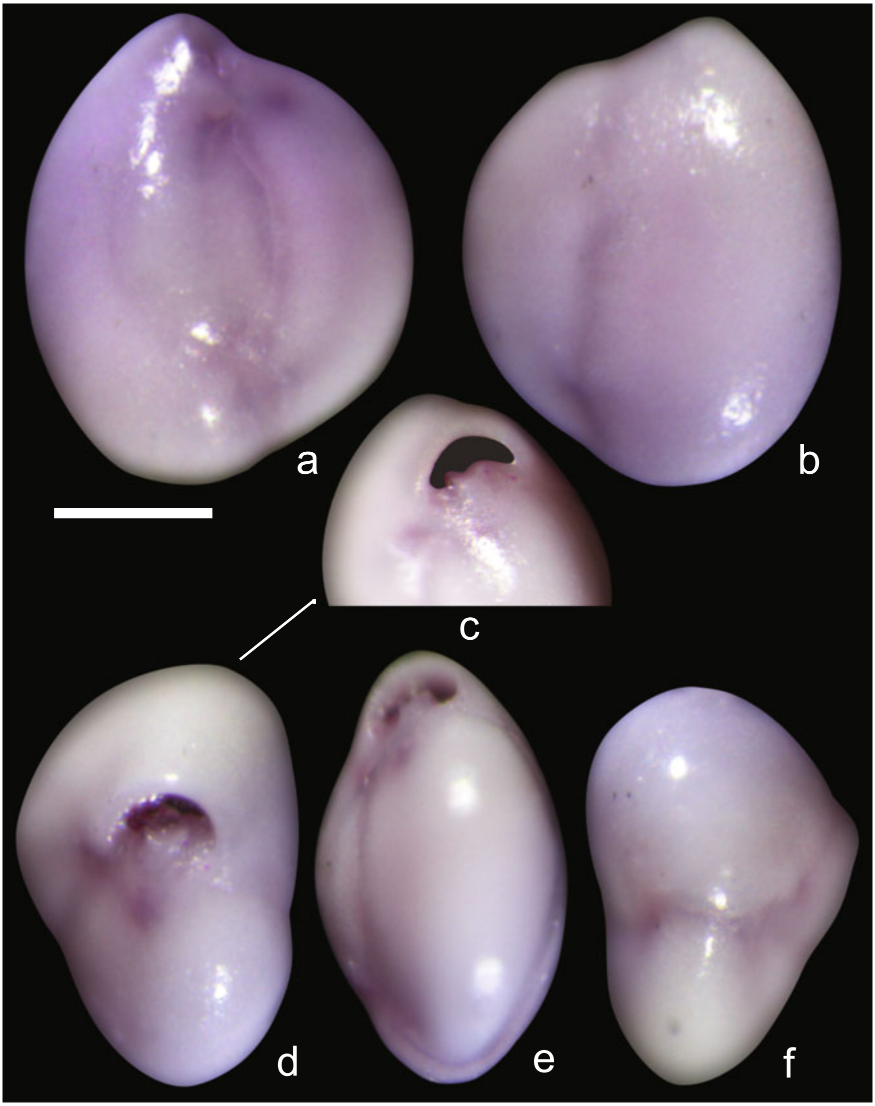

Fig. 24 **a–f** *Triloculina sommeri* Tinoco, 1955, the same specimen of different side of views. **c, d** Apical views showing aperture. **e** Lateral view. **f** Antapical view. Scale bar = 100 µm

Description

Size about 350 µm in length, length:width ratio about 1.2:1. Test ovate, subtriangular in section. Chambers one-half coil in length, only three chambers visible from the exterior. Wall calcareous, imperforate, porcelaneous, thick, and smooth. Aperture rounded, at the end of the final chamber. Tooth very short and bifid.

Remarks

Triloculina sommeri is a new record to China Seas. It distributed from the Yellow Sea to the East China Sea. Our species resembled the Timor's population in several taxonomic characters, i.e., test shape, the apertural and the tooth features (Loeblich & Tappan, 1994), and thus was identified as the same species.

***Triloculina trigonula* (Lamarck, 1804)** (Fig. 25)

Miliolites trigonula Lamarck, 1804, p. 351, pl. 17, Fig. 4; Brady, 1884, pl. 3, Figs. 15–16.

Triloculina trigonula (Lamarck), d'Orbigny, 1826, p. 299, pl. 16, Figs. 5–9; Cushman, 1917, p. 65, pl. 25, Fig. 3; 1929, p. 56, pl. 12, Figs. 10, 11; p. 13, pl. 3, Fig. 3; Cushman, 1940, p. 184, pl. 15, Fig. 1; Asano, 1951, Ill. Catalogue Japan. Tert. Smaller Foram., pt 6, p. 17, Figs. 116–117; Rao, 1970, p. 592, Fig. 21; Bock, et al., 1971, p. 28, pl. 12, Figs. 3, 4; Zheng et al., 1978, p. 185, pl. XIII, Figs. 1, 2, 3; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 76, pl. IV, Figs. 18–20; Albani, 1979, p. 21, Fig. 22-7; Poag, 1981, p. 84, pl. 57, Fig. 2; Wang et al., 1988, p. 131, pl. XV, Figs. 9–10; Zheng, 1988, p. 242, pl. XIX, Fig. 3; pl. XXIII, Fig. 9; pl. XXXIII, Fig. 5; Hottinger et al., 1993, p. 66, pl. 69, Figs. 1–10; Patker, 2009, p. 336, Figs. 266, 267; Debenay, 2012, p. 138; Catalogue Japan. Tert. Smaller Foram., pt 6, p. 17, Figs. 116–117; Holbourn et al., 2013, p. 566.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H145-01	538	328	387
H145-02	649	453	403

Occurrence and Ecology

The Yellow Sea (St DH9-3) (26°24′ N, 121°26′ E), water depth 78.00 m, temperature 24.11 °C, salinity 34.30 ‰, abundance 0.75 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Canada, Celtic Sea, English Channel, Gulf of Aqaba, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, Maldives, Micronesia, Mozambique, New Zealand, North Atlantic Ocean, North Pacific Ocean, United States, New Caledonia, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description

Size about 600 μm in length, length:width ratio about 1.6:1. Test ovate in outline. Chambers one-half coil in length, only three chambers visible from the exterior. Wall calcareous, imperforate, porcelaneous, smooth, and thick. Aperture rounded, at the end of the final chamber. Tooth distinctly bifid, protruded from the aperture region.

Triloculina trigonula (Lamarck, 1804)

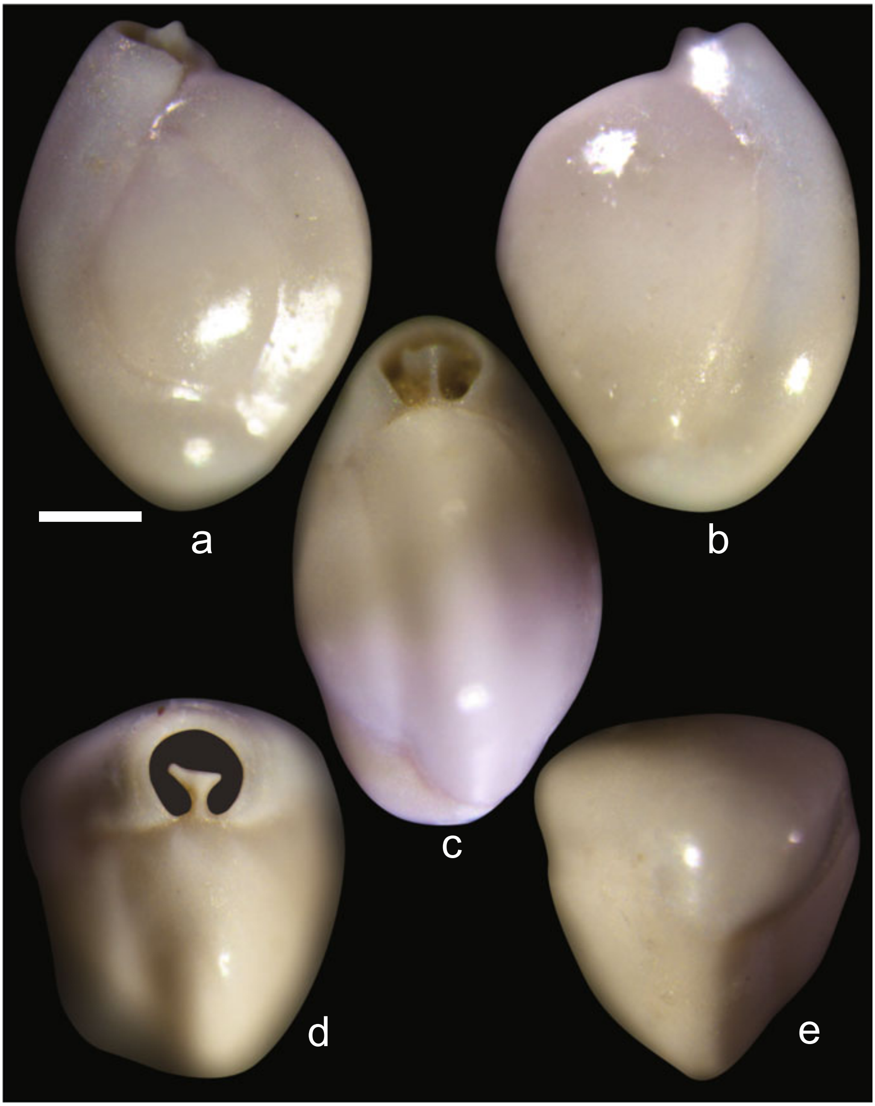

Fig. 25 **a–e** *Triloculina trigonula* (Lamarck, 1804), the same specimen showing different side of views. **c** Lateral view. **d** Apical views. **e** Antapical view. Scale bar = 100 μm

Remarks

Triloculina trigonula is a common species in the China Seas (Wang et al., 1988). It distributed mainly in inner continental shelf sediments, but usually with low abundance. *T. trigonula* differs from *T. inflata* by possessing a more distinctive triangular test outline in sectional view and having a more distinct T-shaped tooth.

Genus *Sigmoilopsis* Finlay, 1947

Sigmoilopsis asperula **(Karrer, 1868)** (Fig. 26)

Spiroloculina asperula Karrer, 1868, p. 136, pl. 1, Fig. 10; Brady, 1884 (part), p. 152, pl. 8, Fig. 4; Boltovskoy, 1960, p. 49, Figs. 12–14.

Sigmoilopsis asperula **(Karrer, 1868)**

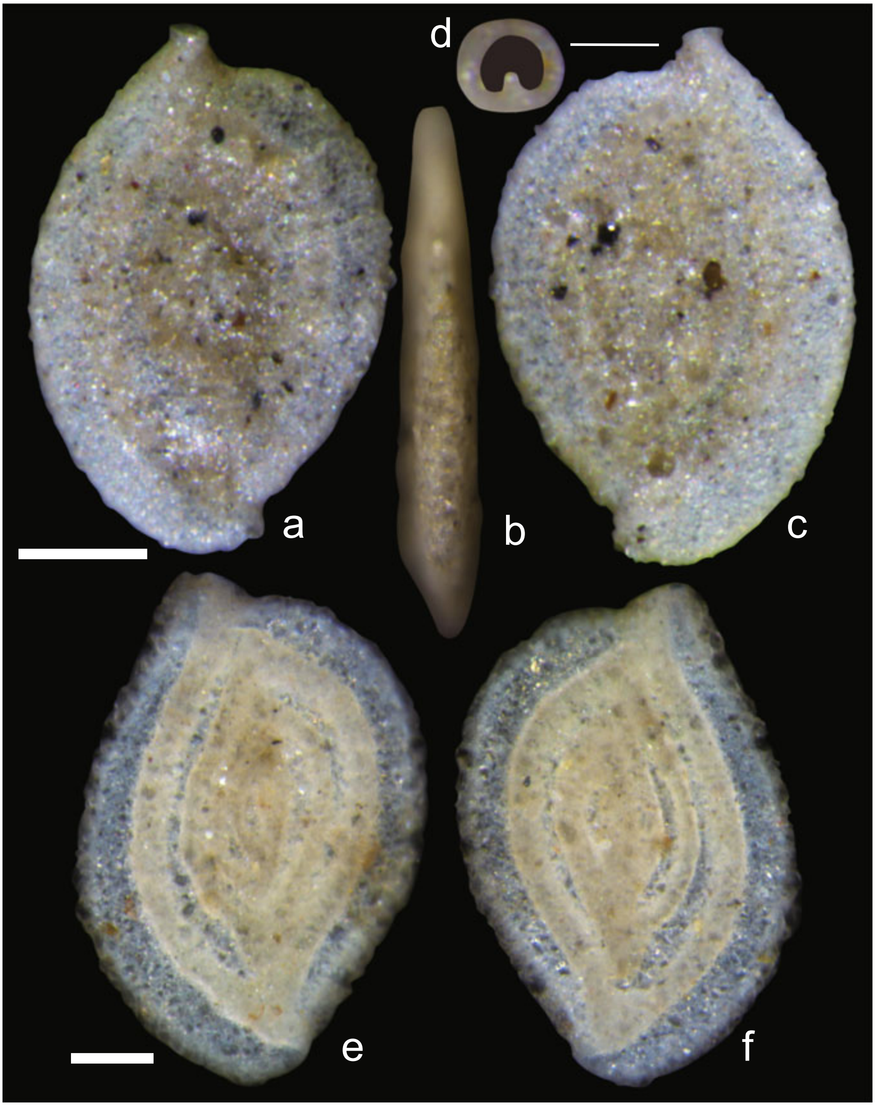

Fig. 26 a–f *Sigmoilopsis asperula* (Karrer, 1868), two specimens showing morphological variabilities. **a–d** From the same specimen. **b** Lateral view. **e, f** Another water immersed specimen showing inner structure of the chambers. Scale bars = 100 µm

Massilina asperula (Karrer, 1868), Cushman, 1921, p. 447.

Proemassilina asperula (Karrer, 1868), Lacroix, 1938, p. 3.

Sigmoilina asperula (Karrer, 1868), Cushman & Todd, 1944, p. 74; Cushman, 1946, p. 33, pl. 5, Figs. 16–18.

Ammomassilina cf. *asperula* (Karrer, 1868), Cushman, 1949, p. 13, pl. 2, Fig. 7.

Sigmoilopsis asperula (Karrer, 1868), He et al., 1965, p. 69, pl. III, Fig. 9a–b; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 73, pl. III, Figs. 1, 2, 6, 7; Wang et al., 1988, p. 131, pl. XV, Fig. 1; Zheng, 1988, p. 265, pl. XVI, Figs. 10, 11; pl. XXXII, Fig. 15.

Spiroglutina asperula (Karrer, 1868), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D28-01	409	280	56
D28-02	563	412	91

Occurrence and Ecology

The Yellow Sea (St CJ-02, St 3300-04, St 3500-02, St 3875-01) (31°49′–38°44′ N, 120°00′–122°59′ E), water depth 30.00–51.00 m, temperature 7.39–17.54 °C, salinity 30.82–31.62 ‰, abundance 0.10–1.12 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Mediterranean Sea, North Atlantic Ocean.

Description

Size about 500 μm in length, length:width ratio about 1.4:1. Test ovate in outline. Chambers one-half coil in length. Sutures indistinct. Wall thick, porcelaneous, enclosing a large quantity of agglutinated quartz particles. Aperture terminal, round in shape, with a small simple tooth.

Remarks

Sigmoilopsis asperula usually distributed in inner continental shelf sediments from the Bohai Sea to the East China Sea, but it is more frequent and abundant in the East China Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988).

***Sigmoilopsis schlumbergeri* (Silvestri, 1904)** (Fig. 27)

Planispirina celata Brady (not Costa) 1884, p. 197, pl. 7, Figs. 1, 4; Schlumberger, 1887, p. 111.

Sigmoilina schlumbergeri (Silvestri), 1904, p. 267; Cushman, 1964, p. 191, pl. 6, Figs. 1, 3; J. Le Calvez & Y. Le Calvez, 1958, p. 210, pl. 8, Fig. 94; Hofker, 1976, p. 132, Fig. 128.

Sigmoilopsis schlumbergeri (Silvestri, 1904), Barker, 1960, p. 16; Chiji & Lopez, 1968, p. 111, pl. 7, Fig. 9; Bock, 1971, p. 186, pl. 3, Figs. 7, 8; Bock et al., 1971, p. 25, pl. 9, Figs. 1, 2; Brooks, 1973, p. 400, pl. 2, Figs. 20–22; Loeblich &

Sigmoilopsis schlumbergeri (Silvestri, 1904)

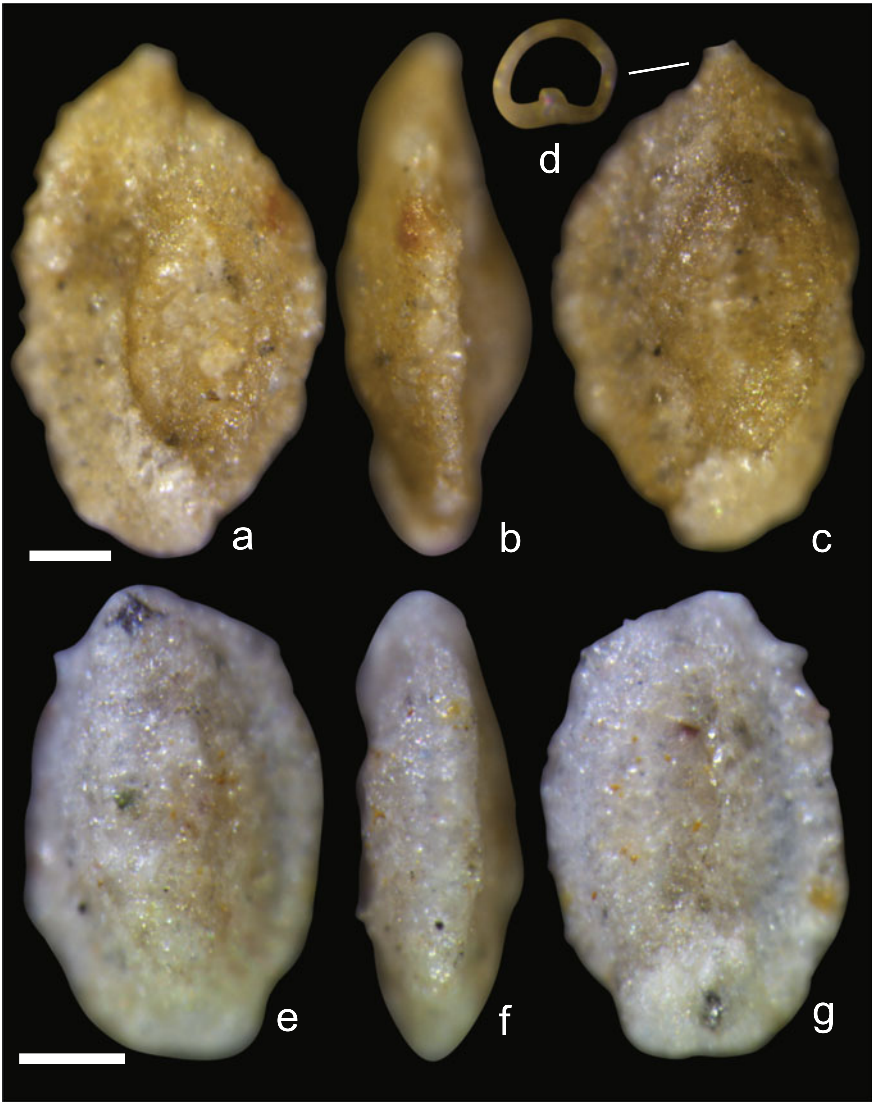

Fig. 27 **a–g** *Sigmoilopsis schlumbergeri* (Silvestri, 1904), two specimens showing morphological variabilities. **a–d** From the same specimen. **e–g** From another specimen. **b, f** Lateral views. Scale bars = 100 μm

Tappan, 1987, p. 350, pl. 356, Figs. 8–13; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 156, pl. 6, Fig. 10; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 73; Zheng 1988, p. 268, pl. XVIII, Figs. 4, 5; pl. XXXII, Fig. 18; He & Hu, 1989, p. 61, pl. 150, Fig. 3; Loeblich & Tappan, 1994, p. 59, pl. 103, Figs. 9–12; Holbourn et al., p. 506.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H111(CSDP)=B29-01	617	381	229
H111(CSDP)=B29-02	441	283	155

Occurrence and Ecology

The Bohai Sea (St 26) (39°00′ N, 119°30′ E), water depth 25.00 m, temperature 2.86 °C, salinity 30.79 ‰, abundance 0.06 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Okinawa Trough.

Bay of Biscay, Canada, Japan, New Zealand, North Atlantic Ocean, United States, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description

Size about 550 μm in length, length:width ratio about 1.6:1. Test ovate in outline, lenticular in section. Chambers one-half coil in length, periphery carinate. Sutures indistinct. Wall thick, porcelaneous but enclosing a large quantity of agglutinated quartz particles. Aperture terminal, rounded, with a small tooth.

Remarks

Sigmoilopsis schlumbergeri was reported by Micropaleontology Group in Marine Geology Department of Tongji University (1978) from the South Yellow Sea. It is a rare species in inner continental shelf sediments and usually occurred in low abundance in the China Seas.

Order Lagenida Delage et Hérouard, 1896

Family Nodosariidae Ehrenberg, 1838

Genus *Dentalina* Risso, 1826

***Dentalina extensa* Zheng & Zhang, 1988** (Fig. 1)

Dentalina extensa Zheng & Zhang, Wang et al., 1988, p. 137, pl. XVII, Fig. 10.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H18-01	1996	249	249
H18-02	1469	281	281

Occurrence and Ecology
The Yellow Sea (St 3300-04, St 3400-08, St 3700-01, St B-06) (32°59′–37°51′ N, 122°20′–123°58′ E), water depth 29.00–80.00 m, temperature 7.54–15.61 °C, salinity 30.31–32.94 ‰, abundance 0.10–0.14 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Description
Size large, about 1700 μm in length, length:width ratio about 8:1. Test elongate and arcuate. Proloculus apiculate, followed by 11 cylindrical chambers uniserially ranged. Sutures straight and horizontal. Wall calcareous, surface with about nine unornamented costae. Aperture terminal, with a series radial slits closed at the apex.

Remarks
Dentalina extensa was discovered by Lianfu Zheng and Jijun Zhang from the East China Sea (Wang et al., 1988). The East China Sea specimen has 16–17 chambers

Y. Lei and T. Li, *Atlas of Benthic Foraminifera from China Seas*,
Springer Geology, DOI 10.1007/978-3-662-53878-4_4

Dentalina extensa Zheng & Zhang, 1988

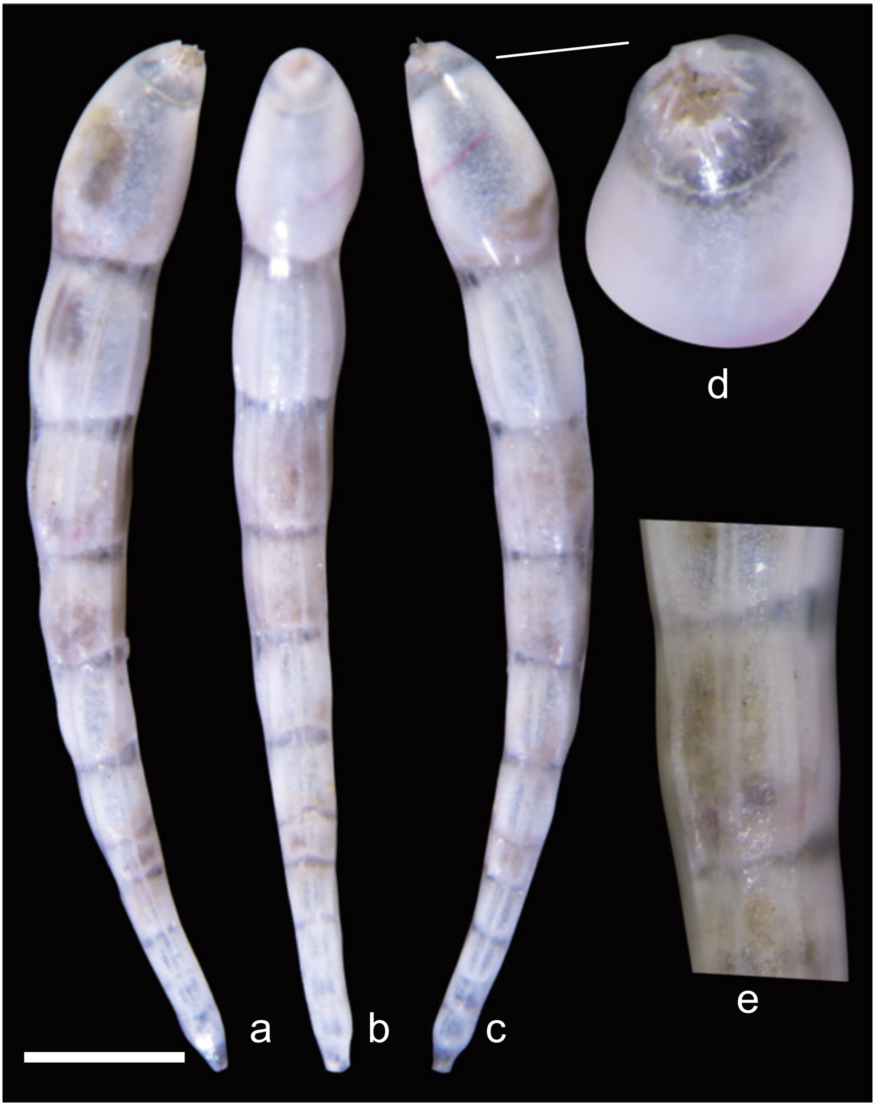

Fig. 1 **a–e** *Dentalina extensa* Zheng & Zhang, 1988, the same specimen with different side of views. **d** Apical view showing aperture. **e** Wall with unornamented costae. Scale bar = 300 μm

and was 8.88 mm in length, much bigger than that from the Yellow Sea. It is a common species in the continental shelf sediments of the East China Sea and the Yellow Sea. *D. extensa* might be an endemic species of the China Seas since it has never been reported from the other sea areas.

Genus *Laevidentalina* Loeblich & Tappan, 1986

***Laevidentalina communis* (d'Orbigny, 1826)** (Fig. 2)

Nodosaria (*Dentalina*) *communis* d'Orbigny, 1826, p. 254; Parker, Jones & Brady, 1871, pl. 9, Fig. 46.

Dentalina communis d'Orbigny, Cushman, 1940, p. 215, pl. 21, Fig. 11; Asano, 1951, p. 23, Fig. 102; Barker, 1960, p. 130, pl. 62, Figs. 21–22; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 83, pl. VII, Figs. 17–18; Wang et al., 1980, p. 195, pl. VIII, Figs. 24–25; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 157, pl. 6, Fig. 18; Wang et al., 1988, p. 137, pl. XV, Fig. 11; Yassini & Jones, 1995, p. 99, Fig. 254.
Laevidentalina communis Debenay, 2012, p. 165.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H13-01	689	122	122
H13-02	1008	196	196

Occurrence and Ecology
The Bohai Sea (St 14) and The Yellow Sea (St CJ-04, St 3400-05, St 3400-06, St 3600-06, St 3700-01) (32°10′–38°16′ N, 120°06′–124°00′ E), water depth 24.00–70.00 m, temperature 3.30–17.02 °C, salinity 30.31–32.98 ‰, abundance 0.02–0.24 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, South Korea, South Pacific Ocean, United States, New Caledonia, Mediterranean Sea.

Description
Size about 800 μm in length. Test elongate, length:width ratio about 5.6:1. Proloculus round, followed by about six uniserial chambers. Sutures straight, horizontal to slightly oblique. Wall calcareous, optically radial, hyaline and very finely perforate, surface smooth, without striae. Aperture with a series of radial slits usually closed or slightly open at the apex.

Remarks
Laevidentalina communis had been identified as *Dentalina communis* by many Chinese publications from the Yellow Sea, the East China Sea and the Okinawa Trough (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing),

Laevidentalina communis (d'Orbigny, 1826)

Fig. 2 **a–f** *Laevidentalina communis* (d'Orbigny, 1826), the same specimen of different side of views. **d, e** Apical views showing aperture. Scale bar = 100 μm

1988; Wang et al., 1988). However, the Genus *Dentalina* Risso, 1826 was diagnosed as "wall surface with numerous longitudinal costae," but the genus *Laevidentalina* Loeblich & Tappan, 1986 was diagnosed as "wall surface smooth and unornamented." Therefore, Hayward et al. (2015) made a new combination of this species as *Laevidentalina communis* (d'Orbigny, 1826), and we agree this point of view. The East China Sea population described by Wang et al. (1988) was larger than the Yellow Sea one.

***Laevidentalina inflexa* (Reuss, 1866)** (Fig. 3)

Nodosaria inflexa Reuss, 1866, p. 131, pl. 2, Fig. 1; Brady, 1884, p. 498, pl. 62, Fig. 9; Saidova, 1961, p. 56, pl. 17, Fig. 108.

Non *Nodosaria inflexa* Reuss, Hofker, 1978, p. 38, pl. 3, Fig. 9.

Dentalina inflexa (Reuss), Asano, 1951f, p. 25, Fig. 109; Asano, 1956a, p. 20, pl. 4, Figs. 36–37.

Laevidentalina inflexa (Reuss), Loebich & Tappan, 1994, p. 65, pl. 114, Figs. 10–16; pl. 115, Fig. 6; Debenay, 2012, p. 166.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H154-01	325	100	249
H154-02	467	82	82
H154-03	473	90	90

Occurrence and Ecology

The Yellow Sea (St 3300-04) (33°00′ N, 122°59′ E), water depth 32.90 m, temperature 19.00 °C, salinity 31.60 ‰, abundance 0.28 ind./g sed.

Distribution

Yellow Sea.

Japan, New Zealand, New Caledonia, Mediterranean Sea, North Atlantic Ocean.

Description

Size about 400 μm in length. Test elongate, length:width ratio about 4.7:1. Proloculus rounded to acute, followed by two to three uniserial chambers. Chamber slightly stout or inflated. Sutures straight, slightly to distinctly oblique. Wall calcareous, fine, thin and hyaline. Surface smooth, without striae. Aperture a closed protuberance with a series of radial slits at the apex.

Remarks

Laevidentalina inflexa is a new record to China Seas. This species was sampled from the Yellow Sea with very low density. Timor Sea population was 0.62–2.60 mm in length, larger than the Yellow Sea one and had more chambers (3–6 vs. 2–3).

Laevidentalina inflexa (Reuss, 1866)

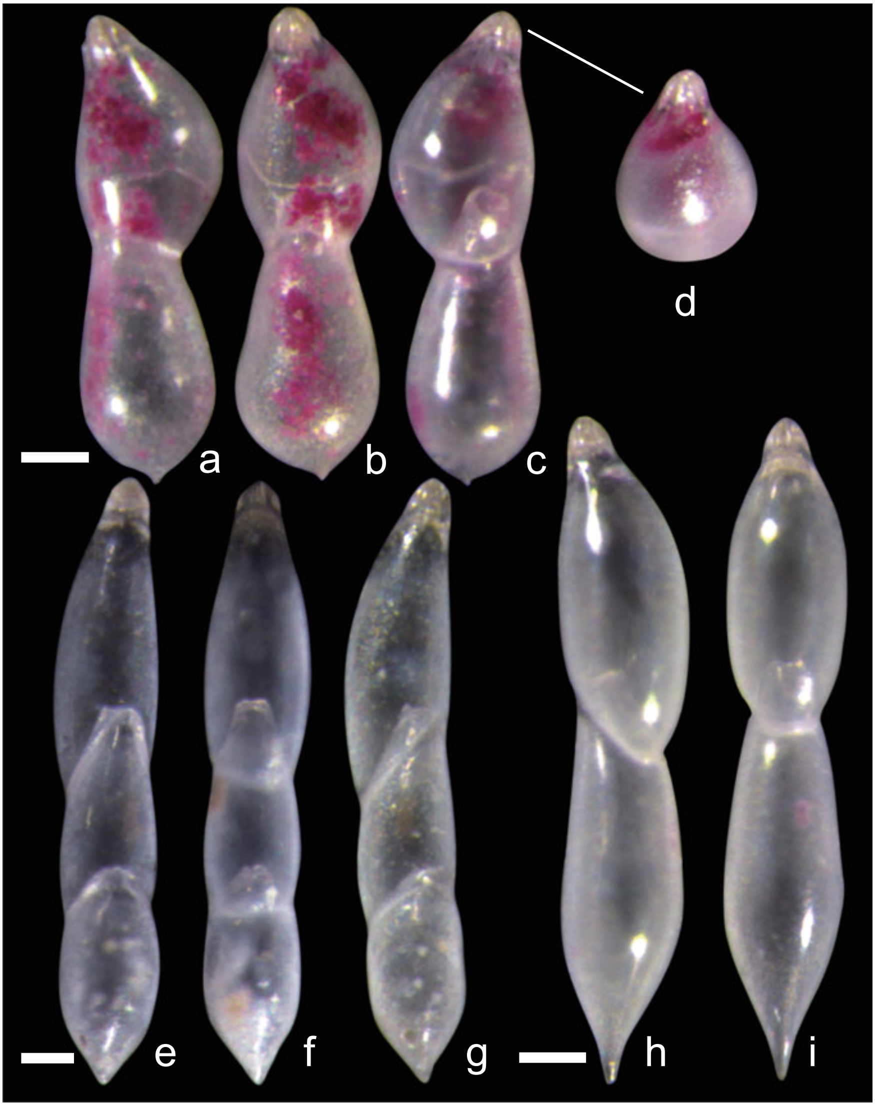

Fig. 3 **a–i** *Laevidentalina inflexa* (Reuss, 1866), three specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **e–g** Another specimen. **h, i** The third specimen. Scale bars = 50 μm

Laevidentalina filiformis (d'Orbigny, 1826) (Fig. 4)

Nodosaria filiformis d'Orbigny, 1826, p. 253; Parker, Jones & Brady, 1871, pl. 9, Fig. 48; Flint, 1897, p. 310, pl. 55, Fig. 6; Cushman, 1913, p. 55, pl. 27, Figs. 1–4; 1921, p. 194, pl. 34, Fig. 9; 1923, p. 76, pl. 12, Figs. 1, 2.

Laevidentalina filiformis (d'Orbigny, 1826)

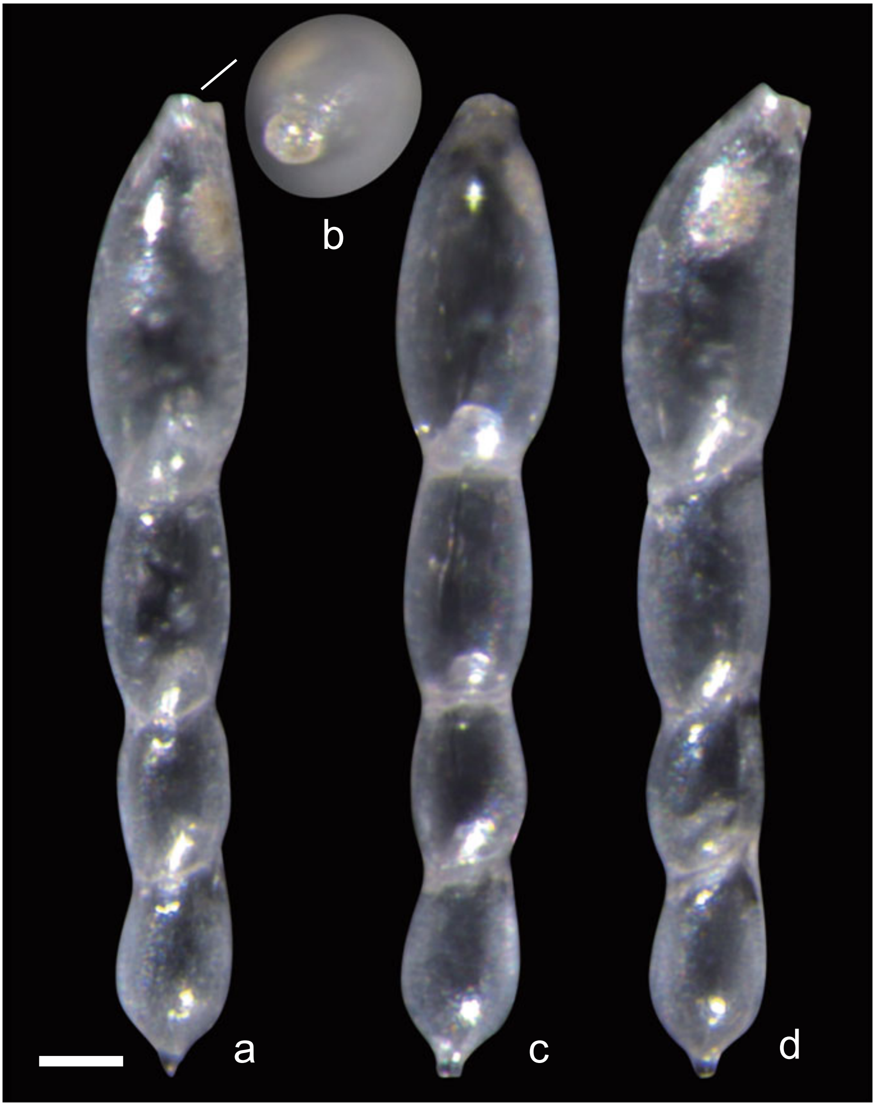

Fig. 4 **a–d** *Laevidentalina filiformis* (d'Orbigny, 1826), the same specimen with different side of views. **b** Apical view showing aperture. Scale bar = 50 μm

Nodosaria (*D.*) *filiformis* d'Orbigny, Brady, 1884, p. 500, pl. 63, Figs. 3–5.

Dentalina filiformis (d'Orbigny), Cushman & McCulloch, 1950, p. 314, pl. 40, Fig. 17; Said, 1950, p. 7, pl. 1, Fig. 19; Asano, 1956, p. 18, pl. 14, Fig. 30; Barker, 1960, p. 132, pl. 63, Figs. 3–5; Zheng, 1979, p. 141, pl. IX, Fig. 12; Wang et al., 1988, p. 137, pl. XVII, Fig. 9; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 157, pl. 6, Figs. 14–15.

Laevidentalina filiformis (d'Orbigny), Yassini & Jones, 1995, p. 99, Figs. 257–258; Hayward et al., 1999, p. 109, pl. 6, Figs. 18–19; Debenay, 2012, p. 165.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H169-01	526	91	91

Occurrence and Ecology

The Yellow Sea (St 3300-04) (33°00′ N, 122°59′ E), water depth 32.90 m, temperature 19.00 °C, salinity 31.60 ‰, abundance 0.09 ind./g sed.

Distribution

Yellow Sea.

China, Japan, North Atlantic Ocean, South Korea, United States, New Caledonia, Southeast U.S. Continental Shelf, Gulf of Mexico.

Description

Size about 500 μm in length. Test elongate, length:width ratio about 5.8:1. Proloculus rounded, followed by four uniserial chambers. Sutures are straight, horizontal to slightly oblique. Wall calcareous, optically radial, hyaline and finely perforate, surface smooth and unornamented. Aperture closed at the apex.

Remarks

Laevidentalina filiformis had been identified as *Dentalina filiformis* in previous Chinese literature (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). However, the Genus *Dentalina* Risso, 1826 was diagnosed as "wall surface with numerous longitudinal costae," but the Genus *Laevidentalina* Loeblich & Tappan, 1986 was diagnosed as "wall surface smooth and unornamented." Since this species has a very fine and smooth wall surface, therefore Hayward et al. (2015) made the combination as *Laevidentalina filiformis* (d'Orbigny, 1826). The East China Sea specimen described by Wang et al. (1988) was 3.44 mm in length, which was much larger than the Yellow Sea one. It is a rarely occurred species in the continental shelf sediments of China Seas.

Family Vaginulinidae Reuss, 1860

Genus *Lenticulina* Lamarck, 1804

***Lenticulina glabrata* (Cushman, 1923)** (Fig. 5)

Cristellaria occidentalis var. *glabrata*, Cushman, 1923, p. 103, pl. 25, Fig. 3.

Lenticulina occidentalis var. *glabrata*, Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 166, pl. 9, Fig. 3.

Lenticulina glabrata (Cushman, 1923), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H15-01	380	255	158
H15-02	296	205	134
H15-03	376	24	145

Occurrence and Ecology

The Yellow Sea (St 3400-06, St 3400-08) (33°59′–33°59′ N, 123°00′–123°58′ E), water depth 67.80–80.00 m, temperature 10.01–12.00 °C, salinity 31.91–32.95 ‰, abundance 0.12–1.22 ind./g sed.

Distribution

Yellow Sea, Okinawa Trough.

North Atlantic Ocean, United States, Gulf of Mexico, Southeast U.S. Continental Shelf.

Description

Size about 350 μm in length. Test planispirally enrolled, length:width ratio about 1.5:1. Periphery smooth but with slight angles from distinct to indistinct. Four to five chambers increased slowly in size as added, but the final one flare and uncoiled. Sutures slightly curved, may distinct or vague among different specimens. Wall hyaline and smooth. Aperture radiate at the peripheral angle and produced.

Remarks

Lenticulina glabrata had been identified as *Lenticulina occidentalis* var. *glabrata* from the Okinawa Trough sediments (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a rare species in the Yellow Sea.

Lenticulina glabrata (Cushman, 1923)

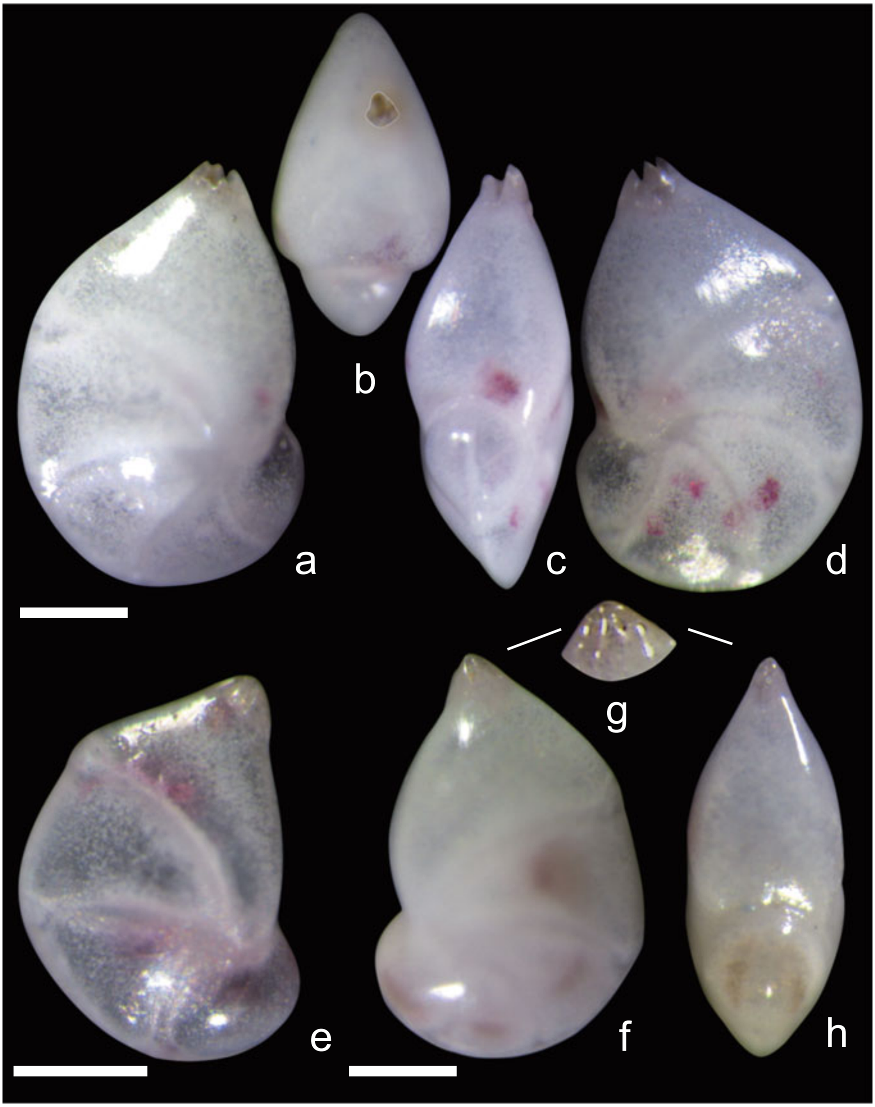

Fig. 5 **a–h** *Lenticulina glabrata* (Cushman, 1923), three specimens showing morphological variabilities. **a–d** Same specimen with different side of views. **b** Apical view. **e** Another specimen. **f–h** The third specimen. Scale bars = 100 μm

Lenticulina orbicularis **(d'Orbigny, 1826)** (Fig. 6)

Robulina orbicularis d'Orbigny, 1826, p. 288, pl. 15, Figs. 8–9.

Lenticulina orbicularis (d'Orbigny, 1826)

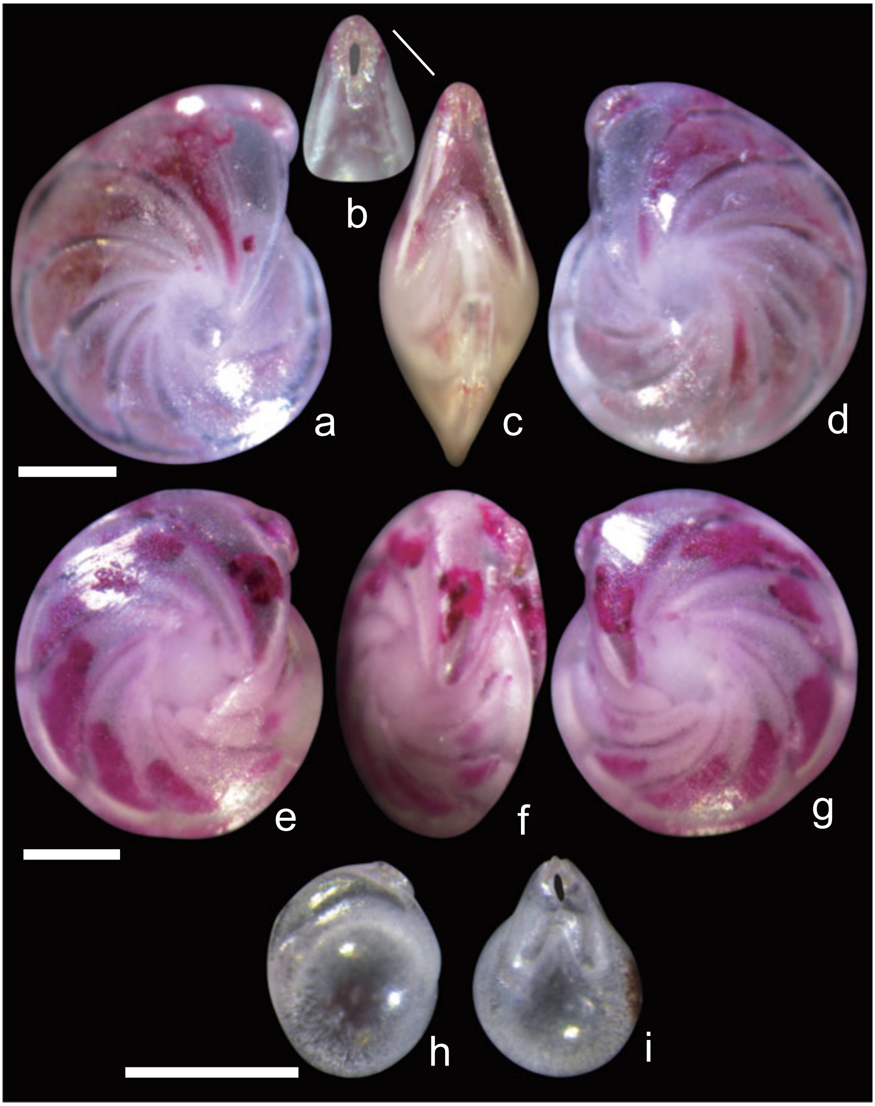

Fig. 6 a–i *Lenticulina orbicularis* (d'Orbigny, 1826), three specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **e–g** Another live specimen. **h, i** A larval specimen. Scale bars = 200 μm

Robulus orbicularis (d'Orbigny), Barker, 1960, pl. 69, Fig. 17; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 83, pl. VII, Figs. 22–23.

Lenticulina orbicularis (d'Orbigny), Hayward et al., 2010, p. 178, pl. 14, Figs. 23–24; Debenay, 2012, p. 224.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H168-01	703	605	295
H168-02	723	661	303
H168-03 (juvenile)	250	198	185

Occurrence and Ecology

The Yellow Sea (St 3400-05, St 3400-08, St 3500-10, St 3600-06) (33°59′–35°58′ N, 122°30′–123°59′ E), water depth 40.00–81.00 m, temperature 9.19–13.75 °C, salinity 31.12–33.39 ‰, abundance 0.02–0.24 ind./g sed.

Distribution

Yellow Sea.

Bay of Biscay, Celtic Sea, Japan, Micronesia, New Zealand, North Atlantic Ocean, South Korea, United States, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 700 μm in length, length:width ratio about 1.1:1. Test enrolled and nearly rounded in shape, lenticular in lateral view, with a distinct umbonal boss. Periphery thin and smooth. About nine chambers increased slowly in size, but the final one less uncoiled. Sutures highly curved, radial and flush. Wall hyaline and perforate radial, surface smooth. Aperture slitlike, located at the peripheral angle, producing from the apical end.

Remarks

Lenticulina orbicularis had been identified as *Robulus orbicularis* in previous Chinese literature from sediments of the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978). This species usually has very low abundance in continental shelf sediments of the Yellow Sea.

Genus *Saracenaria* Defrance, 1824

***Saracenaria italica* Defrance, 1824** (Fig. 7)

Saracenaria italica Defrance, 1824, p. 177; Cushman, 1940, p. 218, pl. 21, Figs. 8, 9; Leroy, 1941b, p. 76, pl. 7, Figs. 21–24; Boomgaart, 1951, p. 82, pl. 6, Fig. 18; South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981, p. 117, pl. 65, Fig. 1; Loeblich & Tappan, 1987, p. 407, pl. 448, Figs. 16–17; Wang et al., 1988, p. 140, pl. XVIII, Fig. 2; Loeblich & Tappan, 1994, p. 69, pl. 125, Figs. 11–16.

Saracenaria italica Defrance, 1824

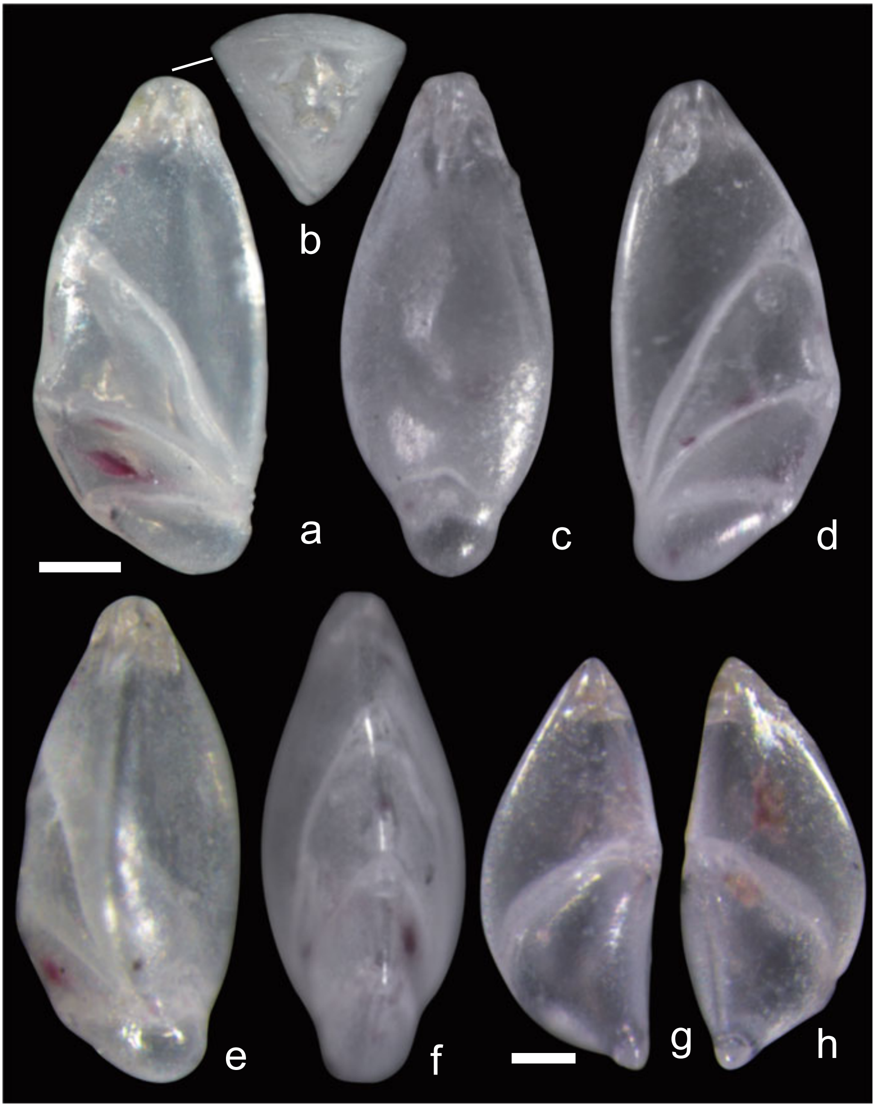

Fig. 7 a–h *Saracenaria italica* Defrance, 1824, two specimens with different side of views. **a–f** Same specimen showing different side of views. **b** Apical view showing triangular cross section. **g, h** A juvenile specimen. Scale bars = 50 µm

Cristellaria italica (Defrance), Brady, 1884, p. 544, pl. 68, Figs. 17, 18, 20–23; Cushman, 1913, p. 78, pl. 33, Fig. 3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H140-01	452	207	188
H140-02	307	138	127
H140-03	422	196	188

Occurrence and Ecology
The Yellow Sea (St 3400-08) (33°59′ N, 123°58′ E), water depth 80.00 m, temperature 10.01 °C, salinity 32.94 ‰, abundance 0.18 ind./g sed.

Distribution
Yellow Sea, East China Sea.

China, Japan, New Zealand, South Korea, United States, Gulf of Mexico, Mediterranean Sea, North Atlantic Ocean.

Description
Size about 400 μm in length, length:width ratio about 2.2:1. Test planispirally enrolled in the early stage, later tending to become rectilinear, triangular in section. Four chambers increased rapidly in size. Periphery with dorsal angle. Sutures curved and flushed. Wall perforate, surface smooth. Aperture radiate at the dorsal angle, producing from the apical end.

Remarks
Saracenaria italica has been reported from modern sediments of the East China Sea (Wang et al., 1988) with low abundance, in addition, this species was also found from the South China Sea, but in the tertiary strata (South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981). It occurred in the Yellow Sea sediment in our investigation with low abundance. The East China Sea specimen described by Wang et al. (1988) was about 0.90 mm in length, larger than that from the Yellow Sea.

Genus *Astacolus* de Montfort, 1808

***Astacolus crepidulus* (Fichtel & Moll, 1798)** (Figs. 8, 9)

Nautilus crepidula Fitchtel & Moll, 1798, p. 107, pl. 19, Figs. g–i.

Cristellaria crepidula (Fichtel & Moll), Brady, 1884 (part), p. 542, pl. 67, Fig. 17 (not Figs. 19, 20); Parker, Brady & Jones, 1888, p. 224, pl. 44, Figs. 8, 9; Cushman, 1913, p. 10, pl. 29, Figs. 2–5; Cusham, 1923, p. 117, pl. 35, Figs. 3–4.

Astacolus crepidulus (Fichtel & Moll, 1798)

Fig. 8 **a–e** *Astacolus crepidulus* (Fichtel & Moll, 1798), the same specimen showing different side of views. **b** Apical view showing aperture and round cross section. Scale bar = 50 μm

Astacolus crepidulus (Fichtel & Moll, 1798)

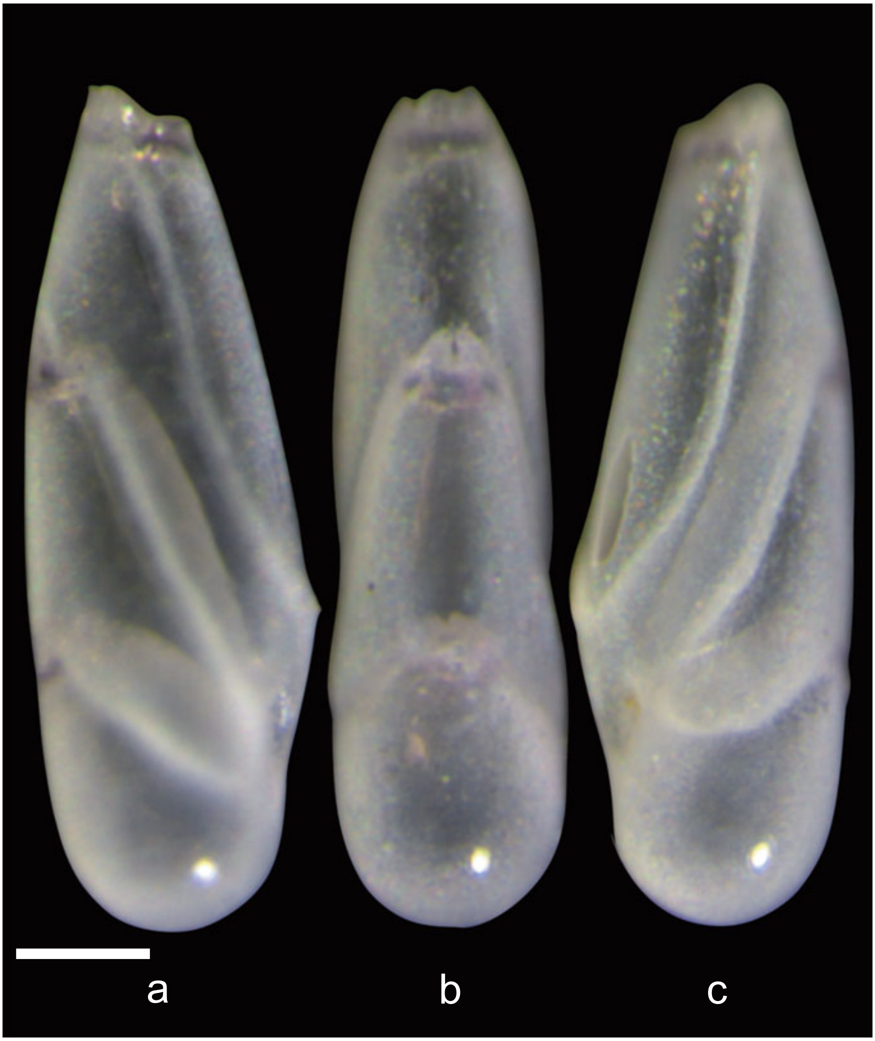

Fig. 9 a–c *Astacolus crepidulus* (Fichtel & Moll, 1798), another specimen with different side of views. Scale bar = 50 μm

Planularia planulata (Galloway & Wissler), Cushman & McCulloch, 1950 (non *Astacolus planulatus* Galloway & Wissler, 1927a), p. 303, pl. 40, Figs. 1–5.

Lenticulina crepidula (Fichtel & Moll), Hofker, 1960, p. 248, Fig. 82.

Astacolus planulatus Galloway & Wissler, Cushman, Todd & Post, 1954 (non *A. planulatus* Galloway & Wissler, 1927a), p. 343, pl. 86, Fig. 7.

Astacolus crepidula (Fichtel & Moll), Zheng, 1979, p. 140, pl. XIV, Fig. 8.

Astacolus crepidulus (Fichtel & Moll), Boltovskoy, 1959, p. 62, pl. 7, Fig. 12; Barker, 1960, pl. 67, Fig. 20; pl. 68, Figs. 1–2; Rögl & Hansen, 1984, p. 66, pl. 26, Figs. 1, 2, text Fig. 27; Loeblich & Tappan, 1987, p. 410, pl. 450, Figs. 7–8; Loeblich & Tappan, 1994, p. 72, pl. 130, Figs. 1–10; Debenay, 2012, p. 217.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D64-01	443	131	101
D64-02	305	106	83

Occurrence and Ecology

The Yellow Sea (St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-02) (32°29′–35°00′ N, 120°00′–125°00′ E), water depth 30.00–80.00 m, temperature 10.01–18.08 °C, salinity 30.82–32.94 ‰, abundance 0.02–1.92 ind./g sed.

Distribution

Yellow Sea, South China Sea.

Bay of Biscay, Celtic Sea, English Channel, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, United States, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 400 μm in length. Test elongate in outline, length:width ratio about 3:1. Three to five chambers added on a slightly curved axis and uncoiling arranged. Sutures oblique, slightly curved only in the very early stage, later became straight. Periphery rounded without distinct angles. Wall perforate and surface smooth. Aperture radiate at the dorsal angle.

Remarks

Astacolus crepidulus (Fichtel & Moll) had been reported from the Xisha Islands, South China Sea in previous Chinese literature. It is a common species in the Yellow Sea but with low abundance.

Genus *Amphicoryna* Schlumberger, 1881

***Amphicoryna scalaris* (Batsch, 1791)** (Fig. 10)

Nautilus (*Ortboceras*) *scalaris* Batsch, 1791, pp. 1–4, pl. 2, Fig. 4.

Nodosaria scalaris (Batsch), Brady, 1884, p. 510, pl. 63, Figs. 28–31; Cushman, 1921, p. 199, pl. 35, Fig. 6.

Amphicoryna scalaris (Batsch, 1791)

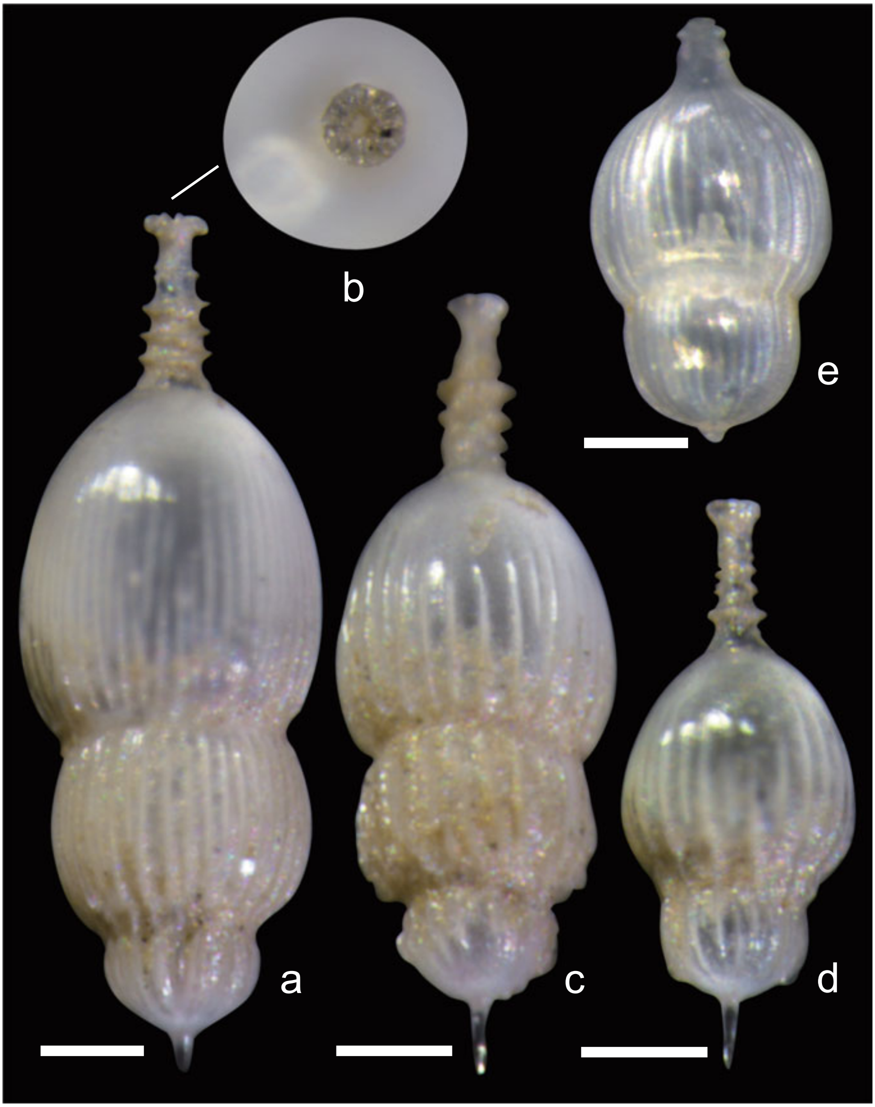

Fig. 10 a–e *Amphicoryna scalaris* (Batsch, 1791), four specimens showing morphological variabilities. **a, b** The same specimen with apical view (**b**). **c** Another specimen. **d** The third specimen. **e** The fourth water immersed specimen showing internal structure with early aperture. Scale bars = 100 μm

Lagenonodosaria scalaris He et al., 1965, p. 75, pl. 5, Fig. 2.

Amphicoryna scalaris (Batsch), Loeblich & Tappan, 1987, p. 410, pl. 450, Figs. 11–14; Wang et al., 1988, p. 139, pl. XVII, Figs. 17, 19; Hatta & Ujiié, 1992b, p. 166, pl. 21, Fig. 8; Debenay, 2012, p. 162; Holbourn, et al., 2013, p. 42.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D22-01	815	288	288
D22-02	665	235	235
D22-03	427	177	177
D22-04	390	217	217

Occurrence and Ecology

The Yellow Sea (St 2950-02) (29°30′ N, 122°59′ E), water depth 40.00–61.60 m, temperature 21.60 °C, salinity 31.12–33.39 ‰, abundance 3.00 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, Micronesia, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 400–800 μm in length. Test elongate, length:width ratio about 2.5:1. Two to three chambers uniserially arranged. Sutures slightly oblique in the astocoline coil stage, but straight and constricted in the rectilinear portion. Wall perforate and radial, surface with longitudinal stripes. Aperture terminal and radiate, at the end of the pronounced neck with ring-like concentric ridges.

Remarks

Amphicoryna scalaris has a unique test shape thus its identification characteristics are distinct. This species had been reported from the sediments of East China Sea and South China Sea as a common species (Wang et al., 1988). It occurred in the Yellow Sea sediments but with very low frequency.

Family Lagenidae Reuss, 1862

Genus *Lagena* Walker & Jacob, 1798

***Lagena elongata* Dunikowski, 1879** (Fig. 11)

Miliola elongate Ehrenberg, 1844, p. 274; Ehrenberg, 1845, p. 371.

Lagena elongata Dunikowski, 1879

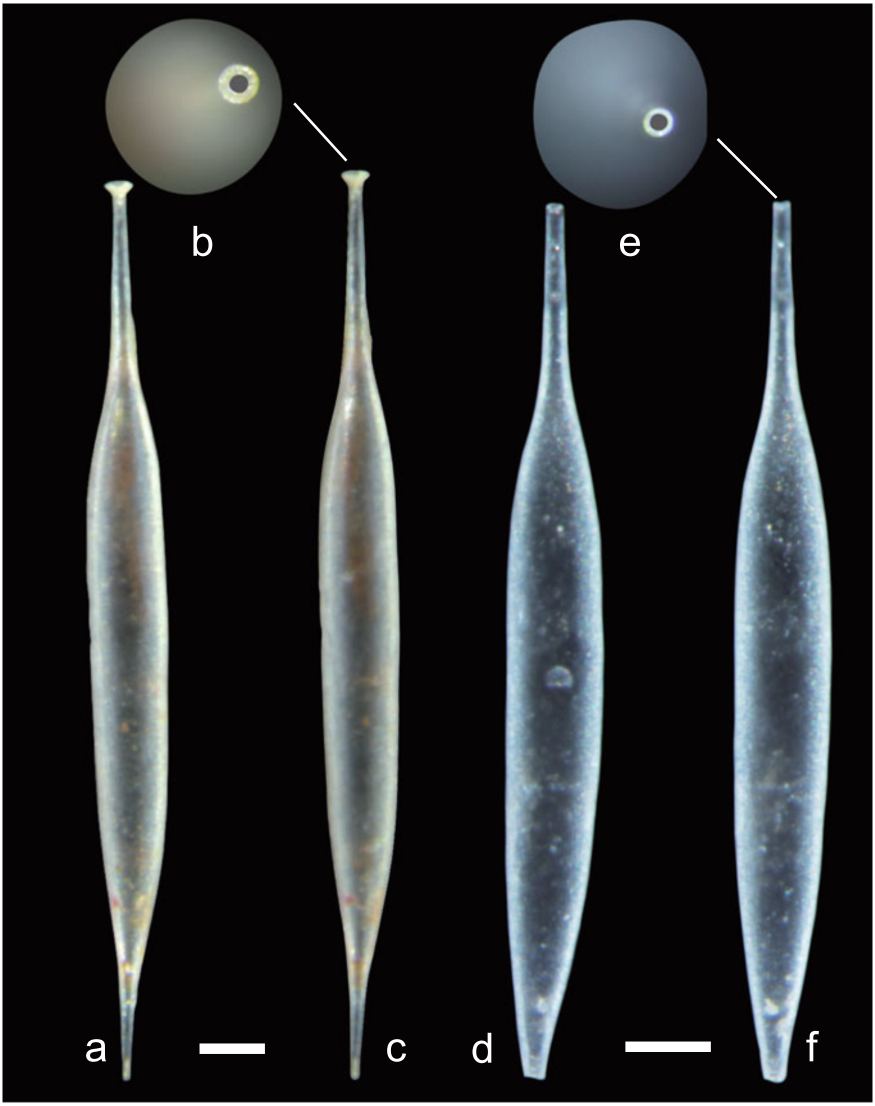

Fig. 11 **a–f** *Lagena elongata* Dunikowski, 1879, two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Apical views showing aperture. Scale bars = 100 μm

Lagena elongate (Ehrenberg), Brady, 1884, p. 457, pl. 56, Fig. 29; Barker, 1960, p. 116, pl. 56, Figs. 27–29; He et al., 1965, p. 76, pl. V, Fig. 5; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 81, pl. VII, Figs. 3–4; Wang et al., 1988, p. 135, pl. XVII, Fig. 8; Research

Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 159, pl. 6, Figs. 12–13.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H51-01	1256	111	111
H51-02	1026	110	110

Occurrence and Ecology

Yellow Sea (St CJ-04, St 3400-05, St 3800-02, St 3875-01) (32°10′–38°44′ N, 121°59′–124°00′ E), water depth 40.00–59.00 m, temperature 7.39–17.02 °C, salinity 31.12–32.08 ‰, abundance 0.02–0.32 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea, Okinawa Trough.

Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, South Korea.

Description

Size about 1200 μm in length, length:width ratio about 10:1. Test unilocular, spindly elongate in shape. Posterior end subulate. Wall fine and hyaline, surface smooth. Aperture rounded and with a phialine lip, produced on a very long neck, having a phialine lip.

Remarks

Lagena elongata have been frequently reported from continental shelf sediments of the Yellow Sea, the East China Sea, the South China Sea and the Okinawa Trough, but its abundance was usually low (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). The East China Sea population described by Wang et al. (1988) was about 0.54 mm in length, which was smaller than the Yellow Sea one.

***Lagena wiesneri* Parr, 1950** (Fig. 12)

Lagena striata (d'Orbigny) var. *interrupta* Wiesner, 1931, p. 119, pl. 18, Fig. 213.

Lagena striata (d'Orbigny) var. *wiesneri* Parr, 1850, p. 301.

Lagena wiesneri Parr, Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 81, pl. VII, Fig. 5; Wang et al., 1988, p. 134, pl. XVI, Fig. 18.

Lagena wiesneri Parr, 1950

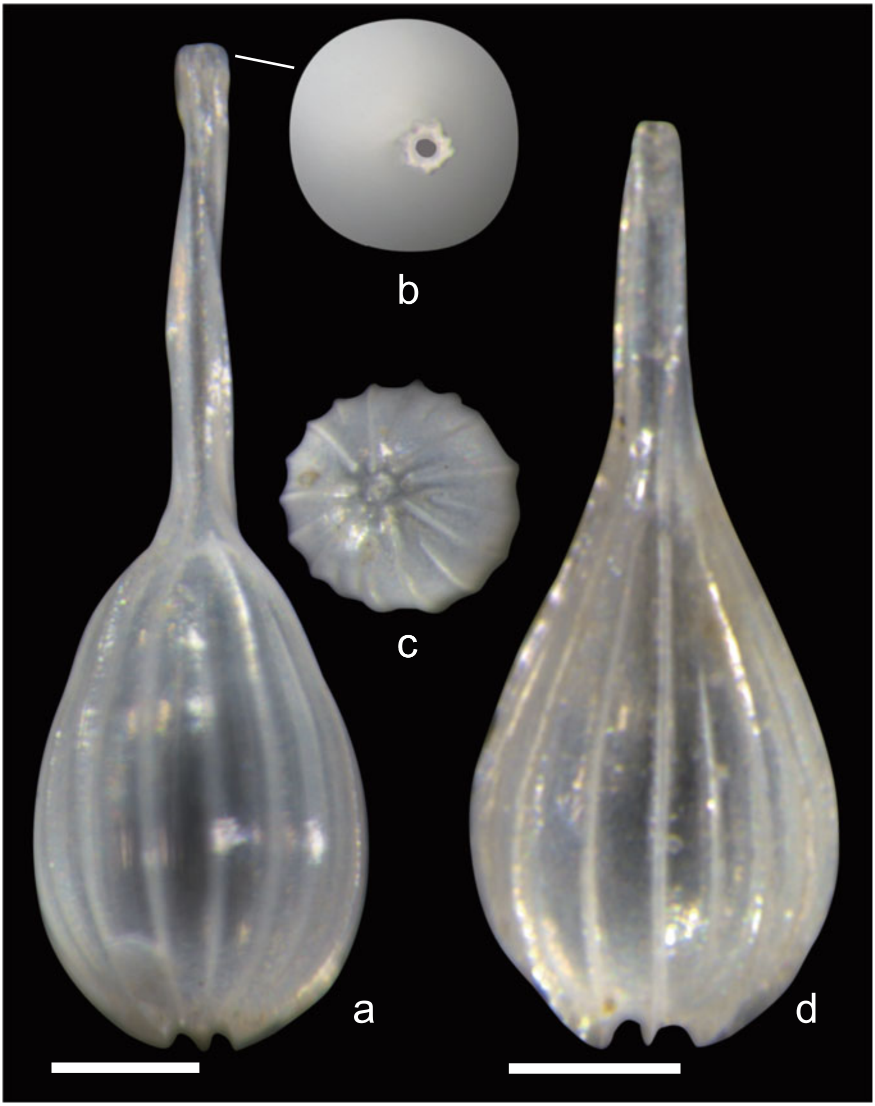

Fig. 12 **a–d** *Lagena wiesneri* Parr, 1950, two specimens showing morphological variabilities. **a–c** Same specimen with different views. **b** Apical view. **c** Antapical view. **d** Another specimen. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B107-01	678	226	226
B107-02	530	213	213
B107-03	340	90	90

Occurrence and Ecology
The Yellow Sea (St B-03) (38°25′ N, 121°57′ E), water depth 50.00 m, temperature 7.72 °C, salinity 31.67 ‰, abundance 0.06 ind./g sed.

Distribution
Yellow Sea, East China Sea.
Gulf of Mexico.

Description
Size about 600 μm in length, length:width ratio about 3:1. Test unilocular, elongated ovate. Anterior portion with a long neck, occupying about half of the body length; posterior portion blunted. Wall hyaline, surface with about 20 distinct longitudinal costae. Aperture rounded, terminal, produced on a long neck.

Remarks
Lagena wiesneri have been reported from continental shelf sediments of the Yellow Sea and the East China Sea, usually with very low abundance (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988). The East China Sea population described by Wang et al. (1988) was about 0.30 mm in length, much smaller than that from the Yellow Sea.

***Lagena nebulosa* (Cushman, 1923)** (Fig. 13)

Lagena laevis var. *nebulosa*, 1923, p. 29, pl. 5, Figs. 4–5.
Lagena nebulosa Cushman, Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 160, pl. 8, Fig. 13.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B65-01	440	172	172

Occurrence and Ecology
The Yellow Sea (St CJ-01) (31°39′ N, 122°30′ E), water depth 29.40 m, temperature 22.40 °C, salinity 31.73 ‰, abundance 0.02 ind./g sed.

Distribution
Yellow Sea, Okinawa Trough.

Lagena nebulosa (Cushman, 1923)

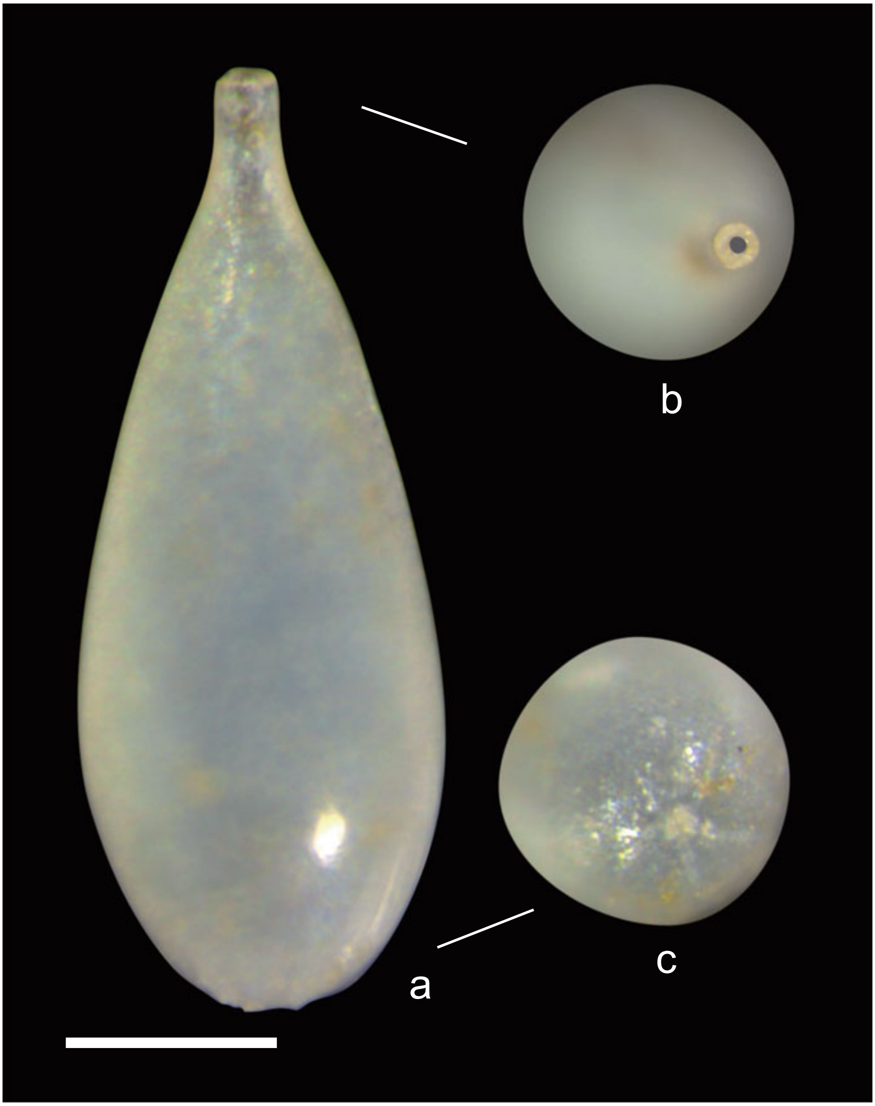

Fig. 13 **a–c** *Lagena nebulosa* (Cushman, 1923), same specimen from different views. **b** Apical view showing aperture. **c** Antapical view. Scale bar = 100 μm

Bay of Biscay, Japan, New Zealand, Arctic Ocean, Gulf of Mexico, North Atlantic Ocean.

Description
Size 440 μm in length, length:width ratio about 2.6:1 (specimen incomplete). Test elongated ovate. Anterior portion with a neck; posterior end blunted, with five indistinct, very short and fuzzy striae. Wall hyaline, surface nebulous, and coarse, poorly transparent. Aperture terminal, rounded, and produced on neck.

Remarks
Lagena nebulosa has been reported from the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). In the Yellow Sea its abundance was very low and occurred only in station St CJ-01 nearing the Yangtze Estuary.

***Lagena paucistriata* Yassini & Jones, 1995** (Fig. 14)

Lagena paucistriata Debenay, 2012, p. 152.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H91-01	450	220	220
H91-02	515	236	236
H91-03	518	231	231

Occurrence and Ecology
The Yellow Sea (St 3500-10) (35°00′ N, 123°59′ E), water depth 81.00 m, temperature 9.62 °C, salinity 33.39 ‰, abundance 0.18 ind./g sed.

Distribution
Yellow Sea.
Australia, New Caledonia.

Description
Size about 500 μm in length, length:width ratio about 2:1. Test unilocular, ovate in the main body portion. Anterior body portion with a neck; posterior body end with a protuberance. Wall calcareous and hyaline, transparent, surface with several indistinct striae. Aperture rounded, produced on the neck, with a lip.

Remarks
Lagena paucistriata is a new record to China Seas. In the Yellow Sea it inhabited at station of 81 m water depth. This species was found distributed in 600 m water depth of Northern shelf of the Southwestern Pacific New Caledonia (Debenay, 2012).

Lagena paucistriata Yassini & Jones, 1995

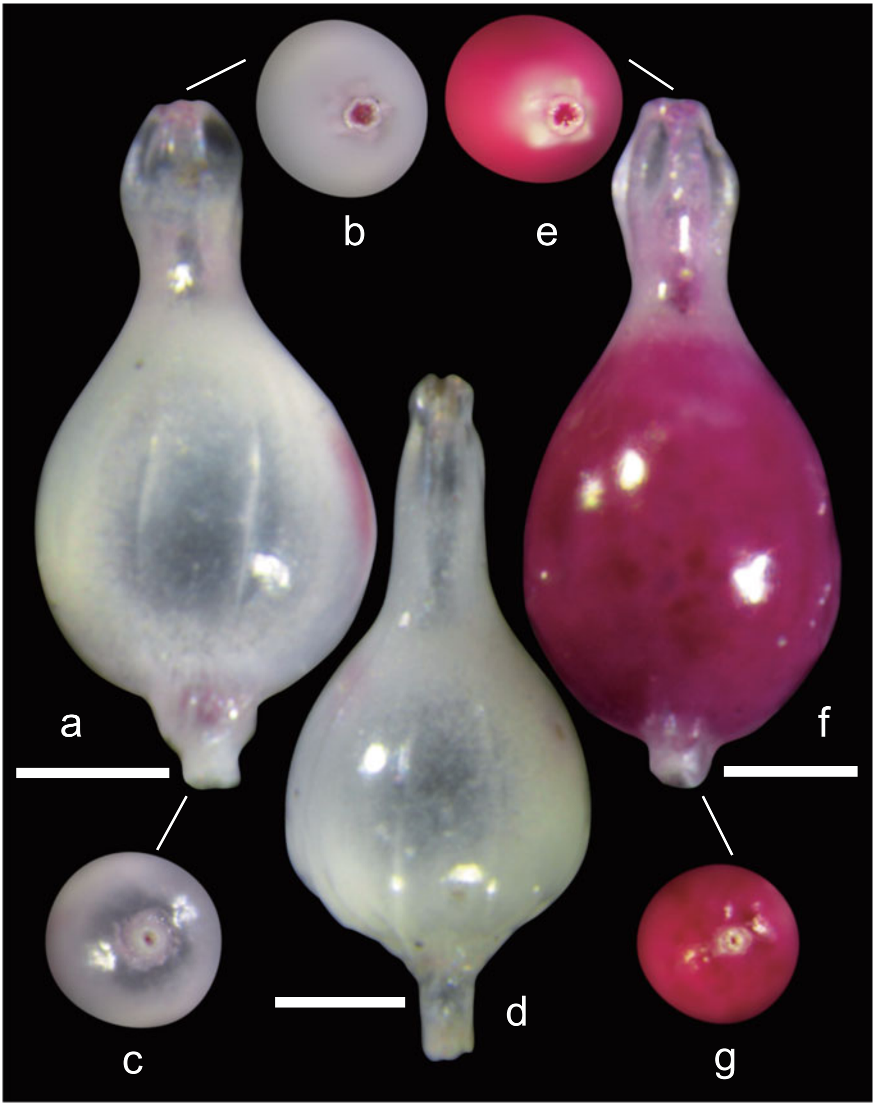

Fig. 14 **a–g** *Lagena paucistriata* Yassini & Jones, 1995, three specimens showing morphological variabilities. **a–c** Same specimen from different views. **d** Another specimen. **e–g** The third live specimen. Scale bars = 100 µm

Lagena perlucida **(Montagu, 1803)** (Fig. 15)

Vermiculum perlucidum Montagu, 1803, p. 525, pl. 14, Fig. 3.

Lagena perlucida (Montagu, 1803)

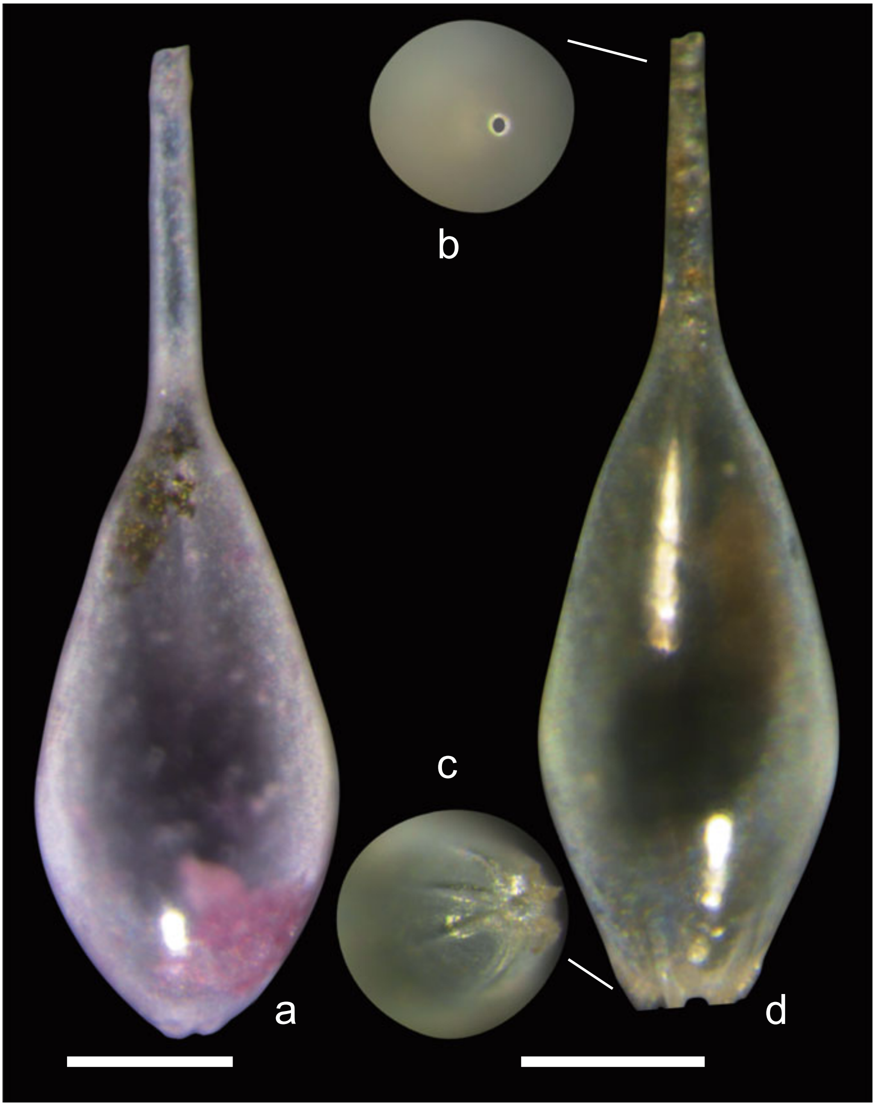

Fig. 15 a–d *Lagena perlucida* (Montagu, 1803), two specimens showing morphological variabilities. **a** A live specimen. **b–d** Another specimen with apical (**b**) and antapical (**c**) views. Scale bars = 100 μm

Pygmaeoseistron oceanicum (Albani), Loeblich & Tappan, 1994, p. 80, pl. 144, Figs. 4–7.

Lagena perlucida (Montagu), Cushman, 1923, U.S. Nat. Mus., Bull. 104, pt. 4, p. 46, pl. 8, Figs. 12, 13; Cushman, 1933c (non *Vermiculum perlucidum* Montagu, 1803), p. 20, pl. 4, Figs. 6–8; Cushman, 1940, p. 221, pl. 21, Fig. 18; Cushman & McCulloch, 1950, p. 342, pl. 46, Figs. 1, 2; He et al., 1965, p. 78, pl. V, Fig. 12; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 82, pl. VII, Fig. 13; Wang et al., 1988, p. 135, pl. XVI, Fig. 16.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D34-01	593	182	182
D34-02	509	157	157

Occurrence and Ecology
The Yellow Sea (St 3400-05, St 3500-08) (34°00′–34°59′ N, 122°30′–123°00′ E), water depth 40.00–72.00 m, temperature 9.25–13.75 °C, salinity 31.12–33.23 ‰, abundance 0.04–0.20 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, United States, Black Sea, Gulf of Mexico, Mediterranean Sea.

Description
Size about 550 μm in length. Test elongated ovate, length:width ratio about 3.3:1. Anterior body portion with neck; posterior end blunted, with about ten ridges. Wall hyaline and transparent, surface smooth, and fine. Aperture terminal, rounded, produced on a long neck.

Remarks
Lagena perlucida has been reported from the Yellow Sea and the East China Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988). Its abundance was usually low in the China Seas. The East China Sea specimen described by Wang (1988) was about only 0.19 mm in length, which was distinctly smaller than the Yellow Sea one.

***Lagena pliocenica* Cushman & Gray, 1946** (Fig. 16)

Lagena pliocenica Cushman & Gray, 1946, p. 68, pl. 12, Figs. 22–25; He et al., 1965, p. 77, pl. V, Fig. 10; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 81, pl. VII, Fig. 6; Wang et al., 1980, p. 195, pl. VIII, Fig. 21.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D59-01	463	238	238
D59-02	489	245	245

Lagena pliocenica Cushman & Gray, 1946

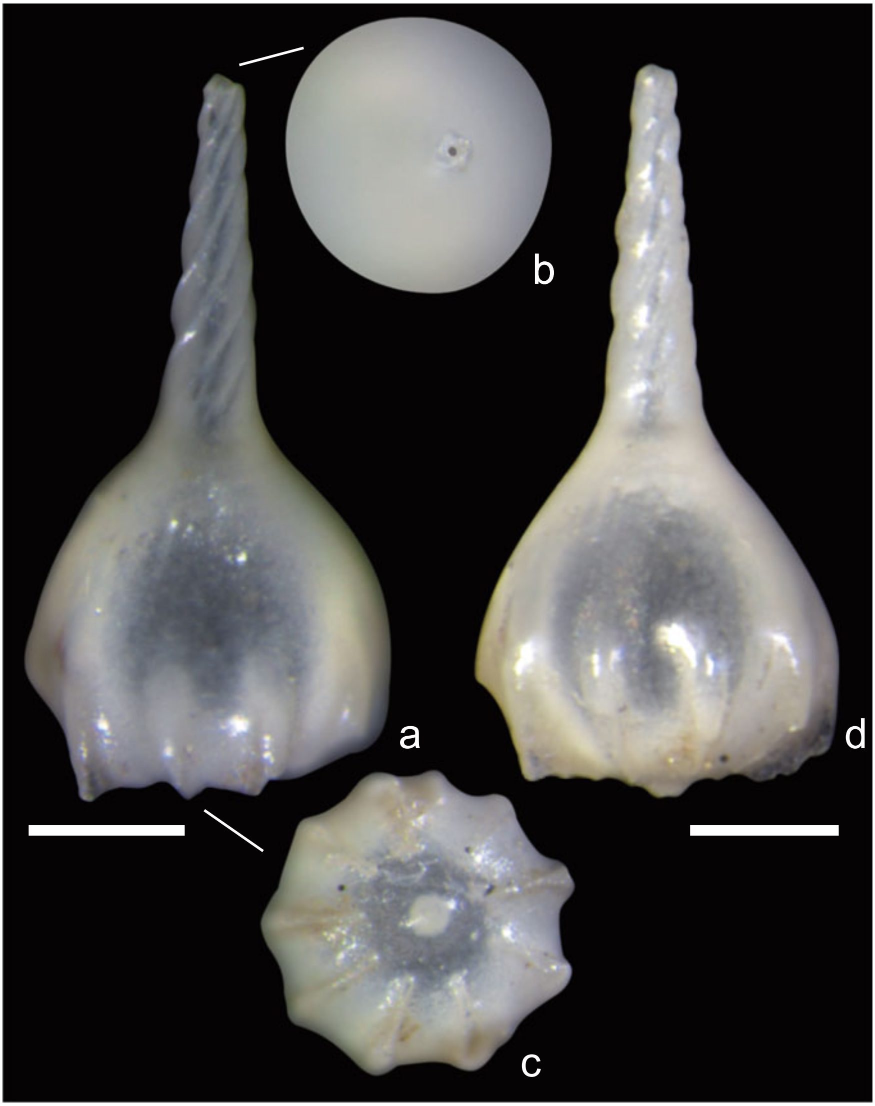

Fig. 16 a–d *Lagena pliocenica* (Cushman & Gray, 1946), two specimens showing morphological variabilities. **a–c** Same specimen with apical (**b**) and antapical views (**c**). **d** Another specimen. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-06, St DH7-3) (27°27′–32°30′ N, 122°25′–124°59′ E), water depth 29.40–92.00 m, temperature 20.30–22.40 °C, salinity 31.00–31.73 ‰, abundance 0.02–4.32 ind./g sed.

Distribution

Yellow Sea.

Japan, New Zealand, South Korea.

Description

Size about 480 µm in length, length:width ratio about 2:1. Test globular in main body portion, anterior portion with a long neck, posterior end truncate. Wall hyaline, anterior portion with spiral ridges in the neck, middle portion smooth, posterior end with about ten distinct large costae. Aperture terminal, rounded.

Remarks

Lagena pliocenica has been reported from the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980). In our investigation this species occurred in three stations in the Yellow Sea with moderate abundance.

Lagena spicata **Cushman & McCulloch, 1950** (Fig. 17)

Lagena sulcata (Walker & Jacob) var. *apiculata* Cushman, 1913b (non *Oolina apiculata* Reuss, 1851), p. 23, pl. 9, Figs. 3, 4.

Lagena sulcata (Walker & Jacob) var. *spicata* Cushman & McCulloch, 1950, p. 360, pl. 48, Figs. 3–7.

Lagena striata paucistriata Yassini & Jones, 1995, pp. 106, 107, Figs. 323, 325.

Lagena sp. A. Hatta & Ujiié, 1992b, p. 167, pl. 22, Fig. 4.

Lagena spicata Cushman & McCulloch, Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 81, pl. VII, Fig. 8; Wang et al., 1980, p. 195, pl. VIII, Fig. 19; Wang et al., 1988, p. 133, pl. XVI, Figs. 9–10; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 160, pl. 7, Fig. 7; Loeblich & Tappan, 1994, p. 78, pl. 139, Figs. 14–16; Hayward et al., 1999, p. 116, pl. 7, Figs. 4–5; Debenay, 2012, p. 152.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H20=B27-01	357	220	220
H20=B27-02	322	223	223

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 11, St 36) (38°22′–39°00′ N, 119°30′–120°07′ E), water depth 25.00–27.00 m, temperature 2.86–3.46 °C, salinity 30.59–30.79 ‰, abundance 0.02–0.10 ind./g sed.

Lagena spicata Cushman & McCulloch, 1950

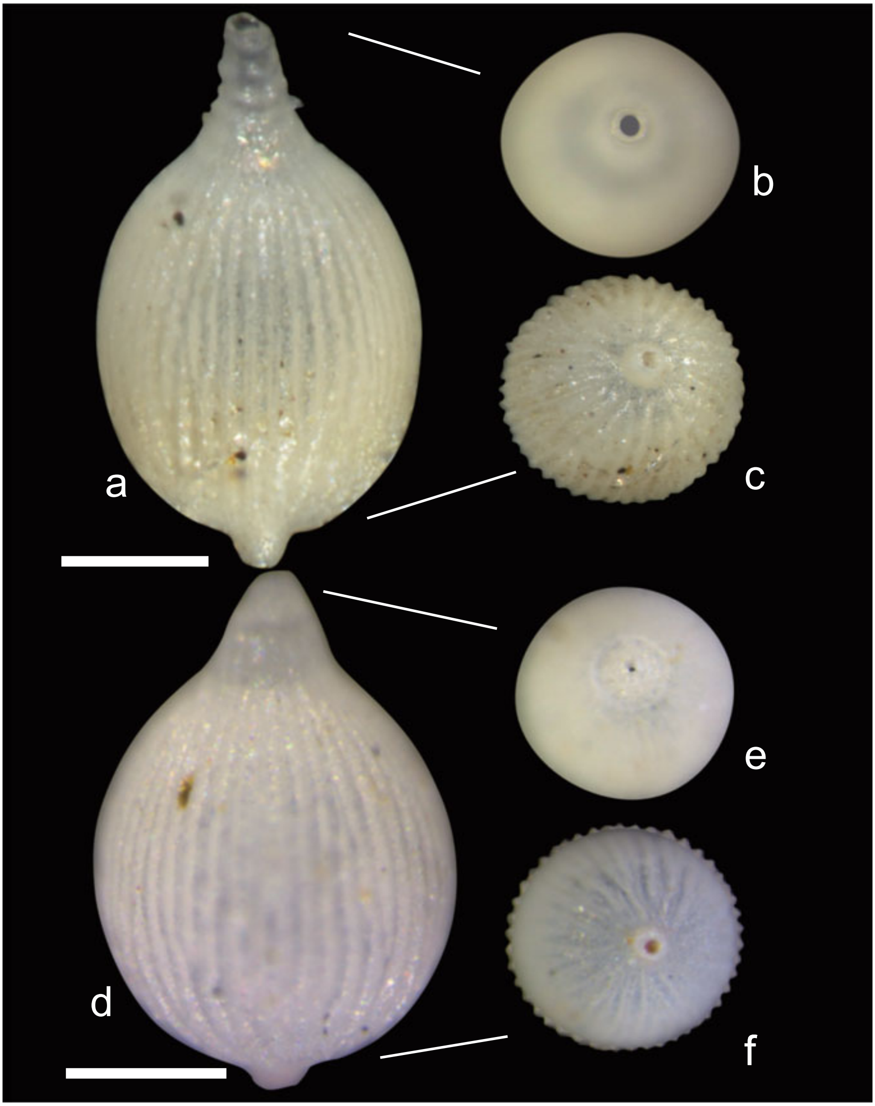

Fig. 17 **a–f** *Lagena spicata* (Cushman & McCulloch, 1950), two specimens showing morphological variabilities. **a–c** Same specimen showing apical (**b**) and antapical views (**c**). **d–f** Another specimen with apical (**e**) and antapical views (**f**). Scale bars = 100 µm

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, New Caledonia, Gulf of Mexico.

Description

Size about 340 μm in length, length:width ratio about 1.5:1 (specimens were incomplete). Test globular to ovate, with a neck in anterior portion and a protuberance at the posterior end. Wall hyaline, surface with densely arranged longitudinal striations in the main body portion, with transverse striations in the neck. Aperture terminal and rounded, produced on neck.

Remarks

Lagena spicata has been reported from continental shelf sediments of the Yellow Sea and the East China Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species but usually with low abundance.

***Lagena striata* (d'Orbigny, 1839)** (Fig. 18)

Oolina striata d'Orbigny, 1839, p. 21, pl. 5, Fig. 12.

Lagena striata Brady, 1884, p. 460, pl. 57, Figs. 22, 24, 28, 29; He et al., 1965, p. 76, pl. V, Fig. 11; Lin et al., 1978, p. 66, pl. 15, Fig. 10; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 66, pl. 151, Fig. 5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H60-01	302	158	158
H60-02	316	179	179
H60-03	295	169	169

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-06, St 3300-06, St 3400-05, St 3500-02, St 3800-02) (31°49′–38°00′ N, 120°00′–125°00′ E), water depth 30.00–59.00 m, temperature 8.35–18.08 °C, salinity 30.82–32.74 ‰, abundance 0.04–0.74 ind./g sed.

Distribution

Yellow Sea.

Bay of Biscay, English Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, Gulf of Mexico, Mediterranean Sea.

Lagena striata (d'Orbigny, 1839)

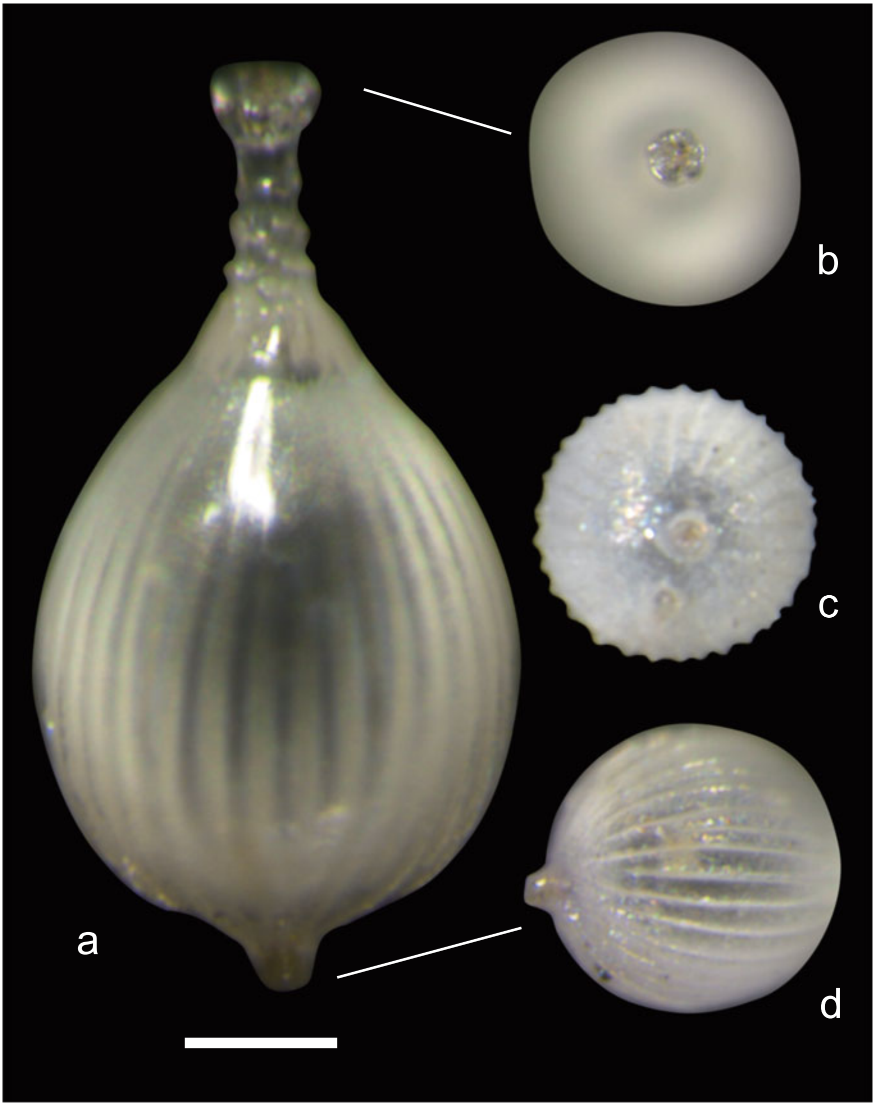

Fig. 18 a–d *Lagena striata* (d'Orbigny, 1839), the same specimen with different side of views. **b** Apical view. **c** Antapical view. **d** Posterior portion showing bottom protuberance. Scale bar = 50 μm

Description
Size about 300 μm in length, length:width ratio about 1.9:1. Test unilocular, ovate in main body portion, with a neck in anterior portion and a protuberance at the posterior end. Wall hyaline, fine and transparent, surface with longitudinal striations in main body portion and several transverse striae in neck. Aperture with a phialine lip, produced on neck.

Remarks
Lagena striata has been reported from the Yellow Sea (He et al., 1965; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It was a common species in the Yellow Sea.

***Lagena strumosa* Reuss, 1858** (Fig. 19)

Lagena striata strumosa Reuss, 1858, p. 434; Yassini & Jones, 1995, p. 107, Figs. 321–322, 326–327, 330–331.
Lagena strumosa Reuss, Debenay, 2012, p. 153.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H64-01	436	239	239

Occurrence and Ecology
The Yellow Sea (St 3400-06, St 3400-08, St 3500-06) (33°59′–34°59′ N, 121°59′–123°00′ E), water depth 52.00–67.80 m, temperature 12.00–12.31 °C, salinity 31.14–31.91 ‰, abundance 0.24–0.60 ind./g sed.

Distribution
Yellow Sea.
Gulf of Aqaba, Japan, New Zealand, New Caledonia.

Description
Size about 400 μm in length, length:width ratio about 1.8:1. Test globular in main body portion, with a neck in anterior portion and a small protuberance at the posterior end. Wall hyaline. Surface strumose and with longitudinal costae in main body portion, but smooth and with transverse striae in neck. Aperture rounded, with a phialine lip, produced on the neck.

Remarks
Lagena strumosa is a new record to China Sea. In the Yellow Sea it occurred in three stations with medium abundance.

Lagena strumosa Reuss, 1858

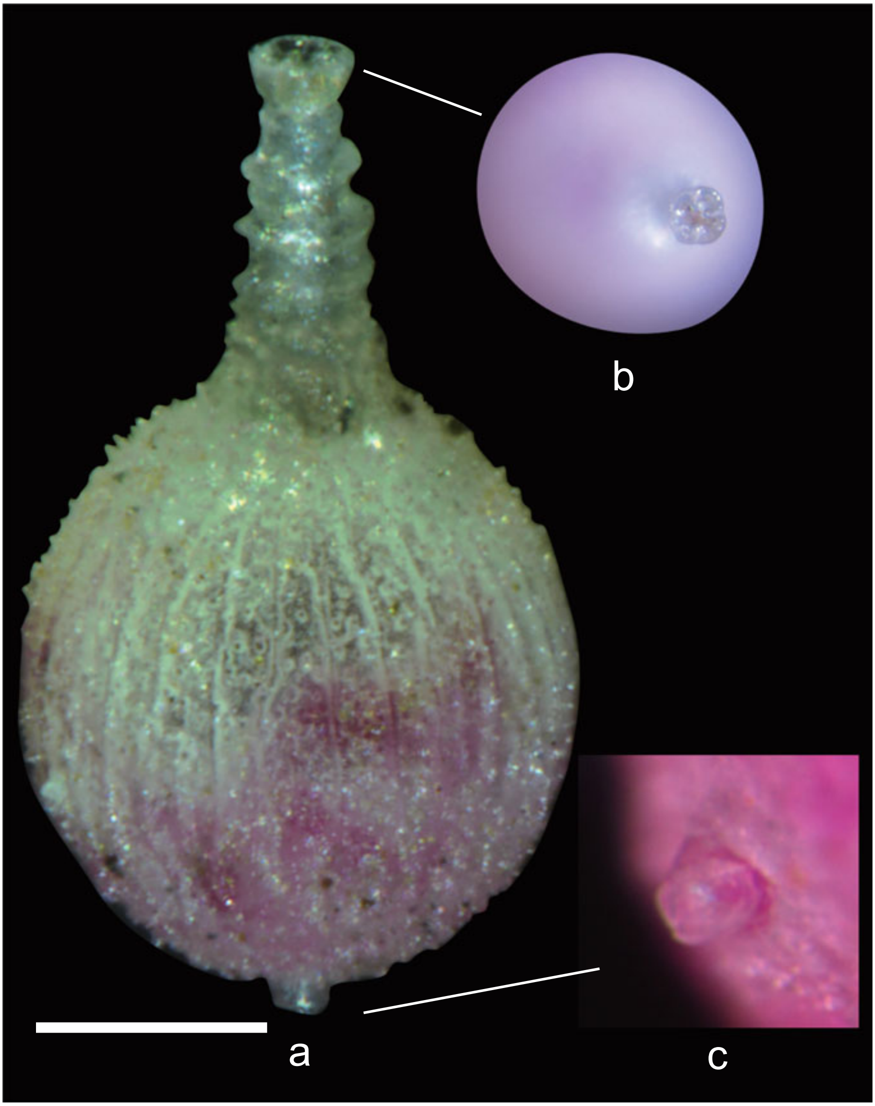

Fig. 19 **a–c** *Lagena strumosa* Reuss, 1858, a live specimen showing different side of views. **b** Apical view. **c** Bottom view showing protuberance. Scale bar = 100 µm

Lagena substriata Williamson, 1848 (Fig. 20)

Lagena vulgaris var. *substriata* Williamson, 1858, p. 7, pl. 1, Fig. 14.

Lagena striata (d'Orbigny) var. *substriata* Williamson, Cushman, 1913b, p. 20, pl. 8, Figs. 1–3.

Lagena substriata Williamson, 1848

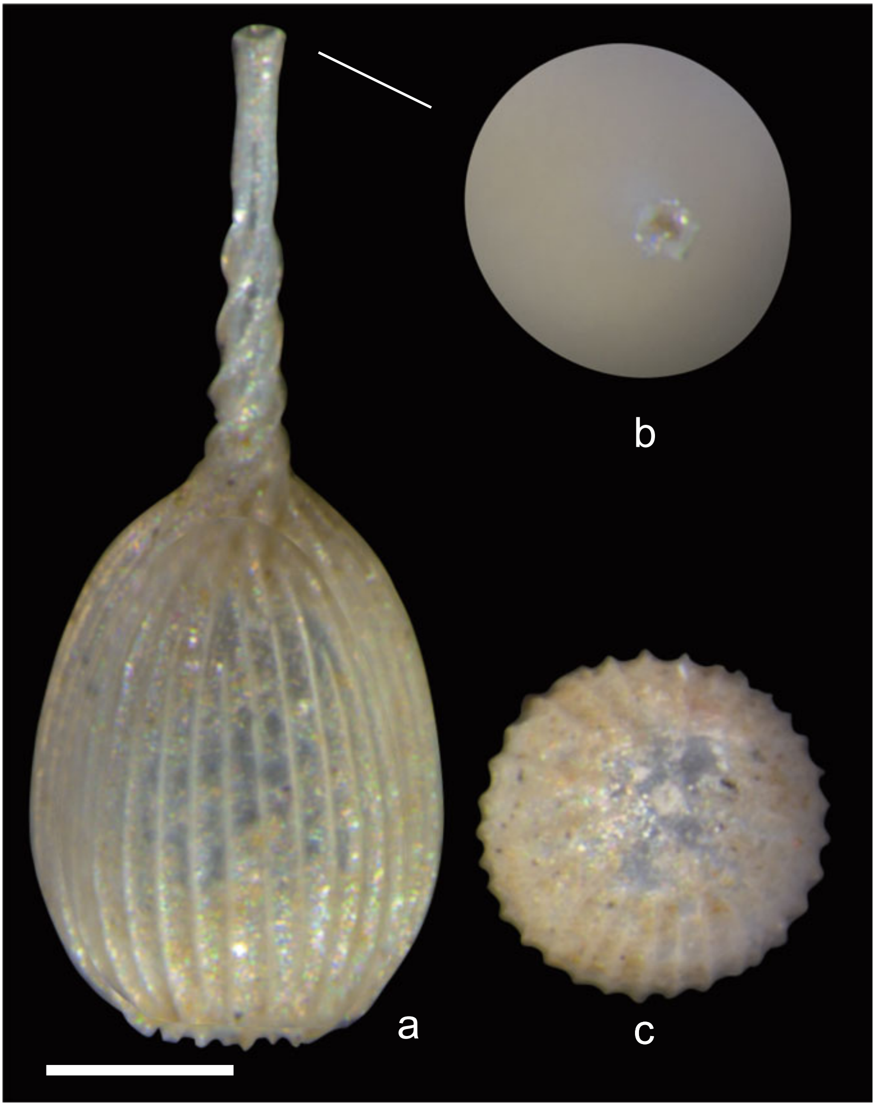

Fig. 20 a–c *Lagena substriata* Williamson, 1848, same specimen showing different side of views. **b** Apical view. **c** Antapical view. Scale bar = 100 μm

Lagena aff. *substriata* Williamson, Ōki, 1989, p. 96, pl. 7, Fig. 1.

Lagena sulcata Walker & Jacob, Ujiié, 1990a (non Walker & Jacob, 1798), p. 19, pl. 5, Fig. 7.

Lagena substriata Williamson, 1848, p. 15, pl. 2, Fig. 12; Cushman, 1923, p. 56, pl. 10, Fig. 11; Hada, 1931, p. 108, text Fig. 64; He et al., 1965, p. 77, pl. V, Figs. 7–8;

Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 14, pl. 3, Fig. 4; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 82, pl. VII, Fig. 9; Wang et al., 1980, p. 195, pl. VIII, Fig. 18; Wang et al., 1988, p. 134, pl. XVI, Fig. 17; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 161, pl. 7, Fig. 18; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 67, pl. 151, Fig. 7; Loeblich & Tappan, 1994, p. 79, pl. 138, Figs. 1–5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D37=B73-01	551	217	217
D37=B73-02	390	190	190

Occurrence and Ecology

The Yellow Sea (St 3500-02, St 3500-10, St 3700-01, St 3800-02) (35°00′–38°00′ N, 120°00′–123°59′ E), water depth 29.00–81.00 m, temperature 7.54–10.68 °C, salinity 30.31–33.39 ‰, abundance 0.18–0.64 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Bay of Fundy, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, United States, Vineyard Sound.

Description

Size about 470 μm in length, length:width ratio about 2.2:1. Test unilocular and ovate in main body portion, with a long neck in anterior portion; posterior end blunted without protuberance. Wall hyaline; surface with densely longitudinal striae in main body portion but spiral striae in neck. Aperture terminal and rounded.

Remarks

Lagena substriata has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), the Yellow Sea, the East China Sea, the Okinawa Trough (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980, 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species and usually abundant in the continental shelf sediments of the China Seas.

***Lagena hispida* Reuss, 1858** (Fig. 21)

Lagena hispida Reuss, 1858, p. 434; Reuss, 1863b, p. 335, pl. 6, Figs. 77–79; Brady, 1884, p. 450, pl. 57, Figs. 1–4; Barker, 1960, p. 116, pl. 57, Figs. 1–4;

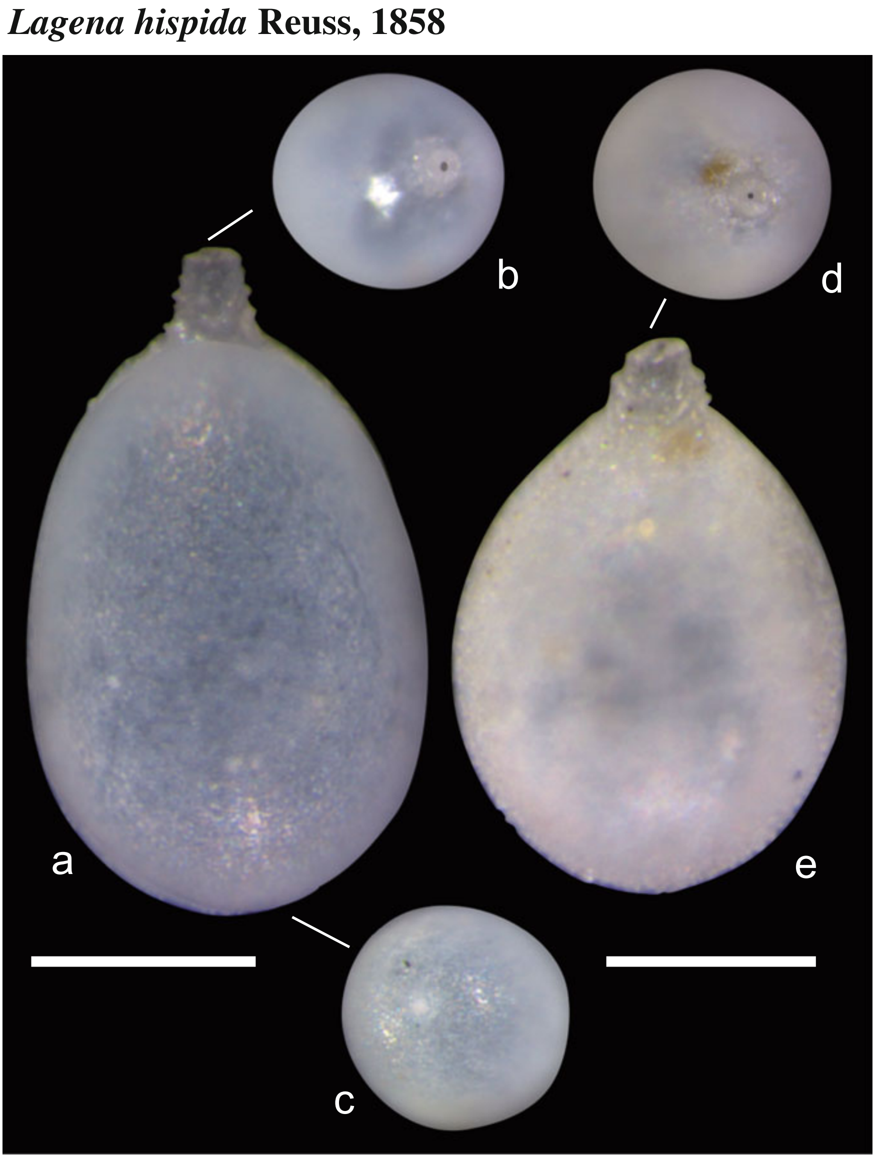

Fig. 21 **a–e** *Lagena hispida* (Reuss, 1858), two specimens showing morphological variabilities. **a–c** Same specimen showing apical (**b**) and antapical (**c**) views. **d, e** Another specimen. Scale bars = 100 μm

He et al., 1965, p. 77, pl. V, Fig. 9; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 82, pl. VII, Fig. 10; Wang et al., 1980, p. 195, pl. VIII, Fig. 20; Wang et al., 1988, p. 135, pl. XVI, Fig. 12; Ujiié, 1990a, p. 18, pl. 5, Fig. 2.

Pygmaeoseistron hispidum (Réuss, 1863), Loeblich & Tappan, 1994, p. 80, pl. 141, Figs. 4–6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H8-01	292	173	173
H8-02	267	190	190

Occurrence and Ecology
The Yellow Sea (St CJ-02, St CJ-06, St 3400-05) (31°49′–34°00′ N, 122°30′–125°00′ E), water depth 40.00–55.20 m, temperature 13.75–18.08 °C, salinity 31.12–32.74 ‰, abundance 0.02–0.16 ind./g sed.

Distribution
Yellow Sea, East China Sea, Okinawa Trough.

Japan, New Zealand, North Atlantic Ocean, Sahul Shelf, Gulf of Mexico.

Description
Size about 280 μm in length, length:width ratio about 1.5:1. Test ovate to elongate ovate in main body portion, with a neck in anterior portion; posterior end bluntly rounded. Wall hyaline, surface nebulous, without many striae or costae in main body portion, but several transverse striae in neck. Aperture terminal and rounded, produced on the neck.

Remarks
Lagena hispida has been reported from the Yellow Sea, the East China Sea and the Okinawa Trough (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980, 1988). It is a common species but usually with low abundance in continental shelf sediments of the Yellow Sea and the East China Sea.

Genus *Procerolagena* Puri, 1954

***Procerolagena clavata* (d'Orbigny, 1846)** (Fig. 22)

Lagena clavata Williamson, 1858, p. 5, pl. 1, Fig. 6; Cushman, 1921, p. 174; Cushman, 1940, p. 336, pl. 44, Fig. 13; He et al., 1965, p. 78, pl. V, Fig. 6; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 83.

Procerolagena clavata (d'Orbigny, 1846)

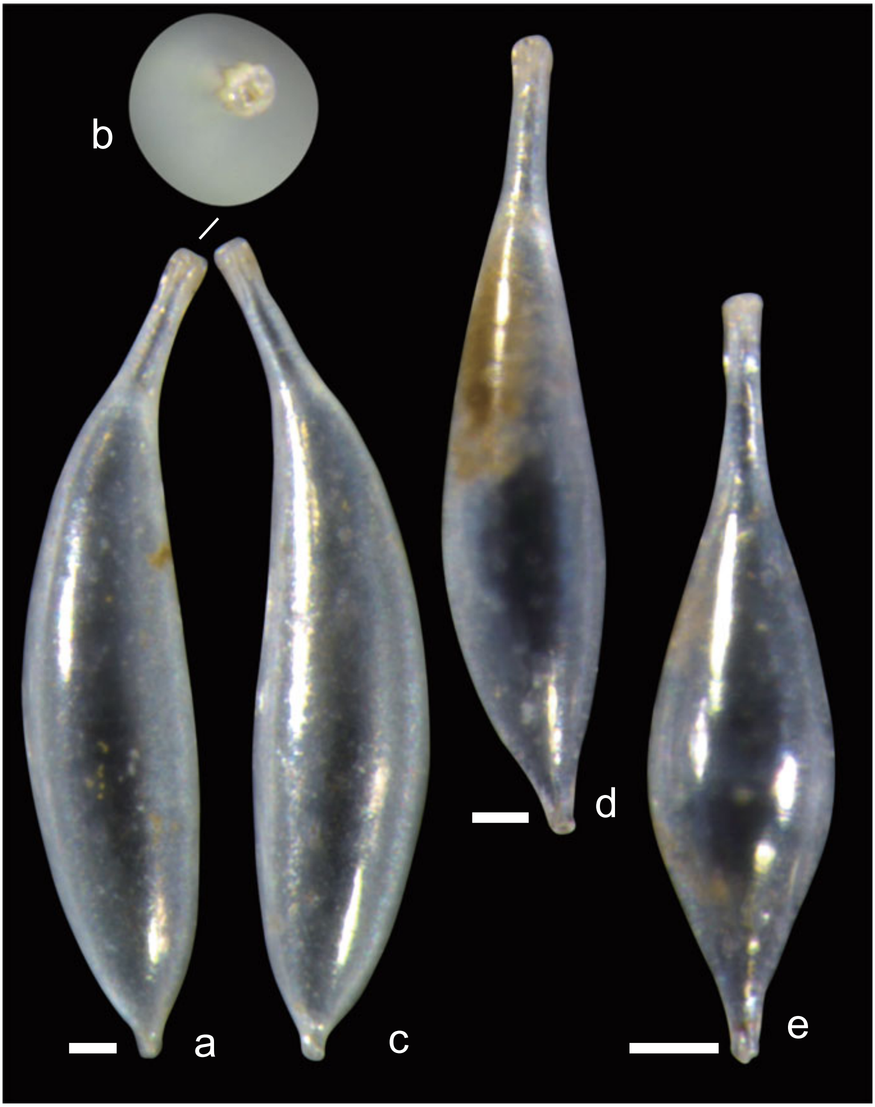

Fig. 22 **a–e** *Procerolagena clavata* (d'Orbigny, 1846) three specimens showing morphological variabilities. **a–c** Same specimen with different side of views. **b** Apical view. **d** Another specimen. **e** The third specimen. Scale bars = 50 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B95=H51-01	747	170	170
B95=H51-02	544	114	114
B95=H51-03	419	104	104

Occurrence and Ecology

The Bohai Sea (St 22, 8-10 cm sediment) and the Yellow Sea (St 3875-01) (38° 44′ N, 121°59′ E), water depth 51.00 m, temperature 7.39 °C, salinity 31.62 ‰, abundance 0.31 ind./g sed.

Distribution

Yellow Sea.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, United States, Northeast U.S. Continental Shelf, Scotian Shelf.

Description

Size about 600 μm in length, length:width ratio about 4.4:1. Test slender and elongate, with a slender neck and an apiculate base. Some specimens may be slightly curved in main body portion. Wall nonperforate, optical transparent, surface fine, and smooth without striae. Aperture rounded, at the end of the neck.

Remarks

Procerolagena clavata has been identified as *Lagena clavata*, which was found from the Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978). It is a rare species with low abundance in the Yellow Sea.

***Procerolagena gracilis* (Williamson, 1848)** (Fig. 23)

Lagena gracilis Williamson, 1848, p. 13, pl. 1, Figs. 3–4; Cushman, 1913b, p. 24, pl. 8, Figs. 5–6.

Procerolagena cf. *P. gracilis* (Williamson), Debenay, 2012, p. 160.

Procerolagena gracilis (Williamson), Loeblich & Tappan, 1987, p. 416, pl. 455, Fig. 2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H98-01	522	121	121
H98-02	485	119	119

Procerolagena gracilis (Williamson, 1848)

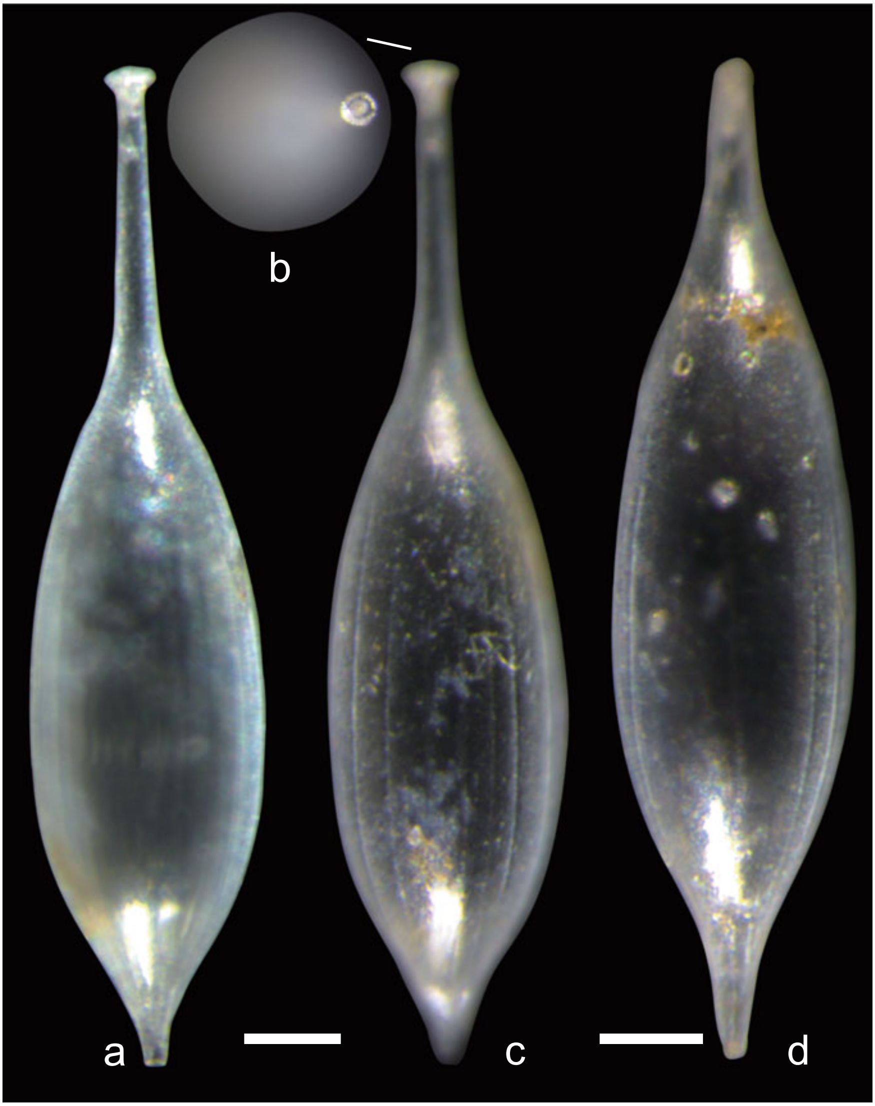

Fig. 23 **a–d** *Procerolagena gracilis* (Williamson, 1848), two specimens showing morphological variabilities. **a–c** The same specimen showing different views. **b** Apical view. **d** Another specimen. Scale bars = 50 μm

Occurrence and Ecology

The Yellow Sea (St CJ-01, St 3300-04) (33°00′–31°40′ N, 122°29′–122°59′ E), water depth 30.00–59.00 m, temperature 20.60–22.40 °C, salinity 30.87–31.73 ‰, abundance 0.02–0.08 ind./g sed.

Distribution

Yellow Sea.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, South Korea, South Pacific Ocean, United States, New Caledonia, Northeast U.S. Continental Shelf, Scotian Shelf, Southeast U.S. Continental Shelf, North Western Weddell Sea, Gulf of Mexico, Mediterranean Sea.

Description

Size about 500 μm in length, length:width ratio about 4.2:1. Test slender and elongate, with a long neck in anterior portion, nearly parallel margins tapering to an apiculate base in posterior portion. Wall nonperforate, optical transparent; surface fine and smooth, with longitudinal striae. Aperture terminal, rounded, at the end of the neck, bordered by an everted lip.

Remarks

Procerolagena gracilis is characterized by having a long neck in anterior portion and slender test shape. In the Yellow Sea it occurred only in two stations with very low abundance.

Family Polymorphinidae d'Orbigny, 1839

Genus *Globulina* d'Orbigny, 1839

***Globulina minuta* (Roemer, 1838)** (Figs. 24, 25)

Polymorphina minuta Roemer, 1838, p. 386, pl. 3, Fig. 35.
Globulina minuta Cushman & Ozawa, 1930, p. 83, pl. 20, Figs. 3, 4; He et al., 1965, p. 81, pl. V, Fig. 19.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H23-01	523	265	265
B55=H23-02	443	232	232

Occurrence and Ecology

The Bohai Sea (St 22, 10-12 cm sediment) and the Yellow Sea (St B-03) (38°25′ N, 121°57′ E), water depth 50.00 m, temperature 7.72 °C, salinity 31.67 ‰, abundance 0.75 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

New Zealand, North Atlantic Ocean, South Korea.

Globulina minuta (Roemer, 1838)

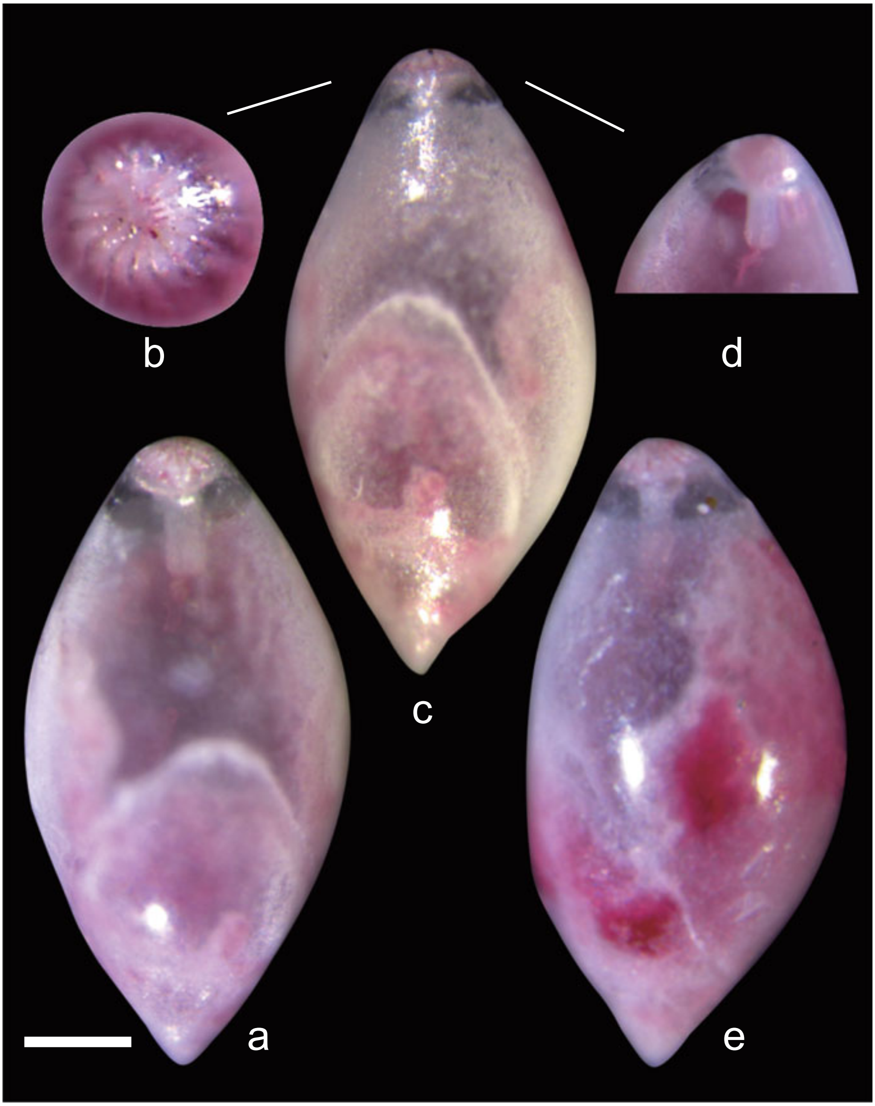

Fig. 24 a–e *Globulina minuta* (Roemer, 1838), a live specimen with different side of views. **b** Apical view showing aperture. **d** Anterior body portion showing fistula. Scale bar = 100 μm

Description

Size about 500 μm in length, length:width ratio about 2:1. Test ovate in side view and circular in section. Chambers strongly overlapping in three planes in later stage. Sutures oblique and distinctly, indistinctly depressed. Wall translucent, perforate, surface smooth. Aperture terminal and radiate, with a fistula.

Globulina minuta (Roemer, 1838)

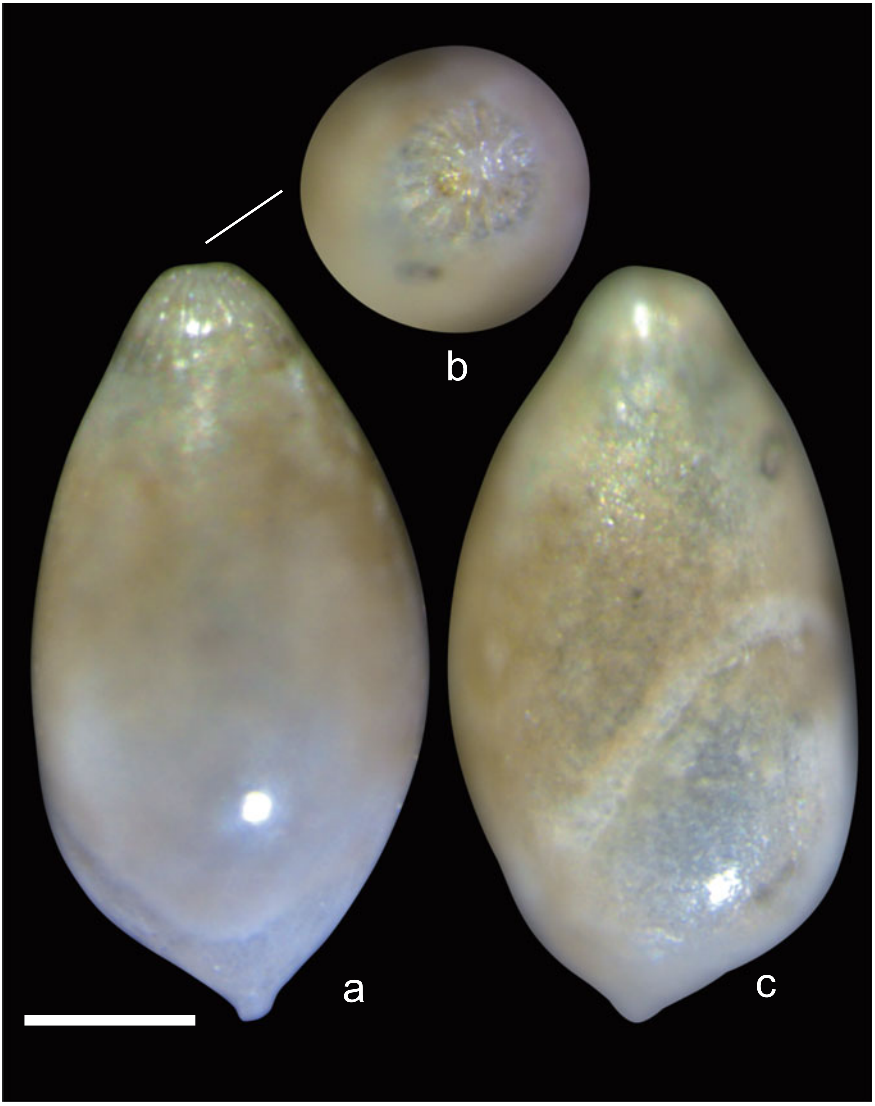

Fig. 25 a–c *Globulina minuta* (Roemer, 1838), same specimen with different side of views. **b** Apical view showing cross section outline and aperture. Scale bar = 100 μm

Remarks

Globulina minuta has been reported by He et al. (1965) from the South Yellow Sea sediment. In our investigation, this species occurred in surface sediments of the Bohai Sea and the Yellow Sea with high abundance.

Genus *Guttulina* d’Orbigny, 1839

Guttulina kishinouyi **Cushman & Ozawa, 1930** (Fig. 26)

Guttulina sp., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 84, pl. VIII, Fig. 2.

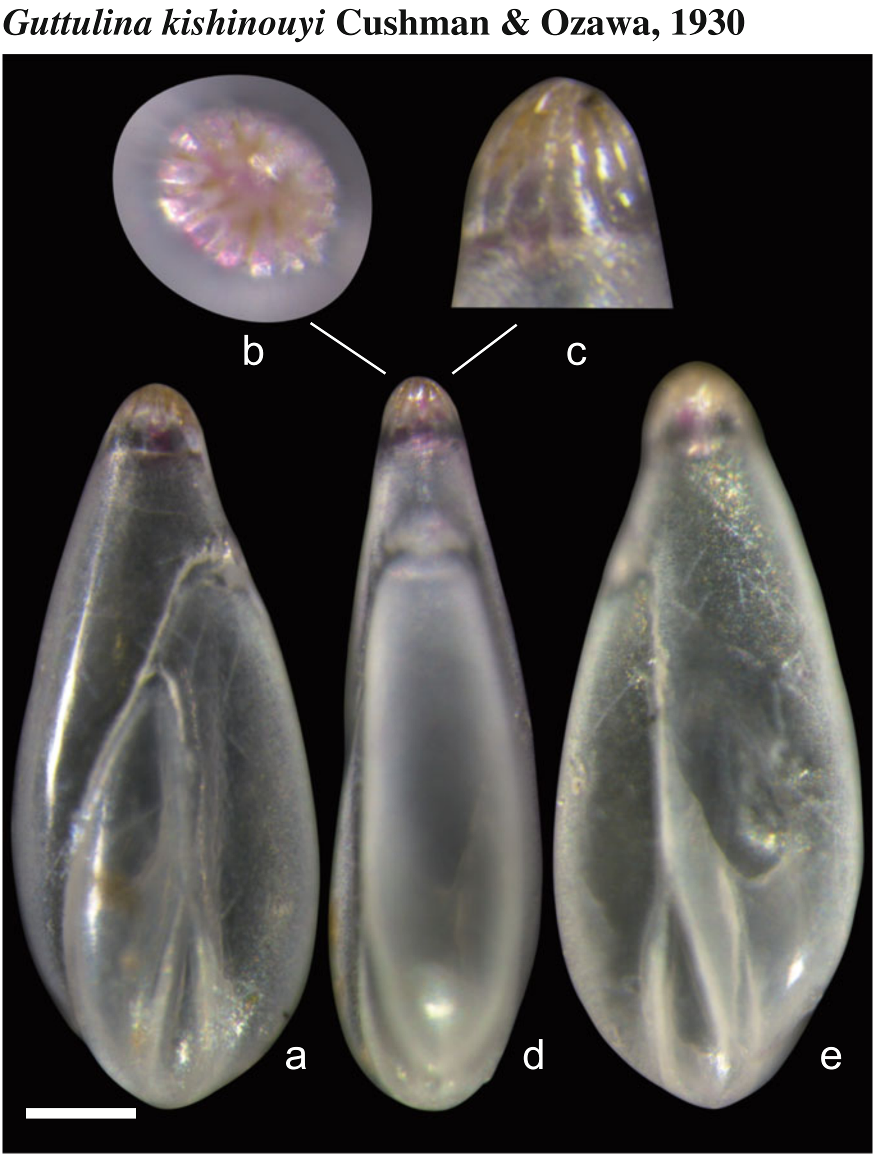

Fig. 26 **a–e** *Guttulina kishinouyi* (Cushman & Ozawa, 1930), same specimen with different side of views. **b** Apical view showing cross section outline and aperture. **c** Anterior portion showing aperture. Scale bar = 100 μm

Guttulina kishinouyi Cushman & Ozawa, 1930, p. 40, pl. 8, Figs. 5, 6; He et al., 1965, p. 81, pl. V, Fig. 18.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D134-01	659	275	190
D134-02	612	232	182

Occurrence and ecology
The Yellow Sea (St CJ-01, St DH5-1) (29°08′–31°40′ N, 122°28′–122°29′ E), water depth 29.40–42.00 m, temperature 22.40 °C, salinity 31.73 ‰, abundance 0.02–0.25 ind./g sed.

Distribution
Yellow Sea.
Japan, South Korea.

Description
Size about 650 μm in length, length:width ratio about 2.5:1. Test elongated ovate. Chambers slight inflated and strongly overlapping. Sutures distinct and slightly depressed. Wall hyaline, surface smooth. Aperture terminal and radiate.

Remarks
Guttulina kishinouyi has been reported from the South Yellow Sea sediments (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978). In our investigation it also occurred in the South Yellow Sea area. Its abundance was low.

***Guttulina regina* (Brady, Parker & Jones, 1870)** (Fig. 27)

Polymorphina regina Brady, Parker & Jones, 1870, p. 241, pl. 41, Fig. 32; Brady, 1884, p. 571, pl. 73, Figs. 11–13.

Guttulina regina (Brady, Parker & Jones), Cushman & Ozawa, 1930, p. 34, pl. 6, Figs. 1, 2; Hada, 1931, p. 112, text Fig. 69; Leroy, 1941b, p. 77, pl. 1, Figs. 6, 7; Wang et al., 1988, p. 142, pl. XVIII, Fig. 22; Loeblich & Tappan, 1994, p. 82, pl. 146, Figs. 1–3; Parker, 2009, p. 405, Fig. 292; Debenay, 2012, p. 240.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D126-01	672	253	253

Guttulina regina (Brady, Parker & Jones, 1870)

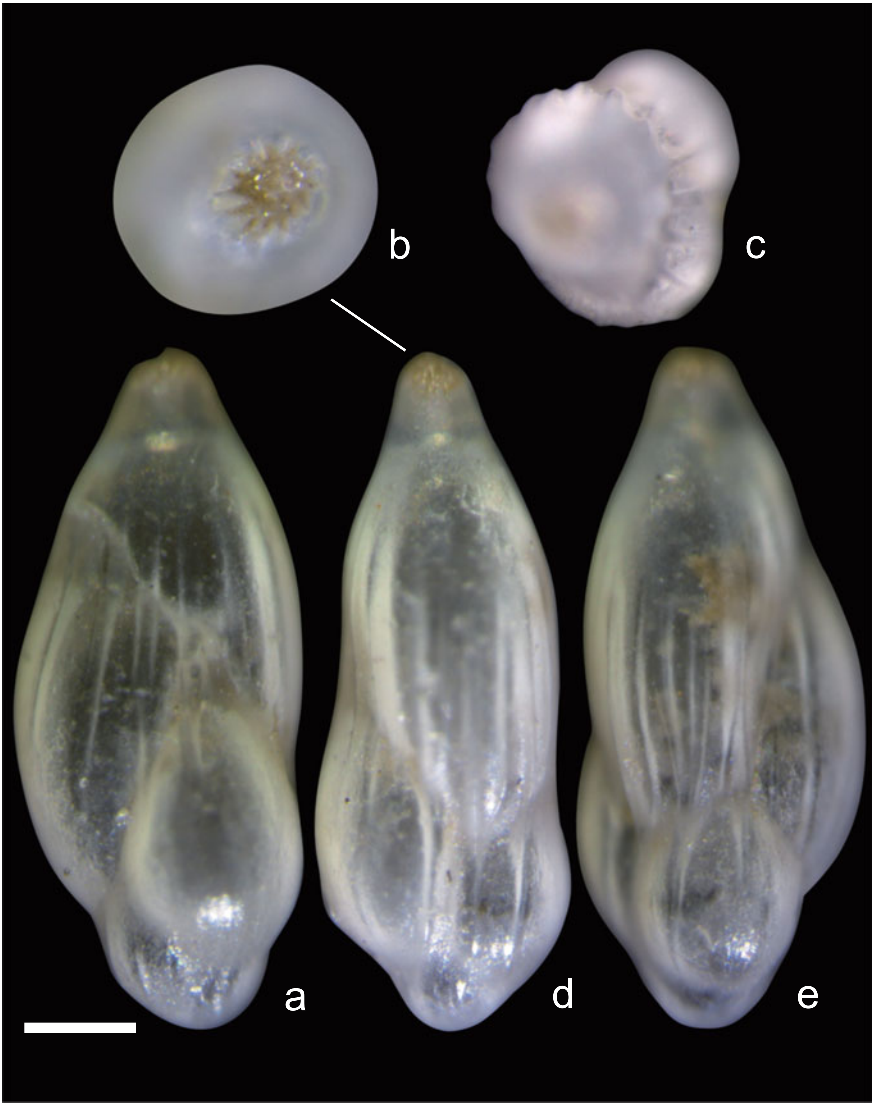

Fig. 27 a–e *Guttulina regina* (Brady, Parker & Jones, 1870), the same specimen with different side of views. **b** Apical view showing aperture. **c** Antapical view showing cross section outline. Scale bar = 100 μm

Occurrence and Ecology

The Yellow Sea (St 3000-02) (29°59′ N, 123°00′ E), water depth 42.77 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 0.27 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, North Atlantic Ocean, South Korea, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 700 μm in length, length:width ratio about 2.7:1. Test elongated ovate. Chambers distinctly inflated and strongly overlapping. Sutures distinct, heavily depressed. Wall hyaline and radial, surface striated. Aperture terminal and radiate.

Remarks

Guttulina regina has been reported from the East China Sea sediments (Wang et al., 1988). The East China Sea specimen was about 0.34 mm in length, was smaller than that from the Yellow Sea. This species is unfrequently occurred and with low abundance in the continental shelf sediments of the China Seas.

Family Ellipsolagenidae A. Silvestri, 1923

Genus *Favulina* Patterson & Richardson, 1987

***Favulina hexagona* (Williamson, 1848)** (Fig. 28)

Entosolenia squamosa (Montagu) var. α *hexagona* Williamson, 1848, p. 20, pl. 2, Fig. 23; Williamson, 1858, p. 13, pl. 1, Fig. 32.

Lagena favosa Reuss, 1863, p. 334, pl. 5, Figs. 72–73.

Lagena hexagona (Williamson), Cushman, 1913b (part), p. 17, pl. 6, Fig. 3 (not Figs. 1, 2).

Oolina hexagona (Williamson), Murray, 1971, p. 93, pl. 37, Figs. 1–3; Albani, 1978, p. 379, Fig. 7N; Lin et al., 1978, p. 74, pl. 17, Fig. 13; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 83, pl. VII, Fig. 27; Wang et al., 1980, p. 195, pl. VIII, Fig. 22; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 173, pl. 11, Fig. 10; Wang et al., 1988, p. 143, pl. XIX, Figs. 4–5; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 76, pl. 153, Fig. 1; Holbourn et al., 2013, p. 382.

Favulina hexagona (Williamson), Patterson & Richardson, 1988, p. 249, Figs. 32, 33; Loeblich & Tappan, 1994, p. 86, pl. 151, Figs. 11, 12; Debenay, 2012, p. 144.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B98-01	193	162	162

Favulina hexagona (Williamson, 1848)

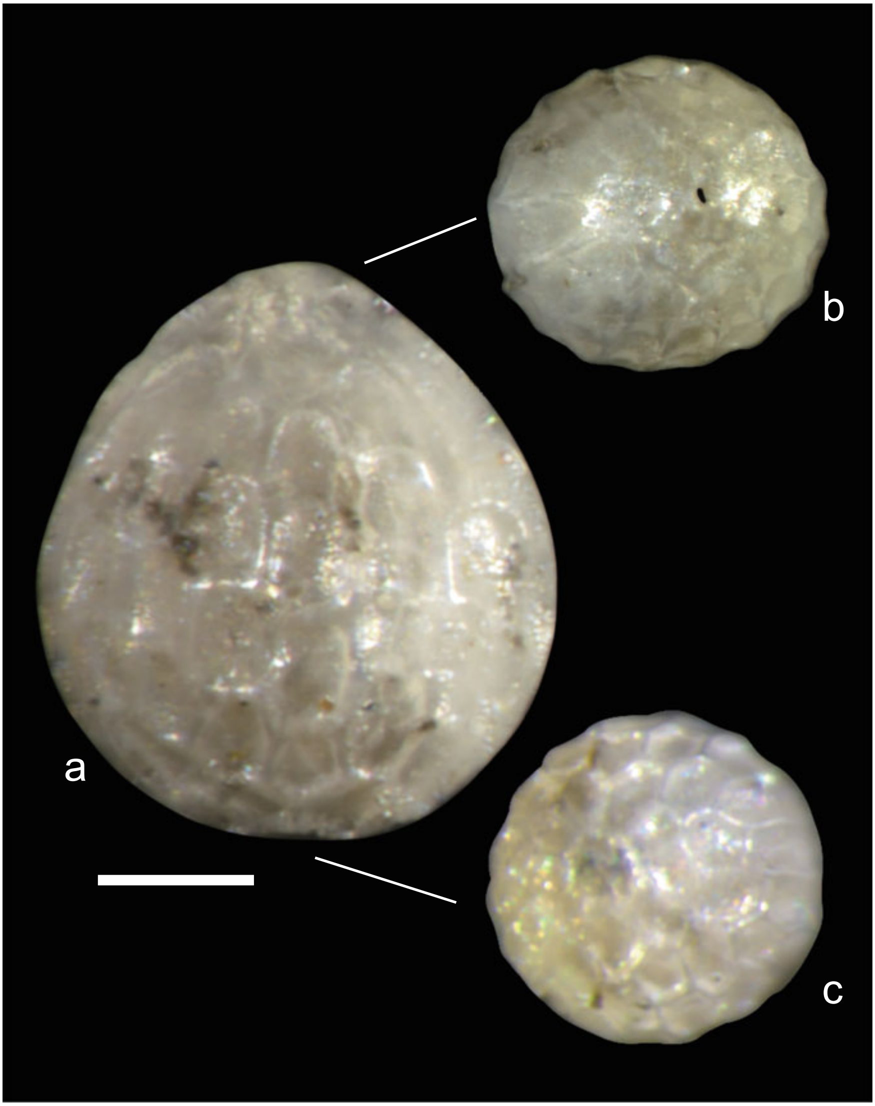

Fig. 28 a–c *Favulina hexagona* (Williamson, 1848), the same specimen with different side of views. **b** Apical view. **c** Antapical view. Scale bar = 50 µm

Occurrence and Ecology

The Bohai Sea (St 22, 4-6 cm sediment) (38°21′ N, 120°08′ E), water depth 26.00 m, temperature 2.36 °C, salinity 30.30 ‰, abundance 0.08 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea, South China Sea, Okinawa Trough.

Bay of Biscay, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, New Caledonia, Scotian Shelf, Gulf of Mexico, Mediterranean Sea.

Description
Size about 200 μm in length, length:width ratio about 1.2:1. Test golf ball like, subglobular in out line, circular in section. Wall translucent, surface covered by elevated ridges forming large polygonal reticulations. Aperture rounded.

Remarks
Favulina hexagona has been identified as *Oolina hexagona* in previous Chinese publications (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988; Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It was a common species in the continental shelf sediments of China Seas.

Genus *Oolina* d'Orbigny, 1839

Oolina laevigata **d'Orbigny, 1839** (Fig. 29)

Oolina laevigata d'Orbigny, 1839, p. 19, pl. 5, Fig. 3; Loeblich & Tappan, 1987, p. 427, pl. 463, Figs. 8–9; Wang et al., 1988, p. 143, pl. XIX, Fig. 12.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D94-01	260	195	195

Occurrence and Ecology
The Yellow Sea (St 3300-04) (32°59′ N, 123°00′ E), water depth 32.80 m, temperature 20.20 °C, salinity 31.36 ‰, abundance 0.02 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Irish Sea and St. George's Channel, North Atlantic Ocean.

Description
Size about 250 μm in length, length:width ratio about 1.3:1. Test near globular to ovate, circular in section. Wall hyaline, radial and transparent, surface smooth. Aperture rounded, slightly produced on a short neck.

Oolina laevigata d'Orbigny, 1839

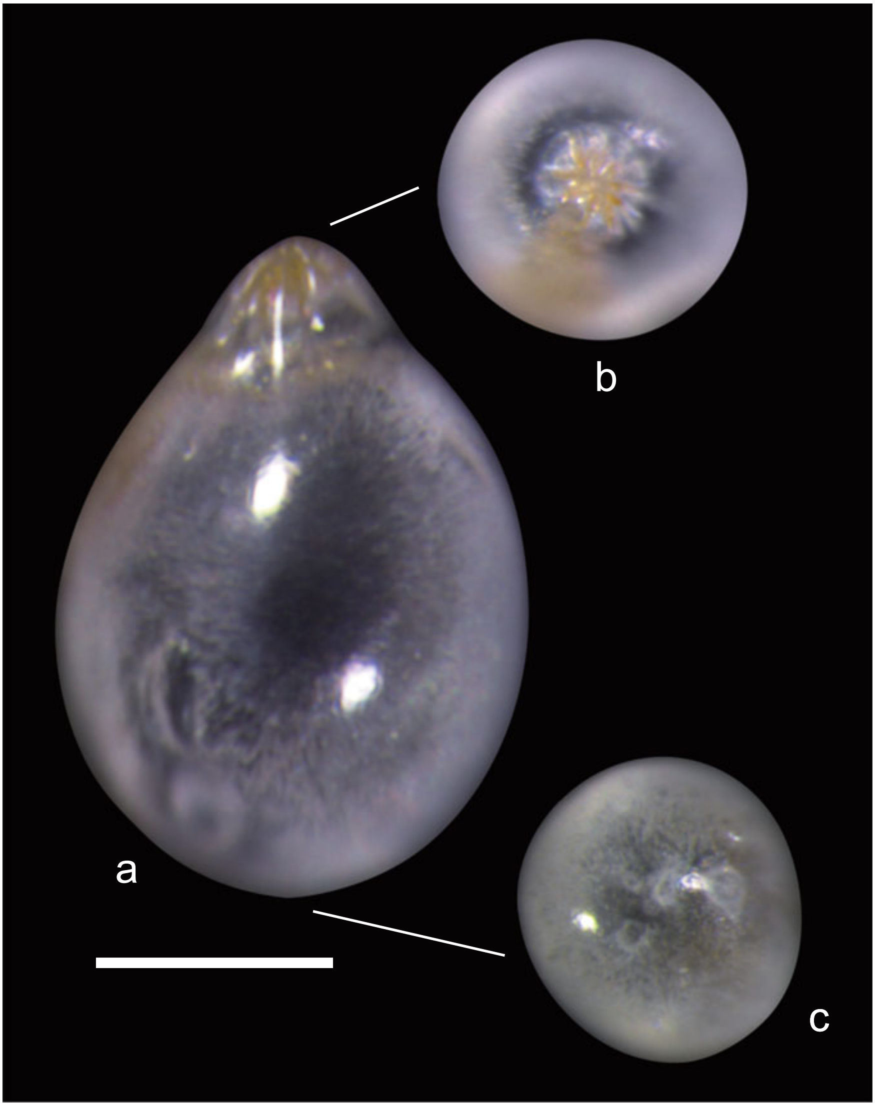

Fig. 29 **a–c** *Oolina laevigata* d'Orbigny, 1839, the same specimen with different side of views. **b** Apical view showing aperture. **c** Antapical view. Scale bar = 100 μm

Remarks

Oolina laevigata has been reported from sediments of the East China Sea (Wang et al., 1988). In our investigation it occurred in the Yellow Sea only in one station. Its abundance was low in the China Seas.

Genus *Fissurina* Reuss, 1850

***Fissurina crebra* (Matthes, 1939)** (Fig. 30)

Lagena crebra Matthes, 1939, p. 72, pl. 5, Figs. 66–70.

Fissurina crebra (Matthes), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 80, pl. VI, Fig. 9; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 18, pl. 3, Fig. 19; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 169, pl. 11, Fig. 6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H73-01	252	235	143
H73-02	277	246	150

Occurrence and Ecology
The Yellow Sea (St 3400-06, St 3400-08) (33°59′–33°59′ N, 123°00′–123°58′ E), water depth 67.80–80.00 m, temperature 10.01–12.00 °C, salinity 31.91–32.94 ‰, abundance 0.12–0.24 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, Okinawa Trough.

Japan, South Pacific Ocean.

Description
Size about 260 μm in length, length:width ratio about 1.1:1. Test rounded in outline, oval in section. Periphery with keels forming a distinct thin layer surrounded the body sides. Wall hyaline, finely perforate, surface smooth. Aperture slitlike within a slightly depressed fissure at the apex, provided internally with an entosolenian tube in central of test.

Remarks
Fissurina crebra has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), the South Yellow Sea and the Okinawa Trough (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). In our investigation this species was rarely occurred and with low abundance in the Yellow Sea.

Fissurina crebra (Matthes, 1939)

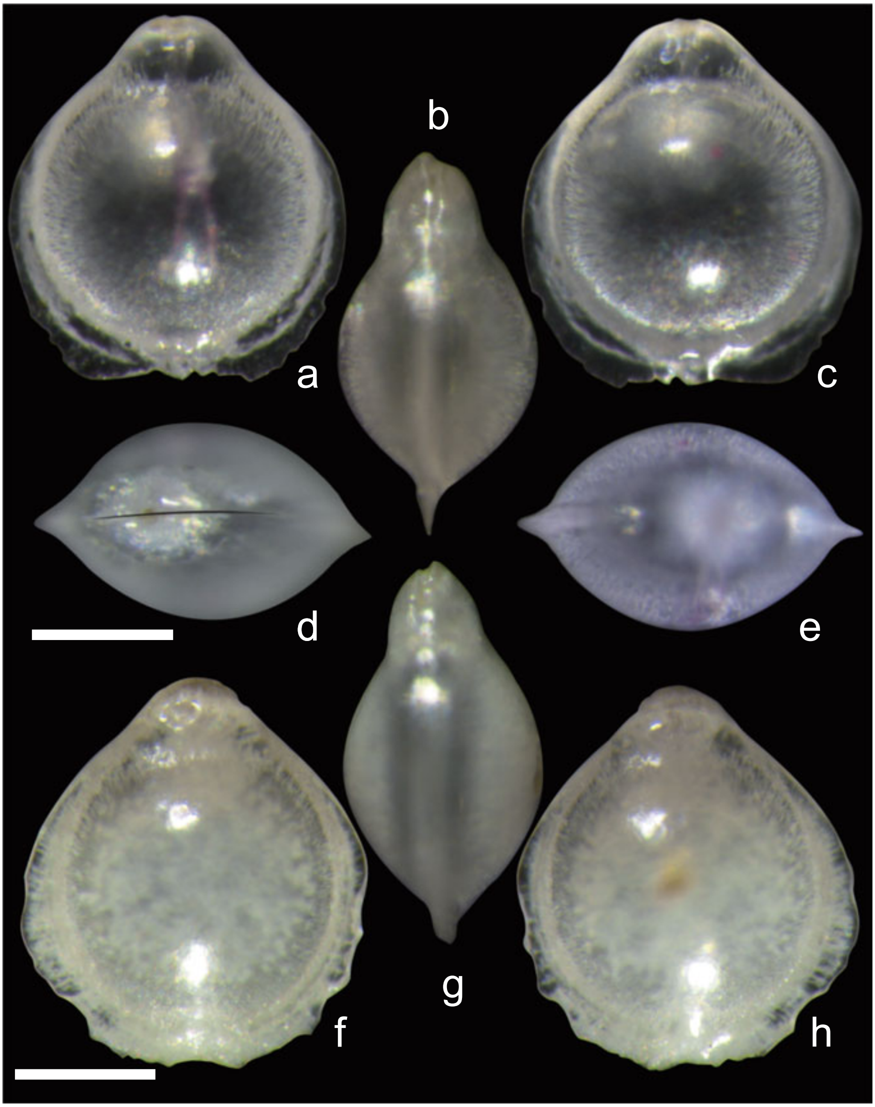

Fig. 30 **a–h** *Fissurina crebra* (Matthes, 1939), two specimens showing morphological variabilities. **a–e** Same specimen with different side of views. **b** Lateral views. **d** Apical view showing aperture. **e** Sectional view. **f–h** Another specimen with different side of views. Scale bars = 100 μm

Fissurina laevigata **Reuss, 1850** (Fig. 31)

Fissurina laevigata Reuss, 1850, p. 366, pl. 46, Fig. 1; Parr, 1947, p. 121, pl. 6, Fig. 8; He et al., 1965, p. 79, pl. 5, Fig. 14; Loeblich & Tappan, 1964, p. 540,

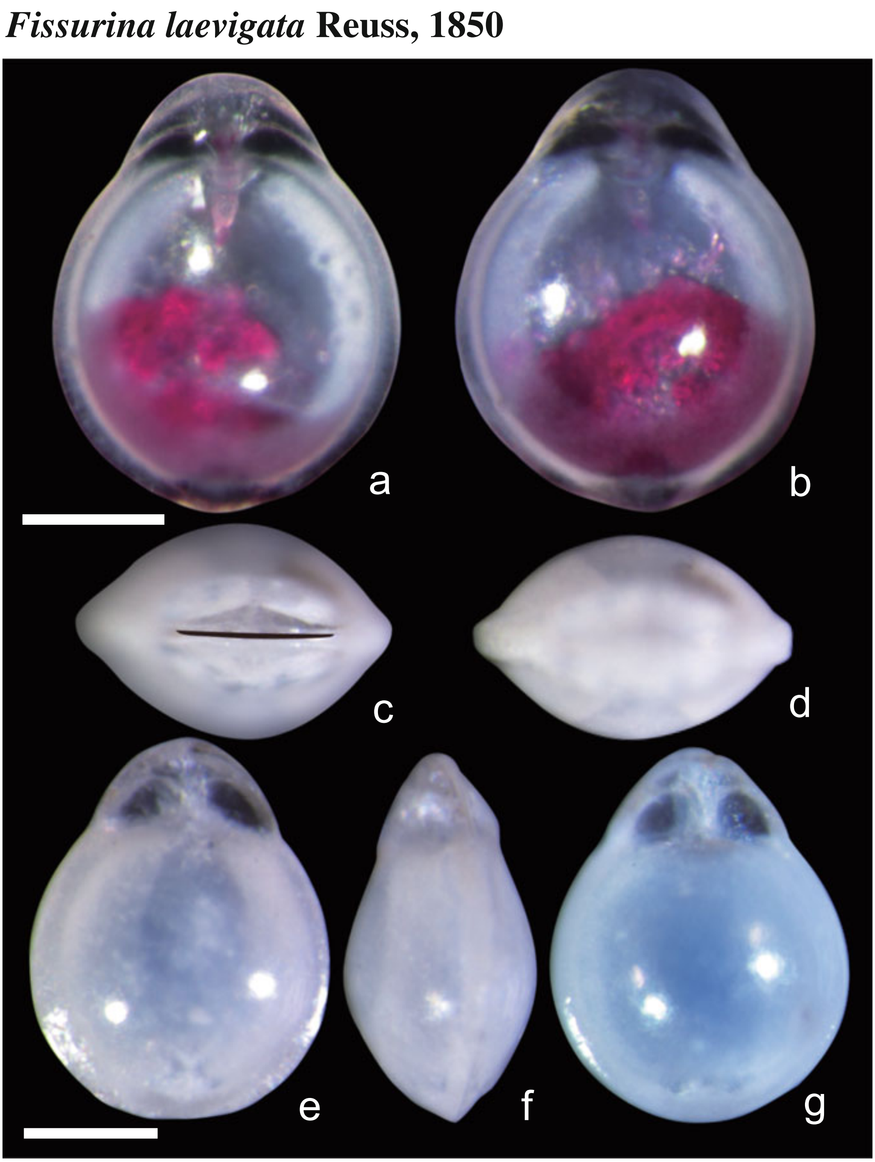

Fig. 31 **a–g** *Fissurina laevigata* Reuss, 1850, two specimens showing morphological variabilities. **a, b** A live specimen showing dorsal and ventral views. **c–g** Another specimen with different side of views. **c** Apical view showing aperture. **d** Sectional view. **f** Lateral view. Scale bars = 100 μm

Fig. 425-8; Wang et al., 1980, p. 195, pl. VIII, Fig. 14; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 80, pl. VI, Figs. 14–15; Baccaert, 1987, p. 163, pl. 69, Fig. 5; Loeblich & Tappan, 1987, p. 428, pl. 465, Figs. 8–9; Wang et al., 1988, p. 144, pl. XIX, Fig. 13; Debenay, 2012, p. 147.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H6-01	309	242	159
H6-02	291	227	149

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-06, St 3400-05, St 3400-08, St 3500-08, St 3500-10, St 3600-02, St 3600-06, St 3700-01, St 3800-02) (31°49′–38°00′ N, 121°00′–125°00′ E), water depth 29.00–81.00 m, temperature 7.54–18.08 °C, salinity 30.31–33.39 ‰, abundance 0.04–1.42 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Bay of Biscay, Canada, Celtic Sea, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, Southern Ocean, United States, New Caledonia, Vineyard Sound, Arctic Ocean, Gulf of Mexico, Mediterranean Sea.

Description

Size about 300 μm in length, length:width ratio about 1.3:1. Test ovate in outline, lenticular in section. Periphery with a circle of ring-like keels, smooth in outline. Wall hyaline, surface smooth. Aperture slitlike, within a slightly depressed fissure at the test apex, provided internally with an entosolenian tube in central of the test.

Remarks

Fissurina laevigata has been reported from the South Yellow Sea and the East China Sea (Wang et al., 1980; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988). It is a very common species usually occurred with high abundance in continental shelf sediments of the Yellow Sea and the East China Sea.

***Fissurina lucida* (Williamson, 1848)** (Fig. 32)

Entosolenia marginata (Montagu) var. *lucida* Williamson, 1848, p. 17, pl. 2, Fig. 17.

Lagena lucida, Sidebottom, 1906, p. 6, pl. 1, Figs. 9–12.

Entosolenia lucida Williamson, Hada, 1931, pp. 129–130, text Fig. 86; Cushman, 1948, p. 63, pl. 7, Fig. 2.

Lagena lucida (Williamson), Buchner, 1940, p. 477, pl. 14, Figs. 259–261.

Fissurina lucida (Williamson), Detling, 1958, p. 27, Fig. 15; J.W. Murray, 1972, p. 97, pl. 39, Figs. 1–3; Haynes, 1973, p. 95, pl. 14, Figs. 1, 2; text fig; Zheng et al., 1978, p. 44, pl. IV, Fig. 13; Research Institute of petroleum exploration and

Fissurina lucida (Williamson, 1848)

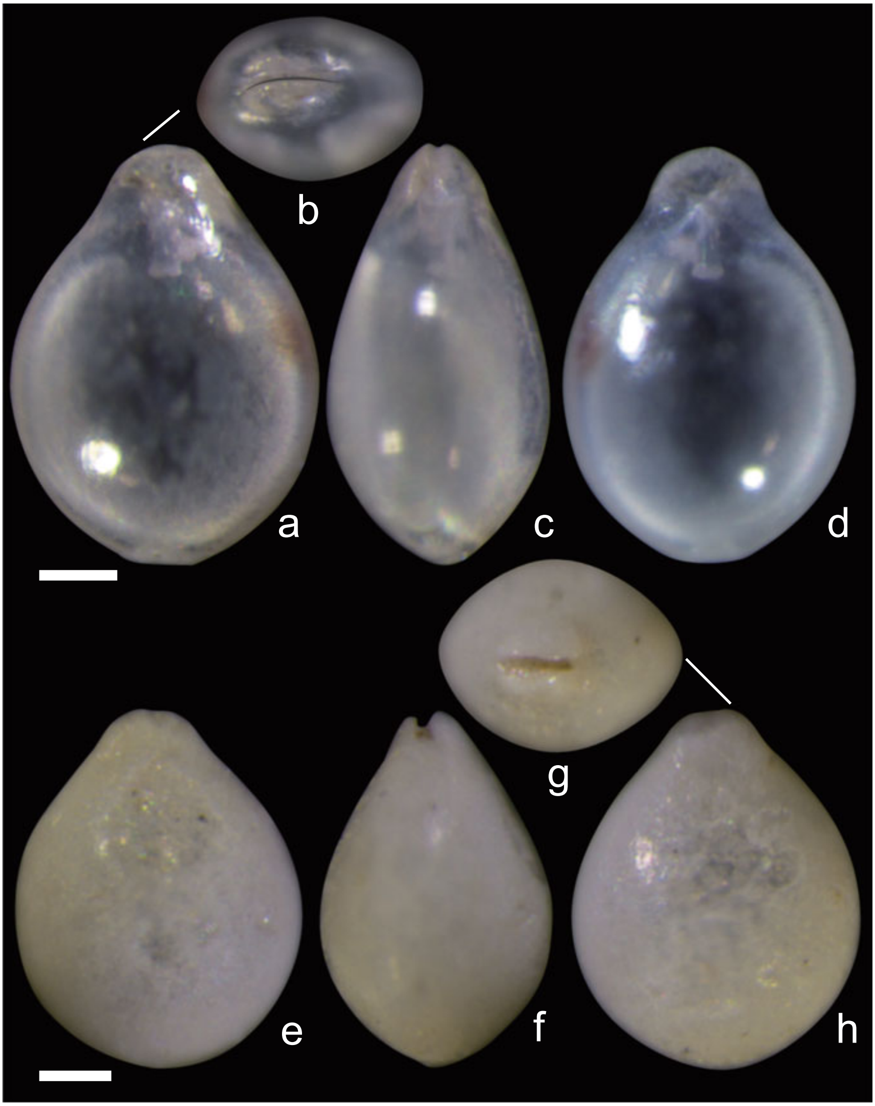

Fig. 32 a–h *Fissurina lucida* (Williamson, 1848), two specimens showing morphological variabilities. **a–d** Same specimen with different views. **b** Apical view showing aperture. **c** Lateral view. **e–h** Another specimen with different side of views. **g** Apical view. Scale bars = 50 μm

development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 17, pl. 3, Fig. 15; Micropaleontology Group in Marine Geology Department of Tongji

University, 1978, p. 80, pl. VI, Figs. 4–5; Wang et al., 1988, p. 144, pl. XIX, Fig. 14; Loeblich & Tappan, 1994, p. 90, pl. 156, Figs. 1–3; Hayward & Triggs, 1994, pl. 1, Fig. 17q, w; Yassini & Jones, 1995, p. 124, Fig. 873; Debenay, 2012, p. 147.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D25-01	266	195	141
D25-02	248	197	162

Occurrence and Ecology
The Yellow Sea (St 3400-05, St 3500-08) (34°00′–34°59′ N, 122°30′–123°00′ E), water depth 40.00–72.00 m, temperature 9.25–13.75 °C, salinity 31.12–33.23 ‰, abundance 0.02–0.82 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Bay of Biscay, Bay of Fundy, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description
Size about 250 μm in length, length:width ratio about 1.3:1. Test ovate in outline, oval in section. Periphery smooth, no keels. Wall smooth. Aperture terminal, slit-like, within a slightly depressed fissure at the test apex, provide internally with an entosolenian tube.

Remarks
Fissurina lucida has been reported from the Bohai Sea, the Yellow Sea and the East China Sea (He et al., 1978; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1988). It was a very common species and usually occurred with high abundance in continental shelf sediments of the Yellow Sea and the East China Sea.

Genus *Parafissurina* Parr, 1947

Parafissurina lateralis **(Cushman, 1913)** (Fig. 33)

Lagena lateralis Cushman, 1913b, p. 9, pl. 1, Fig. 1.

Parafissurina lateralis (Cushman), Ujiié, 1990, p. 27, pl. 10, Fig. 1.

Parafissurina lateralis Loeblich & Tappan, 1994, p. 94, pl. 164, Figs. 1–10.

Parafissurina lateralis (Cushman, 1913)

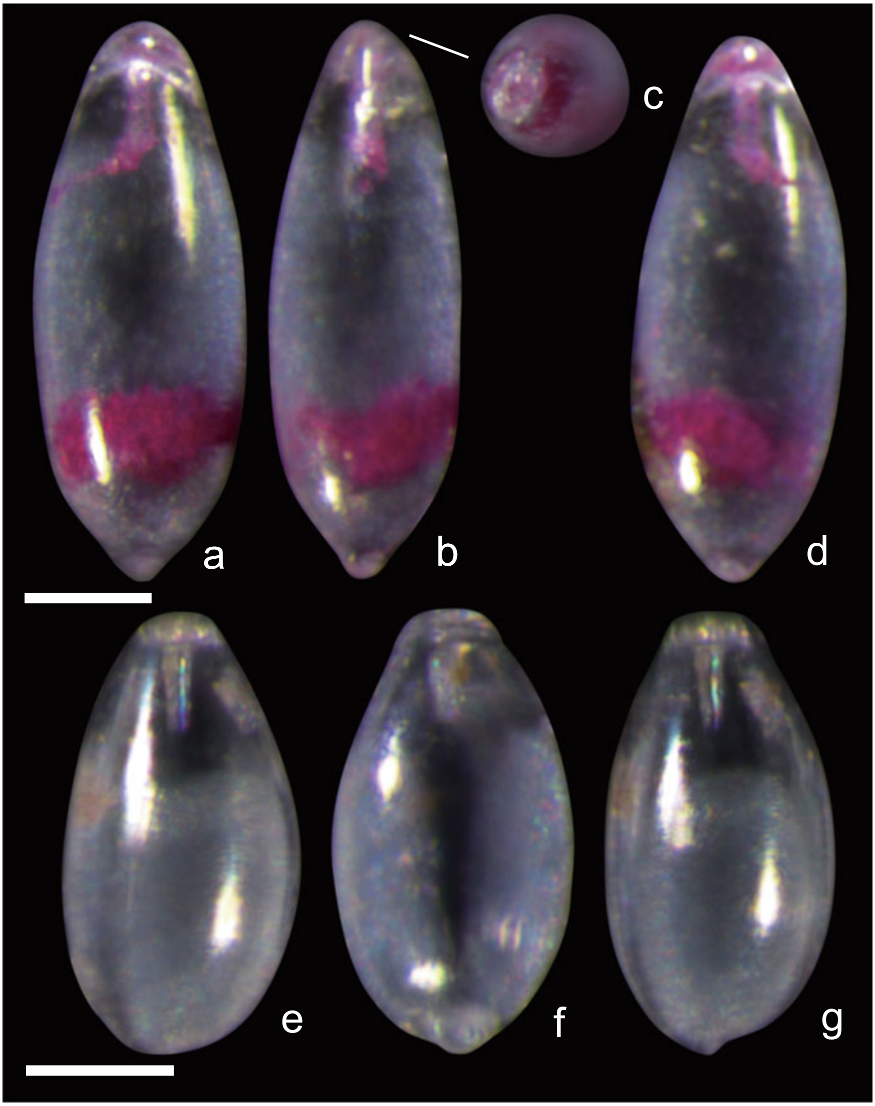

Fig. 33 a–g *Parafissurina lateralis* (Cushman, 1913), two specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **c** Apical view. **e–g** Another specimen with different side of views. Scale bars = 50 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H167-01	213	83	83
H167-02	143	79	79

Occurrence and Ecology
The Yellow Sea (St 3600-04, St 3300-04) (33°00′–35°59′ N, 122°00′–123°30′ E), water depth 43.90–47.40 m, temperature 6.60–19.00 °C, salinity 31.60–31.81 ‰, abundance 0.01–0.12 ind./g sed.

Distribution
Yellow Sea.

Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, Black Sea, Gulf of Mexico, Mediterranean Sea.

Description
Size about 180 μm in length, length:width ratio about 2.2:1. Test unilocular, elongate in outline, slightly compressed. Peripheral margin round and smooth. Wall hyaline and transparent, surface smooth. Aperture crescentic, entosolenian tube curved and attached to the inner dorsal wall.

Remarks
Parafissurina lateralis is a new record to China Sea. It occurred in two stations and with low abundance in continental shelf sediments of the Yellow Sea.

Family Glandulinidae Reuss, 1860

Genus *Glandulina* d'Orbigny, 1839

***Glandulina ovula* d'Orbigny, 1846** (Fig. 34)

Nodosaria (*Glandulina*) *laevigata* d'Orbigny, 1826, p. 252, pl. 10, Figs. 1–3.

Glandulina laevigata (d'Orbigny), Cushman & Ozawa, 1930, p. 143, pl. 40, Fig. 1; Cushman, 1940, p. 228, pl. 22, Fig. 13; Loeblich & Tappan, 1953, p. 82, pl. 16, Figs. 2–5; Whittaker & Hodgkinson, 1979, pp. 51–52, Fig. 47; Loeblich & Tappan, 1965, p. c537, Figs. 421, 1–2; Wang et al., 1980, p. 201, pl. XVII, Fig. 4; Loeblich & Tappan, 1987, p. 432, pl. 468, Figs. 1–4; Wang et al., 1988, p. 144, pl. XIX, Fig. 15; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 173, pl. 9, Fig. 17; Hottinger et al., 1993, p. 83, pl. 96, Figs. 1–5, 8; Debenay, 2012, p. 164.

Glandulina ovula d'Orbigny, 1846

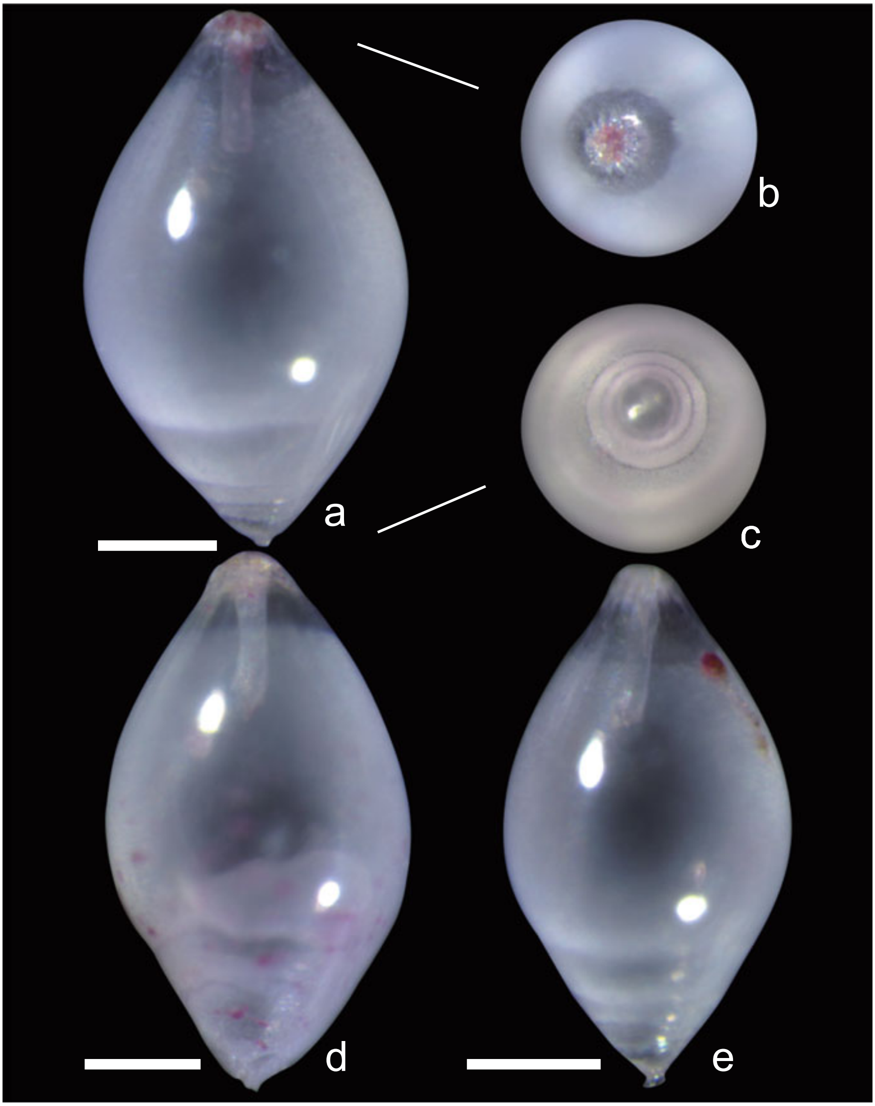

Fig. 34 a–e *Glandulina ovula* d'Orbigny, 1846, three specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **b** Apical view showing aperture. **c** Antapical view. **d** Another specimen. **e** The third specimen. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D68-01	475	286	286
D68-02	448	255	255
D68-03	380	209	209

Occurrence and Ecology
The Yellow Sea (St 3800-02, St B-03) (38°00′–38°25′ N, 121°57′–122°59′ E), water depth 50.00–59.00 m, temperature 7.72–8.35 °C, salinity 31.67–31.96 ‰, abundance 0.18–0.32 ind./g sed.

Distribution
Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Canada, Gulf of Saint Lawrence, Japan, Micronesia, New Zealand, North Atlantic Ocean, Norway, South Korea, New Caledonia, Scotian Shelf, Gulf of Mexico, Mediterranean Sea.

Description
Size about 450 μm in length, length:width ratio about 1.7:1. Test fusiform, circular in section. Chambers uniserial and rectilinear arranged, increasing rapidly in size as added, strongly overlapping previous chambers. External sutures distinct and flush. Wall radial, commonly opaque except for a narrow hyaline and translucent band just below the aperture, surface smooth. Aperture terminal, radiate, provided with a short entosolenian tube.

Remarks
Glandulina ovula has been identified as *Glandulina laevigata* in previous Chinese publications (Wang et al., 1980, 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It was a rare species usually occurred with low abundance in continental shelf sediments of the China Seas.

Genus *Laryngosigma* Loeblich & Tappan, 1953

***Laryngosigma lactea* (Walker & Jacob, 1798)** (Fig. 35)

Serpula lactea Walker & Jacob, 1798, p. 634, pl. 14, Fig. 4.

Guttulina lactea (Walker & Jacob), Ozawa, 1929, p. 36, pl. 6, Figs. 6–10; Haynes, 1958, p. 4, pl. 3, Fig. 1; He et al., 1965, p. 80, pl. V, Fig. 16; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 84, pl. VIII, Fig. 1; Zheng et al., 1978, p. 43, pl. IV, Fig. 11.

Laryngosigma lactea (Walker & Jacob, 1798)

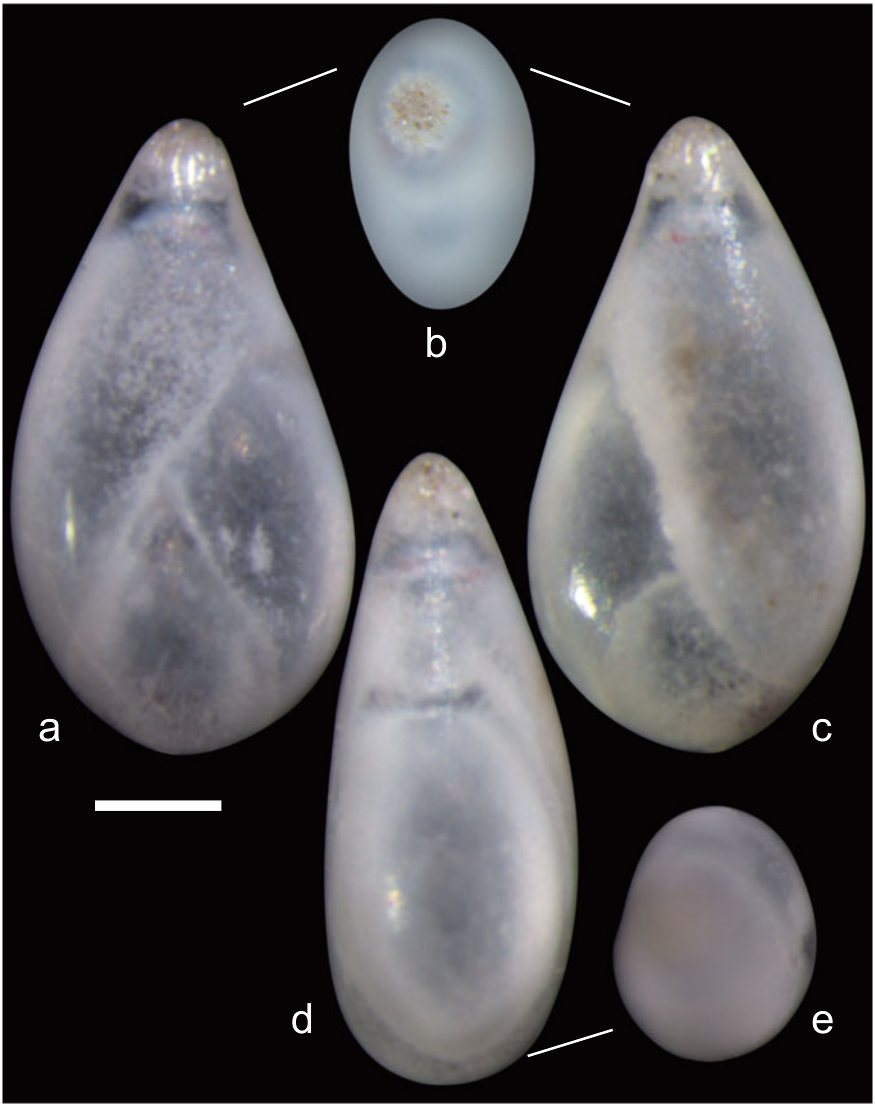

Fig. 35 a–e *Laryngosigma lactea* (Walker & Jacob, 1798), the same specimen with different side of views. **b** Apical view showing aperture. **d** Lateral view. **e** Antapical view showing cross section outline. Scale bar = 100 µm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H50-01	511	263	199

Occurrence and Ecology
The Yellow Sea (St 3500-02, St 3800-02, St 3875-01) (35°00′–38°44′ N, 120°00′–122°59′ E), water depth 30.00–59.00 m, temperature 7.39–10.68 °C, salinity 30.82–31.96 ‰, abundance 0.16–0.38 ind./g sed.

Distribution
Bohai Sea, Yellow Sea.

Bay of Biscay, Bay of Fundy, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, North Atlantic Ocean, Norway, United States, Grand Bank, Vineyard Sound, English Channel, Gulf of Mexico, Mediterranean Sea, United Kingdom.

Description
Size about 500 μm in length, length:width ratio about 2:1. Test elongate ovate, somewhat compressed. Chambers biserial and sigmoid. Sutures oblique and curved, slightly depressed. Wall hyaline, surface smooth. Aperture terminal, radiate, with a short straight entosolenian tube.

Remarks
Laryngosigma lactea has been identified as *Guttulina lacteal* from the Bohai Sea and the Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Zheng et al., 1978). In our investigation, it was a common species occurring in the North Yellow Sea with high abundance.

Order Rotaliida Delage et Hérouard, 1896

Family Bolivinidae Glaessner, 1937

Genus *Bolivina* d'Orbigny, 1839

Bolivina obscura **Ho, Hu & Wang, 1965** (Fig. 1)

Bolivina obscura Ho, Hu & Wang, 1965, He et al., 1965, p. 88, pl. VI, Figs. 1–3.
Bolivina obscura He, Hu & Wang, 1965, Panchang & Nigam, 2014, p. 25, pl. XXIII, Fig. 5; Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B97-01	366	223	103
B97-02	310	193	91

Occurrence and Ecology
The Yellow Sea (St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3400-02, St 3400-05, St 3400-06, St 3400-08, St 3600-02, St 3600-06, St 3875-01) (31°49′–38°44′ N, 120°59′–125°00′ E), water depth 32.90–80.00 m, temperature 7.39–18.08 °C, salinity 29.15–32.98 ‰, abundance 0.05–7.63 ind./g sed.

Distribution
Yellow Sea.
Bay of Bengal.

Description
Size about 350 μm in length. Test ovoid in outline, posterior end narrowly rounded; distinctly compressed in side view, around 2:1 flattened laterally; length:width ratio about 1.6:1. Chambers obscure, broad and low, biserial throughout, about seven chambers in each row. Septa slightly depressed, obscured by surface ornamentation.

Y. Lei and T. Li, *Atlas of Benthic Foraminifera from China Seas*,
Springer Geology, DOI 10.1007/978-3-662-53878-4_5

Bolivina obscura Ho, Hu & Wang, 1965

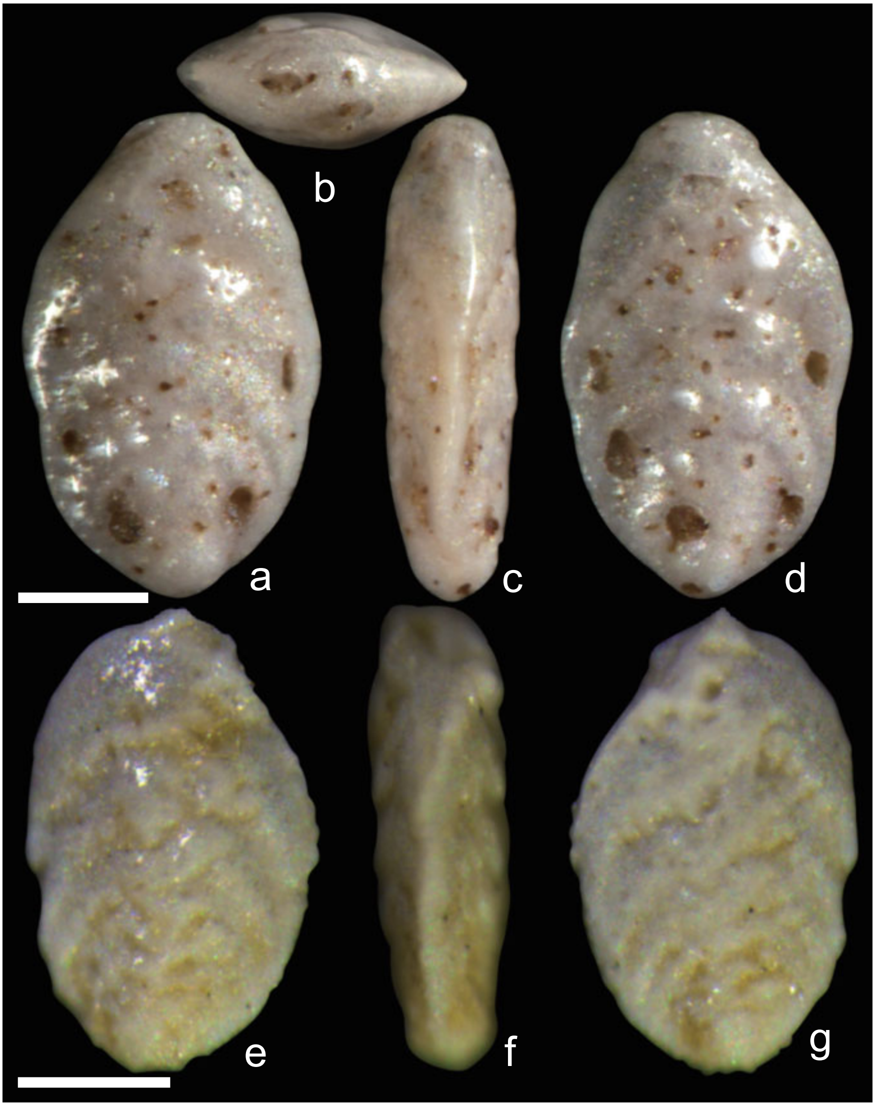

Fig. 1 a–g *Bolivina obscura* Ho, Hu & Wang, 1965, two specimens showing morphological variabilities. **a–d** The same specimen with different side of views. **e–g** From another specimen. **b** Apical view showing aperture and cross section outline. **c, f** Lateral views. Scale bars = 100 μm

Wall calcareous, opaque, surface ornamented with irregularly costae, which may have occasional pores. Aperture a narrow loop at the base of the apertural face, bordered by a rim.

Remarks

Bolivina obscura was discovered by He et al. (1965) from Jiangsu, the South Yellow Sea area. Because of different versions of the Chinese phonetic alphabet, some publications used “He, Hu et Wang” as the author name. Since original description mentioned the author name was “Ho, Hu & Wang,” therefore we consider the original name should have priority. Therefore, *Bolivina obscura* Ho, Hu & Wang, 1965 should be the right name of this species. *B. obscura* resembles *Bolivina robusta* in test shape, but characterized by owing obscure chambers. It is a common species and usually abundant in the Yellow Sea.

Bolivina dilatata **Reuss, 1850** (Fig. 2)

Bolivina dilatata Reuss, 1850, Denkschr. Akad. Wiss. Wien., vol. 1, p. 381, pl. 48, figs. 15a-c; Reuss, 1850, p. 17, pl. 3, fig. 15; Cushman, 1911, p. 33, text-fig. 54; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 15, pl. 3, fig. 9; Schiebel, 1992, p. 31, pl. 1, fig. 4a; Mendes et al., 2004, p.180, pl. 2, fig. 1; Leiter, 2008, p. 22, pl. 3, fig. 6.

Brizalina dilatata (Reuss), Cimerman & Langer, 1991, p. 59, pl. 62, fig. 2; Kaminski et al., 2002, p. 173, pl. 2, fig. 13; Milke & Schmiedl, 2012, p. 81, pl. 19.30; Panchang & Nigam 2014, p. 25, pl. XXIII, figs. 27, 28.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D102-01	558	291	146
D102-02	559	288	148
D102-03	527	253	141

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-04, St 3400-05, St 3400-06) (31°49′–34°00′ N, 122°30′–124°00′ E), water depth 40.00–67.80 m, temperature 12.00–17.54 °C, salinity 31.12–32.08 ‰, abundance 0.10–0.62 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George’s Channel, North Atlantic Ocean, Mediterranean Sea.

Description

Size about 550 μm in length. Test triangular in outline, posterior end narrowly rounded, distinctly compressed in side view, about 2:1 flattened laterally; length: width about 1.9:1. Chambers very distinct throughout, broad and low, about ten chambers in each biserial row. Sutures distinct, depressed and limbate. Periphery laciniate and sharp. Wall calcareous, hyaline, perforate, have multiple pores along septa in surface, surface ornamented with anastomosing costae. Aperture a narrow loop at the base of the apertural face.

Bolivina dilatata Reuss, 1850

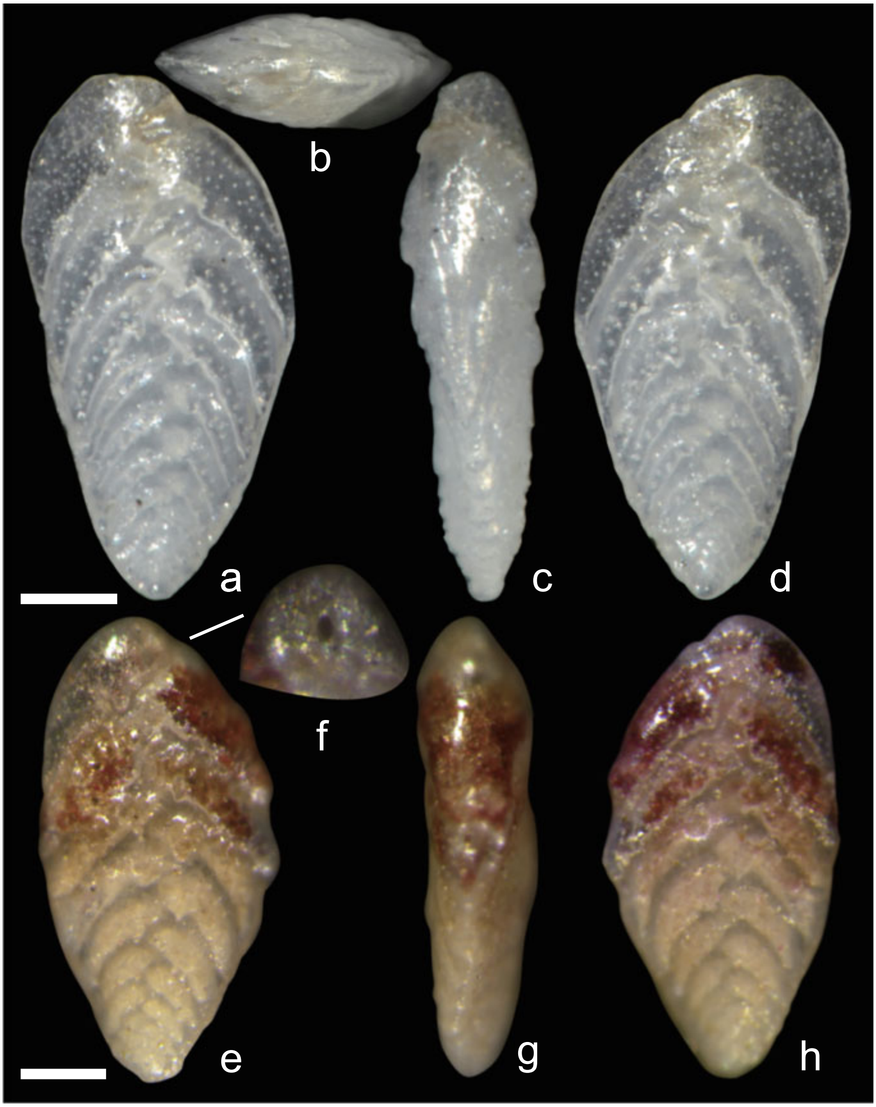

Fig. 2 **a–h** *Bolivina dilatata* Reuss, 1850 two specimens showing morphological variabilities. **a–d** Same specimen with different side of views. **e–h** Another live specimen. **b** Apical view. **c, g** Lateral views. **f** Anterior portion showing aperture. Scale bars = 100 μm

Remarks

Bolivina dilatata has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese

Academy of Sciences, 1978). This species is characterized by owning a laciniate and sharp periphery. In our investigation it occurred also in the South Yellow Sea with low abundance.

***Bolivina punctatostriata* Kreuzberg, 1930** (Fig. 3)

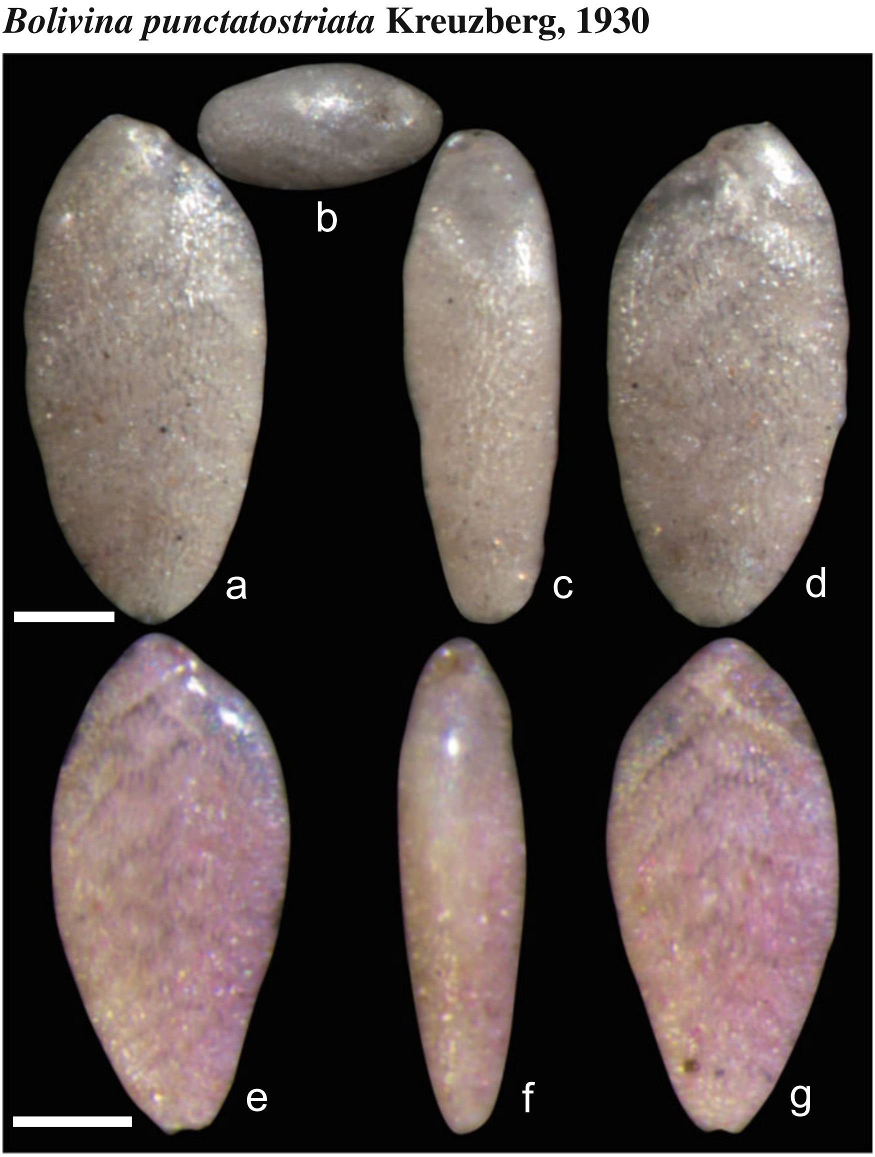

Fig. 3 **a–g** *Bolivina punctatostriata* Kreuzberg, 1930, two specimens showing morphological variabilities. **a–d** Same specimen with different side of views. **e–g** Another live specimen. **b** Apical view showing cross section outline. **c, f** Lateral views. Scale bars = 50 μm

Bolivina punctatostriata Kreuzberg, 1930, p. 278, pl. 20, Fig. 5; Hayward & Buzas, 1979, p. 43, pl. 6, Fig. 71.

Brizalina punctatostriata (Kreuzberg), Wang et al., 1988, p. 148, pl. XX, Fig. 19.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H52-01	237	115	73
H52-02	226	102	63

Occurrence and Ecology
The Yellow Sea (St CJ-01) (31°40′ N, 122°29′–124°00′ E), water depth 27.20 m, temperature 11.00 °C, salinity 33.78 ‰, abundance 0.10 ind./g sed.

Distribution
Yellow Sea, East China Sea.
New Zealand.

Description
Size about 230 μm in length. Test elongate ovoid in outline, about 1.6:1 compressed laterally; length:width ratio about 2:1. Chambers only clearly visible in late portion, obscure in early portion; broad and low, about ten chambers in each biserial row. Periphery smooth and rounded. Sutures indistinct in early portion, moderately distinct in late portion. Wall calcareous, perforate, have many tiny and indistinct longitudinal striae in surface, anastomosing costae with intensive mini pores. Aperture a narrow loop at the base of the apertural face.

Remarks
Bolivina punctatostriata has been identified as *Brizalina punctatostriata* in Chinese publications (Wang et al., 1988) from the East China Sea, where it usually occurred in 50–100 m water depth with relatively high abundance. In the Yellow Sea, it is a not common species and only appeared near Yangtze Estuary sea area (near East China Sea). In addition, the Yellow Sea specimens are distinctly smaller than those from the East China Sea (~570 μm in length).

***Bolivina robusta* Brady, 1881** (Fig. 4)

Bolivina robusta Brady, 1881, p. 57; Brady, 1884, p. 421, pl. 53, Figs. 7–9; Cushman, 1937, p. 131, pl. 17, Figs. 1–3; Asano, 1950d, p. 9, Fig. 38; Hofker, 1951a, p. 76, text Fig. 41, 42; Barker, 1960, p. 108, pl. 53, Figs. 7–9; He et al., 1965, p. 87, pl. VI, Fig. 13; Lin et al., 1978, p. 79, pl. 18, Fig. 12; Van Marle, 1988, p. 139, pl. 1, Figs. 25, 26; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 177, pl. 12, Figs. 8–9; Wang et al., 1988, p. 147, pl. XXXIV, Figs. 1–5; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 78, pl. 153, Fig. 13; Van Marle, 1991, p. 162, pl. 10, Figs. 8, 9; Loeblich & Tappan, 1994, p. 111, pl. 215, Figs. 17, 18; Debenay, 2012, p. 171.

Bolivina robusta Brady, 1881

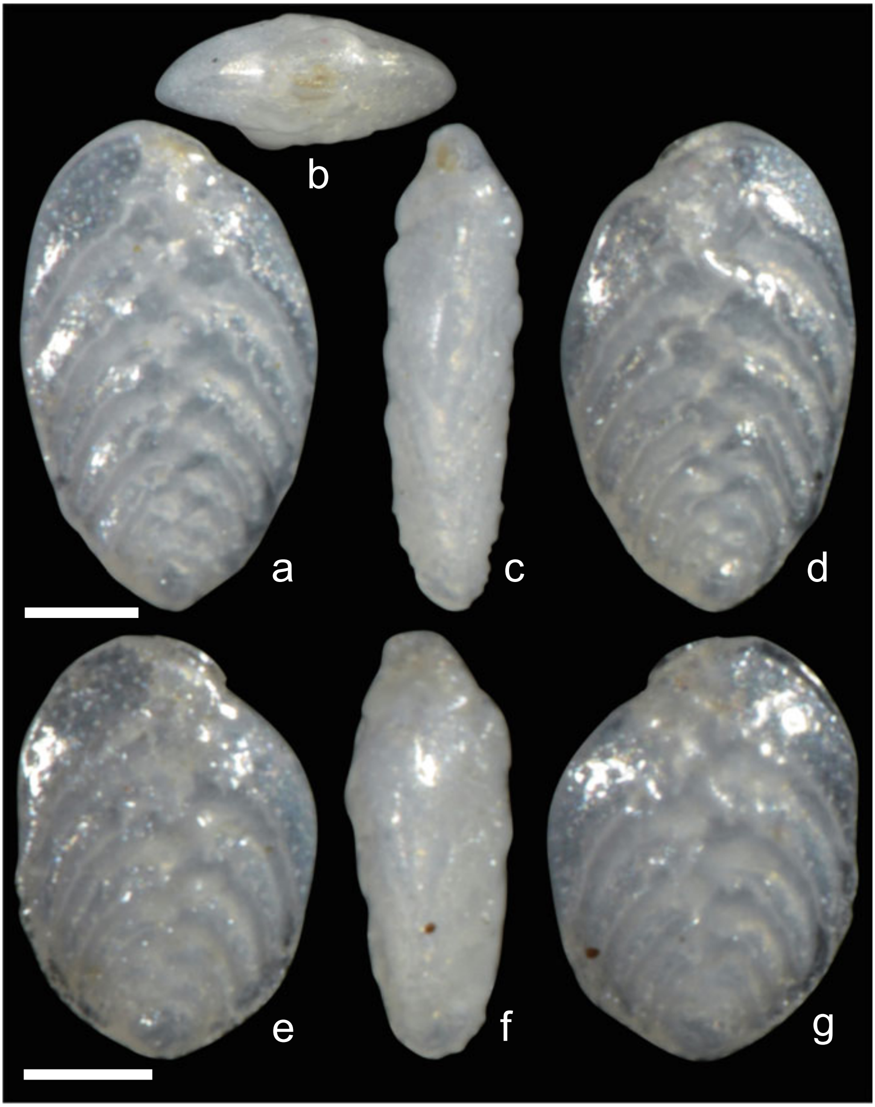

Fig. 4 a–g *Bolivina robusta* Brady, 1881, two specimens showing morphological variabilities. **a–d** Same specimen with different side of views. **e–g** From another specimen. **b** Apical view. **c, f** Lateral views. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D4-01	445	269	127
D4-02	337	233	132

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3400-02, St 3400-05, St 3400-06, St 3400-08, St 3600-02, St 3600-06, St 3875-01) (31°49′–35°59′ N, 120°59′–125°00′ E), water depth 17.60–80.00 m, temperature 7.39–18.08 °C, salinity 29.15–32.98 ‰, abundance 0.04–7.62 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Japan, Micronesia, New Zealand, North Atlantic Ocean, Norway, South Korea, New Caledonia.

Description

Size about 450 μm in length. Test ovoid in outline, distinctly compressed in side view, about 2:1 flattened laterally; length:width ratio about 1.5:1. Chambers clear optically, about eight chambers in each biserial row. Sutures evident, distinctly depressed. Wall calcareous, hyaline, transparent, with many pores scattered in wall surface; surface ornamented with anastomosing costae. Aperture a narrow loop at the base of the apertural face, bordered by a thickened and imperforate rim.

Remarks

Bolivina robusta is a common species that has been reported from the Yellow Sea (He et al., 1965), the East China Sea, South China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is characterized by having an ovoid shape, distinct sutures, and transparent wall. *B. robusta* is a common and abundant species in the China Seas. The Yellow Sea specimens were smaller than those from the East China Sea.

***Bolivina spathulata* (Williamson, 1858)** (Fig. 5)

Textularia variabilis var. *spathulata* Williamson, 1858, p. 76, pl. 6, Figs. 164–165.

Brizalina spathulata (Williamson), Murray, 1971, p. 111, pl. 45, Figs. 1–4; Wang et al., 1988, p. 148, pl. XX, Fig. 15.

Bolivina spathulata (Williamson), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 89, pl. IX, Fig. 15.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H176-01	540	210	109

Occurrence and Ecology

The Yellow Sea (St 3000-02) (29°59′ N, 123°00′ E), water depth 50.00 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 0.27 ind./g sed.

Bolivina spathulata (Williamson, 1858)

Fig. 5 **a–d** *Bolivina spathulata* (Williamson, 1858), the same specimen with different side of views. **b** Apical view showing cross section outline. **c** Lateral view showing aperture (*arrow*). Scale bar = 100 μm

Distribution

Yellow Sea, East China Sea.

Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, English Channel, Gulf of Mexico, Mediterranean Sea.

Description

Size about 550 μm in length. Test elongate ovoid in outline, distinctly compressed, about 2:1 flattened laterally, length:width ratio is about 2.6:1. Chambers broad and low, biserial throughout, about eight chambers in each row, rather distinct optically. Septa slightly depressed. Wall calcareous, hyaline, perforate, surface have multiple pores and ornamented with anastomosing imperforate costae. Aperture a narrow loop at the base of the apertural face.

Remarks

Bolivina spathulata has been identified as *Brizalina spathulata* (Wang et al., 1988) from the East China Sea. It was also reported from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978). This species is characterized by elongate test shape. In the Yellow Sea it is rare, but is a common and abundant species in East China Sea.

Bolivina striatula **Cushman, 1922** (Fig. 6)

Brizalina striatula (Cushman), Sliter, 1970, p. 170, pl. 7, Fig. 6; pl. 8, Fig. 19; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 87, pl. VIII, Figs. 20–21; pl. IX, Fig. 3; Wang et al., 1980, p. 199, pl. XIII, Fig. 9; p. 202, pl. XVIII, Fig. 3; Wang et al., 1988, p. 147, pl. XX, Fig. 13; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 79, pl. 153, Fig. 11.

Bolivina (*Brizalina*) *striatula* Cushman, Haynes, 1973, p. 137, pl. 10, Fig. 1; pl. 11, Fig. 1.

Bolivina striatula Cushman, 1922a, p. 27, pl. 3, Fig. 10; Cushman, 1937, p. 154, pl. 18, Figs. 30, 31; Cushman, 1942, p. 30, pl. 9, Fig. 1; Höglund, 1947, pp. 266–267, pl. 24, Fig. 4; Bhatia, 1956, p. 21, pl. 1, Fig. 9; Arnal, 1958, p. 37, pl. 11, Figs. 13–15; He et al., 1965, p. 86, pl. VI, Fig. 12; Boltovskoy & Lena, 1966, p. 287, pl. 1, Figs. 22, 23; Resig, 1974, p. 76, pl. 1, Fig. 5; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 15, pl. 3, Fig. 8; Hottinger et al., 1993, p. 92, pl. 112, Figs. 3–8; Debenay, 2012, p. 171.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B43=H93-01	273	118	80

Bolivina striatula Cushman, 1922

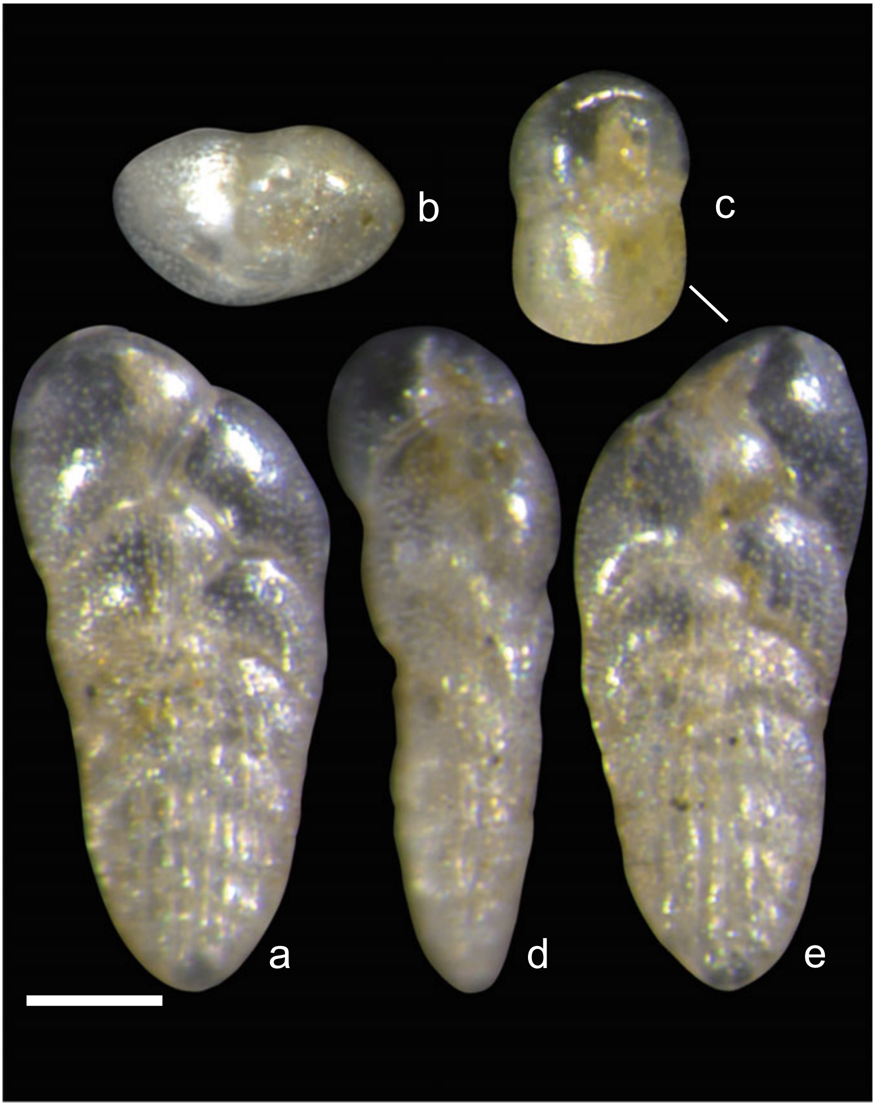

Fig. 6 **a–e** *Bolivina striatula* Cushman, 1922, the same specimen with different side of views. **b** Apical view showing cross section outline. **c** Aperture view. Scale bar = 50 μm

Occurrence and Ecology

The Bohai Sea (St 26, 2-4 cm and 6-8 cm sediments) and the Yellow Sea (St 3600-08, St 3800-02, St 3875-01) (39°00′ N, 119°30′ E), water depth 25.00 m, temperature 2.86 °C, salinity 30.11–33.31 ‰, abundance 0.05–0.07 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, Irish Sea and St. George's Channel, Japan, Maldives, Micronesia, New Zealand, North Atlantic Ocean, South Korea, United States, New Caledonia, Southeast U.S. Continental Shelf, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description

Size about 270 μm in length. Test elongate, triangular in outline, distinctly compressed in early portion, slightly compressed in late portion, about 1.5:1 flattened laterally, length:width ratio about 2.3:1. Chambers biserial throughout, about nine chambers in each row, broad and low in early portion, while inflated and heightened in late portion. Sutures fairly distinct and depressed. Wall calcareous, hyaline, perforate, many scattered mini pores in wall surface, with many striates, which are distinct in early portion. Aperture a narrow loop at the base of the apertural face.

Remarks

Bolivina striatula has been identified as *Brizalina striatula* from the South Yellow Sea in previous Chinese literature (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980) and East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). This species is characterized by having a striate wall and high chambers. It rarely occurred in the Bohai Sea and the Yellow Sea, but is common and abundant in the East China Sea (He et al., 1965; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978).

Genus *Bolivinellina* Saidova, 1975

***Bolivinellina pseudopunctata* (Höglund, 1947)** (Fig. 7)

Bolivina pseudopunctata Höglund, 1947, p. 273, pl. 24, Fig. 5; pl. 32, Figs. 23, 24; He et al., 1965, p. 88, pl. VI, Fig. 15; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 15, pl. 3, Fig. 5.

Bolivinellina pseudopunctata (Höglund, 1947), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D19-01	465	131	98

Bolivinellina pseudopunctata (Höglund, 1947)

Fig. 7 a–d *Bolivinellina pseudopunctata* (Höglund, 1947), the same specimen with different side of views. **b** Apical view showing cross section outline. Scale bar = 50 µm

Occurrence and Ecology

The Yellow Sea (St CJ-01) (31°40′ N, 122°29′ E), water depth 29.40 m, temperature 22.40 °C, salinity 31.73 ‰, abundance 0.02 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, North Atlantic Ocean, Southern Ocean, United States, Scotian Shelf, South Pacific Ocean, Arctic Ocean, Mediterranean Sea.

Description

Size about 450 μm in length. Test elongate, narrow, oval in section, length:width ratio about 3.5:1. Chambers narrow and high, biserial throughout, about ten chambers in each row. Sutures oblique, slightly depressed. Periphery smooth. Wall calcareous, translucent, and poreless. Aperture a narrow loop at the base of the apertural face.

Remarks

Bolivinellina pseudopunctata has been identified as *Bolivina pseudopunctata* from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) and the Yellow Sea (He et al., 1965). This species is characterized by elongate test shape and high chamber shape. It is a rare species in the Bohai Sea and the Yellow Sea.

Family Cassidulinidae d'Orbigny, 1839

Genus *Globocassidulina* Voloshinova, 1960

***Globocassidulina crassa* (d'Orbigny, 1839)** (Fig. 8)

Cassidulina crassa d'Orbigny, 1839c, p. 56, pl. 7, Figs. 18–20.

Globocassidulina crassa (d'Orbigny), Nomura, 1983, p. 37, pl. 3, Figs. 9–10; pl. 6, Fig. 17; pl. 18, Figs. 3–5; Debenay, 2012, p. 239.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H49=D82-01	140	123	88
H49=D82-02	110	99	76

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-04, St 3400-05, St 3400-06, St 3600-08, St 3875-01) (31°49′–38°44′ N, 121°59′–123°59′ E), water depth 40.00–78.00 m, temperature 7.39–17.54 °C, salinity 31.12–33.31 ‰, abundance 0.16–0.62 ind./g sed.

Distribution

Yellow Sea.

Globocassidulina crassa (d'Orbigny, 1839)

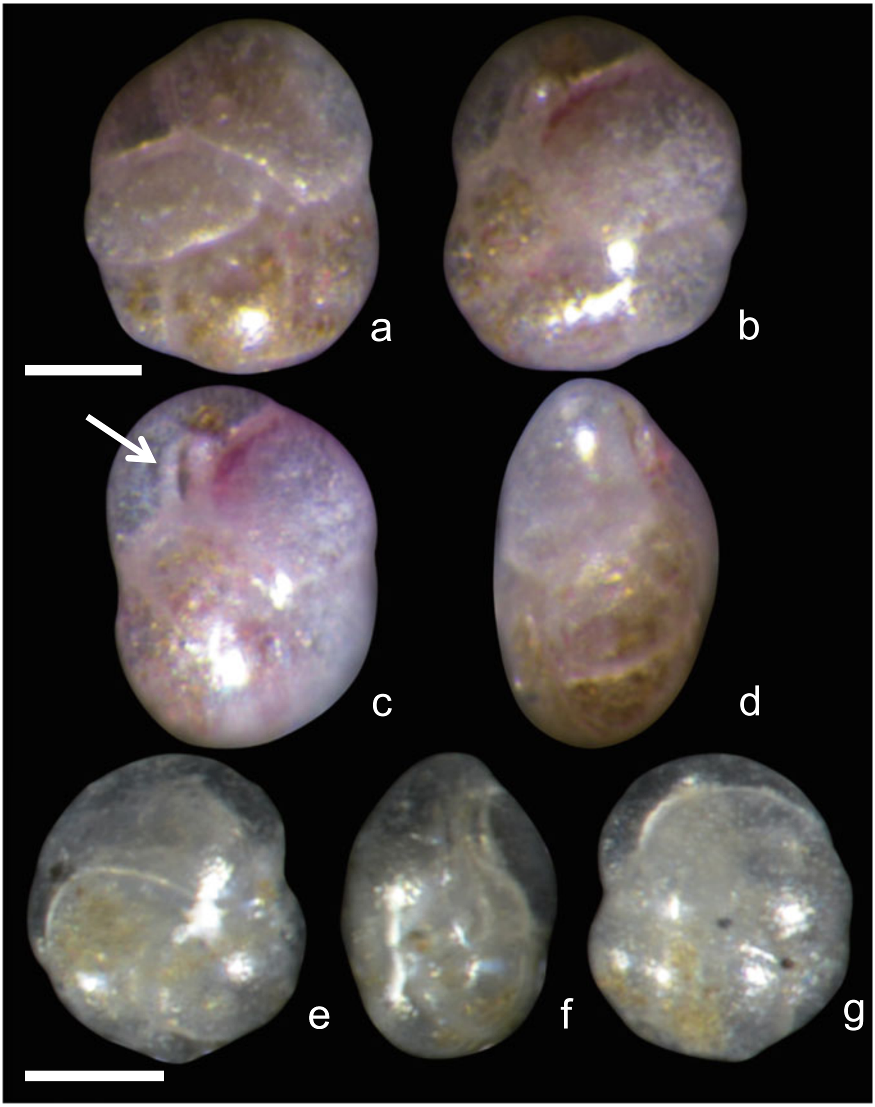

Fig. 8 **a–g** *Globocassidulina crassa* (d'Orbigny, 1839), two specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **e–g** From another specimen. *Arrow* denotes aperture. Scale bars = 50 µm

Bay of Biscay, Celtic Sea, English Channel, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, South Korea, United States, New Caledonia, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Southern Ocean, Ross Sea, Mediterranean Sea.

Description
Size about 130 μm in length. Test globular, slightly compressed in side view, about 1.3:1 flatted laterally; length:width ratio about 1.1:1. Periphery rounded and smooth. Chambers biserially arranged and enrolled, with zigzag suture along the periphery. Sutures oblique, slightly depressed. Wall calcareous, optically granular, perforate, surface smooth and polished. Aperture slit-like to buttonhole-like, extending up the apertural face at an angle to the base.

Remarks
Globocassidulina crassa is a new record to China Sea. This species is very small in size. It occurred with moderate amount of abundance in the sea areas near Yangtze Estuary and the Yellow Sea Cold Water Mass, where the water depth was within 40–78 m.

Family Stainforthiidae Reiss, 1963

Genus *Hopkinsina* Howe & Wallace, 1932

Hopkinsina pacifica Cushman, 1933 (Fig. 9)

Hopkinsina pacifica var. *atlantica* Cushman, 1944, p. 30, pl. 4, Fig. 1.

Hopkinsina pacifica Cushman, 1933b, p. 86, pl. 8, Fig. 16; Cushman, 1942, p. 51, pl. 15, Fig. 1; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 86, pl. VIII, Fig. 12; Buzas & Severin, 1982, p. 33, pl. 5, Fig. 14; Wang et al., 1988, p. 155, pl. XXX, Fig. 3; Loeblich & Tappan, 1994, p. 118, pl. 231, Figs. 1, 2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H32-01	235	83	71
H32-02	169	73	49

Occurrence and Ecology
The Yellow Sea (St 3400-05, St 3600-02, St 3600-04, St 3875-03) (34°00′–38°44′ N, 121°00′–127°00′ E), water depth 33.80–55.00 m, temperature 7.80–13.75 °C, salinity 31.11–31.88 ‰, abundance 0.02–0.26 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Japan, Gulf of Mexico, Mediterranean Sea, North Atlantic Ocean.

Description
Size about 200 μm in length. Test elongate, narrow, length:width ratio about 2.5:1. Chambers slightly inflated, increasing in size as added, early stage triserial, later

Hopkinsina pacifica Cushman, 1933

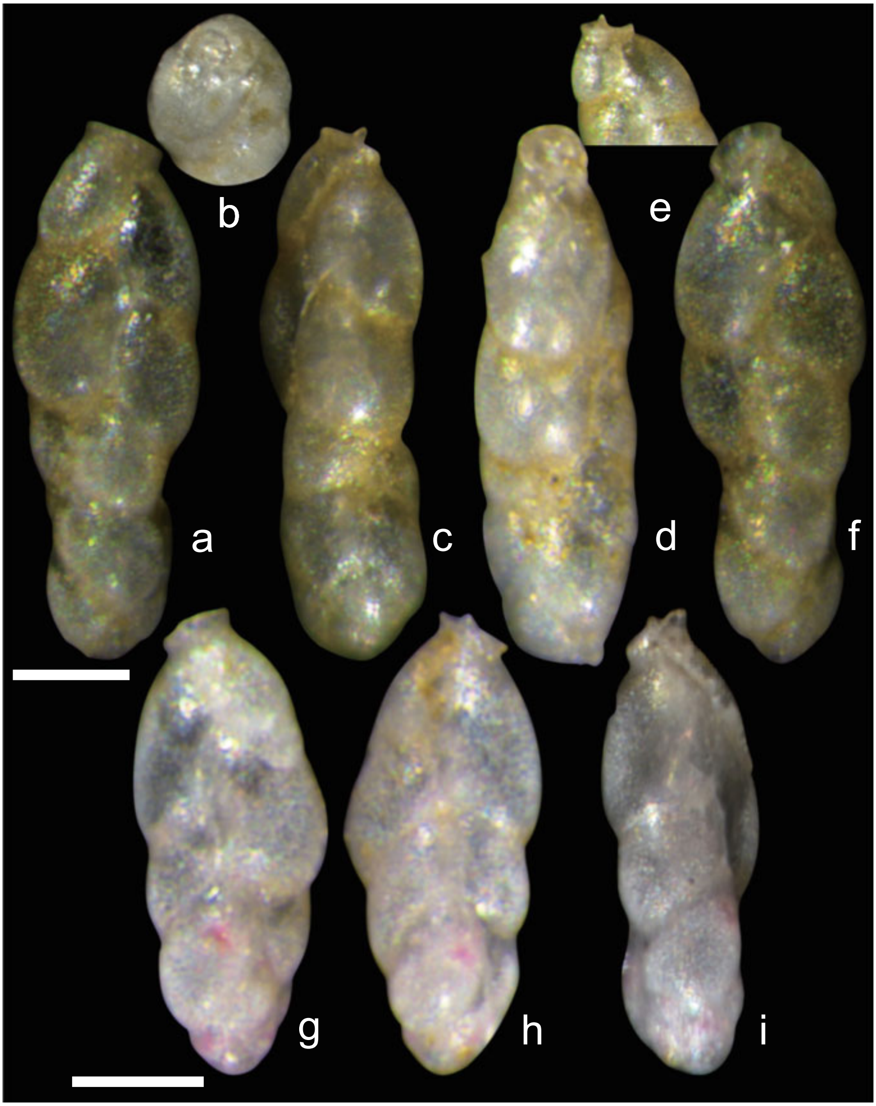

Fig. 9 a–i *Hopkinsina pacifica* Cushman, 1933, two specimens showing morphological variabilities. **a–f** Same specimen with different side of views. **g–i** Another live specimen. **b** Apical view. **e** Anterior portion view showing aperture tooth. Scale bars = 50 µm

biserial. Sutures depressed, oblique. Wall calcareous, perforate, translucent, surface smooth. Aperture terminal, slightly produced, bordered with a lip, tooth plate present.

Remarks

Hopkinsina pacifica has been reported from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and the East China Sea (Wang et al., 1988). It is usually distributed in inshore water sediments but with low abundance.

The original diagnosis of the genus *Hopkinsina* Howe & Wallace, 1932 did not give definite description for the aperture structure whether present or absent a toothplate (Loeblich & Tappan, 1987). Our specimen indicated that *H. pacifica* clearly presented a toothplate. Therefore we suggest toothplate should be a typical feature of this genus.

We revised the diagnosis of the genus *Hopkinsina* Howe & Wallace, 1932 as follows: Test elongate, narrow, chambers slightly inflated, increasing in size as added, early stage triserial, later biserial, sutures depressed, oblique; wall calcareous, perforate, surface longitudinally striate or with low costae; aperture terminal, ovate, slightly produced, bordered with a lip, toothplate presence.

Family Siphogenerinoididae Saidova, 1981

Genus *Siphogenerina* Schlumberger, 1882

***Siphogenerina raphana* (Parker & Jones, 1865)** (Fig. 10)

Uvigerina (*Sagrina*) *raphanus* Parker & Jones, 1865, p. 364, pl. 18, Figs. 16–17.

Sagrina raphanus (Parker & Jones), Brady, 1884, p. 585, pl. 75, Figs. 21–22.

Rectobolivina raphana (Parker & Jones), Hofker, 1951b, p. 62; Loeblich & Tappan, 1964, p. C553, pl. 438, Figs. 9–11; Zheng et al., 1978, p. 204, pl. 18, Figs. 13–15; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 89, pl. VIII, Fig. 26; Wang et al., 1980, p. 196, pl. VIII, Fig. 29; Wang et al., 1988, p. 146, pl. XX, Fig. 20; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 179, pl. 13, Fig. 15; Hatta & Ujiié, 1992b, p. 174, pl. 26, Figs. 11–12.

Siphogenerina raphanus (Parker & Jones), Cushman, 1926b, p. 4, pl. 1, Figs. 1–4; pl. 2, Figs. 1–3; pl. 5, Figs. 1, 2; Cushman, 1940, p. 274, pl. 28, Figs. 18, 19; Bandy, 1952, pp. 17–18, pl. 5, Fig. 1; Cusham Todd & Post, 1954, p. 356, pl. 88, Figs. 23, 24; Cushman & Militante, 1959, p. 87, pl. 13, Fig. 8.

Siphogenerina raphana (Parker & Jones), Hayward et al., 1999, p. 130, pl. 9, Fig. 4; Debenay, 2012, p. 169.

Siphogenerina raphana (Parker & Jones, 1865)

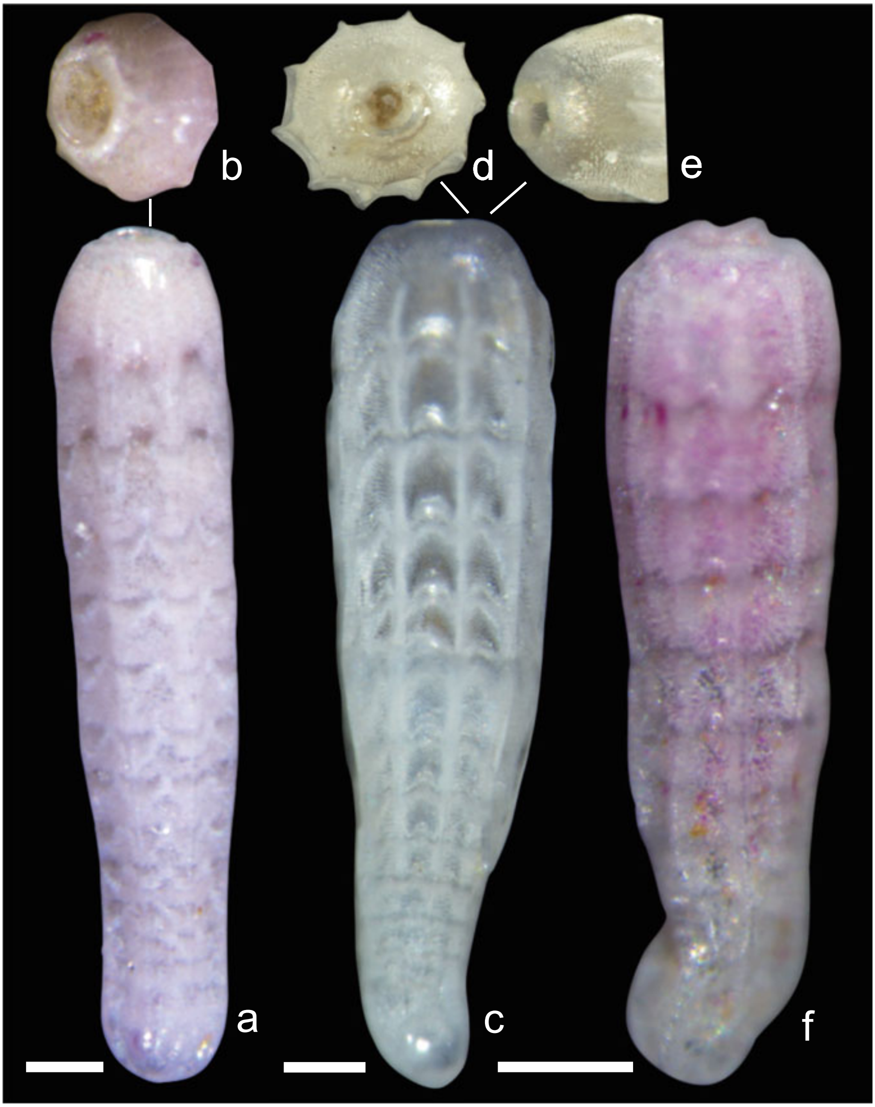

Fig. 10 a–f *Siphogenerina raphana* (Parker & Jones, 1865), three specimens showing morphological variabilities. **a, b** A live specimen. **c–e** Another specimen. **f** The third live specimen. **b, e** Anterior portion views. **d** Apical view showing cross section outline. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H7-01	1130	218	218
H7-02	1131	275	275
H7-03	671	173	173
H7-04	840	247	247

Occurrence and Ecology

The Bohai Sea (St A8) and the Yellow Sea (St CJ-06, St 3300-06, St 3400-05, St 3600-02, St 3600-04) (32°29′–38°29′ N, 119°52′–125°00′ E), water depth 25.00–55.20 m, temperature 3.34–18.08 °C, salinity 30.68–32.74 ‰, abundance 0.02–0.27 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Japan, Micronesia, Mozambique, New Zealand, South Korea, New Caledonia.

Description

Test elongate and robust, about 1000 μm in length. Chambers subcylindrical, uniserially arranged in later portion. Sutures horizontal and depressed. Wall thick and hyaline, surface with heavy and continuous longitudinal costae. Aperture round, with a short neck and lip.

Remarks

Siphogenerina raphana has been identified as *Rectobolivina raphana* in previous Chinese literature (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980, 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species and widely distributed in China Seas, but its abundance is usually low.

Family Buliminidae Jones, 1875

Genus *Bulimina* d'Orbigny, 1826

Bulimina gibba Fornasini, 1902 (Fig. 11)

Bulimina elegans d'Orbigny, Brady, 1884, p. 398, pl. 50, Figs. 1–2 (not Figs. 3–4).

Bulimina gibba Fornasini, 1902, p. 378, pl. O, Figs. 32–34; Cushman & Parker, 1947, p. 125, pl. 28, Figs. 37–38; pl. 29, Figs. 1–5; Barker, 1960, pl. 50, Figs. 1–2 (not Figs. 3–4); Research Party of Marine Geology, Ministry of Geology and

Bulimina gibba Fornasini, 1902

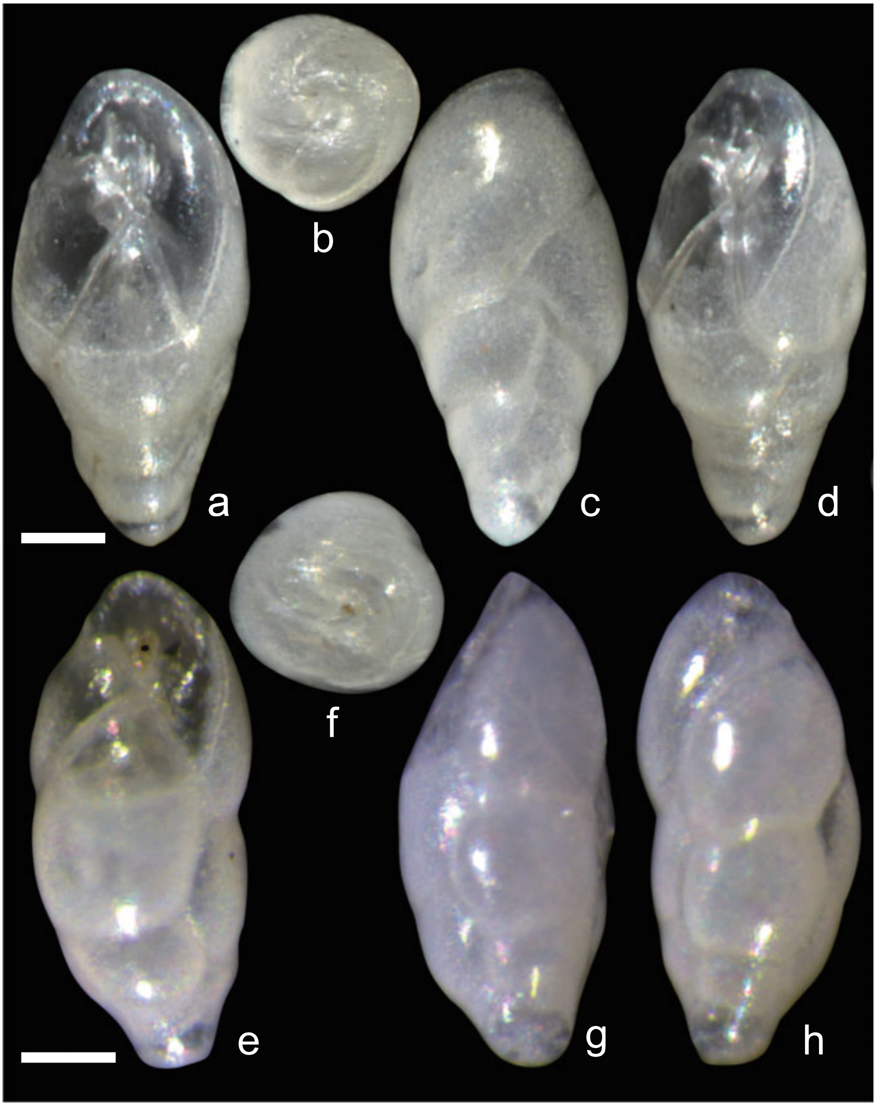

Fig. 11 **a–h** *Bulimina gibba* Fornasini, 1902, two specimens showing morphological variabilities. **a–d** Same specimen. **e–h** Another specimen. **b, f** Apical views showing cross section outline. Scale bars = 50 μm

Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 181, pl. 14, Fig. 9; pl. 15, Fig. 3; Jones, 1994, p. 54, pl. 50, Figs. 1–2; Millker and Schmiedl, 2012, p. 88, Figs. 20, 22; Holbourn et al., 2013, p. 96.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H109-01	289	143	143
H109-02	265	119	119

Occurrence and Ecology
The Yellow Sea (St CJ-01) (31°40′ N, 122°29′ E), water depth 29.40 m, temperature 22.40 °C, salinity 31.73 ‰, abundance 0.02 ind./g sed.

Distribution
Yellow Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George's Channel, New Zealand, North Atlantic Ocean, South Korea, Southeast U.S. Continental Shelf, Mediterranean Sea.

Description
Size 265–289 × 119–143 μm in length, usually near 280 × 130 μm. Test fusiform to clavate in shape, gradually narrowed in posterior end; rounded in section, length: width ratio about 2.1:1. Chambers triserial, slightly inflated and strongly overlapping. Sutures strongly oblique to nearly vertical, distinctly depressed. Wall calcareous, optically radial, perforate, surface smooth. Aperture a circular hole to a narrow curved slit, extending from the base of the final chamber.

Remarks
In the West Pacific region, *Bulimina gibba* has been reported from Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). In the Yellow Sea this species is rare and with low abundance. However, the West Pacific population of this species has a blunted posterior end. But the Atlantic population was characterized by have an acute posterior end (Holbourn et al., 2013). We consider that the morphological difference was due to different geological region.

***Bulimina marginospinata* Cushman & Parker, 1938** (Fig. 12)

Bulimina marginospinata Cushman & Parker, He et al., 1965, p. 85, pl. VI, Fig. 8; Panchang & Nigam, 2014, p. 28, pl. XXVI, Fig. 9.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H132-01	247	173	173
H132-02	239	187	187

Bulimina marginospinata Cushman & Parker, 1938

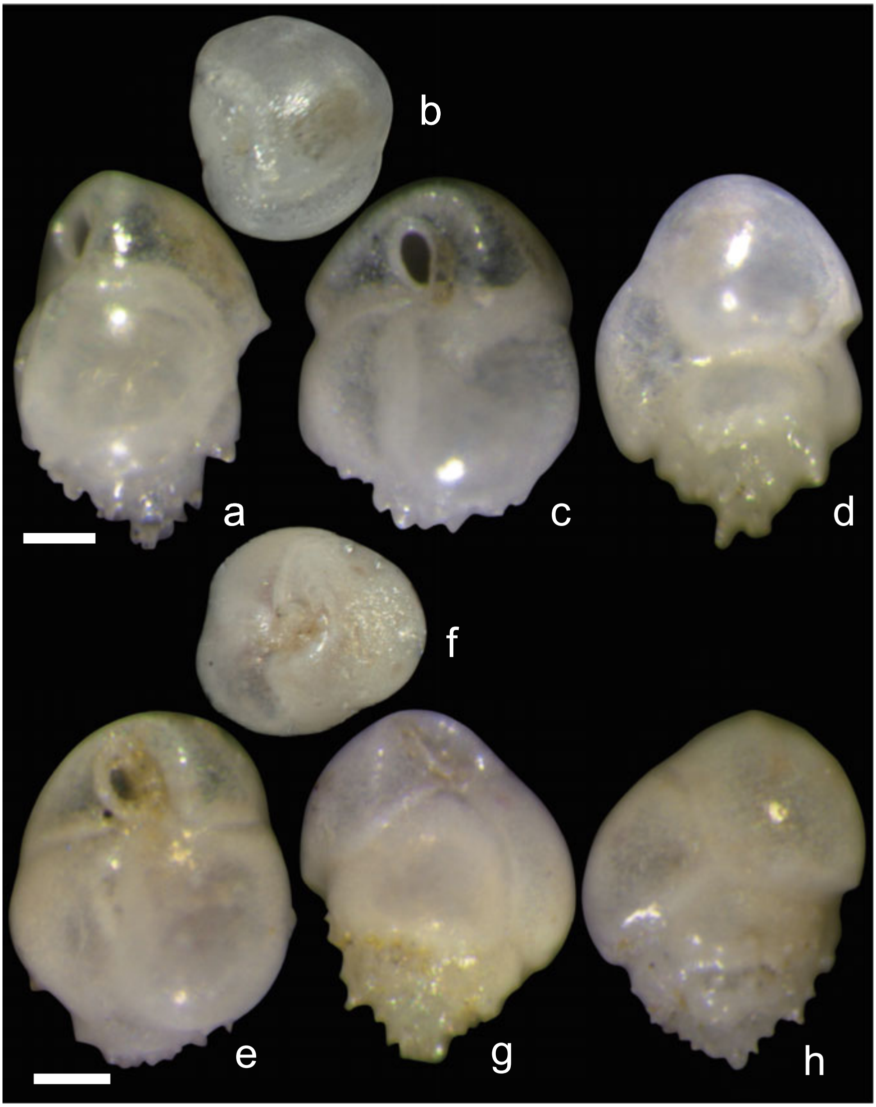

Fig. 12 a–h *Bulimina marginospinata* Cushman & Parker, 1938, two specimens showing morphological variabilities. **a–d** The same specimen. **e–h** Another specimen. **b, f** Apical views showing cross section outline. Scale bars = 50 μm

Occurrence and Ecology

The Yellow Sea (St 3000-02, St CJ-01, St 3400-06, St 3500-08, St 3600-06, St 3600-08) (29°59′–39°59′ N, 122°29′–123°59′ E), water depth 29.40–78.00 m, temperature 12.00–21.60 °C, salinity 31.50–34.27 ‰, abundance 0.04–1.07 ind./g sed.

Distribution
Yellow Sea.

Description
Size about 240 μm in length. Test elongate ovate, length:width ratio about 1.4:1. Chambers triserially arranged, but later ones nearly centered, occupying more than 1/3 of the body length. Septa distinct, depressed. Wall calcareous, finely perforate, surface smooth, but lower margin of chambers having many spines. Aperture a loop extending up the face from the base of the last chamber.

Remarks
Bulimina marginospinata has been reported by He et al. (1965) from the South Yellow Sea sediments as a new subspecies of *Bulimina marginospinata ovata* due to having a relatively smaller size and chambers having more spines. We consider the morphological difference in He et al. (1965) was due to different populations, thus was within the variabilities of the species. In the Yellow Sea this species is common but with low abundance.

***Bulimina subula* [Wang, 1978] nov. stat.** (Fig. 13)

Bulimina subula sp. nov., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 86, pl. VIII, Figs. 7–10.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H12-01	315	108	108
H12-02	302	118	118

Nomenclature
Bulimina subula was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978) in a Chinese local publication. According to International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), Recommendation 51D in Article 51.2.1, "Author anonymous, or anonymous but know or inferred,… if the authorship is known or inferred from external evidence, the name of the author, if cited, should be enclosed in square brackets to show the original anonymity." Therefore, we assigned Dr. Pin Xian Wang as the author since he guided the book publication.

Diagnosis
Size about 300 μm in length. Test elongate ovate, with a tapering posterior end, forming an awl-like in shape, rounded in section, length:width ratio about 2.7:1. Chambers triserial, slightly inflated and strongly overlapping. Sutures strongly oblique to nearly vertical, depressed. Wall calcareous, optically radial, perforate, surface smooth. Aperture a loop, extending from the base of the final chamber.

Etymology
The Latin adjective *subulatus* (awl-like), referring to the awl-like body shape.

Bulimina subula [Wang, 1978] nov. stat.

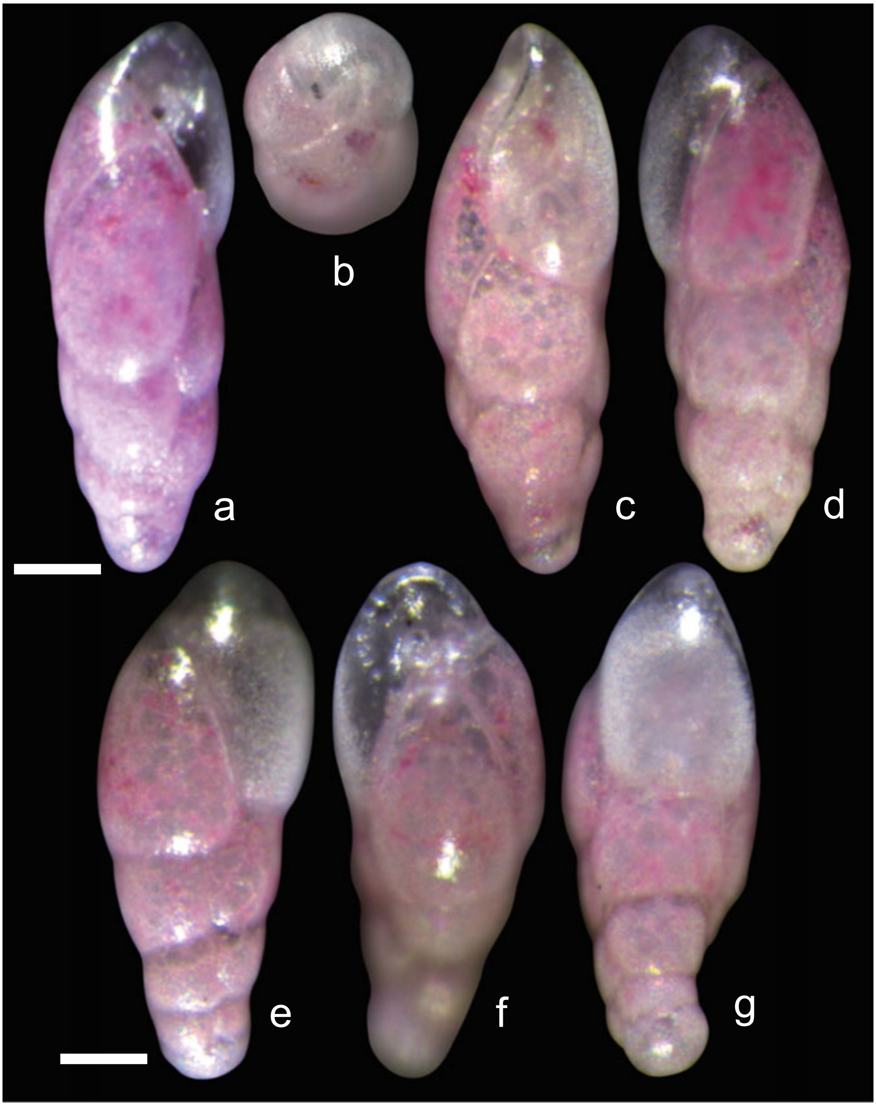

Fig. 13 **a–g** *Bulimina subula* [Wang, 1978], two specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **e–g** Another live specimen. **b** Apical view showing aperture and cross section outline. Scale bars = 50 μm

Occurrence and Ecology

The Yellow Sea (St CJ-04, St 3400-02, St 3800-02, St B-03) (32°10′–38°25′ N, 120°59′–124°00′ E), water depth 17.60–59.00 m, temperature 7.72–17.02 °C, salinity 29.15–32.08 ‰, abundance 0.08–1.61 ind./g sed.

Distribution
Yellow Sea.

Description
Size 302–315 × 108–118 μm in length, usually near 310 × 110 μm. Test elongate ovate with a tapering posterior end, forming an awl-like in shape; rounded in section, length:width ratio about 2.7:1. Chambers triserial, gradually increase size successively, slightly inflated and strongly overlapping. Sutures strongly oblique to nearly vertical, depressed. Wall calcareous, optically radial, perforate, surface smooth. Aperture a loop, extending from the base of the final chamber.

Remarks
Bulimina subula was discovered from sediments of the Southern Yellow Sea by Micropaleontology Group in Marine Geology Department of Tongji University (1978). Since publication of the book was guided by Dr. Pin Xian Wang, we assigned the authorship of this species as Wang, 1978. In our investigation, this species mainly distributed from the North to the South parts of the Yellow Sea (water depth 17.60–59.00 m) but with low abundance, indicating it might be an endemic species of the China Seas.

Family Buliminellidae Hofker, 1951

Genus *Buliminella* Cushman, 1911

***Buliminella elegantissima* (d'Orbigny, 1839)** (Fig. 14)

Bulimina elegantissima d'Orbigny, 1839, p. 51, pl. 7, Figs. 13–14; Murray, 1971, p. 105, pl. 42, Figs. 1–4.

Buliminella elegantissima (d'Orbigny), Cushman, 1940, p. 264, pl. 27, Fig. 4; Cushman & Parker, 1947, p. 67, pl. 17, Figs. 10–12; Barker, 1960, pl. 50, Figs. 20–22; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 85, pl. VIII, Figs. 4–5; Wang et al., 1988, p. 146, pl. XX, Fig. 8; Loeblich & Tappan, 1987, p. 522, pl. 572, Figs. 7–11; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 176, pl. 12, Fig. 10; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 78, pl. 153, Fig. 4; Yassini & Jones, 1995, p. 144, Figs. 638–640, 643–645; Debenay et al., 1998, pl. 4, Figs. 2, 3; Hayward et al., 1999, p. 133, pl. 9, Figs. 18–19; Debenay, 2012, p. 188; Panchang & Nigam, 2014, p. 28, pl. XXVI, Figs. 26, 27.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H110-01	238	102	93

Buliminella elegantissima (d'Orbigny, 1839)

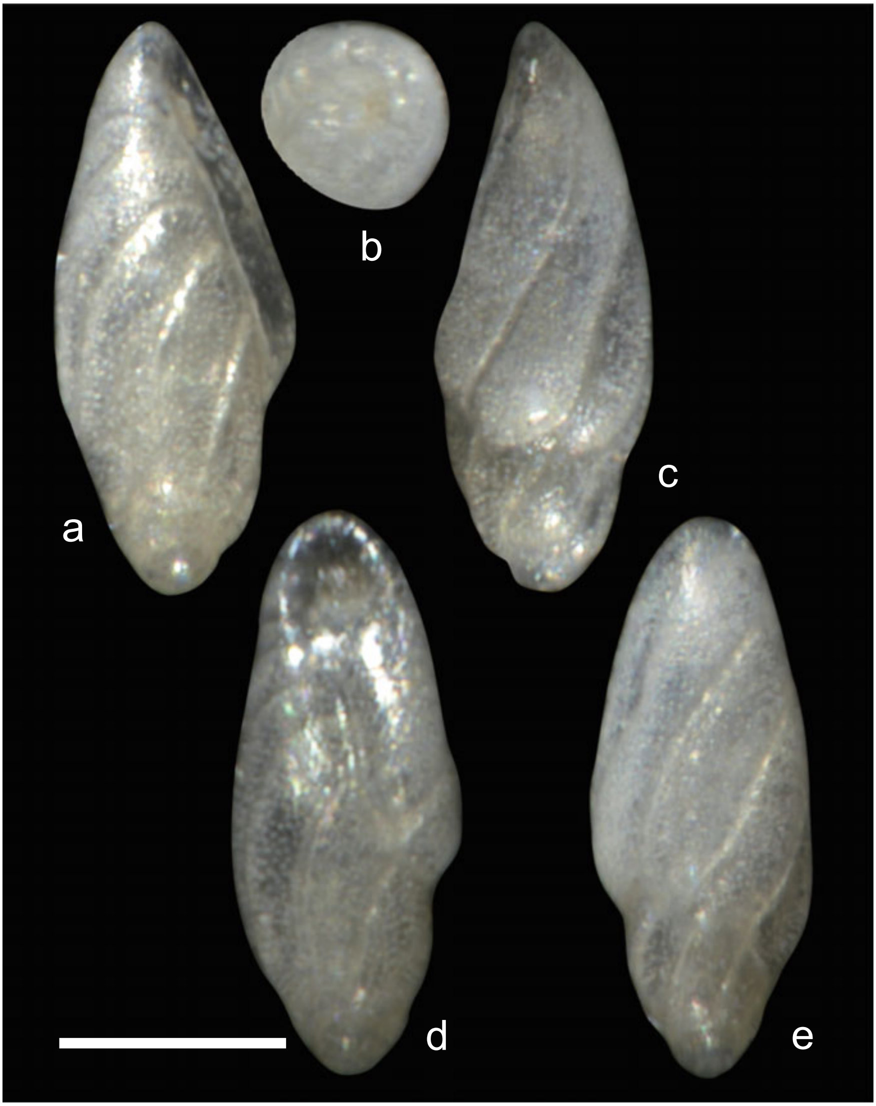

Fig. 14 **a–e** *Buliminella elegantissima* (d'Orbigny, 1839), the same specimen with different side views. **b** Apical view showing cross section outline. Scale bar = 100 μm

Occurrence and Ecology

The Yellow Sea (St 3600-02) (35°59′ N, 121°00′ E), water depth 33.80 m, temperature 10.35 °C, salinity 31.11 ‰, abundance 0.08 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, Southern Ocean, United States, New Caledonia, Scotian Shelf, Vineyard Sound, Arctic Ocean, Gulf of Mexico, Mediterranean Sea.

Description

Size about 240 μm in length. Test elongate ellipsoidal, length:width ratio about 2.3:1, sectional view rounded. About four chambers forming high trochospiral coil. Sutures slightly curved and spiral, almost paralleling the long axis of the test, slightly depressed. Wall calcareous, perforate, surface smooth. Aperture a loop in the depressed face of the final chamber.

Remarks

Buliminella elegantissima has been reported by previous Chinese publications from the Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species but usually with low abundance occurring in sediments of the offshore waters.

Family Uvigerinidae Haeckel, 1894

Genus *Uvigerina* d'Orbigny, 1826

***Uvigerina dirupta* Todd, 1948** (Fig. 15)

Uvigerina peregrina var. *dirupta*, Todd, 1948, p. 267, pl. 34, Fig. 3a–d; Resig, 1981, pl. 2, Fig. 6; Van Marle, 1988, p. 149, pl. 3, Fig. 14; Van Marle, 1991, p. 104, pl. 7, Figs. 16, 17.

Uvigerina peregrina dirupta, Asano, 1950, p. 16, text Figs. 60, 70; Ingle, Keller and Kolpack, 1980, p. 146, pl. 5, Figs. 16–17.

Uvigerina dirupta Todd, Wang et al., 1980, p. 193, pl. III, Fig. 6; South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981, p. 122, pl. 66, Fig. 2; Wang et al., 1988, p. 153, pl. XXII, Figs. 1–2; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 186, pl. 15, Figs. 18–20; Loeblich & Tappan, 1994, p. 128, pl. 250, Figs. 7–10.

Uvigerina dirupta Todd, 1948

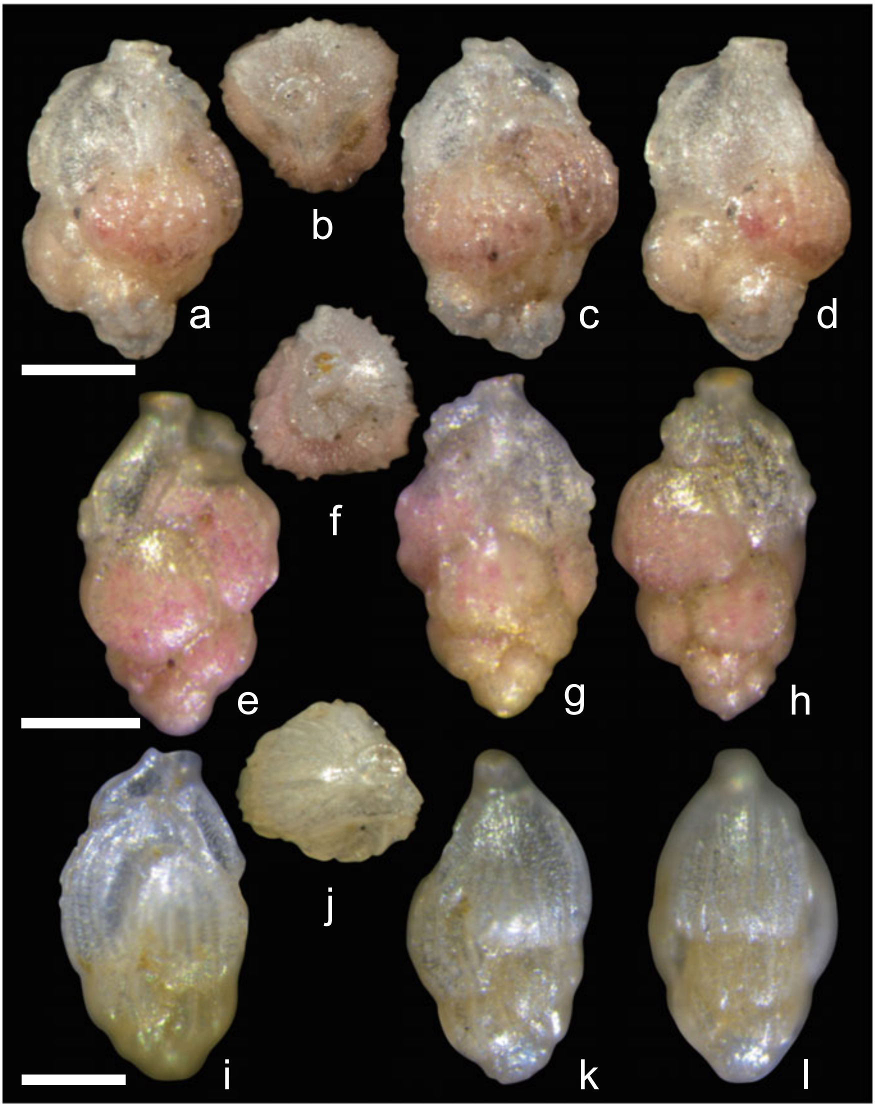

Fig. 15 a–l *Uvigerina dirupta* Todd, 1948, three specimens showing morphological variabilities. **a–d** A live specimen. **e–h** Another live specimen. **i–l** The third specimen. **b, f, j** Apical views showing cross section outline. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D21-01	282	189	189
D21-02	280	162	162
D21-03	313	181	181

Occurrence and Ecology

The Yellow Sea (St CJ-04, St 3800-02, St 3875-01, St 3875-03, St B-03) (32°10′–38°44′ N, 121°57′–124°00′ E), water depth 42.00–59.00 m, temperature 7.39–17.02 °C, salinity 31.62–32.08 ‰, abundance 0.04–1.92 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea (Miocene), Okinawa Trough.
Japan, North Atlantic Ocean.

Description

Size about 300 μm in length. Test ovoid, length:width ratio about 1.6:1. Chambers closely appressed in early stage but inflated in late stage, increasing in size as added, triserial ranged. Sutures distinct, depressed. Wall calcareous, perforate, surface with longitudinal platy costae and/or some strumose. Aperture terminal, produced on a neck and bordered with a phialine lip.

Remarks

Uvigerina dirupta has been reported by Chinese literature from the East China Sea (Wang et al., 1980, 1988), Miocene sediments of the South China Sea (South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). The Morphology of this species is rather variable from juvenile to adult. In Yellow Sea, it is also a common species occurring with moderate abundance within water depth from 42.00 to 59.00 m.

Uvigerina peregrina **Cushman, 1923** (Fig. 16)

Uvigerina cf. *U. peregrina* Cushman, Debenay, 2012, p. 184.

Uvigerina peregrina Cushman, 1923, p. 166, pl. 42, Figs. 7–10; Phleger & Parker, 1951, p. 18, pl. 8, Figs. 22, 24–26; Loeblich & Tappan, 1987, p. 525, pl. 573, Figs. 24–28; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 186, pl. 15, Fig. 13; Ujiié, 1990, p. 31, pl. 13, Figs. 1–3; Szareck, 2001, p. 130, pl. 18, Fig. 13; Panchang & Nigam, 2014, p. 29, pl. XXVII, Fig. 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B63-01	420	172	172
B63-02	380	179	179

Uvigerina peregrina Cushman, 1923

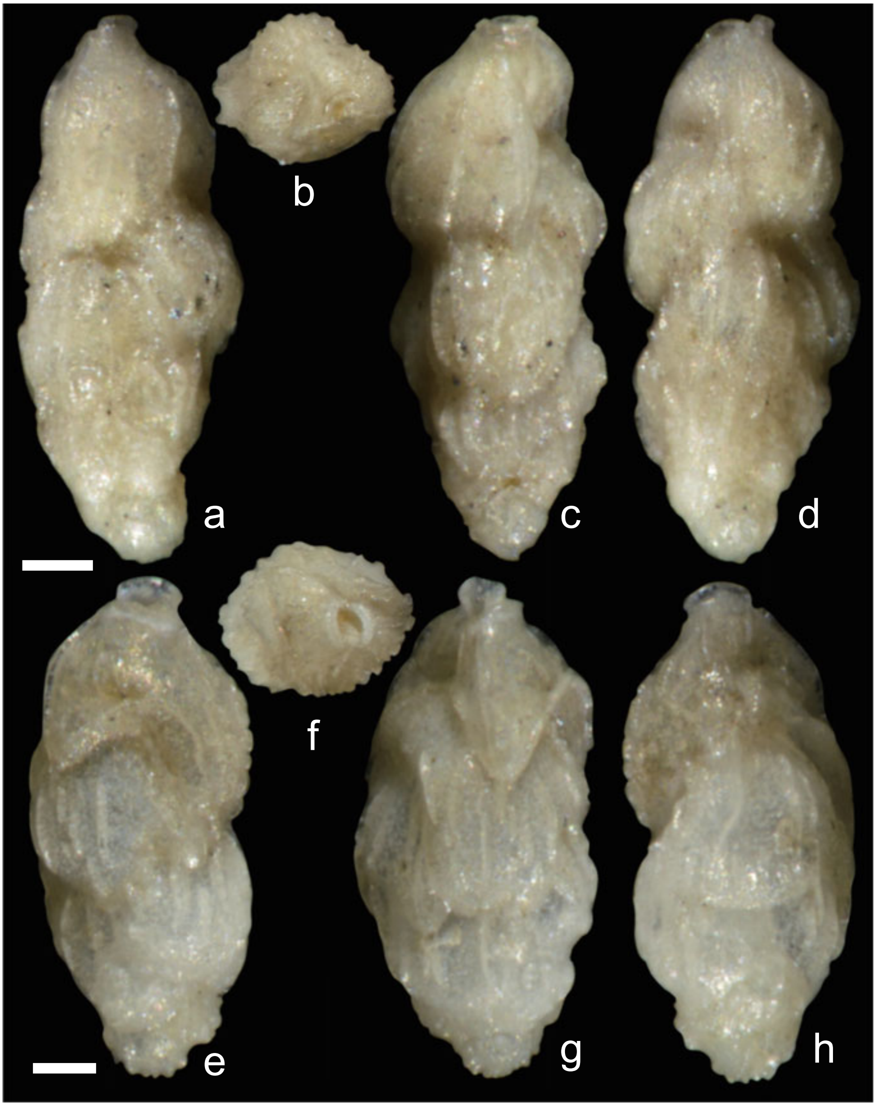

Fig. 16 a–h *Uvigerina peregrina* Cushman, 1923, two specimens showing morphological variabilities. **a–d** Same specimen. **e–h** Another specimen. **b, f** Apical views showing cross section outline. Scale bars = 50 μm

Occurrence and Ecology

The Bohai Sea (St 6, 4-6 cm and 8-10 cm sediments) and the Yellow Sea (St 3800-02) (38°00′–38°30′ N, 120°10′–122°59′ E), water depth 26.00–59.00 m, temperature 8.35 °C, salinity 30.51–31.96 ‰, abundance 0.02–0.08 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description

Size about 400 μm in length. Test elongate, narrow, length:width ratio about 2.3:1. Test elongate, triangular in section. Chambers triserial arranged. Early chambers closely appressed, later ones inflated. Sutures distinct, depressed, somewhat oblique. Wall calcareous, perforate, surface with longitudinal platy costae. Aperture terminal, produced on a neck and bordered with a phialine lip.

Remarks

Uvigerina peregrina has been reported from sediments of the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). The Yellow Sea specimens were relative smaller than those from the Okinawa Trough. It occurred usually with low abundance in the Yellow Sea.

Family Fursenkoinidae Loeblich & Tappan, 1961

Genus *Fursenkoina* Loeblich & Tappan, 1961

***Fursenkoina pauciloculata* (Brady, 1884)** (Fig. 17)

Virgulina pauciloculata Brady, 1884, p. 414, pl. 52, Figs. 4–5; Heron-Allen & Earland, 1922, p. 132; Cushman, 1932c, p. 10, pl. 2, Fig. 3; Cushman, 1937c, p. 25, pl. 4, Figs. 1–6; Cushman, 1942, p. 14, pl. 5, Figs. 1–3; Collins, 1958, p. 389.

Fursenkoina pauciloculata (Brady), He et al., 1965, p. 86, pl. VI, Figs. 9a, b; 10a, b; Lin et al., 1978, p. 108, pl. 28, Fig. 2; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 123, pl. 160, Fig. 11; Loeblich & Tappan, 1994, p. 131, pl. 256, Figs. 1–5; Debenay, 2012, p. 174; Panchang & Nigam, 2014, p. 30, pl. XXVIII, Figs. 18–20.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H149-01	268	113	93

Fursenkoina pauciloculata (Brady, 1884)

Fig. 17 a–e *Fursenkoina pauciloculata* (Brady, 1884), the same specimen with different side views showing morphological features. **b** Anterior body portion showing aperture. **c** Apical view showing cross section outline. Scale bar = 50 μm

Occurrence and Ecology

The Yellow Sea (St CJ-04) (32°10′ N, 124°00′ E), water depth 42.00 m, temperature 17.02 °C, salinity 32.08 ‰, abundance 0.09 ind./g sed.

Distribution
Yellow Sea, East China Sea.
Gulf of Saint Lawrence, Japan, New Caledonia, Gulf of Mexico.

Description
Size about 260 μm in length. Test elongate, ovate in section, length:width ratio about 2.4:1. Chambers high and narrow, slightly inflated, biserial throughout, but twisted around test axis. Sutures oblique, slightly depressed. Wall calcareous, hyaline, finely perforate, surface smooth. Aperture narrow, elliptical in shape, extending up the face of the final chamber.

Remarks
Fursenkoina pauciloculata has been reported from sediments of the South Yellow Sea (He et al., 1965) and the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). In our investigation, it occurred in water depth of 42.00 m in the Yellow Sea and with low abundance.

***Fursenkoina schreibersiana* (Czjzek, 1848)** (Fig. 18)

Virgulina schreibersiana Czjzek, 1848, p. 147, pl. 13, Figs. 18–21; Heron-Allen & Earland, 1915, p. 642, pl. 49, Figs. 1–12; Cushman, 1937c, p. 13, pl. 2, Figs. 11–20; Cushman, 1942, p. 12, pl. 4, Fig. 1; Asano, 1950d, p. 7, Figs. 28, 29; Hofker, 1951a, p. 241, text Fig. 160, 161; Asano, 1958, p. 15, text Figs. 1–4; Graham & Militante, 1959, p. 90, pl. 13, Figs. 18–20.
Cassidella schreibersiana (Czjzek), Azazi, 1992, pl. 2, Fig. 89.
Fursenkoina schreibersiana (Czjzek), Belford, 1966, p. 136, pl. 9, Figs. 18–21; Lin et al., 1978, p. 108, pl. 28, Fig. 3; Wang et al., 1988, p. 173, pl. XXX, Fig. 5; Ōki, 1989, p. 142, pl. 18, Fig. 5; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 124, pl. 160, Fig. 10; Loeblich & Tappan, 1994, p. 131, pl. 257, Figs. 1–12; Revets, 1996, p. 12, pl. 8, Figs. 5–8; Debenay, 2012, p. 174.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D39-01	647	178	153

Occurrence and Ecology
The Yellow Sea (St 3000-02, St CJ-01) (29°59′–31°40′ N, 122°29′–123°00′ E), water depth 29.40–42.77 m, temperature 22.33–22.40 °C, salinity 31.73–34.27 ‰, abundance 0.02–0.80 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Fursenkoina schreibersiana (Czjzek, 1848)

Fig. 18 **a–e** *Fursenkoina schreibersiana* (Czjzek, 1848), the same specimen with different side views showing morphological features. **b** Anterior body portion showing aperture. **c** Apical view showing cross section outline. Scale bar = 50 µm

Bay of Biscay, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, Northeast U.S. Continental Shelf.

Description

Size about 650 μm in length. Test elongate, narrow, ovate in section, length:width ratio about 3.6:1. Chambers high and narrow, slightly inflated, biserial throughout, slightly twisted about the test axis. Sutures oblique, depressed. Wall calcareous, hyaline, very finely perforate, surface smooth. Aperture narrow, slit-shaped, extending up the face of the final chamber.

Remarks

Fursenkoina schreibersiana has been reported from the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in the Yellow Sea and the East China Sea, especially in the middle continental shelf area.

Genus *Neocassidulina* McCulloch, 1977

***Neocassidulina abbreviata* (Heron-Allen & Earland, 1924)** (Fig. 19)

Bolivina limbata Brady var. *abbreviata* Heron-Allen & Earland, 1924a, p. 622, pl. 36, Figs. 25–27.

Bolivina abbreviate Heron-Allen & Earland, Cushman, 1937c, p. 143, pl. 18, Figs. 34, 35; Cushman, 1942, p. 33, pl. 9, Fig. 5.

Brizalina abbreviata (Heron-Allen & Earland), Hatta & Ujiié, 1992b, p. 172, pl. 25, Fig. 8.

Neocassidulina abbreviata (Heron-Allen & Earland), Loeblich & Tappan, 1994, p. 131, pl. 258, Figs. 1–7; Debenay, 2012, p. 175.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D137-01	547	185	150

Occurrence and Ecology

The Yellow Sea (St 3100-06) (31°00′ N, 124°59′ E), water depth 58.00 m, temperature 22.00 °C, salinity 32.00 ‰, abundance 2.54 ind./g sed.

Distribution

Yellow Sea.

South Korea, New Caledonia, Timor sea, Beagle Gulf, Bonaparte Gulf, Sahul Shelf.

Description

Size about 550 μm in length. Test elongate, flattened, lenticular in section, length: width ratio about 3:1. Chambers biserial and rectilinear throughout, about six

Neocassidulina abbreviata (Heron-Allen & Earland, 1924)

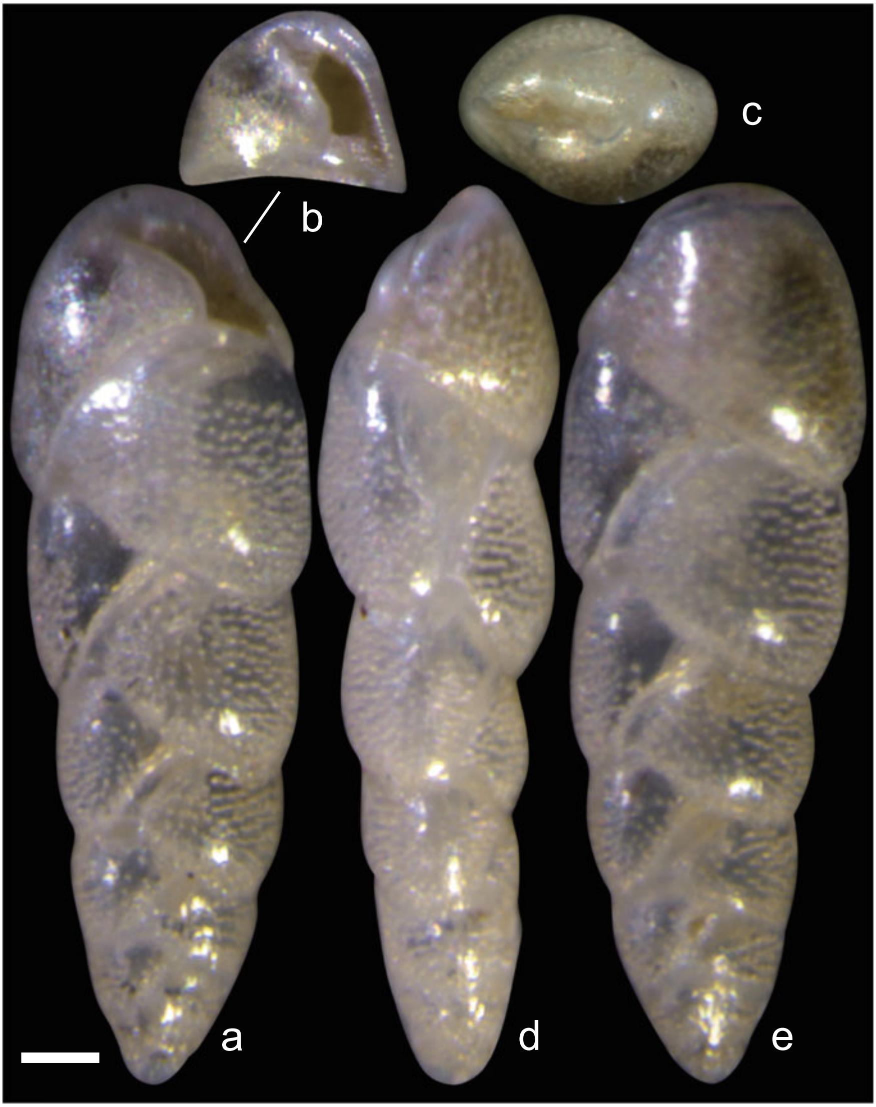

Fig. 19 a–e *Neocassidulina abbreviata* (Heron-Allen & Earland, 1924), same specimen with different side of views showing morphological features. **b** Anterior body portion showing aperture. **c** Apical view showing cross section outline. Scale bar = 50 µm

chambers in each row, increasing rapidly in height. Sutures oblique, depressed. Wall calcareous, distinctly perforate, glossy, surface smooth. Aperture an elongate curved slit extending up the face of the final chamber parallel to the distal margin and bordered by a narrow lip.

Remarks

Neocassidulina abbreviata might be a tropical species mainly distributing in South Pacific Ocean and Indian Ocean. In the Yellow Sea, it occurred only in one station within the Yellow Sea Cold Water Mass region of water depth 58.00 m.

Family Bagginidae Cushman, 1927

Genus *Cancris* de Montfort, 1808

***Cancris auriculus* (Fichtel & Moll, 1798)** (Fig. 20)

Nautilus auricula var. *alpha* Fichtel & Moll, 1798, p. 108, pl. 20, Figs. a–c.

Nautilus auricula var. *beta* Fichtel & Moll, 1798, p. 110, pl. 20, Figs. d–f.

Pulvinulina auricula (Fichtel & Moll), Cushman, 1921, p. 329, pl. 69, Fig. 3.

Cancris auriculus (Fichtel & Moll), Cushman, 1931, p. 72, pl. 15, Fig. 1a–c; Cushman, 1940, p. 297, pl. 31, Fig. 8; Leroy, 1941c, p. 117, pl. 3, Figs. 7–9, 16–18; Cushman & Todd, 1942, p. 74, pl. 18, Figs. 1–11; pl. 23, Fig. 6; Asano, 1951e, p. 19, text Figs. 144, 145; Graham & Militante, 1951, p. 91, pl. 13, Fig. 18; Leroy, 1964, p. F-39, pl. 6, Figs. 23, 24; Todd, 1965, p. 22, pl. 5, Fig. 5; He et al., 1965, p. 94, pl. VIII, Fig. 6a–c; Belford, 1966, p. 96, pl. 15, Figs. 1–5; Murray, 1971, p. 137, pl. 57, Figs. 1–7; Sellier De Civrieux, 1977, p. 13, pl. 2, Figs. 1–8; Lin et al., 1978, p. 86, pl. 19, Fig. 7; Rögl and Hansen, 1984, p. 67, pl. 26, Figs. 3–8, text Fig. 28; Loeblich & Tappan, 1987, p. 545, pl. 591, Figs. 1–3; Wang et al., 1988, p. 158, pl. XXIII, Fig. 13; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 189, pl. 16, Figs. 10–11; Ōki, 1989, p. 128, pl. 14, Fig. 8; Inoue, 1989, pl. 30, Fig. 6; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 85, pl. 155, Fig. 7a–c; Hatta & Ujiié, 1992b, p. 179, pl. 29, Fig. 4; Panchang & Nigam, 2014, p. 30, pl. XXVIII, Fig. 27; Loeblich & Tappan, 1994, p. 134, pl. 265, Fig. 7–10; Debenay, 2012, p. 189.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D12-01	473	323	188
D12-02	443	288	169

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3500-06, St 3875-03, St 3000-02) (29°59′–38°44′ N, 121°59′–127°00′ E), water depth 26.90–67.80 m, temperature 7.80–22.33 °C, salinity 30.31–34.27 ‰, abundance 0.04–3.21 ind./g sed.

Cancris auriculus (Fichtel & Moll, 1798)

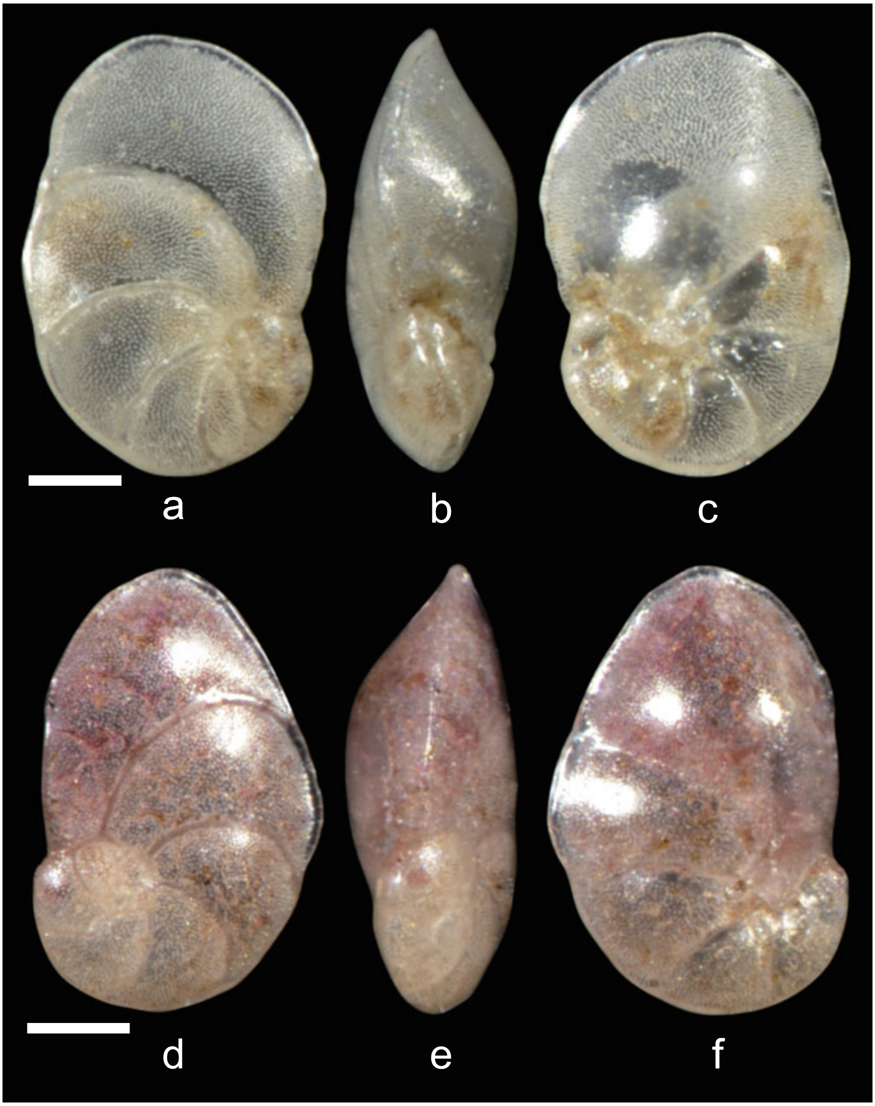

Fig. 20 a–f *Cancris auriculus* (Fichtel & Moll, 1798), two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another live specimen. **b, e** Lateral views. Scale bars = 100 μm

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George's Channel, Japan, Micronesia, Mozambique, North Atlantic Ocean, South Korea, United Kingdom, United States, New Caledonia, Gulf of Mexico.

Description
Size about 450 μm in length. Test auriculate, lenticular in section, length:width ratio about 1.5:1. Chambers increasing rapidly in breadth as added in a flaring trochospiral coil, about six to seven in final whorl. Periphery smooth, with feathered margin. Sutures depressed, arched on the spiral side, nearly radial around the umbilicus on the opposite side. Wall calcareous, perforate, but with an imperforate area above the aperture continuing into the imperforate umbilical apertural flap, surface smooth. Aperture a low interiomarginal opening on the umbilical side.

Remarks
Cancris auriculus has been reported from the Yellow Sea (He et al., 1965), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species in the middle continental shelf sediments of the China Seas.

Family Eponididae Hofker, 1951

Genus *Poroeponides* Cushman, 1944

***Poroeponides lateralis* (Terquem, 1878)** (Fig. 21)

Rosalina lateralis Terquem, 1878, p. 25, pl. 2, Fig. 11.

Poroeponides lateralis (Terquem), Cushman, 1940, p. 295, pl. 52, Fig. 14; Cushman, 1944b, p. 34, pl. 4, Fig. 23a–b; Loeblich & Tappan, 1987, p. 550, pl. 595, Figs. 1–3; Hottinger et al., 1993, p. 107, pl. 138, Figs. 1–9; Debenay, 2012, p. 210.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H146-01	822	544	265
H146-02(juvenile)	439	346	385

Occurrence and Ecology
Jiaozhou Bay, the Yellow Sea (St C1, St D7) (36°02′–36°06′ N, 120°10′–120° 22′ E), water depth 5.40–12.00 m, temperature 14.09–15.42 °C, salinity 30.77–30.96 ‰, abundance 0.37–0.41 ind./g sed.

Poroeponides lateralis (Terquem, 1878)

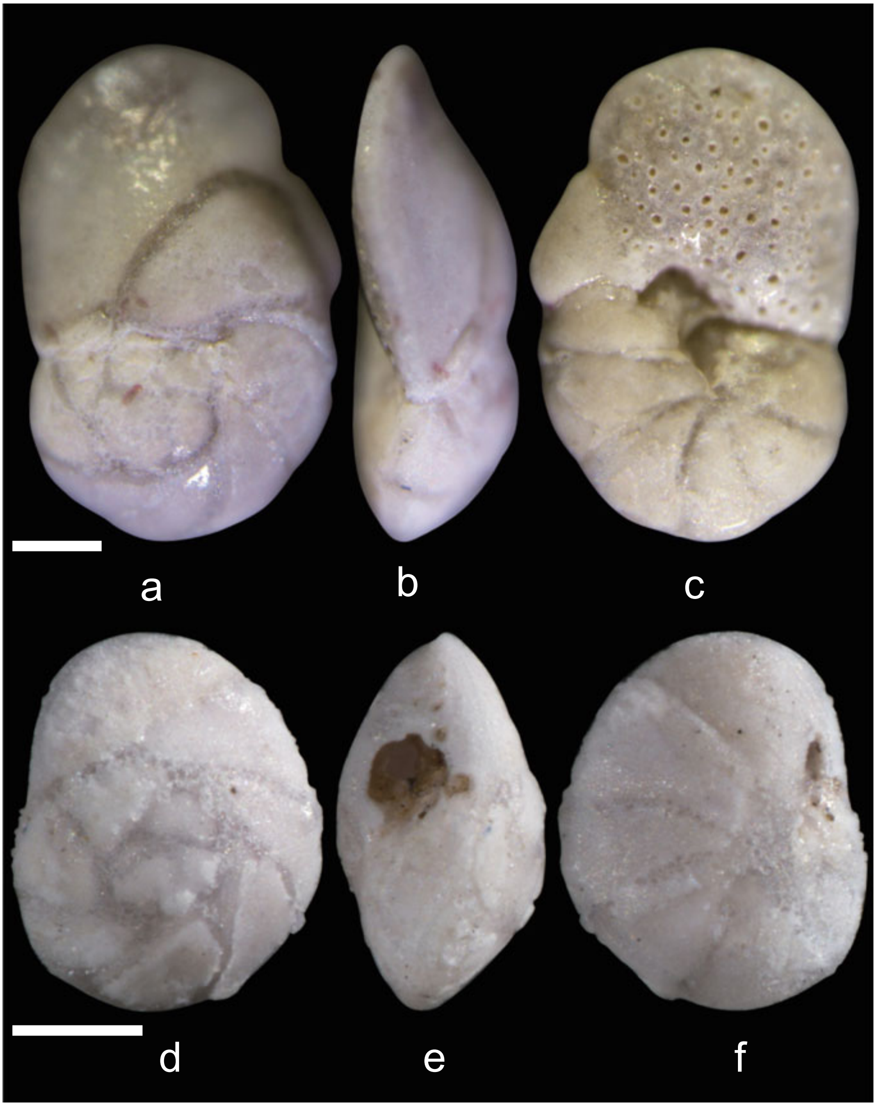

Fig. 21 **a–f** *Poroeponides lateralis* (Terquem, 1878), two specimens showing morphological variabilities. **a–c** An adult specimen with dorsal, lateral and ventral views. **d–f** A juvenile specimen. Scale bars = 150 μm

Distribution

Yellow Sea.

Celtic Sea, English Channel, Japan, New Zealand, North Atlantic Ocean, North Pacific Ocean, South Korea, United States, Chesapeake Bay, New Caledonia, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description

Size about 800 μm in length. Test elliptical in dorsal view, planoconvex to biconvex with strongly elevated spiral side, length:width ratio about 1.5:1; distinctly compressed in side view, around 2:1 flattened laterally. About seven chambers in final whorl. The last chamber with many pores scattered on ventral side in adult age, but in juvenile age may have no pores. Sutures curved and oblique on the spiral side, nearly radial on the umbilical side. Umbilical region depressed. Wall calcareous, perforate, surface smooth. Primary aperture interiomarginal, extending from the umbilicus to the peripheral margin and bordered above by a narrow lip.

Remarks

Poroeponides lateralis is a new record to China Seas. It occurred from Jiaozhou Bay, the Yellow Sea, where the water depth was within 5.40–12.00 m, temperature was 14.09–15.42 °C and salinity was 30.77–30.96 ‰. This species is characterized by having many scattered pores in the last chamber on the umbilical side in adults, thus is easily identified.

Family Rosalinidae Reiss, 1963

Genus *Rosalina* d'Orbigny, 1826

***Rosalina bradyi* (Cushman, 1915)** (Fig. 22)

Discorbina globularis (d'Orbigny), Brady, 1884, p. 643, pl. 86, Fig. 8a–c.

Discorbis globularis var. *brabyi*, Cushman, 1915, p. 12, pl. 8, Fig. 1.

Discopulvinulina bradyi Asano, 1951, p. 4, Figs. 25, 26.

Rosalina bradyi (Cushman), Barker, 1960, pl. 86, Fig. 8a–c; He et al., 1965, p. 89, pl. 7, Figs. 5a–c, 6a–c; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 90, pl. IX, Figs. 20–22; Wang et al., 1988, p. 156, pl. XXIII, Fig. 12; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 84, pl. 155, Figs. 4a–c; Hayward et al., 1999, p. 142, pl. 11, Fig. 1; Debenay, 2012, p. 211; Panchang & Nigam, 2014, p. 32, pl. XXX, Fig. 5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H38-01	416	337	152
H38-02	490	417	196

Rosalina bradyi (Cushman, 1915)

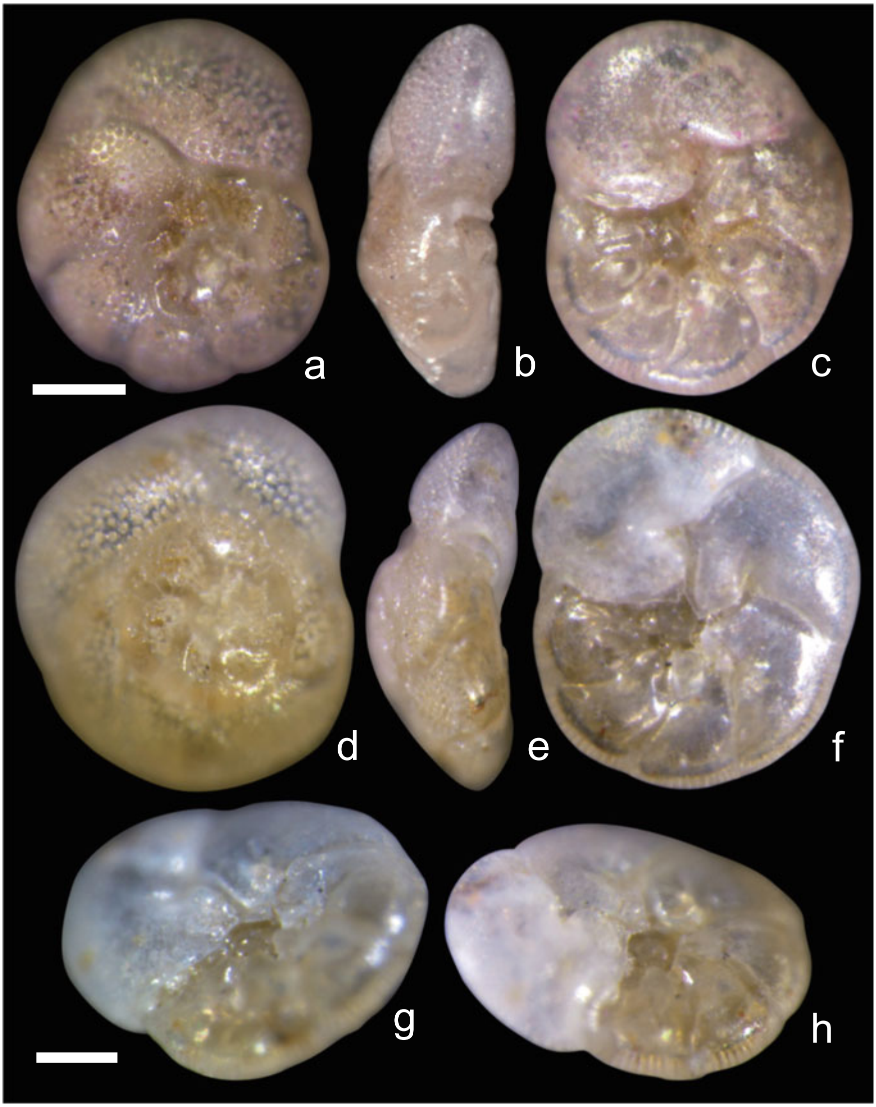

Fig. 22 a–h *Rosalina bradyi* (Cushman, 1915), two specimens showing morphological variabilities. **a–c** Same specimen. **d–h** Another specimen with different side of views. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St 3400-05, St 3500-02, St 3875-01), the Jiaozhou Bay (St C1, St C3, St C4, St D7) and intertidal flat of the Qingdao Bay (34°00′–38°44′ N, 120°00′–122°30′ E), water depth 0.00–51.00 m, temperature 7.39–22.80 °C, salinity 30.78–34.00 ‰, abundance 0.02–8.94 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, New Zealand, North Atlantic Ocean, South Korea, New Caledonia, Mediterranean Sea.

Description
Size about 450 μm in length, length:width ratio about 1.2:1. Test ovate in shape, planoconvex to concavoconvex, around 2.2:1 flattened laterally. Chambers increased rapidly in size, about six to seven chambers in final whorl; chamber surface with many minute pores on dorsal side; on the umbilical side chambers are subtriangular and strongly overlapping, the final chamber occupying about one-third of the circumference and the last one to two chambers usually heterochromous. Sutures strongly curved and depressed. Umbilicus open, bordered by a triangular umbilical flap from each chamber of the final whorl. Periphery subacute. Wall calcareous, distinctly perforate, surface smooth, very coarse. Aperture a low interiomarginal arch near the periphery on the umbilical side, with narrow bordering lip.

Remarks
Rosalina bradyi has been reported from the Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species usually occurring in shallow water region of the continental shelf sediments in the Yellow Sea and the East China Sea.

***Rosalina floridana* (Cushman, 1922)** (Fig. 23)

Discorbis floridana Cushman, 1922a, p. 39, pl. 5, Figs. 11, 12; Cushman, 1931, p. 21, pl. 4, Figs. 7a–8c; Cushman, 1949, p. 238, pl. 15, Figs. 16–18.

Rosalina floridana (Cushman), Schnitker, 1971, p. 210, pl. 5, Fig. 19; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 20, pl. 10, Figs. 14, 15; Sgarrella & Moncharmont-Zei, 1993, p. 218, pl. 17, Fig. 6; Debenay, 2012, p. 211.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H80-01	135	120	68
H80-02	100	85	50
H80-03	85	75	40

Rosalina floridana (Cushman, 1922)

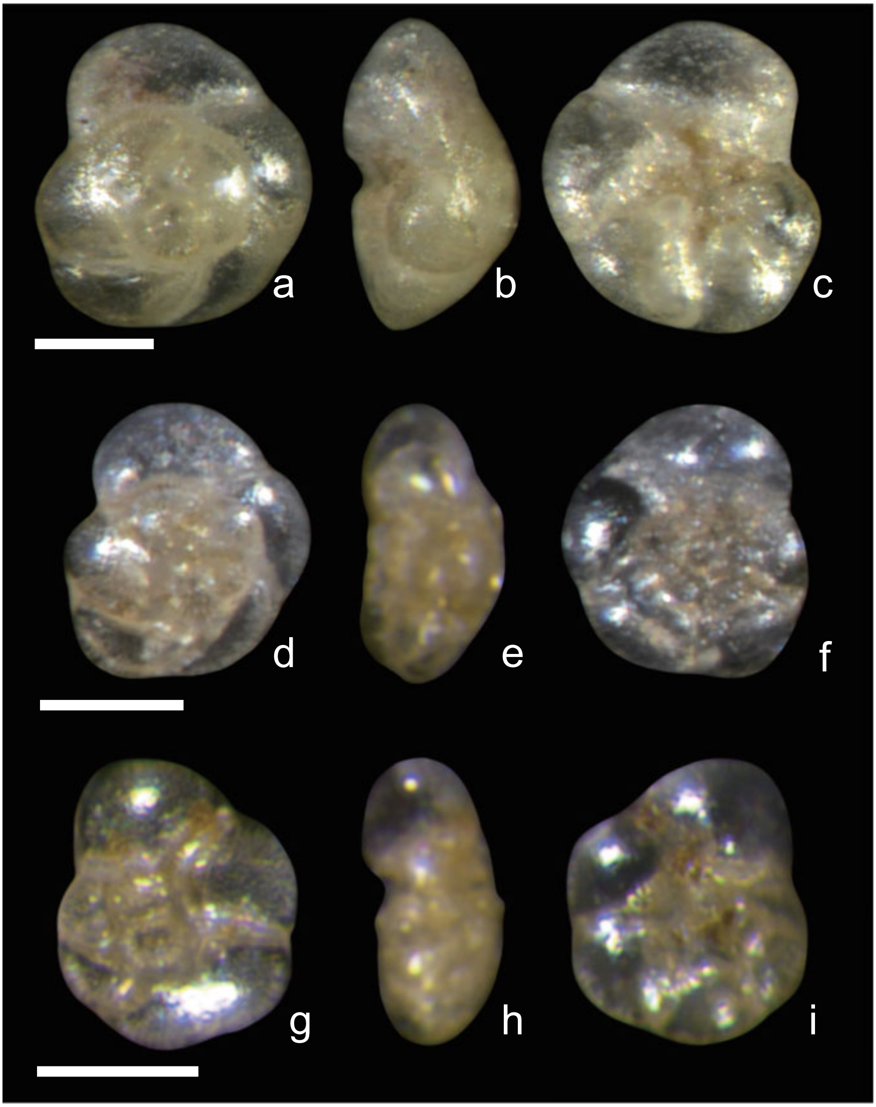

Fig. 23 a–i *Rosalina floridana* (Cushman, 1922), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 50 μm

Occurrence and Ecology

The Yellow Sea (St CJ-02, St CJ-04, St 3400-05) and intertidal flat of the Qingdao Bay (31°49′–36°00′ N, 120°30′–124°00′ E), water depth 3.00–42.00 m, temperature 2.00–17.54 °C, salinity 31.12–34.00 ‰, abundance 0.2–2.32 ind./g sed.

Distribution

Yellow Sea, Bohai Sea (Quaternary).

Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, South Korea, Southern Ocean, United Kingdom, United States, Grand Bank, New Caledonia, Scotian Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description

Size small, about 120 μm in length, length:width ratio about 1.1:1. Test planoconvex to concavoconvex, around 1.7:1 flattened laterally. Five chambers in final whorl, on the umbilical side chambers are strongly overlapping, the final chamber occupying about quarter of the circumference. Periphery subacute. Sutures strongly curved, slightly depressed and curved back at the periphery. Umbilicus open, bordered by a triangular umbilical flap from each chamber of the final whorl. Wall calcareous, distinctly perforate, surface smooth, very fine and transparent. Aperture a low interiomarginal arch near the periphery on the umbilical side.

Remarks

Rosalina floridana has been reported from the Quaternary sediment from littoral zone of the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), but the Yellow Sea specimens were relatively smaller. This species usually occurred in shallow water region of the Yellow Sea sediment near Yangtze Estuary.

Rosalina vilardeboana **d'Orbigny, 1839** (Fig. 24)

Discorbina vilardeboana (d'Orbigny), Heron-Allen & Earland, 1932, p. 409, pl. 13, Figs. 37–39.

Rosalina vilarbodeana Brady, 1884, p. 645, pl. 86, Figs. 9, 12; pl. 88, Fig. 2.

Rosalina vilarbodeana d'Orbigny, 1839, p. 44, pl. 6, Figs. 13–15; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 91, pl. IX, Figs. 19, 23, 24; pl. X, Figs. 1–3; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 84, pl. 155, Fig. 6a–c.

Rosalina vilardeboana d'Orbigny, Todd, 1965, p. 13, pl. 3, Figs. 2, 5; Matoba, 1967, p. 257, pl. 26, Figs. 15a–c, 16a–c; 1970, p. 61, pl. 4, Fig. 11a–c; Zheng et al., 1979, p. 169, pl. XVIII, Fig. 11; Wang et al., 1988, p. 156, pl. XXII, Figs. 17–18; Ōki, 1989 (non d'Orbigny, 1939c), p. 128, pl. 14, Fig. 7.

Discorbis vilardeboanus (d'Orbigny, 1839), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H31-01	275	233	121
H31-02	267	230	88
H31-03	255	207	73

Rosalina vilardeboana d'Orbigny, 1839

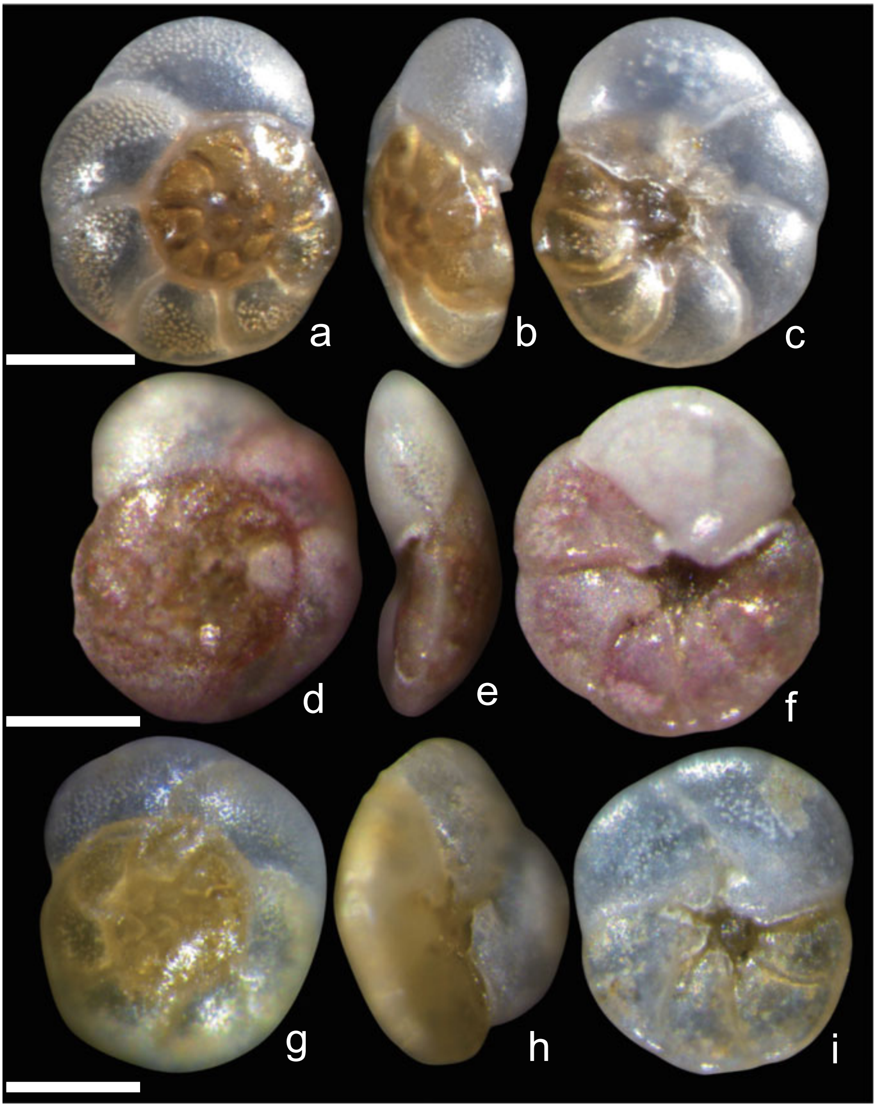

Fig. 24 a-i *Rosalina vilardeboana* d'Orbigny, 1839, three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another live specimen. **g–i** The third specimen. Scale bars = 100 μm

Occurrence and Ecology

The Bohai Sea (St A8) and the Yellow Sea (St CJ-04, St 3400-08, St 3500-02, St 3600-02, St 3700-01, St 3875-03) and intertidal flat of the Qingdao Bay

(32°10′–39°00′ N, 119°30′–124°00′ E), water depth 0.00–80.00 m, temperature 7.54–23.50 °C, salinity 30.82–38.00 ‰, abundance 0.02–2.98 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan, New Zealand, North Atlantic Ocean, Norway.

Description

Size about 270 μm in length, length:width ratio about 1.2:1. Test concavoconvex, around 2.4:1 flattened laterally. About two and a half whorls, six to seven chambers in final whorl, which is usually heterochromous. Sutures curved, slightly depressed and curved back at the periphery. Periphery rounded. Chambers on the umbilical side are subtriangular and strongly overlapping, the final chamber occupying about a quarter of the circumference. Umbilicus open, bordered by a triangular umbilical flap or folium from each chamber of the final whorl. Wall calcareous, distinctly perforate, surface smooth, fairly coarse. Aperture a low interiomarginal arch near the periphery on the umbilical side, with narrow bordering lip.

Remarks

Rosalina vilardeboana has been reported from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in continental shelf sediments of the China Seas (Wang et al., 1988). This species matches important features within the Genus of *Rosalina*, such as test morphology and open umbilicus, which was bordered by a triangular umbilical flap or folium from each chamber of the final whorl. Therefore it should not be affiliated with the Genus *Discorbis* (Hayward et al., 2015).

Family Glabratellidae Loeblich & Tappan, 1964

Genus *Murrayinella* Farias, 1977

***Murrayinella globosa* (Millet, 1903)** (Fig. 25)

Discorbina imperatoria (d'Orbigny) var. *globosa* Millett, 1903, p. 701, pl. 7, Fig. 6a–c.

Rotalia erinacea Heron-Allen & Earland, 1915, p. 720, pl. 53, Figs. 23–26.

Pararotalia cf. *imperatorial* (d'Orbigny) var. *globose* (Millett), Chiji & Lopez, 1968, p. 109, pl. 12, Fig. 5.

Schackoiella (?) *dissensa* Mcculloch, 1977, p. 317, pl. 169, Figs. 5, 10–12.

Murrayinella erinacea (Heron-Allen & Earland), Farıas, 1977, p. 343, pl. 1, Fig. 7.

Pararotalia globosa (Millett), Matta & Ujiiė, 1992b, p. 198, pl. 43, Fig. 5.

Murrayinella globosa (Millet, 1903)

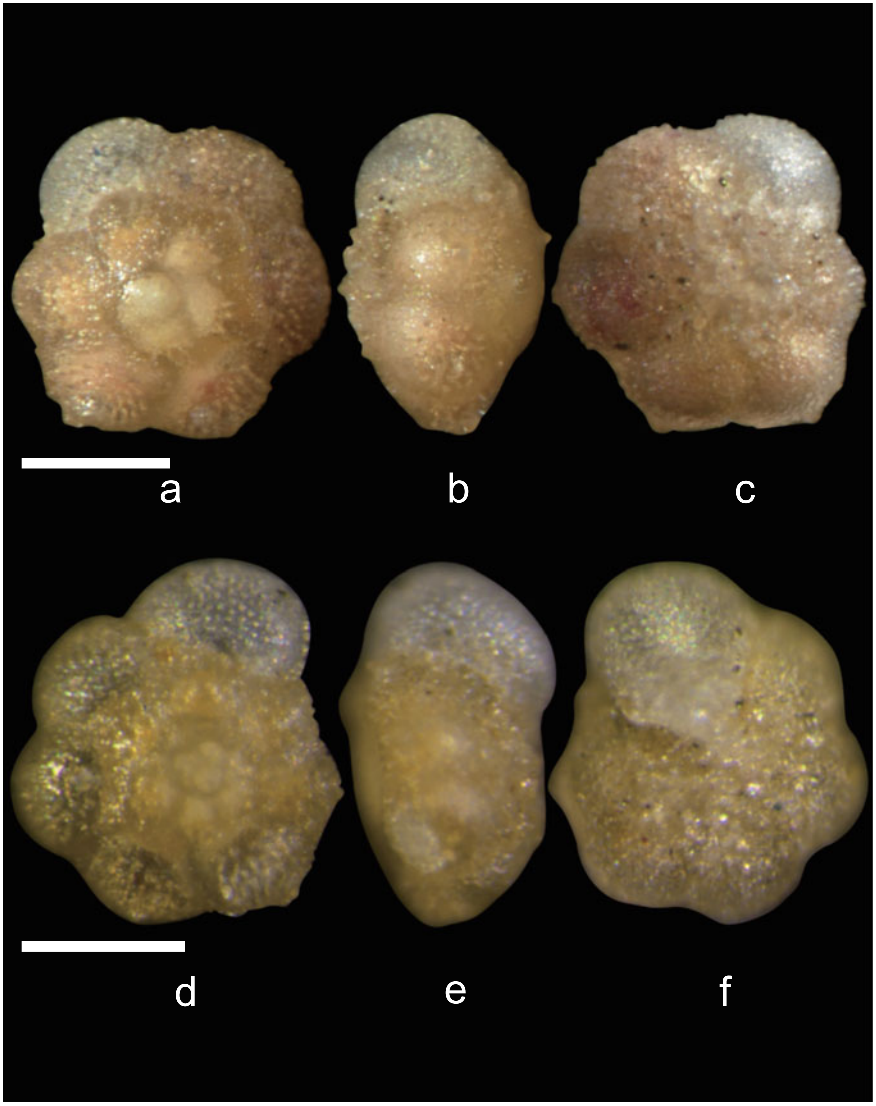

Fig. 25 a–f *Murrayinella globosa* (Millet, 1903), two specimens showing morphological variabilities. **a–c** A live specimen. **d–f** Another specimen. Scale bars = 100 μm

Pararotalia murrayi (Heron-Allen & Earland), Ujiie, 1963, p. 239, pl. 3, Figs. 3–9.

Schackoinella globosa (Millett), Loeblich & Tappan, 1994, p. 142, pl. 294, Figs. 1–10; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 93, pl. XI, Figs. 4–12.

Ammonia globosa (Millett), Zheng et al., 1978, p. 49, pl. V, Figs. 7–11; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 87, pl. 156, Fig. 6a, b.

Murrayinella globosa (Millett), Nomura & Takayanagi, 2000, p. 174, Fig. 1 nos 1–8; Debenay, 2012, p. 202.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H115-01	240	213	141
H115-02	228	203	123

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 1.50–26.50 °C, salinity 31.00–38.00 ‰, abundance 0.21–7.05 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea, East China Sea.

Japan, South Korea, New Caledonia.

Description

Test small, size about 230 μm in diameter, trochospirally enrolled, about six chambers forming about two whorls. Sutures deeply depressed. Umbilicus closed. Peripheral outline lobulated. Wall hyaline, perforate, surface hispid, fairly coarse. Aperture a low interiomarginal slit.

Remarks

Murrayinella globosa has been identified as *Schackoinella globosa* (Micropaleontology Group in Marine Geology Department of Tongji University, 1978) or *Ammonia globosa* (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) in previous Chinese literature. In the Yellow Sea, it occurred in intertidal flat sediments but not in continental shelf during several years samplings, indicating it might be an intertidal environmental indicator.

Family Parrelloididae Hofker, 1956

Genus *Cibicidoides* Thalmann, 1939

***Cibicidoides pseudoungeriana* (Cushman, 1922)** (Fig. 26)

Truncatulina pseudoungeriana Cushman, 1922, p. 97, pl. 20, Fig. 9.

Cibicides pseudoungeriana, Cushman, 1931, p. 123, pl. 22, Figs. 3–7.

Cibicidoides pseudoungeriana (Cushman, 1922)

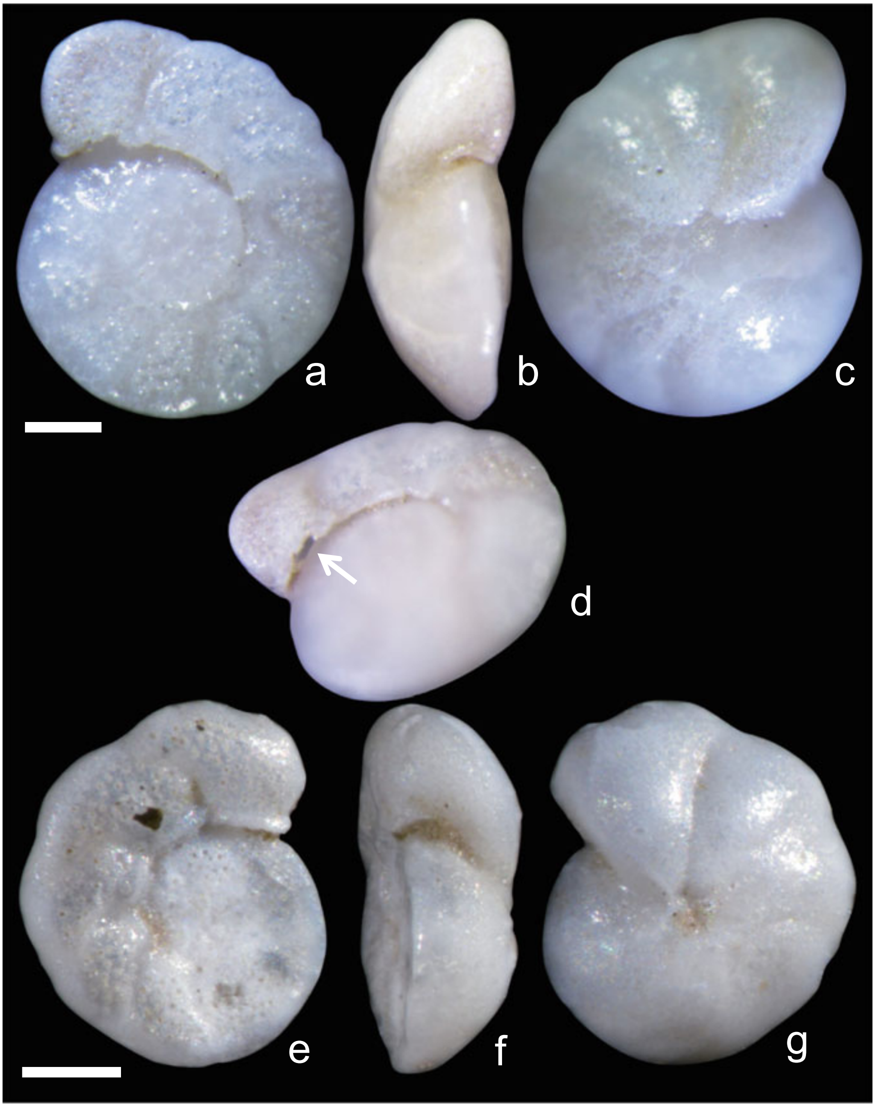

Fig. 26 a–g *Cibicidoides pseudoungeriana* (Cushman, 1922), two specimens showing morphological variabilities. **a–d** Same specimen. **e–g** Another specimen. **b, f** Lateral views. *Arrow* denotes aperture. Scale bars = 100 μm

Cibicides pseudoungerianus (Cushman), He et al., 1965, p. 95, pl. IX, Fig. 1a–c; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 92, pl. X, Figs. 22–24; Wang et al., 1988, p. 162, pl. XXV, Figs. 15–16;

Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 122, pl. 161, Fig. 4.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H4-01	507	431	181
H4-02	375	317	160

Occurrence and Ecology
The Yellow Sea (St CJ-06, St 3300-04, St 3300-06, St 3400-08, St 3500-02, St 3875-01) and intertidal flat of the Qingdao Bay (32°29′–38°44′ N, 120°00′–125° 00′ E), water depth 0.00–80.00 m, temperature 1.50–23.50 °C, salinity 30.82–36.00 ‰, abundance 0.10–7.83 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Celtic Sea, Gulf of Saint Lawrence, Japan, Micronesia, New Zealand, North Atlantic Ocean, South Korea, United States, Northeast U.S. Continental Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description
Size about 450 μm in length, length:width ratio about 1.2:1. Test biumbonate, or spiral side flat while ventral side convex, around 2.1:1 flattened laterally, with about two to three whorls. Eight to ten chambers in the final whorl. Sutures cured and limbate on the spiral side; umbilical side with nearly straight and radial sutures around the elevated umbo. Periphery somewhat angular. Wall calcareous, coarsely perforate on the spiral side, perforations in early chambers only near the spiral suture but cover most of the later chamber surfaces; umbilical side without pores. Aperture a low interiomarginal and equatorial arch at the base of the apertural face, on the periphery and above the keel of the previous whorl, bordered by a small lip.

Remarks
Cibicidoides pseudoungeriana has been identified as *Cibicides pseudoungerianus* in Chinese literature from sediments of the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and from the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in continental shelf sediments of the China Seas.

***Cibicidoides subhaidingerii* (Parr, 1950)** (Fig. 27)

Truncatulina Haidingerii (d'Orbigny), Brady, 1884, p. 663, pl. 95, Fig. 7.

Cibicidoides subhaidingerii (Parr, 1950)

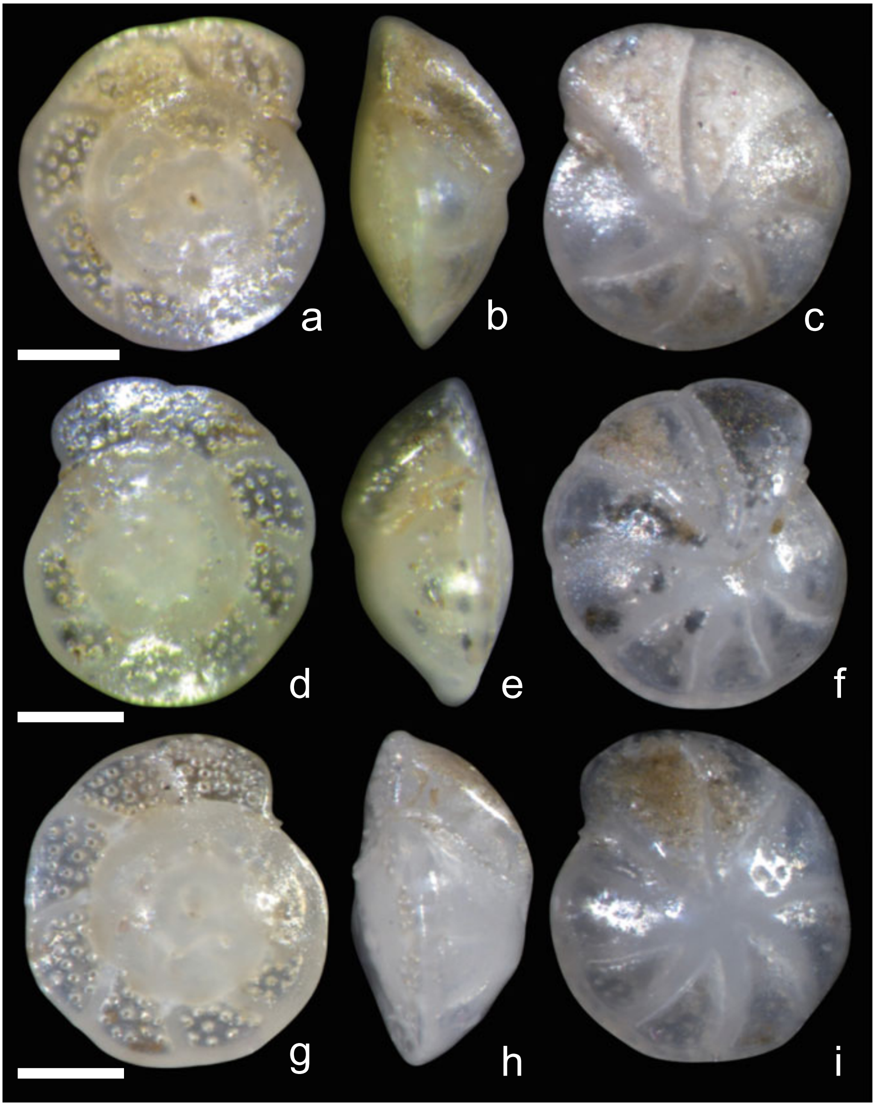

Fig. 27 **a–i** *Cibicidoides subhaidingerii* (Parr, 1950), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Cibicides subhaidingeri Parr, 1950, p. 364, pl. 15, Fig. 7; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 123, pl. 161, Fig. 2; Inoue, 1989, pl. 21, Fig. 1.

Cibicides subhaidingerii Parr, Barker, 1960, pl. 95, Fig. 7.

Cibicidoides yoitaensis Matsunaga, 1963, p. 117, pl. 52, Fig. 3a–c.

Cibicidoides subhaidingerii (Parr), Van Morkhoven et al., 1986, p. 95, pl. 28; Jones, 1994, p. 99, pl. 95, Fig. 7; Robertson, 1998, p. 208, pl. 81, Fig. 4; Holbourn et al., 2013, p. 204.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D43-01	320	303	165
D43-02	293	263	148
D43-03	305	275	165

Occurrence and Ecology

The Yellow Sea (St 3000-02) (29°59′ N, 123°00′ E), water depth 42.77 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 1.34 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, New Zealand, North Atlantic Ocean, South Korea, New Caledonia, Sahul Shelf.

Description

Size about 300 μm in length, length:width ratio about 1.1:1. Test biconvex, or spiral side slightly convex while umbilical side greatly convex, with about three whorls, around 1.8:1 flattened laterally. Eight to nine chambers in the final whorl. Sutures curved and limbate. Periphery rounded or petaloid. Wall calcareous, fine and transparent, coarsely perforate on the spiral side, perforations in early chambers only near the spiral suture but cover most of the later chamber surfaces, umbilical side without pores. Aperture a low interiomarginal and equatorial arch at the base of the apertural face, on the periphery and above the keel of the previous whorl, bordered by a small lip.

Remarks

Cibicidoides subhaidingerii has been identified as *Cibicides subhaidingeri* from the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). In the Yellow Sea, it occurred in shallow water sediments with water depth of 42.77 m.

Family Pseudoparrellidae Voloshinova, 1952

Genus *Epistominella* Husezima & Maruhasi, 1944

***Epistominella naraensis* (Kuwano, 1950)** (Fig. 28)

Epistominella naraensis (Kuwano, 1950)

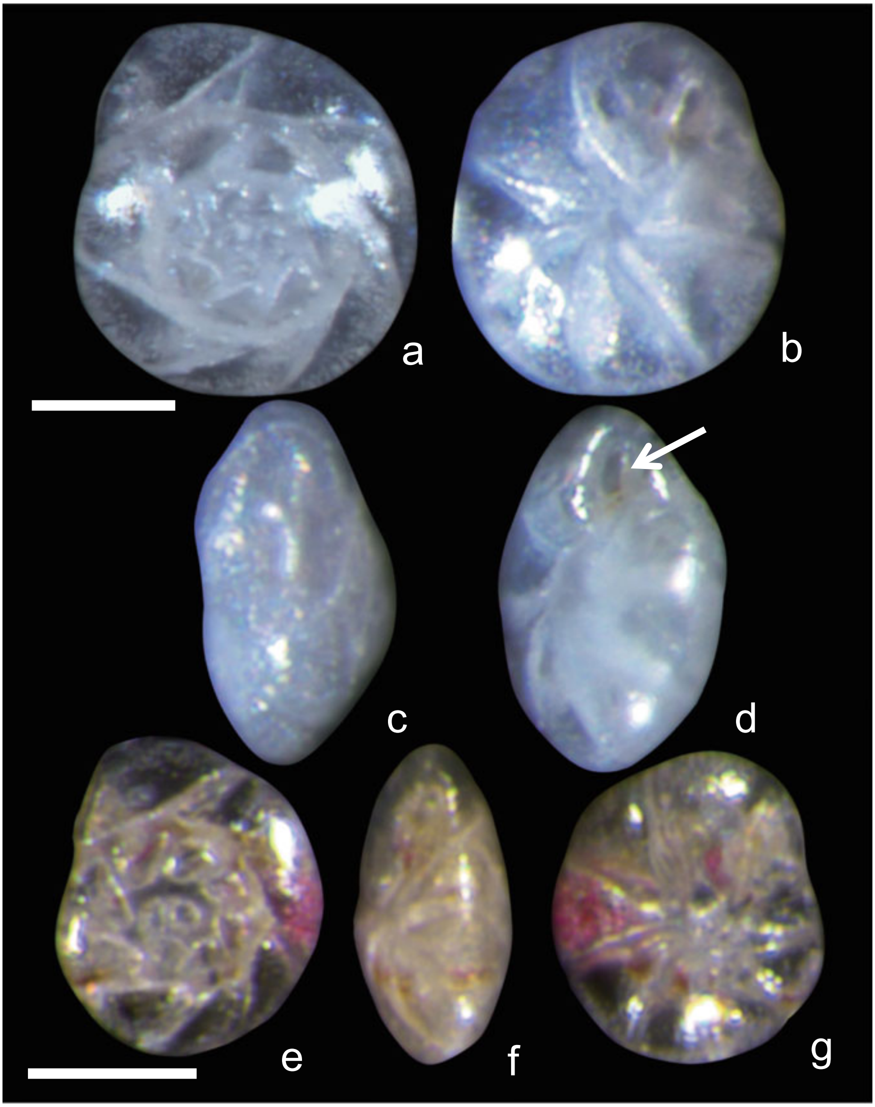

Fig. 28 **a–g** *Epistominella naraensis* (Kuwano, 1950), two specimens showing morphological variabilities. **a–d** Same specimen. **e–g** Another live specimen. **c, f** Lateral views. *Arrow* denotes aperture. Scale bars = 50 μm

Pseudoparella naraensis Kuwano, 1950, p. 317, tf. 6.

Epistominella naraensis (Kuwano), Matoba, 1967, p. 254, pl. 26, Fig. 11a–c; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 91, pl. X, Figs. 4–6; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 84, pl. 154, Fig. 8a–c; Wang et al., 1980, p. 193, pl. III, Fig. 21; Wang et al., 1985, p. 48, 52, pl. 4, Fig. 19; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 190, pl. 17, Figs. 6–7; Wang et al., 1988, p. 156, pl. XXII, Fig. 13.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H122-01	130	119	66
H122-02	98	80	47

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St 3400-05, St 3600-02, St 3600-06, St 3600-08, St 3875-03) (31°39′–38°44′ N, 121°00′–127°00′ E), water depth 26.90–78.00 m, temperature 7.80–17.54 °C, salinity 30.31–32.98 ‰, abundance 0.04–0.78 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, South Korea, North Atlantic Ocean.

Description

Test small, about 100 μm in length, length:width ratio about 1.1:1, around 1.8:1 flattened laterally. Test subglobose, trochospiral, about three whorls visible on the strongly convex spiral side. Chambers broad, low and crescentic, seven to eight chambers in the final whorl. Sutures strongly oblique and depressed on spiral side while radial and nearly straight on the flattened umbilical side. Periphery rounded. Wall calcareous, hyaline, optically radial, perforate, surface smooth. Aperture an interiomarginal slit extending along the basal suture and then up the depressed apertural face of the final chamber, bordered by a narrow lip.

Remarks

Epistominella naraensis has been reported from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989; Wang et al., 1980) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in previous Chinese literature. It is a small species but rather common in the continental shelf of the China Seas. At first glance, it resembles *Buccella frigida* in test shape and chamber morphology, but they have totally different aperture and umbilical side view, thus were easily distinguished from each other.

Family Discorbinellidae Sigal, 1952

Genus *Discorbinella* Cushman & Martin, 1935

***Discorbinella subcomplanata* (Parr, 1950)** (Fig. 29)

Fig. 29 a–d *Discorbinella subcomplanata* (Parr, 1950), the same specimen showing different side of views. **c** Lateral view. Scale bar = 100 μm

Discorbis subcomplanata Parr, 1950, p. 355, pl. 14, Figs. 1–2.

Rosalina subcomplanata (Parr, 1950), Zheng et al., 1979, p. 169, pl. XVIII, Fig. 8.

Discorbinella subcomplanata (Parr, 1950), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H120-01	270	235	90

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 0.00–3.00 m, temperature 2.00–23.50 °C, salinity 32.00–34.00 ‰, abundance 0.22 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea.

Description

Size 270 μm in length. Test trochospiral, planoconvex, circular in outline, length: width ratio about 1.1:1, around 2.6:1 flattened laterally. Chambers broad and low, enlarging rapidly as added, about seven to eight chambers in final whorl; on the umbilical side, each chamber with a projecting semicircular umbilical folium, posterior end of the folium of earlier chambers leaving an indentation in the sutures. Sutures slightly cured. Umbilical side flattened. Periphery rounded. Wall calcareous, finely perforate, surface smooth. Primary aperture an interiomarginal arch at the periphery, with a small secondary opening at the posterior end of the folium.

Remarks

Discorbinella subcomplanata had been identified as *Rosalina subcomplanata* in Chinese literature (Zheng et al., 1979). It is a common species in intertidal sediments of the Yellow Sea but usually occurred with low abundance.

Family Planulinidae Bermúdez, 1952

Genus *Hyalinea* Hofker, 1951

***Hyalinea balthica* (Schröter, 1783)** (Fig. 30)

Nautilus balthica Schröter, 1783, p. 20, pl. 1, Fig. 2.

Operculina complanata (Defrance), Parker & Jones, 1857, p. 285, pl. 11, Figs. 3–4.

Nonionina elegans Williamson, 1858, p. 35, pl. 3, Figs. 74–75.

Operculina ammonoides (Gronovius), Brady, 1884, p. 745, pl. 112, Figs. 1, 2.

Hofkerinella balthica Bermudez, 1952, p. 74.

Hyalinea balthica (Schröter, 1783)

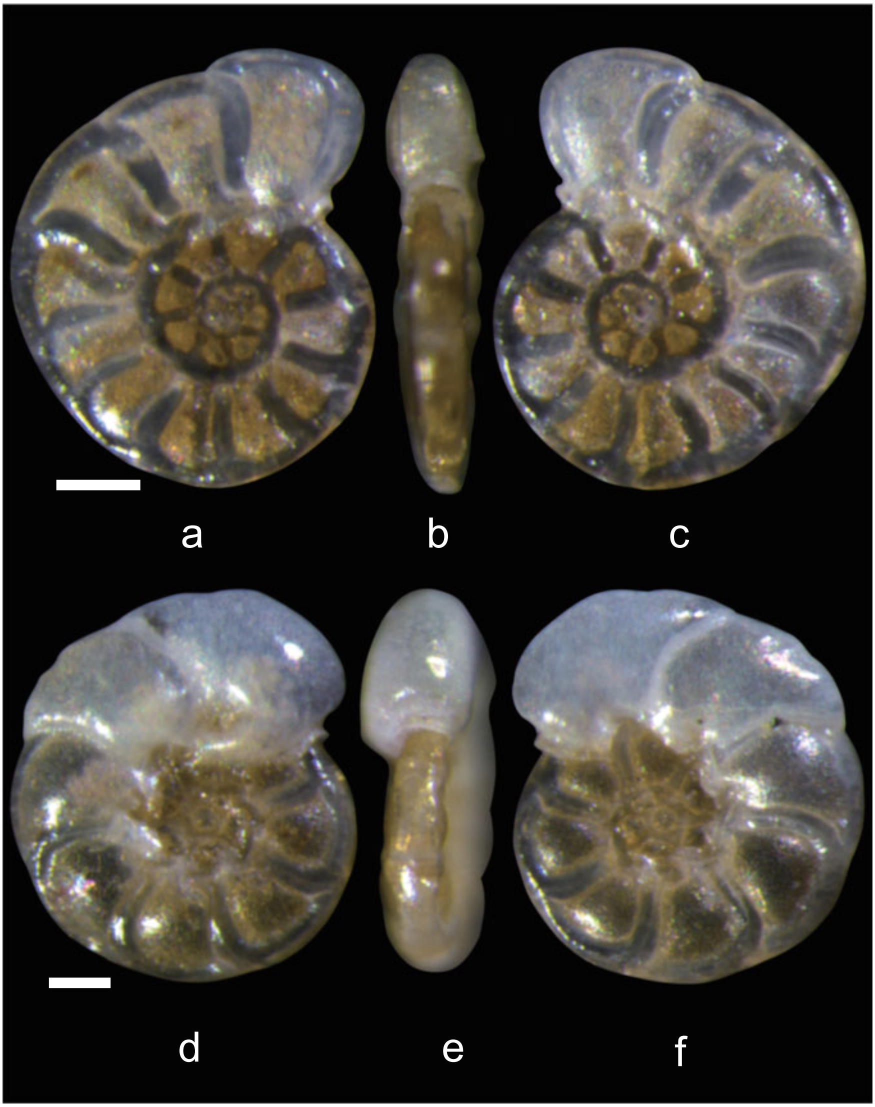

Fig. 30 a–f *Hyalinea balthica* (Schröter, 1783), two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Lateral views. Scale bars = 50 μm

Hyalinea baltica (Schröter), Wang et al., 1985, p. 256, pl. 2, Fig. 4a–b; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 120, pl. 160, Fig. 8a–b.

Hyalinea balthica (Schröter), Barker, 1960, p. 230, pl. 112, Figs. 1–2; He et al., 1965, p. 122, pl. XV, Fig. 7a–b; Loeblich & Tappan, 1987, p. 580, pl. 632, Figs. 5–8; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 195, pl. 19, Fig. 7; Wang et al., 1988, p. 164, pl. XXVI, Figs. 4–5; Jones, 1994, p. 110, pl. 112, Figs. 1–2; Holbourn et al., 2013, p. 308; Panchang & Nigam, 2014, p. 33, pl. XXXI, Fig. 8.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D18-01	260	220	62
D18-02	297	271	86
D18-03	293	253	77
D18-04	231	199	72

Occurrence and Ecology

The Yellow Sea (St 3000-02) (29°59′ N, 123°00′ E), water depth 42.77 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 0.54 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Celtic Sea, English Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, Mediterranean Sea.

Description

Size about 250 μm in length, length:width ratio about 1.3:1. Test discoidal, nearly planispiral, semievolute on both sides, around 3.2:1 flattened laterally. Two to three slowly enlarging whorls, eight to eleven chambers in the final whorl. Umbilical margin of the chambers with folium. Sutures radial, slightly cured, limbate, elevated. Periphery angular. Wall calcareous, optical radial, finely perforate, surface smooth. Aperture a low equatorial and interiomarginal arch, bordered above by a narrow lip.

Remarks

Hyalinea balthica has been reported from the South Yellow Sea (He et al., 1965), the East China Sea (Wang et al., 1985, 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in Chinese literature. It is a common species usually occurring in shallow water sediments of the Yellow Sea.

Family Cibicididae Cushman, 1927

Genus *Cibicides* de Montfort, 1808

Cibicides wuellerstorfi **(Schwager, 1866)** (Fig. 31)

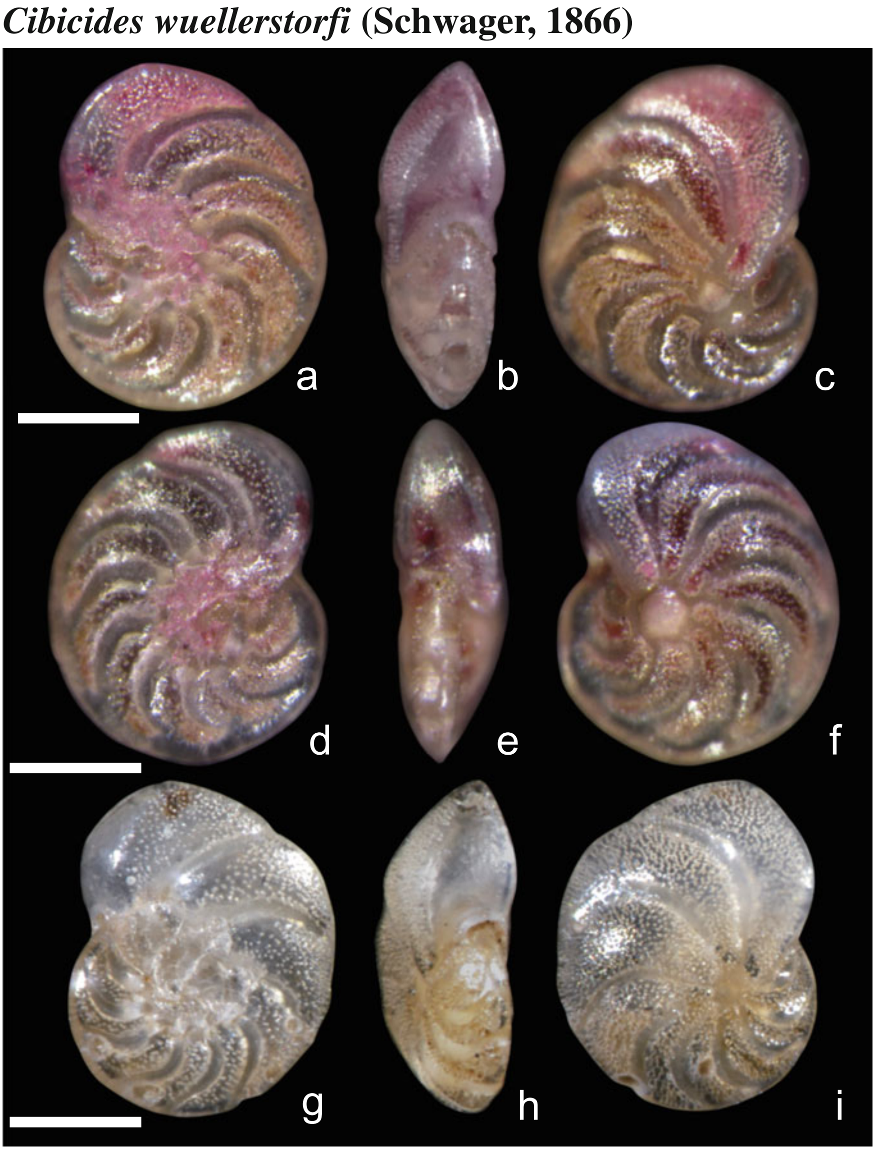

Fig. 31 **a–i** *Cibicides wuellerstorfi* (Schwager, 1866), three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** Another live specimen. **g–i** A fossil specimen. Scale bars = 200 μm

Anomalina wuellerstorfi, Schwager, 1866, p. 258, pl. 7, Figs. 105, 107.

Truncatulina americana Cushman, 1918, p. 68, pl. 23, Fig. 2.

Discorbis sp. Cushman, 1923, p. 39, pl. 5, Figs. 5–6.

Planulina wuellerstorfi (Schwager), Barker, 1960, p. 192, pl. 93, Fig. 9.

Cibicides wuellerstorfi (Schwager), Leroy, 1941a, p. 46, pl. 1, Figs. 27–29; Hofker, 1951a, p. 350, text Fig. 237; Leroy, 1964, p. F-45, pl. 8, Figs. 25, 26; Pflum and Frerichs, 1976, p. 116, pl. 4, Figs. 2–4; Srinivasan and Sharma, 1980, p. 56, pl. 8, Figs. 11–13; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 195, pl. 19, Fig. 3; Akimoto, 1990, p. 195, pl. 23, Fig. 17.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D45-01	560	458	181
D45-02	497	426	152
D45-03	521	410	203

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-04, St CJ-06, St 3300-04, St 3400-06, St 3400-08, St 3500-10, St 3600-06, St 3600-08) (31°39′–36°00′ N, 122°30′–125°00′ E), water depth 26.90–81.00 m, temperature 9.12–17.02 °C, salinity 30.31–33.39 ‰, abundance 0.08–2.64 ind./g sed.

Distribution

Yellow Sea, Okinawa Trough.

Bay of Biscay, Japan, Micronesia, New Zealand, North Atlantic Ocean, Norway, South Korea, New Caledonia, Arctic Ocean, Gulf of Mexico, Mediterranean Sea.

Description

Size about 520 μm in length, length:width ratio about 1.2:1, around 2.5:1 flattened laterally. Test reniform in outline, planoconvex, spiral side flat and evolute; umbilical side convex and involute, with a large umbo. Nine to ten chambers in the final whorl. Periphery basically smooth. Sutures curved, limbate, thickened and elevated on spiral side while depressed on umbilical side. Wall calcareous, optical radial, transparent, spiral side coarsely perforate, the pores being filled in earlier chambers by lamellar thickening of the wall, umbilical side finely perforate and peripheral keel imperforate, surface smooth. Aperture a low interiomarginal equatorial opening that extends a short distance onto the umbilical side but continues along the spiral suture on the spiral side.

Remarks

Cibicides wuellerstorfi has been reported from the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in previous Chinese literature. It is a very common species in the continental shelf sediments of the Yellow Sea with water depth of 26.90–81.00 m.

Genus *Lobatula* Fleming, 1828

***Lobatula lobatula* (Walker & Jacob, 1798)** (Fig. 32)

Nautilus lobatulus Walker & Jacob, 1798, p. 642, pl. 14, Fig. 36.

Lobatula vulgaris Fleming, 1828, p. 232.

Truncatulina lobatula d'Orbigny, Brady, 1884, p. 660, pl. 92, Fig. 10; pl. 93, Figs. 1, 4–5; pl. 115, Figs. 4–5.

Cibicides lobatulus (Walker & Jacob), Cushman, 1931, p. 118, pl. 21, Fig. 3a–c; Cushman, 1940, p. 335, pl. 36, Fig. 11; Asano, 1951, p. 17, Figs. 36–38; Cushman, Todd & Post, 1954, p. 371, pl. 91, Figs. 27, 28; Graham & Militante, 1959, p. 116, pl. 19, Fig. 12; Perelis and Reiss, 1975, p. 76, pl. 1, Figs. 1–6; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 92, pl. X, Figs. 28–30; Wang et al., 1980, p. 196, pl. IX, Figs. 16–17; p. 197, pl. XI, Figs. 10–11; Wang et al., 1988, p. 162, pl. XXV, Figs. 12–14; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 194, pl. 19, Fig. 4; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 122, pl. 161, Figs. 1, 3; Van Marle, 1991, p. 198, pl. 21, Figs. 12–14.

Lobatula lobatula (Walker & Jacob), Loeblich & Tappan, 1987, p. 583, pl. 637, Figs. 10–13; Loeblich & Tappan, 1994, p. 150, pl. 316, Figs. 8–11; pl. 319, Figs. 1–7; Debenay, 2012, p. 201.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H39-01	428	316	98

Occurrence and Ecology

The Yellow Sea (St 3875-01) (38°44′ N, 121°59′ E), water depth 51.00 m, temperature 7.39 °C, salinity 31.62 ‰, abundance 0.16 ind./g sed.

Distribution

Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, Micronesia, New Zealand, North Atlantic Ocean, Norway, South Pacific Ocean, Southern Ocean, United States, Chesapeake Bay, Grand Bank, Northeast U.S. Continental Shelf, Scotian Shelf, Vineyard Sound, Arctic Ocean.

Lobatula lobatula (Walker & Jacob, 1798)

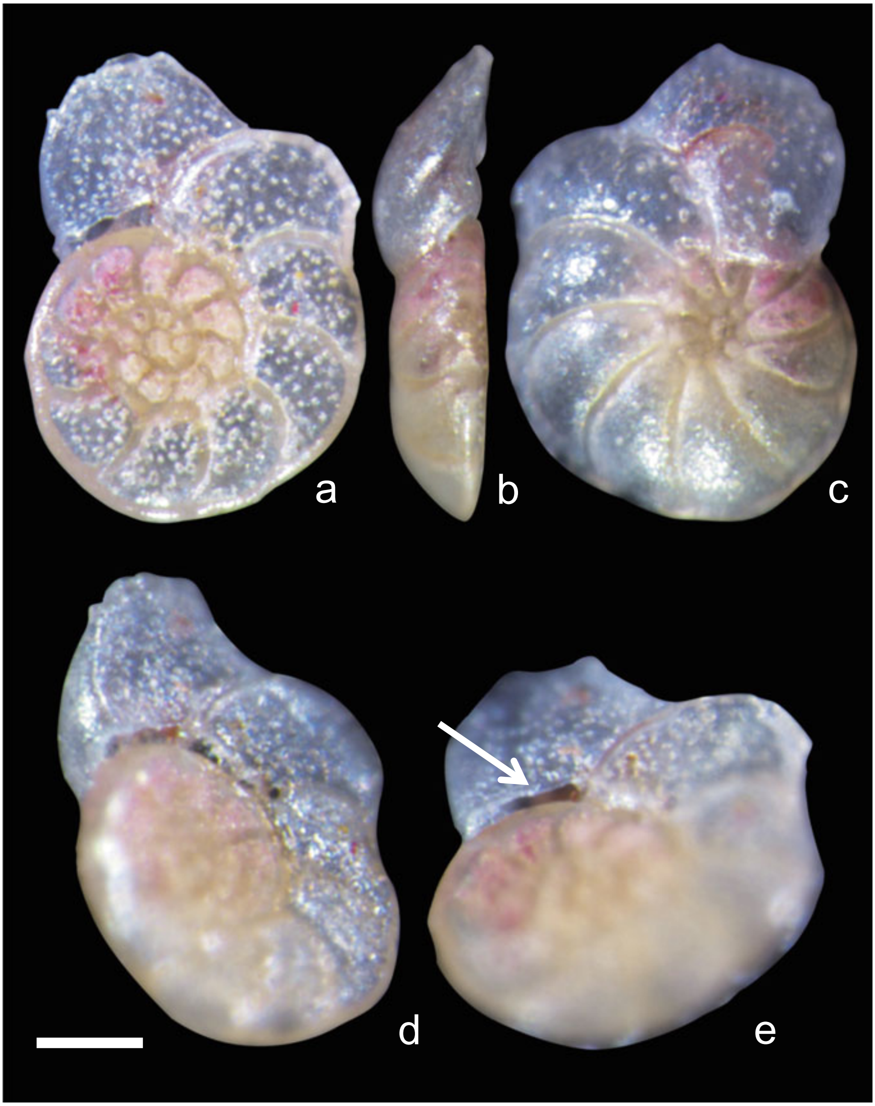

Fig. 32 a–e *Lobatula lobatula* (Walker & Jacob, 1798), a live specimen showing different side of views. **b** Lateral view. *Arrow* denotes aperture. Scale bar = 100 μm

Description

Size 428 μm in length, length:width ratio about 1.4:1, around 3.2:1 flattened laterally. Test trochospiral and planoconvex, spiral side flat and evolute, umbilical side convex and involute. With about three and half whorls, nine chambers in the final whorl. Sutures thickened, curved and slightly depressed, limbate. Periphery carinate, outline lobulate. Wall calcareous, spiral side coarsely perforate, but keel, apertural lip and area bordering the aperture are imperforate, surface smooth. Aperture an interiomarginal, equatorial arch, bordered by a lip and extending onto the spiral side beneath a narrow folium.

Remarks
Lobatula lobatula has been identified as *Cibicides lobatulus* from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in previous Chinese literature. This species is easily recognized by characterized morphology. Its abundance is low in China Seas.

Family Acervulinidae Schultze, 1854

Genus *Planogypsina* Bermúdez, 1952

***Planogypsina acervalis* (Brady, 1884)** (Fig. 33)

Planorbulina acervalis Brady, 1884, p. 657, pl. 92, Fig. 4; Brady, Parker & Jones, 1888, p. 227, pl. 46, Fig. 11; Cushman, 1915, p. 29, text Fig. 32; pl. 14, Fig. 1; Cushman, 1931b, p. 130, p. 25, Fig. 1a–b; Said, 1949, p. 43, pl. 4, Fig. 28; Cushman, Todd & Post, 1954, p. 372, pl. 82, Fig. 14; pl. 91, Figs. 34–36; Graham & Militante, 1959, p. 118, pl. 19, Fig. 16; Hofker, 1964, p. 85, Figs. 217–219; Todd, 1965, p. 54, pl. 22, Fig. 2; Zheng et al., 1978, p. 234, pl. XXII, Fig. 1a–c; Baccaert, 1987, p. 220, pl. 88, Figs. 1–3; Hatta & Ujiié, 1992b, p. 189, pl. 38, Fig. 1; Loeblich & Tappan, 1994, p. 151, pl. 326, Figs. 1–10; Panchang & Nigam, 2014, p. 34, pl. XXXII, Fig. 2.

Planogypsina acervalis (Brady, 1884), Hottinger et al., 1993, p. 125, pl. 169, Figs. 1–9; pl. 170, Figs. 1–8; Parker, 2009, p. 697, Figs. 490a–d, 491a–i; Debenay, 2012, p. 246.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
EP2-01	703	573	291
EP2-02 (juvenile)	305	260	146
EP2-03 (juvenile)	282	248	137

Planogypsina acervalis (Brady, 1884)

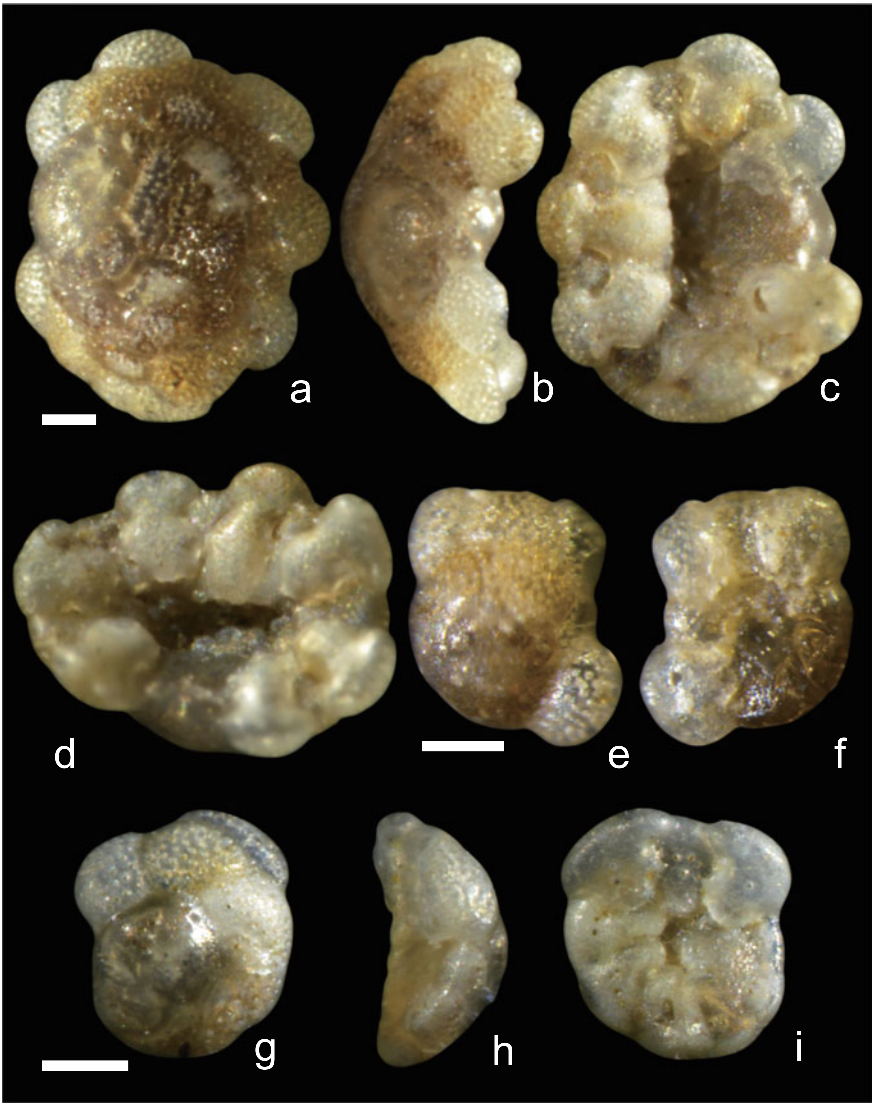

Fig. 33 a–i *Planogypsina acervalis* (Brady, 1884), three specimens showing morphological variabilities. **a–d** An adult specimen. **e, f** A juvenile specimen. **g–i** Another juvenile specimen. Scale bars = 100 μm

Occurrence and Ecology

Qingdao Bay (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 24.50 °C, salinity 31.00 ‰.

Distribution

Qingdao Bay of the Yellow Sea.

Bay of Biscay, Japan, Micronesia, New Zealand, North Atlantic Ocean, United States, Gulf of Mexico.

Description

Size about 700 μm in length, length:width ratio about 1.2:1. Test yellowish to brownish, discoidal, spiral side convex, umbilical side concave, around 2:1 flattened laterally. About nine chambers in the final whorl in adult. Early stage with globular chambers in planispiral arrangement, later chambers elongate to vermiform and added irregularly in a single layer. Wall calcareous, perforated by septal pores.

Remarks

Planogypsina acervalis was found attached to *Enteromorpha prolifera*, a green algae, which might have been floated from offshore waters of other sea area. However, many juvenile specimens were sampled, indicating it might be also inhabited in the Qingdao Bay, the Yellow Sea.

Family Epistomariidae Hofker, 1954

Genus *Pseudoeponides* Uchio, 1950

Pseudoeponides japonicus **Uchio, 1950** (Fig. 34)

Ammonia faceta, He et al., 1965, p. 104, pl. XI, Fig. 4a–c.

Pseudoeponides japonicus Uchio, 1950, p. 190, text Fig. 16; Asano, 1951e, p. 19, text Figs. 138–140; Leroy, 1964, p. F-39, pl. 9, Figs. 20–22; Loeblich & Tappan, 1987, p. 602, pl. 667, Figs. 10–12; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 86, pl. 156, Fig. 1a–c; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 91, pl. X, Figs. 7–12; Loeblich & Tappan, 1994, p. 156, pl. 338, Figs. 1–12.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H89-01	260	215	92
H89-02	213	195	87

Occurrence and Ecology

The Yellow Sea (St 3400-06, St 3400-08) (33°59′ N, 123°00′–123°58′ E), water depth 68.10–80.00 m, temperature 9.90–10.01 °C, salinity 32.94 ‰, abundance 0.04–0.09 ind./g sed.

Pseudoeponides japonicus Uchio, 1950

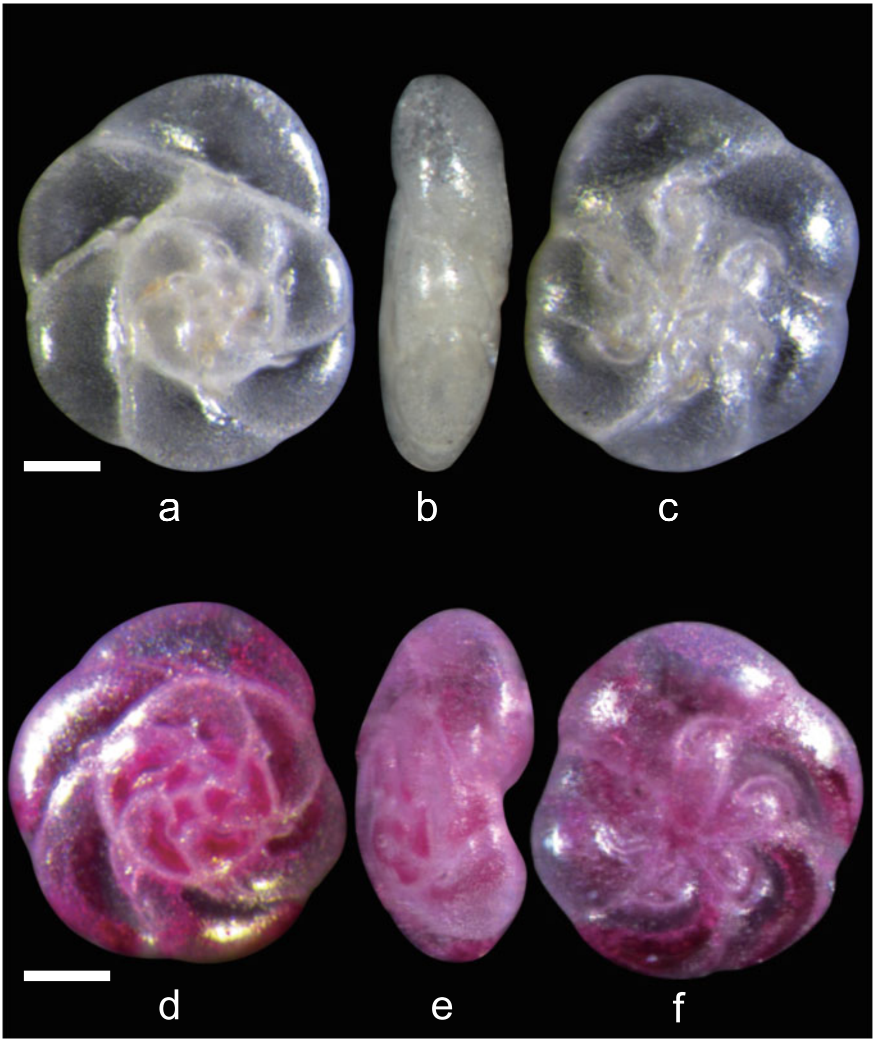

Fig. 34 **a–f** *Pseudoeponides japonicus* Uchio, 1950, two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another live specimen. Scale bars = 50 µm

Distribution

Yellow Sea, East China Sea.
South Korea, Sahul Shelf.

Description

Size about 250 µm in length, length:width ratio about 1.1:1. Test biconvex, three whorls on spiral side, around 2.2:1 flattened laterally. Chambers crescentic, five to six chambers in the final whorl. Sutures slightly curved, strongly oblique and slightly depressed. Wall calcareous, very finely perforate, surface smooth. Aperture an interiomarginal arch, curved on umbilical side forming a hooklike shape, meeting with antecedent aperture traces in ventral chambers forming a swirled shape in ventral view.

Remarks
Pseudoeponides japonicus has been reported from the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) in Chinese literature. It is a common species but usually occurred with low abundance in continental shelf sediments of the China Seas.

Family Nonionidae Schultze, 1854

Genus *Haynesina* Banner & Culver, 1978

***Haynesina depressula* (Walker & Jacob, 1798)** (Fig. 35)

Nautilus depressulus Walker & Jacob, 1798, p. 641, pl. 14, Fig. 33.

Nonion depressulum (Walker & Jacob), Cushman, 1930, p. 3, pl. 1, Figs. 3–6; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 33, pl. 5, Fig. 10.

Haynesina depressula depressula (Walker & Jacob), Hayward et al., 1997, p. 98, pl. 19, Figs. 4–7.

Haynesina depressula (Walker & Jacob), Hayward et al., 1999, p. 158, pl. 15, Figs. 10–11; Debenay, 2012, p. 222.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H67-01	381	315	165
H67-02	291	235	131
H67-03	292	263	142

Occurrence and Ecology
The Yellow Sea (St 3400-06, St 3600-06, St 3600-08) and the Jiaozhou Bay (St C1, St D7) (33°59′–36°06′ N, 120°10′–123°59′ E), water depth 4.41–78.00 m, temperature 9.12–15.42 °C, salinity 30.77–33.31 ‰, abundance 0.19–10.56 ind./g sed.

Haynesina depressula (Walker & Jacob, 1798)

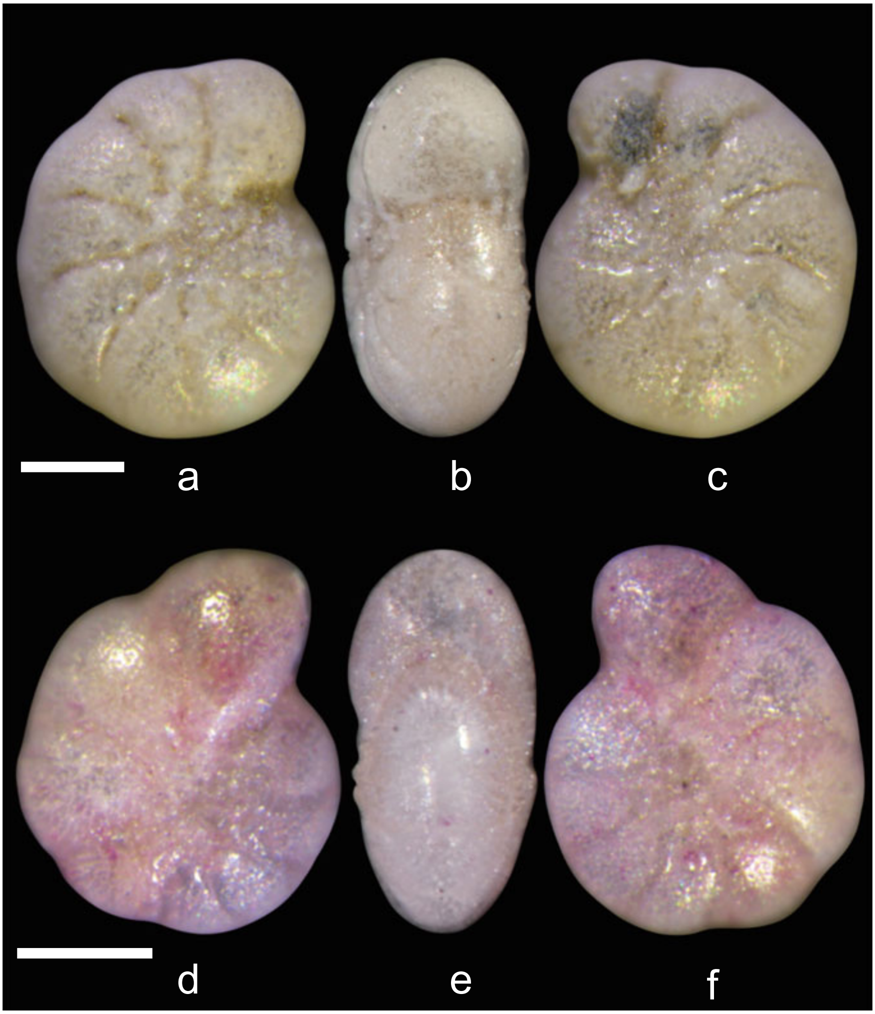

Fig. 35 a–f *Haynesina depressula* (Walker & Jacob, 1798), two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another live specimen. Scale bars = 100 μm

Distribution

Yellow Sea, Bohai Sea.

Australia, Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, South Pacific Ocean, New Caledonia, Mediterranean Sea.

Description
Size about 320 μm in length, length:width ratio about 1.2:1. Test planispiral, involute, biumbilicate, around 1.8:1 flattened laterally. About nine chambers per whorl, enlarging gradually as added. Periphery broadly rounded. Sutures curved and depressed, narrow, symmetrical on both sides, deeply incised near the umbilicus. Without distinct umbo on both sides. Wall calcareous, perforate, surface with minute granular.

Remarks
Haynesina depressula has been identified as *Nonion depressulum* in previous Chinese literature (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) from the Bohai Sea. It is a common and abundant species in the continental shelf sediments of the Yellow Sea of water depth of 4.41–78.00 m.

***Haynesina depressula* subsp. *simplex* (Cushman, 1933)** (Fig. 36)

Elphidium simplex Cushman, 1933c, p. 52, pl. 12, Figs. 8, 9; Cushman, 1939a, p. 62, pl. 17, Fig. 10; Asano, 1960, p. 200, pl. 22, Fig. 4; Azazi, 1992, pl. 1, Figs. 20, 21; Wang et al., 1988, p. 170, pl. XXVIII, Figs. 18–19; Loeblich & Tappan, 1994, p. 170, pl. 385, Figs. 1–12.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H92-01	277	232	135
H92-02	307	262	145
H92-03	283	232	121

Occurrence and Ecology
The Yellow Sea (St 3600-02) and Intertidal flat of the Qingdao Bay (35°59′–36°00′ N, 120°30′–120°59′ E), water depth 0.00–33.00 m, temperature 2.50–18.30 °C, salinity 31.30–36.00 ‰, abundance 0.05–0.43 ind./g sed.

Distribution
Yellow Sea, East China Sea.
Australia, Japan, South Pacific Ocean, New Caledonia.

Description
Size about 290 μm in length, length:width ratio about 1.2:1. Test planispiral, involute, biumbilicate, around 1.8:1 flattened laterally. About eight to nine chambers per whorl, enlarging gradually as added. Periphery rounded. Sutures curved and depressed, deeply incised near the umbilicus, forming wide grooves on both sides. With umbo on each side, the size of umboes on two sides may be same or different, ranging from 10 to 63 μm (on average of 36 μm). Wall calcareous, perforate, surface smooth, except to the suture regions, which are filled with minute granules.

Haynesina depressula subsp. *simplex* (Cushman, 1933)

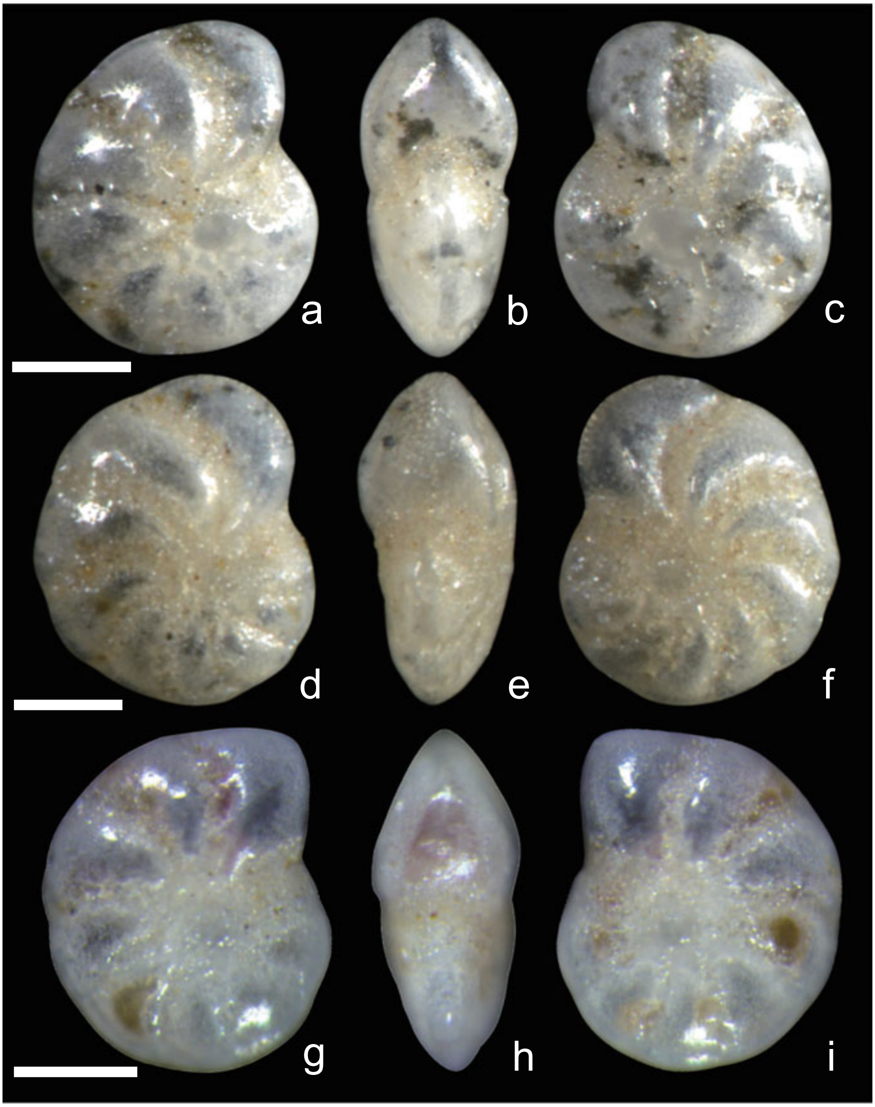

Fig. 36 a–i *Haynesina depressula* subsp. *simplex* (Cushman, 1933), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Remarks

Haynesina depressula simplex has been identified as *Elphidium simplex* in previous Chinese literature (Wang et al., 1988) from the East China Sea. In the Yellow Sea, it is distributed from intertidal flat to shallow water region of water depth 0–33 m.

This species is characterized by having a big umbo on each side, although the umbo may differ in size. In comparison with *H. depressula*, *H. depressula simplex* likely prefer more shallow water environment.

Genus *Nonion* de Montfort, 1808

***Nonion belridgense* Barbat & Johnson, 1934** (Fig. 37)

Nonion belridgense Barbat & Johnson, 1934, p. 11, pl. 1, Figs. 8, 9; He et al., 1965, p. 112, pl. XIII, Fig. 14a, b.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D3-01	426	296	220
D3-02	441	315	227
D3-03	388	261	183

Occurrence and Ecology
The Yellow Sea (St CJ-02, St CJ-06, St 3000-02, St 3600-02) (31°49′–35°59′, 121° 00′–122°59′ E), water depth 33.80–40.00 m, temperature 10.35–17.54 °C, salinity 31.11–31.59 ‰, abundance 0.06–0.16 ind./g sed.

Distribution
Yellow Sea.

Description
Size about 420 μm in length, length:width ratio about 1.4:1. Test planispiral, ovate in out line, coiling involute, laterally compressed and biumbilicate, around 1.4:1 flattened laterally. Ten to eleven chambers, umbilici filled with pustules on inner margins of the chambers. Sutures curved, depressed near the umbilici. Periphery rounded, outline smooth. Wall calcareous, surface smooth except for the granular region and sutures. Aperture a low interiomarginal and equatorial slit at the base of the arched apertural face, extending laterally nearly to the umbilici.

Remarks
Nonion belridgense has been reported from sediments of the South Yellow Sea in previous Chinese literature (He et al., 1965). It is a common species but usually with low abundance occurring in continental shelf sediments of the Yellow Sea, water depth of 33.80–40.00 m.

***Nonion sinensis* [Wang, 1978] nov. stat.** (Fig. 38)

Nonion sinensis sp. nov., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 97, pl. XIV, Figs. 28–29.

Nonion belridgense Barbat & Johnson, 1934

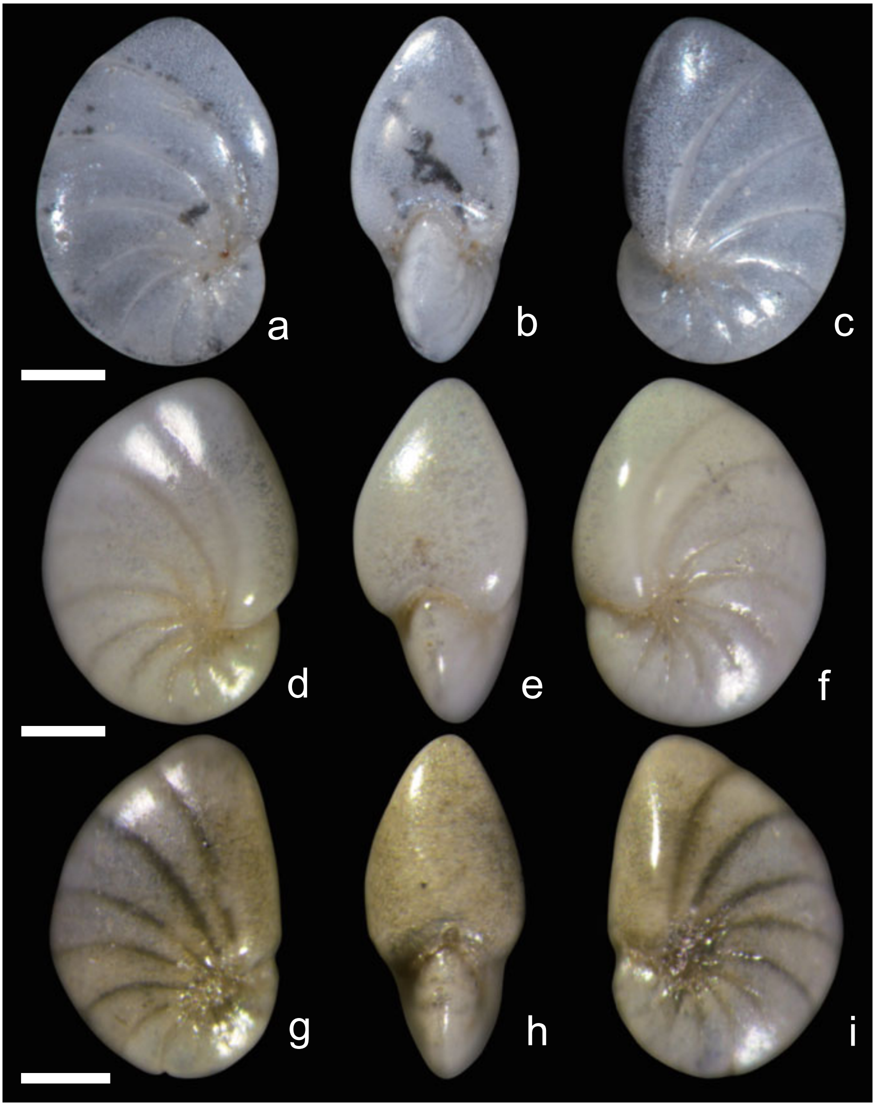

Fig. 37 **a–i** *Nonion belridgense* Barbat & Johnson, 1934, three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Nonion sinensis [Wang, 1978] nov. stat.

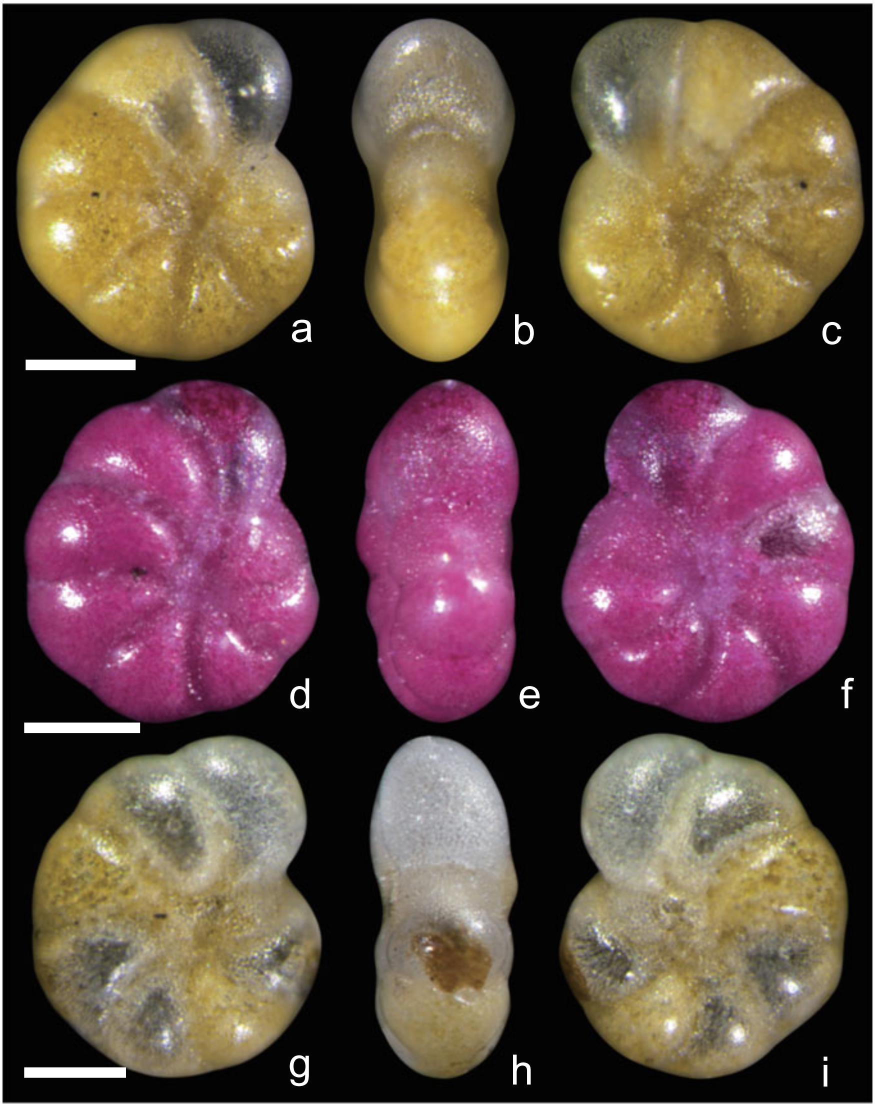

Fig. 38 **a–i** *Nonion sinensis* [Wang, 1978], three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** A live specimen. **g–i** The third specimen. **b, e, h** Lateral views. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B6-01	316	268	147
B6-02	290	251	125
B6-03	333	290	138
B6-04	387	338	157

Nomenclature

Nonion sinensis was established by Micropaleontology Group in Marine Geology Department of Tongji University (1978) in a Chinese local publication. According to International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), Recommendation 51D in Article 51.2.1, "Author anonymous, or anonymous but know or inferred,… if the authorship is known or inferred from external evidence, the name of the author, if cited, should be enclosed in square brackets to show the original anonymity." Therefore, we assigned Dr. Pin Xian Wang as the author since he guided the book publication.

Diagnosis

Size about 300 μm in length. Test yellowish, planispiral, circular in outline, coiling involute, biumbilicate, length:width ratio about 1.2:1. About seven chambers in the final whorl. Sutures radial to slightly curved, depressed near the umbilici. Periphery subangular. Umbilici filled with very minute pustules. Wall calcareous, fine and transparent, surface smooth except for the granular region and sutures. Aperture a low interiomarginal and equatorial.

Etymology

The Latin adjective *sinicus* (Chinese), referring to the location for discovery of this species.

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 14, St 31) and the Yellow Sea (St CJ-01) (31°40′–39°00′ N, 119°30′–122°29′ E), water depth 24.00–29.40 m, temperature 2.25–22.40 °C, salinity 30.11–31.73 ‰, abundance 0.02–0.40 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Description

Size about 330 μm in length, length:width ratio about 1.2:1. Test yellowish, planispiral, circular in outline, coiling involute, biumbilicate, around 2:1 flattened laterally. Seven to eight chambers. Sutures radial to slightly curved, distinctly depressed near the umbilici. Periphery subangular. Umbilici filled with very minute pustules. Wall calcareous, fine and transparent, surface smooth except for the granular region and sutures. Aperture a low interiomarginal and equatorial slit at the base of the arched apertural face, extending laterally nearly to the umbilici.

Remarks
Nonion sinensis was established by the anonymous publication of Micropaleontology Group in Marine Geology Department of Tongji University (1978). This book was guided by Dr. Pin Xian Wang, therefore the right species name should be *Nonion sinensis* [Wang, 1978]. This species is characterized by having a yellowish color test, which is rounded in outline. It is a very common species in the Yellow Sea.

Genus *Nonionella* Cushman, 1926

Nonionella basiloba **Cushman & McCulloch, 1940** (Fig. 39)

Nonionella basiloba Cushman & McCulloch, 1940, p. 162, pl. 18, Fig. 3; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 99, pl. XIII, Figs. 13–15; Panchang & Nigam, 2014, p. 36, pl. XXXIV, Fig. 2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H166-01	309	200	186
H166-02	295	192	156

Occurrence and Ecology
The Yellow Sea (St 3050-01, St 2950-02) (28°57′–30°31′ N, 122°59′–123°00′ E), water depth 46.50–60.70 m, temperature 23.18–24.20 °C, salinity 32.67–33.69 ‰, abundance 0.42–0.75 ind./g sed.

Distribution
Yellow Sea.
South Korea, Gulf of Mexico.

Description
Size about 300 μm in length, length:width ratio about 1.5:1. Test in a low trochospiral coil, ovate in outline, slightly compressed, around 1.2:1 flattened laterally. Spiral side partially evolute around umbonal boss, umbilical side involute. Seven to eight chambers, the last one forming a flaplike projection beside the umbilicus, those of successive chambers overlapping. The last chamber covered full length of the test, until to the posterior end. Sutures radial to slightly curved. Periphery rounded, outline smooth. Wall calcareous, optically granular, finely perforate, transparent, surface smooth and without pustules. Aperture a small interiomarginal arch.

Nonionella basiloba Cushman & McCulloch, 1940

Fig. 39 a–f *Nonionella basiloba* Cushman & McCulloch, 1940, two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Lateral views. Scale bars = 100 μm

Remarks

Nonionella basiloba has been reported from sediment of the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978). This species is characterized by having a very long final chamber, which covered full length of the longitudinal axis of the test. Its abundance is usually low in the Yellow Sea.

***Nonionella decora* Cushman & McCulloch, 1940** (Fig. 40)

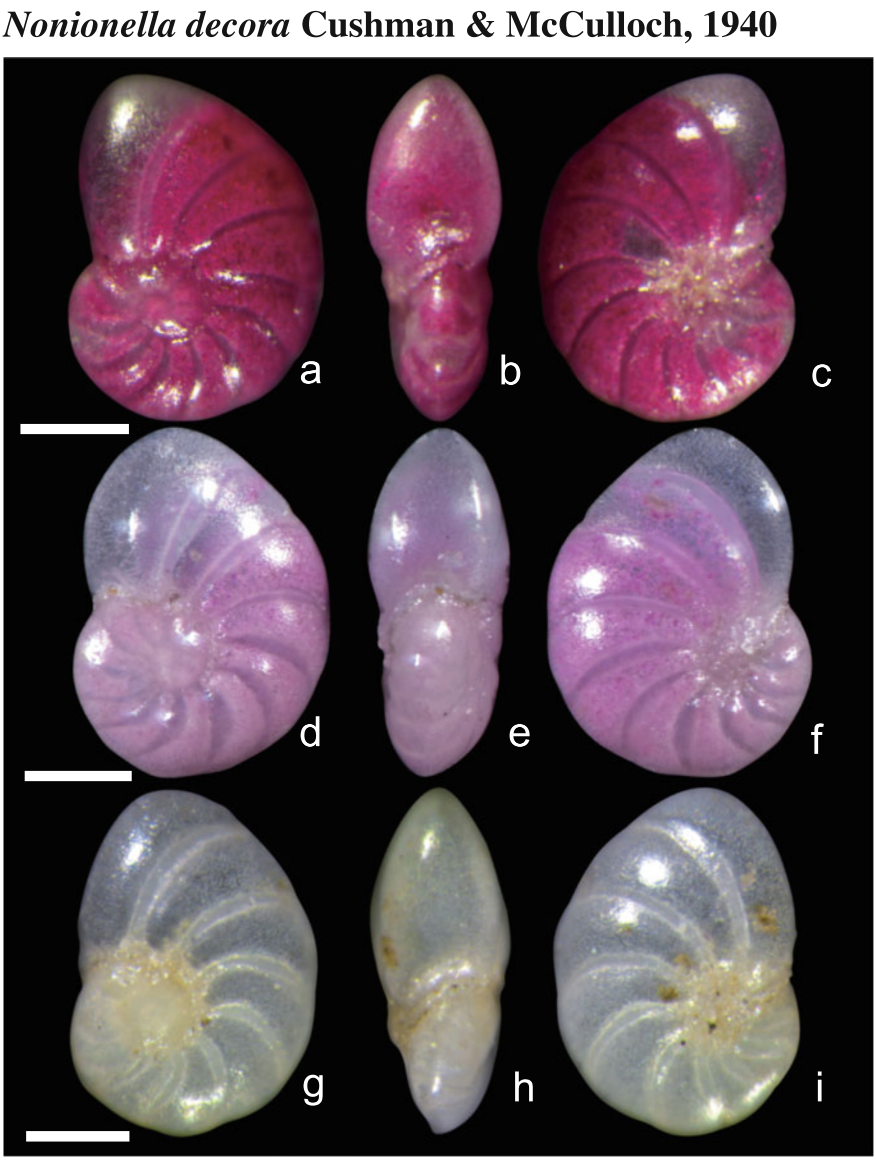

Fig. 40 a–i *Nonionella decora* Cushman & McCulloch, 1940, three specimens showing morphological variabilities. **a–c** A live same specimen. **d–f** Another live specimen. **g–i** The third specimen. **b, e, h** Lateral views. Scale bars = 100 μm

Nonionella decora Cushman & McCulloch, 1940, p. 160, pl. 7, Figs. 11–12; He et al., 1965, p. 118, pl. XIV, Fig. 8a–b; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 130, pl. 162, Fig. 8.
Pseudononion decorum (Cushman & McCulloch, 1940), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D44-01	290	233	111
D44-02	339	248	137
D44-03	317	238	123

Occurrence and Ecology
The Yellow Sea (St 3000-02, St CJ-01, St CJ-02, St CJ-04, St 3400-05, St 3400-08, St 3600-06) (29°59′–35°58′ N, 122°29′–124°00′ E), water depth 26.90–70.00 m, temperature 9.19–17.02 °C, salinity 30.31–34.27 ‰, abundance 0.12–2.41 ind./g sed.

Distribution
Yellow Sea, Okinawa Trough.
California, Mississippi, Gulf of Mexico, Peru.

Description
Size about 320 μm in length, length:width ratio about 1.3:1. Test in a low trochospiral coil, ovate in outline, slightly compressed, around 1.9:1 flattened laterally. Spiral side partially evolute around umbonal boss, umbilical region with minute granules; umbilical side involute. Ten to eleven chambers, one and half whorls visible. The last chamber covered more than half of the test length. Sutures curved and slightly depressed, limbate. Periphery rounded, outline smooth. Wall calcareous, finely perforate, transparent, surface smooth except for the umbilical region on spiral side. Aperture a small interiomarginal arch, extending somewhat onto the umbilical side.

Remarks
Nonionella decora has been reported from sediments of the South Yellow Sea (He et al., 1965) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) in previous Chinese literature. This species was combined as *Pseudononion decorum* by Hayward et al. (2015). However, the Genus *Pseudononion* is diagnosed as species must have involute test on both sides. *Nonionella decora* is characterized by the following feature, i.e., spiral side partially evolute around an umbonal boss, umbilical side involute, thus matched the diagnosis of the Genus *Nonionella*. Obviously, it should be affiliated to the Genus *Nonionella*.

Nonionella jacksonensis Cushman, 1933

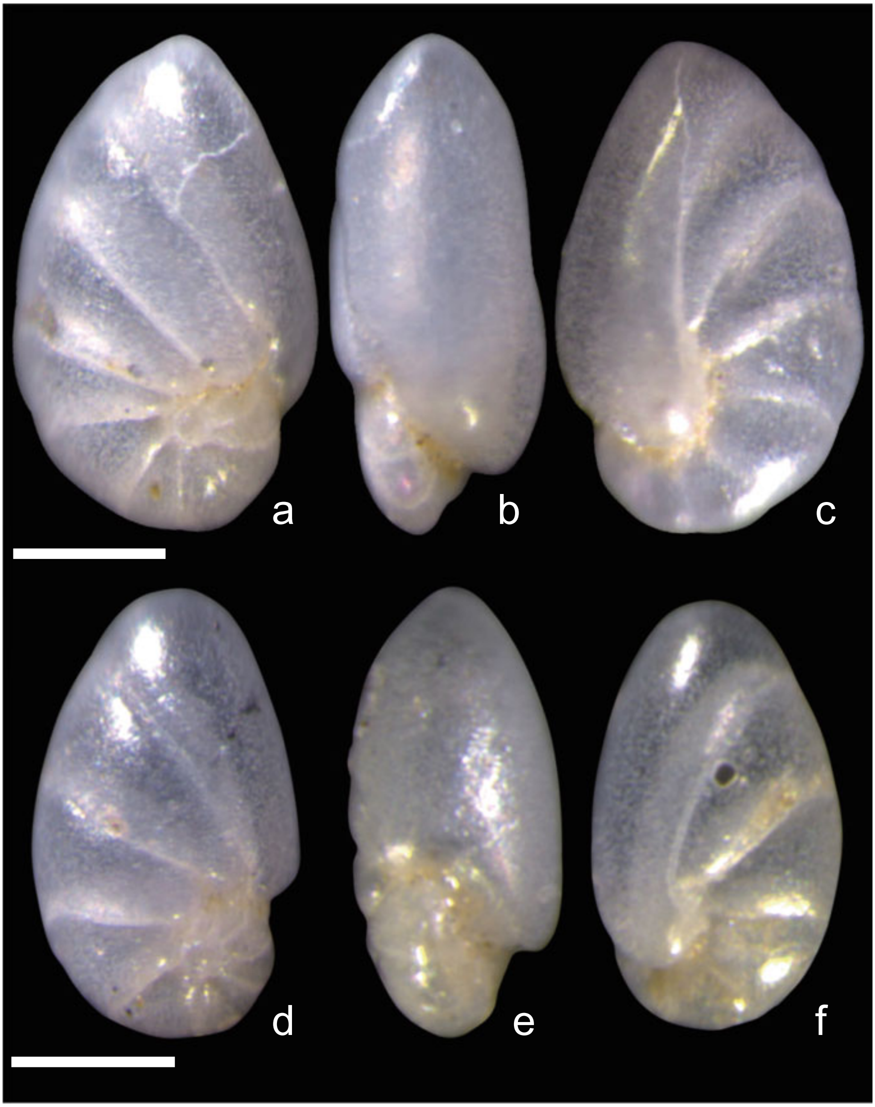

Fig. 41 **a–f** *Nonionella jacksonensis* Cushman, 1933, two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Lateral views. Scale bars = 100 μm

Nonionella jacksonensis **Cushman, 1933** (Fig. 41)

Nonionella jacksonensis Cushman, 1933, p. 10, pl. 1, Fig. 3a–c; Cushman, 1935, p. 71, pl. 12, Figs. 3, 4; He et al., 1965, p. 119, pl. XIV, Fig. 11a–c; Wang et al., 1988, p. 176, pl. XXXII, Figs. 1–2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D106-01	315	193	133
D106-02	276	163	129

Occurrence and Ecology

The Yellow Sea (St 3875-03, St 3300-04) (33°00′–38°44′ N, 122°59′–127°00′ E), water depth 33.00–55.00 m, temperature 7.80–20.00 °C, salinity 30.87–31.88 ‰, abundance 0.02–0.08 ind./g sed.

Distribution

Yellow Sea, East China Sea.

America (Pliocene sediment).

Description

Size about 300 μm in length, length:width ratio about 1.7:1. Test in a low trochospiral coil, elliptical in outline, slightly compressed, around 1.4:1 flattened laterally. Spiral side partially evolute around umbonal boss, umbilical side involute. About nine chambers, only one and a little bit more whorl visible. The last chamber covered about five sixth of the test length, but not to the posterior end. Whorls progressively enlarging and produce a somewhat flaring test, chambers with a flaplike projection overhanging the umbilicus, those of successive chambers overlapping. Sutures straight to indistinctly curved, slightly depressed. Periphery rounded to somewhat subangular. Wall calcareous, finely perforate, transparent, surface smooth. Aperture a small interiomarginal arch, extending somewhat onto the umbilical side.

Remarks

Nonionella jacksonensis has been reported from sediments of the South Yellow Sea (He et al., 1965) and the East China Sea (Wang et al., 1988). It occurred with low abundance in station of water depth 55.00 m in the Yellow Sea. *N. jacksonensis* differs to *N. basiloba*, its most similar congener, by having more slender test shape and shorter final chamber.

***Nonionella japonica* (Asano, 1938)** (Fig. 42)

Nonion japonicum Asano, 1938, p. 593, pl. 15, Figs. 1a–b, 2a–b.

Nonionella japonica (Asano), Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 216, pl. 28, Fig. 8.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H170-01	475	405	273
H170-02	401	363	259
H170-03	436	346	237

Nonionella japonica (Asano, 1938)

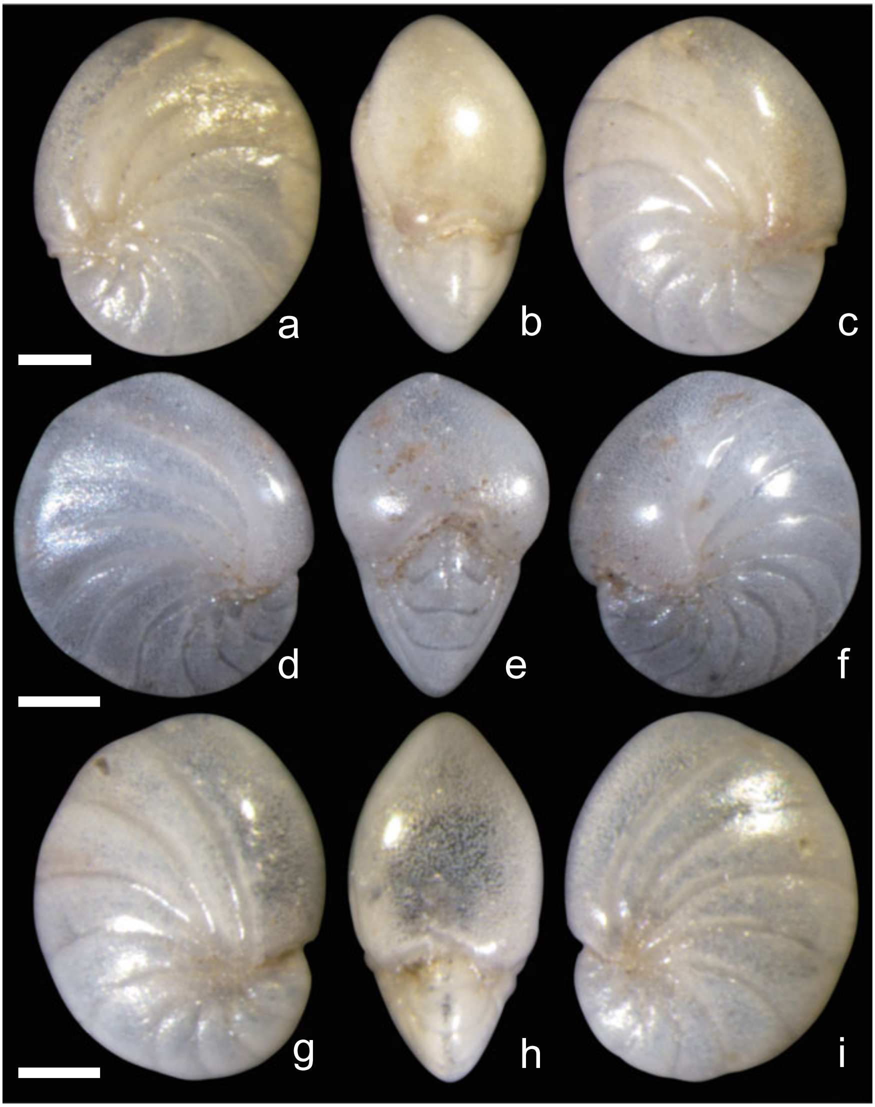

Fig. 42 a–i *Nonionella japonica* (Asano, 1938), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. **b, e, h** Lateral views. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St 2900-03) (28°58′ N, 123°00′ E), water depth 67.00 m, temperature 24.20 °C, salinity 33.69 ‰, abundance 1.64 ind./g sed.

Distribution

Yellow Sea, Okinawa Trough.

Japan, Micronesia, South Korea.

Description

Size about 440 µm in length, length:width ratio about 1.2:1. Test in a low trochospiral coil, ovate to circular in outline, slightly compressed, around 1.5:1 flattened laterally. Spiral side indistinctly evolute around an umbonal boss, umbilical side involute. Ten to eleven chambers visible in the final whorl. The last chamber covered about two third of the test length. Sutures curved, slightly depressed. Periphery rounded, outline smooth. Wall calcareous, finely perforate, translucent, surface smooth. Aperture a small interiomarginal and nearly equatorial arch, extending somewhat onto the umbilical side.

Remarks

Nonionella japonica has been reported from sediment of the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in previous Chinese literature. In the Yellow Sea this species is not frequent, it occurred in very low abundance with water depth of 55.00 m.

***Nonionella stella* Cushman & Moyer, 1930** (Fig. 43)

Nonionella miocenica var. *stella* Cushman & Moger, 1930, p. 56, pl. 7, Fig. 17; Cushman & McCulloch, 1940, p. 162, pl. 18, Fig. 2.

Nonionella stella (Cushman & Moyer), Uchio, 1960, p. 61, pl. 14, Figs. 15, 16; Wang et al., 1988, p. 176, pl. XXXI, Figs. 13–16; Panchang & Nigam, 2014, p. 36, pl. XXXIV, Fig. 7.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
H40-01	573	427	309
H40-02	427	305	198
H40-03	453	325	249

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St 3300-04, St 3400-05, St 3400-06, St 3500-08, St 3600-04, St 3600-06, St 3600-08, St 3800-02, St 3875-01, St B-06) and intertidal flat of the Qingdao Bay (31°49′–38°44′ N, 120°30′–123°59′ E), water depth 0.00–78.00 m, temperature 1.50–22.40 °C, salinity 30.87–36.00 ‰, abundance 0.06–4.82 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, North Atlantic Ocean, South Korea.

Nonionella stella Cushman & Moyer, 1930

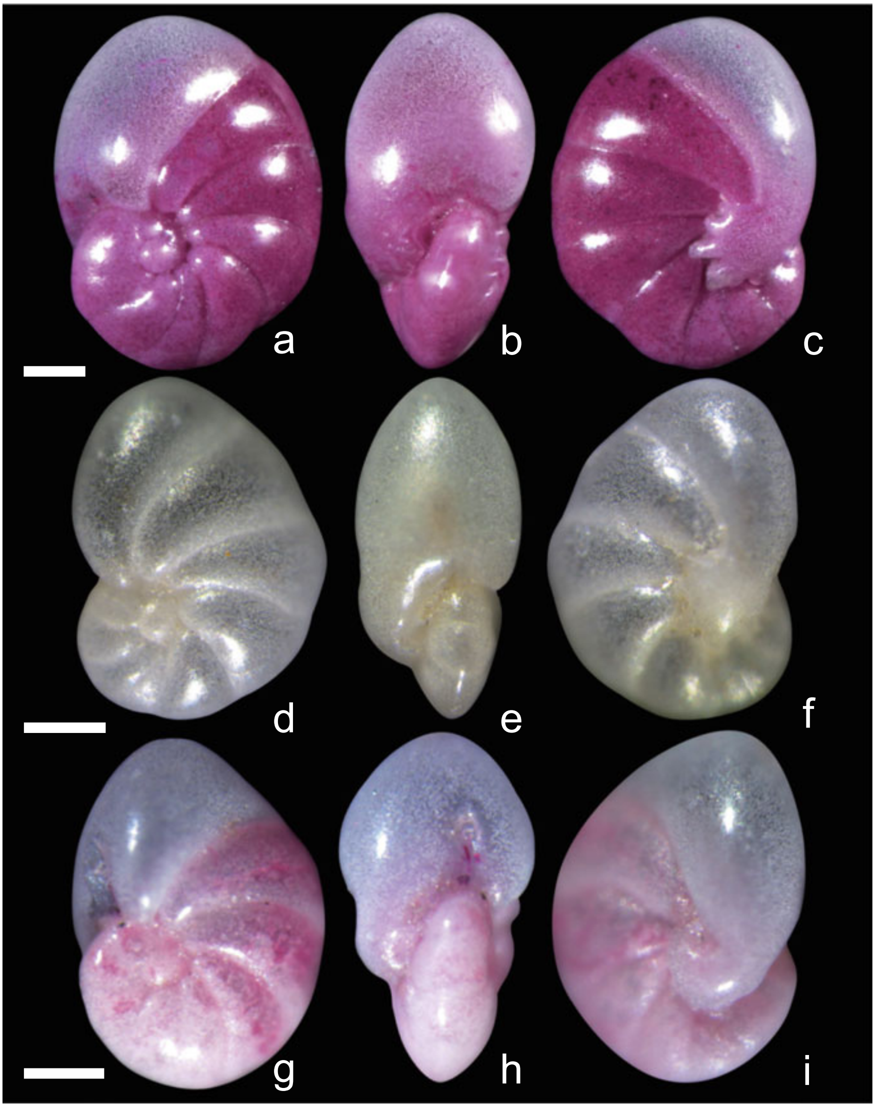

Fig. 43 a–i *Nonionella stella* Cushman & Moyer, 1930, three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. **g–i** Another live specimen. **b, e, h** Lateral views. Scale bars = 100 μm

Description

Size about 500 μm in length, length:width ratio about 1.4:1. Test in a low trochospiral coil, ovate in outline, compressed, around 1.4:1 flattened laterally. Spiral side partially evolute around an umbonal boss, umbilical side involute. About eight chambers visible in the final whorl. The last chamber covered about two third of the test length on spiral side; but on the umbilical side, the last chamber covered most of the test length, inner margin curved and branched, forming a stellate structure. Sutures curved, slightly depressed. Periphery rounded to somewhat subangular, outline smooth. Wall calcareous, finely perforate, transparent, surface smooth. Aperture a small interiomarginal arch, extending somewhat onto the umbilical side.

Remarks

Nonionella stella has been reported from sediments of the East China Sea (Wang et al., 1988) in Chinese literature. It is a very common and abundant species widely distributing from intertidal flat to continental shelf sediments of the China Seas.

Genus *Protelphidium* Haynes, 1956

***Protelphidium glabrum* (Ho, Hu & Wang, 1965)** (Fig. 44)

Nonion glabrum Ho, Hu & Wang, 1965, He et al., 1965, p. 113, pl. 13, Fig. 6a, b.

Nonion shansiensis, Wang et al., 1975, pp. 27–28, pl. 2, Figs. 1–20; Figs. 17–19; Wang et al., 1980, p. 192. pl. I, Figs. 1–2, 5–9.

Evolutononion shanxiense, Wang, 1981, pp. 15–16, pl. 1, Figs. 1–12.

Protelphidium glabrum (Ho, Hu & Wang, 1965), Wang et al., 1988, p. 172, pl. XXXI, Figs. 1–3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H56-01	281	260	155
H56-02	295	245	165
H56-03	319	256	189

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St 3400-05, St 3600-06) and intertidal flat of the Qingdao Bay (31°39′–36°00′ N, 120°30′–124°00′ E), water depth 3.00–81.00 m, temperature 9.19–17.54 °C, salinity 30.31–34.00 ‰, abundance 0.02–0.52 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 300 μm in length, length:width ratio about 1.2:1. Test planispiral, circular to ovate in outline, coiling involute, laterally compressed and biumbilicate, around 1.5:1 flattened laterally. Eight to nine chambers in the final whorl, umbilici filled with pustules on inner margins of the chambers. Sutures curved and

Protelphidium glabrum (Ho, Hu & Wang, 1965)

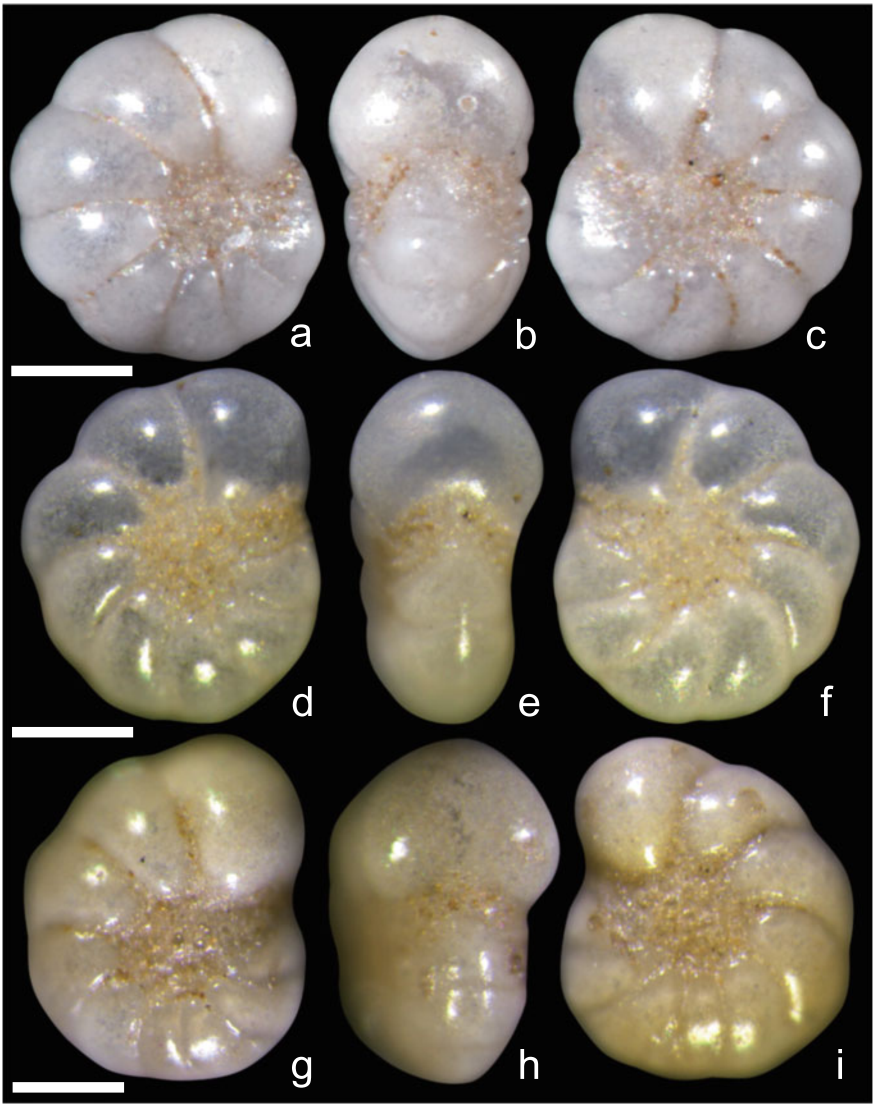

Fig. 44 a–i *Protelphidium glabrum* (Ho, Hu & Wang, 1965), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

depressed. Periphery rounded, outline smooth. Wall calcareous, surface smooth except for the granular region in umbilici. Aperture a low interiomarginal and equatorial slit at the base of the arched apertural face.

Remarks

Nonion glabrum Ho, Hu & Wang, 1965 was established by He et al. (1965). Several species names, *Nonion shansiensis* (Wang et al., 1975, 1980), *Evolutononion shanxiense* (Wang, 1981), *Protelphidium glabrum* (Wang et al., 1988) should be synonyms of this species. It is a very common and abundant species in the Yellow Sea and the East China Sea (Wang et al., 1988).

***Protelphidium tuberculatum* (d'Orbigny, 1846)** (Fig. 45)

Nonionina tuberculata d'Orbigny, 1846, p. 108, pl. 5, Fig. 13–14.

Protelphidium tuberculatum (d'Orbigny), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 103, pl. XV, Fig. 23; Wang et al., 1980, p. 200, pl. XVI, Fig. 7; Wang et al., 1988, p. 171, pl. XXIX, Figs. 14–15; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 93, pl. 159, Fig. 10a, b.

Melonis pompilioides (Fichtel & Moll, 1798), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H21-01	313	267	150
H21-02	352	305	159
H21-03	232	203	97

Occurrence and Ecology

The Yellow Sea (St 3400-05, St 3500-06, St 3600-06, St 3875-01) (34°00′–38°44′ N, 121°59′–123°00′ E), water depth 40.00–70.00 m, temperature 7.39–13.75 °C, salinity 31.12–32.98 ‰, abundance 0.14–11.22 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 300 μm in length, length:width ratio about 1.2:1. Test yellowish, planispiral, around 1.9:1 flattened laterally, not biconcave. Eight to nine gradually enlarging chambers in the final whorl. Sutures radial, curved, limbate, deeply incised toward the close umbilici but without intercameral lacunae, both umbilici filled by a complex of fused imperforate and tuberculate umbilical flaps, one from each chambers, the tubercules thickened by lamellar additions until older ones become pillar like. Periphery rounded, peripheral outline lobulated. Wall calcareous, perforate, optical radial but morphologically microgranular, surface with prominent tubercles on lower part of apertural face and on the preceding whorl adjacent to the aperture, as well as over the umbilical structure of flaps, tubercles, and pillars and extending along the margins of the incised sutures. Aperture a low, narrow, interiomarginal and equatorial arch.

Protelphidium tuberculatum (d'Orbigny, 1846)

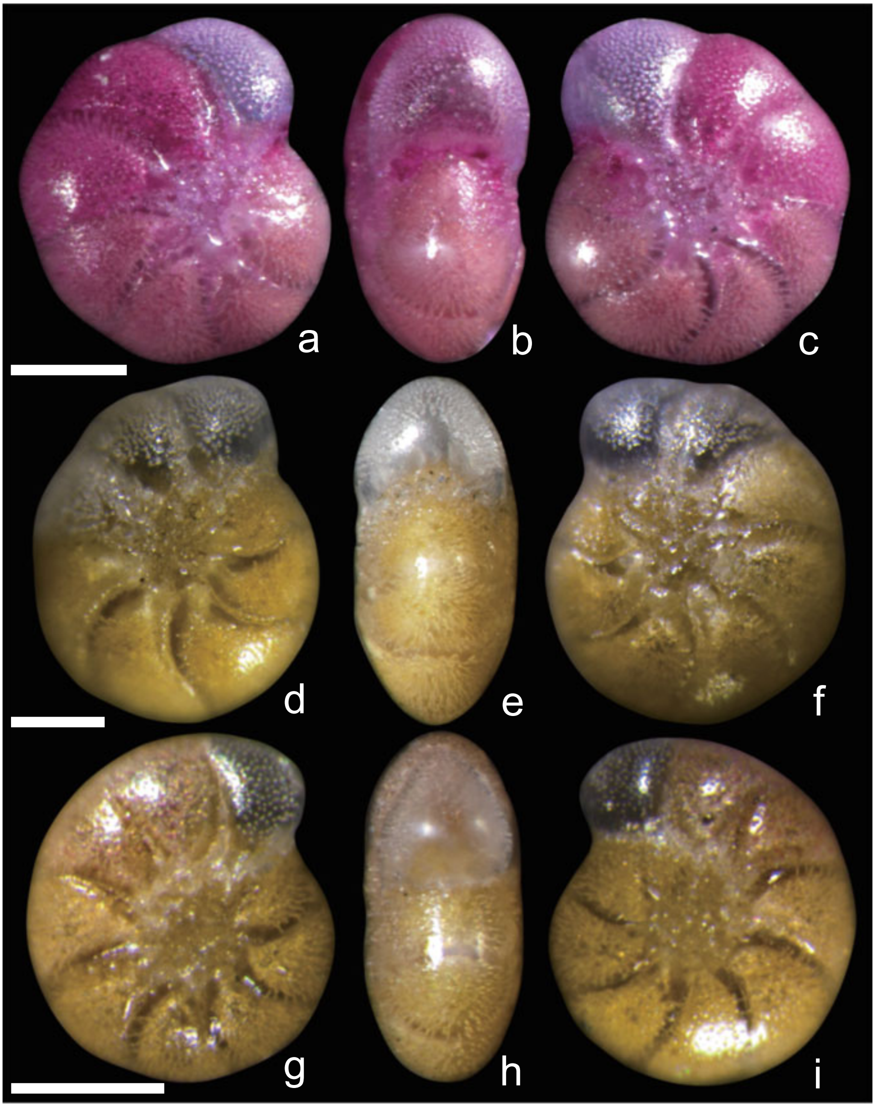

Fig. 45 a–i *Protelphidium tuberculatum* (d'Orbigny, 1846), three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. **g–i** The third specimen. Scale bars = 100 μm

Remarks

Protelphidium tuberculatum has been frequently reported from the Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980) and the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) in previous Chinese literature. In the Yellow sea, it is very common and abundant species occurring in shallow water region of the continental shelf sediments with water depth of 40.00–70.00 m.

Hayward et al. (2015) combined this species as *Melonis pompilioides* (Fichtel & Moll, 1798), however, the diagnoses of the Genus *Melonis* are characterized by having deep and open umbilici. But *Protelphidium tuberculatum* has no this important feature. It has a closed umbilici, which is filled by a complex of fused imperforate and tuberculate umbilical flaps. Therefore, obviously, it should not be attributed to the Genus of *Melonis*.

Genus *Astrononion* Cushman & Edwards, 1937

Astrononion gallowayi **Loeblich & Tappan, 1953** (Fig. 46)

Astrononion stellatum Cushman & Edwards, 1937, p. 32, pl. 3, Figs. 9–11.

Astrononion gallowayi Loeblich & Tappan, 1953, p. 90, pl. 17, Figs. 4–7; He et al., 1965, p. 116, pl. XIV, Fig. 6a, b; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 99, pl. XIII, Figs. 24–25; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 213, pl. 32, Fig. 19.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H54-01	290	246	143
H54-02	291	247	133

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3000-02, St 3300-04, St 3300-06, St 3400-05, St 3400-08, St 3500-08) (29°59′–34°59′ N, 122°30′–125°00′ E), water depth 26.90–80.00 m, temperature 10.01–22.40 °C, salinity 30.31–34.27 ‰, abundance 0.08–1.08 ind./g sed.

Distribution

Yellow Sea, Okinawa Trough.

Bay of Biscay, Canada, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, Norway, United States, Scotian Shelf, Arctic Ocean, Gulf of Mexico.

Description

Size about 290 μm in length, length:width ratio about 1.2:1. Test somewhat yellowish, planispiral and involute, laterally compressed, bilaterally symmetrical, around 1.8:1 flattened laterally. Seven to eight chambers in the final whorl, each

Astrononion gallowayi Loeblich & Tappan, 1953

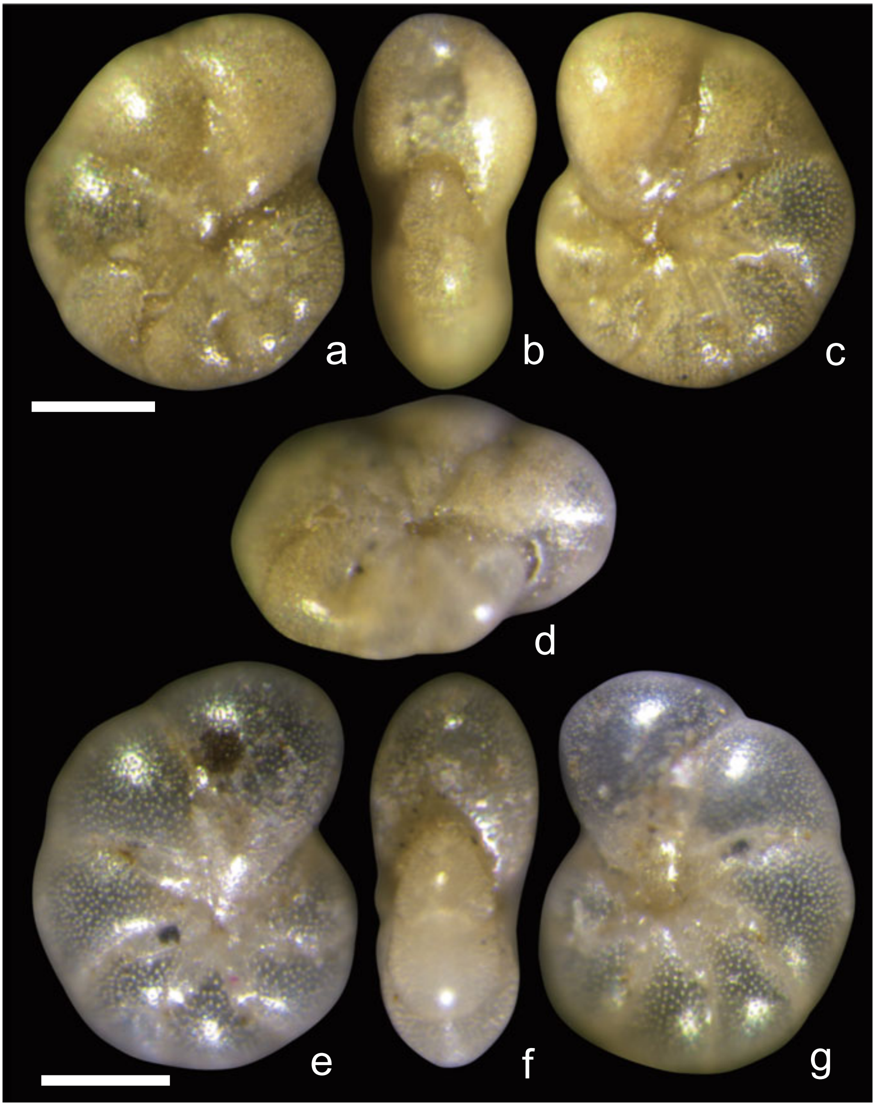

Fig. 46 a–g *Astrononion gallowayi* Loeblich & Tappan, 1953, two specimens showing morphological variabilities. **a–d** From same specimen. **e–g** Another specimen. Scale bars = 100 μm

chamber with a rhomboidal to triangular plate extending from the umbilicus along the intercameral suture at the back of the chamber. Sutural plates attached along the forward margin but open proximally, successive plates may partly fuse in the umbilical region. Periphery rounded. Wall calcareous, thin, optically granular, hyaline, finely and densely perforate, surface smooth. Aperture a low interiomarginal, equatorial slit, bordered with a lip and extending laterally to the umbilici.

Remarks

Astrononion gallowayi has been reported from sediments of the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in previous Chinese literature. It is a rather common species in the Yellow Sea.

Genus *Melonis* de Montfort, 1808

***Melonis affinis* (Reuss, 1851)** (Fig. 47)

Nonionina affinis, Reuss, 1851, p. 72, pl. 5, Fig. 32a–b.

Nonionina barleeana, Williamson, 1858, p. 32, pl. 3, Figs. 68–69.

Nonion affinis (Reuss), Cushman, 1929d, p. 89, pl. 13, Fig. 24.

Melonis barleeanus (Williamson), Loeblich & Tappan, 1994, p. 159, pl. 347, Figs. 1–5.

Melonis affinis (Reuss), Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 221, pl. 30, Figs. 3–4; Szareck, 2001, p. 143, pl. 23, Figs. 12–14; Debenay, 2012, p. 226.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H63-01	335	283	153
H63-02	266	209	126

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-06, St 3500-08, St 3500-10, St 3600-04, St 3600-06, St 3600-08, St 3800-02) and intertidal flat of the Qingdao Bay (31°49′–38°00′ N, 120°30′–125°00′ E), water depth 3.00–81.00 m, temperature 8.35–18.08 °C, salinity 31.12–33.39 ‰, abundance 0.05–2.88 ind./g sed.

Distribution

Yellow Sea, Okinawa Trough.

New Zealand, South Korea, New Caledonia, Gulf of Mexico.

Melonis affinis (Reuss, 1851)

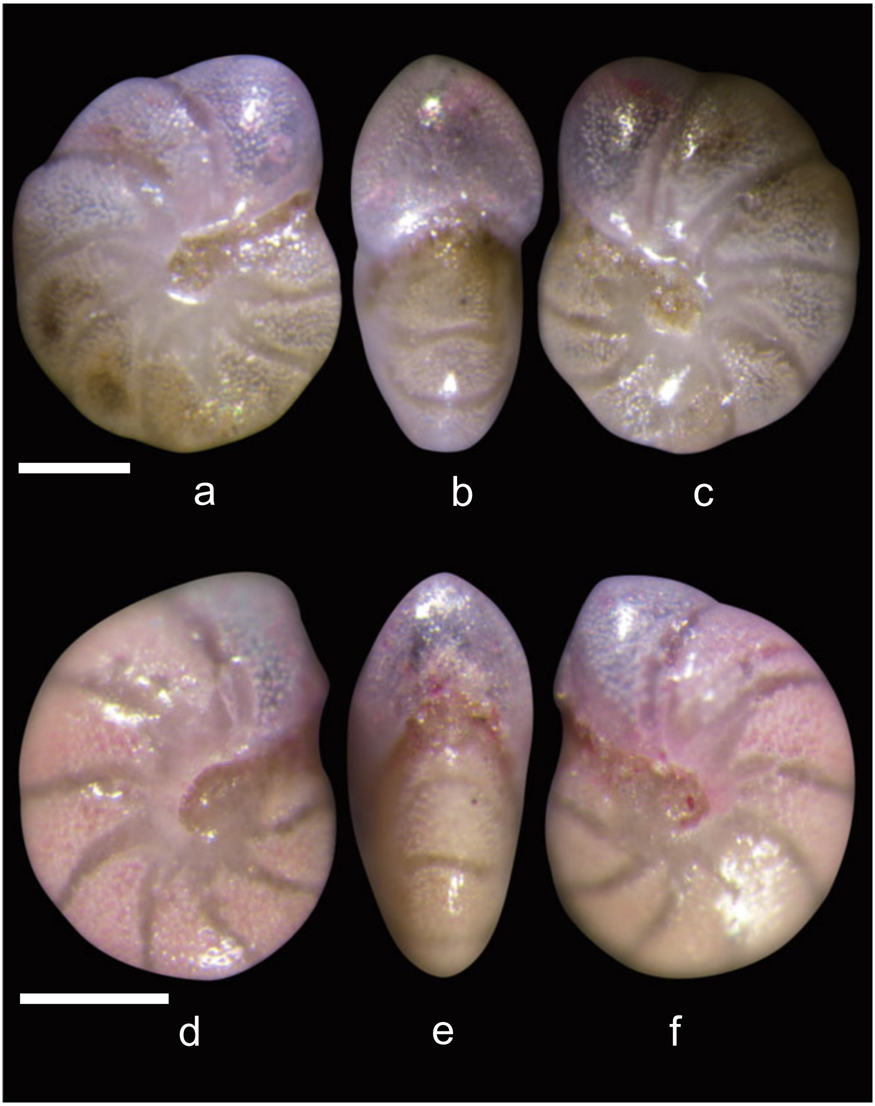

Fig. 47 a–f *Melonis affinis* (Reuss, 1851), two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another live specimen. Scale bars = 100 μm

Description

Size about 300 μm in length, length:width ratio about 1.2:1. Test planispiral and symmetrical and involute, biumbilicate, with deep and open umbilici, around 1.8:1 flattened laterally. Chambers broad and low, about nine in the final whorl. Sutures radial and slightly curved, limbate, somewhat thickened, septal flap added against the previous apertural face as new chambers are added. Periphery broadly rounded, peripheral outline smooth. Wall calcareous, hyaline, optically granular, coarsely perforate other than the imperforate apertural face, sutures, and thickened umbilical rim, surface without ornamentation. Aperture a low interiomarginal and equatorial slit, extending to the umbilici and remaining open around the umbilical margin, bordered with a distinct and protruding lip.

Remarks

Melonis affinis has been reported from sediments of the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988) in Chinese literature. In continental shelf of the Yellow Sea, it is a very common and abundant species occurring in water depth of 3.00–81.00 m.

***Melonis barleeanus* (Williamson, 1858)** (Fig. 48)

Nonionina crassula (Walker), Parker & Jones, 1857, p. 14, pl. 11, Figs. 5–6.

Nonionina barleeana Williamson, 1858, p. 32, pl. 3, Figs. 68, 69.

Nonion barleeanum (Williamson), Cushman, 1930, p. 11, pl. 4, Fig. 5; Cushman, 1939a, p. 23, pl. 6, Fig. 11.

Melonis barleeanum (Williamson), Corliss, 1979, p. 10, pl. 5, Figs. 7, 8; Ingle, Keller & Kolpack, 1980, p. 142, pl. 7, Figs. 14–15; Tappan & Loeblich, 1982, pl. 53, Fig. 9 (not Fig. 8); Loeblich & Tappan, 1987, p. 621, pl. 696, Figs. 5, 6; Miller & Katz, 1987, p. 136, pl. 4, Fig. 5; Wang et al., 1988, p. 179, pl. XXXII, Fig. 14; Hermelin, 1989, p. 88, pl. 17, Fig. 2; Holbourn et al., 2013, p. 354.

Melonis barleeanus (Williamson), Thomas, 1985, p. 677, pl. 12, Fig. 3; Loeblich & Tappan, 1994, p. 159, pl. 347, Figs. 1–5; Pflum & Frerichs, 1976, pl. 7, Figs. 5, 6.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H69-01	368	290	180

Occurrence and Ecology

The Yellow Sea (St 3300-04, St 3400-05, St 3400-08, St 3600-08) (32°59′–36°00′ N, 122°30′–123°59′ E), water depth 32.90–80.00 m, temperature 9.12–15.61 °C, salinity 31.12–33.31 ‰, abundance 0.02–0.40 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Japan, North Atlantic Ocean, Norway, Ross Sea, Gulf of Mexico, Mediterranean Sea.

Melonis barleeanus (Williamson, 1858)

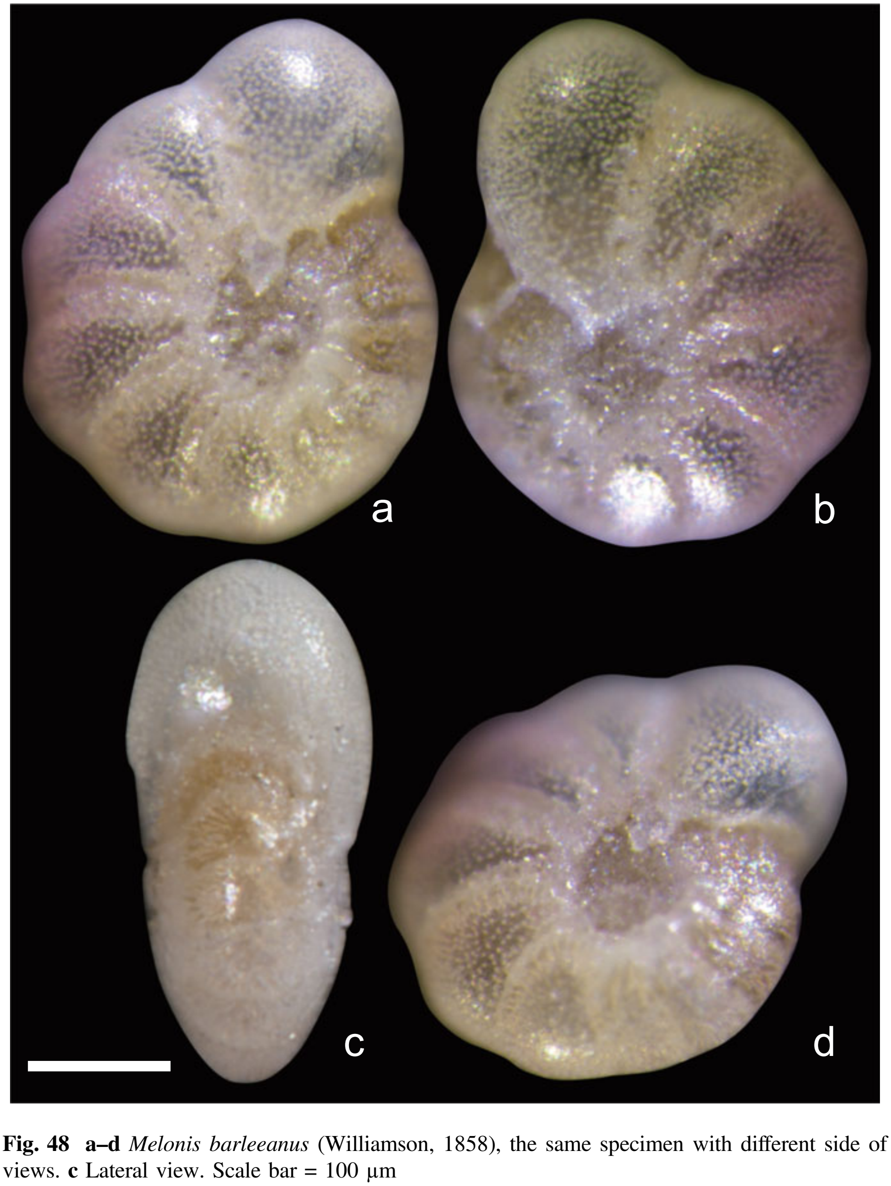

Fig. 48 **a–d** *Melonis barleeanus* (Williamson, 1858), the same specimen with different side of views. **c** Lateral view. Scale bar = 100 μm

Description

Size 368 μm in length, length:width ratio about 1.2:1. Test planispiral and symmetrical and involute, biumbilicate, with deep and open umbilici, around 1.6:1 flattened laterally. Ten chambers in the final whorl. Sutures radial and straight. Periphery broadly rounded, peripheral outline smooth. Wall calcareous, hyaline, optically granular, coarsely perforate; surface without ornamentation. Aperture a low interiomarginal and equatorial slit, extending to the umbilici and remaining open around the umbilical margin, bordered with a distinct and protruding lip.

Remarks
Melonis barleeanus has been reported from the East China Sea (Wang et al., 1988) in Chinese literature. In the Yellow Sea, it is a common species occurring in water depth of 32.90–80.00 m.

Genus *Pullenia* Parker & Jones, 1862

***Pullenia quinqueloba* (Reuss, 1851)** (Fig. 49)

Nonionina quinqueloba Reuss, 1851, p. 71, pl. 5, Fig. 31.
Pullenia subcarinata (d'Orbigny), Barker, 1960, pl. 84, Figs. 14–15.
Pullenia quinqueloba (Reuss), Brady, 1884, p. 617, pl. 84, Figs. 14–15; Cushman, 1940, p. 320, pl. 33, Fig. 19; Cushman & Todd, 1943, p. 10, pl. 2, Fig. 5; pl. 3, Fig. 8; Bermúdez, 1949, p. 276, pl. 21, Figs. 32–33; He et al., 1965, p. 108, pl. XIII, Fig. 1a, b; Wang et al., 1980, p. 193, pl. III, Figs. 19–20; Tjalsma & Lohmann, 1983, p. 36, pl. 16, Fig. 2; Miller & Katz, 1987, p. 138, pl. 4, Fig. 2; Wang et al., 1988, p. 176, pl. XXXII, Fig. 5; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 132, pl. 163, Fig. 2; Thomas, 1990, p. 590; Ujiié, 1990, p. 43, pl. 24, Figs. 1–5; Van Marle, 1991, p. 194, pl. 20, Figs. 11–12; Bolli et al., 1994, p. 152, Figs. 41, 31–32; Jones, 1994, p. 92, pl. 84, Figs. 14–15; Kuhnt et al., 2002, p. 152, pl. 12, Figs. 18–21; Ortiz & Thomas, 2006, p. 128, pl. 10, Fig. 10; Hayward et al., 2010, p. 226, pl. 29, Figs. 18–20; Debenay, 2012, p. 231; Holbourn et al., 2013, p. 448.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B68=H5-01	262	213	153
H5=B68-01	263	227	133
H5=B68-02	300	253	152

Occurrence and Ecology
The Bohai Sea (St 6, 6-8 cm sediment) and the Yellow Sea (St CJ-06, St 3875-01) (32°29′–38°44′ N, 120°10′–125°00′ E), water depth 26.00–55.20 m, temperature 2.25–18.08 °C, salinity 30.51–32.74 ‰, abundance 0.04–0.16 ind./g sed.

Distribution
Yellow Sea, East China Sea.

Pullenia quinqueloba (Reuss, 1851)

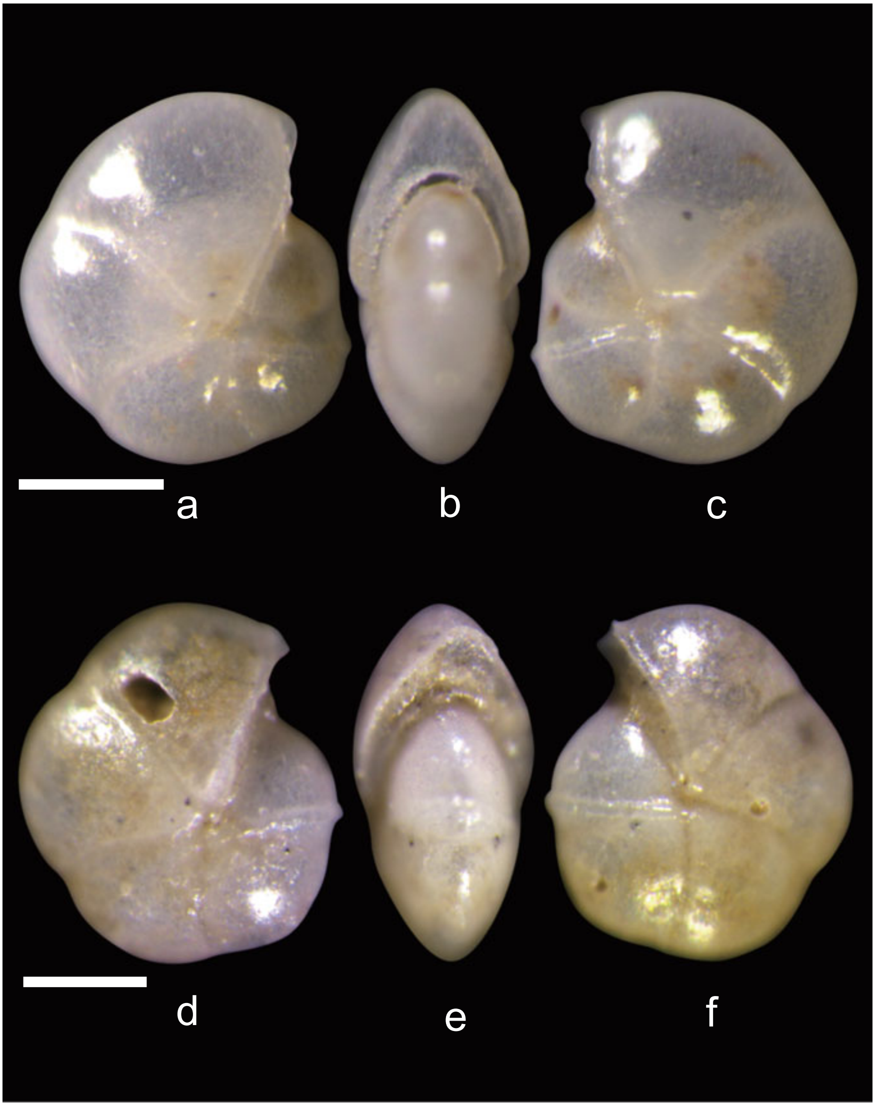

Fig. 49 a–f *Pullenia quinqueloba* (Reuss, 1851), two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Lateral views. Scale bars = 100 μm

Bay of Biscay, Gulf of Saint Lawrence, Japan, New Zealand, North Atlantic Ocean, Norway, South Korea, United States, New Caledonia, Northeast U.S. Continental Shelf, Gulf of Mexico, Mediterranean Sea.

Description
Size about 280 μm in length, length:width ratio about 1.2:1. Test circular in outline, planispiral and symmetrical and involute, around 1.6:1 flattened laterally. Five moderately inflated chambers in the final whorl. Sutures radial, slightly depressed. Periphery rounded, peripheral outline smooth. Wall calcareous, finely perforate, surface smooth. Aperture a narrow interiomarginal crescentic slit, extending across the periphery to the umbilici.

Remarks
Pullenia quinqueloba has been reported from the Yellow Sea (He et al., 1965; Wang et al., 1980) and the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in the continental shelf sediment of the Yellow Sea and the East China Sea.

Family Gavelinellidae Hofker, 1956

Genus *Gyroidinoides* Brotzen, 1942

***Gyroidinoides nipponica* (Ishizaki, 1944)** (Fig. 50)

Gyroidina nipponica Ishizaki, 1944, p. 102, pl, 3, Fig. 3a–c; Wang et al., 1988, p. 177, pl. XXXII, Figs. 9–10.
Gyroidinoides nipponica (Ishizaki, 1944), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D5-01	219	201	170
D5-02	151	127	109

Occurrence and Ecology
The Yellow Sea (St 3600-04, St 3875-01) (35°59′–38°44′ N, 121°59′–122°00′ E), water depth 44.00–51.00 m, temperature 7.39–9.80 °C, salinity 31.13–31.62 ‰, abundance 0.16–0.26 ind./g sed.

Distribution
Yellow Sea, East China Sea.
Japan, South Korea.

Description
Size about 190 μm in length, length:width ratio about 1.1:1. Test trochospiral, planoconvex, with flat and evolute spiral side and convex and involute umbilical side, on average 1.2:1 flattened laterally. Umbilicus open but partially obscured by

Gyroidinoides nipponica (Ishizaki, 1944)

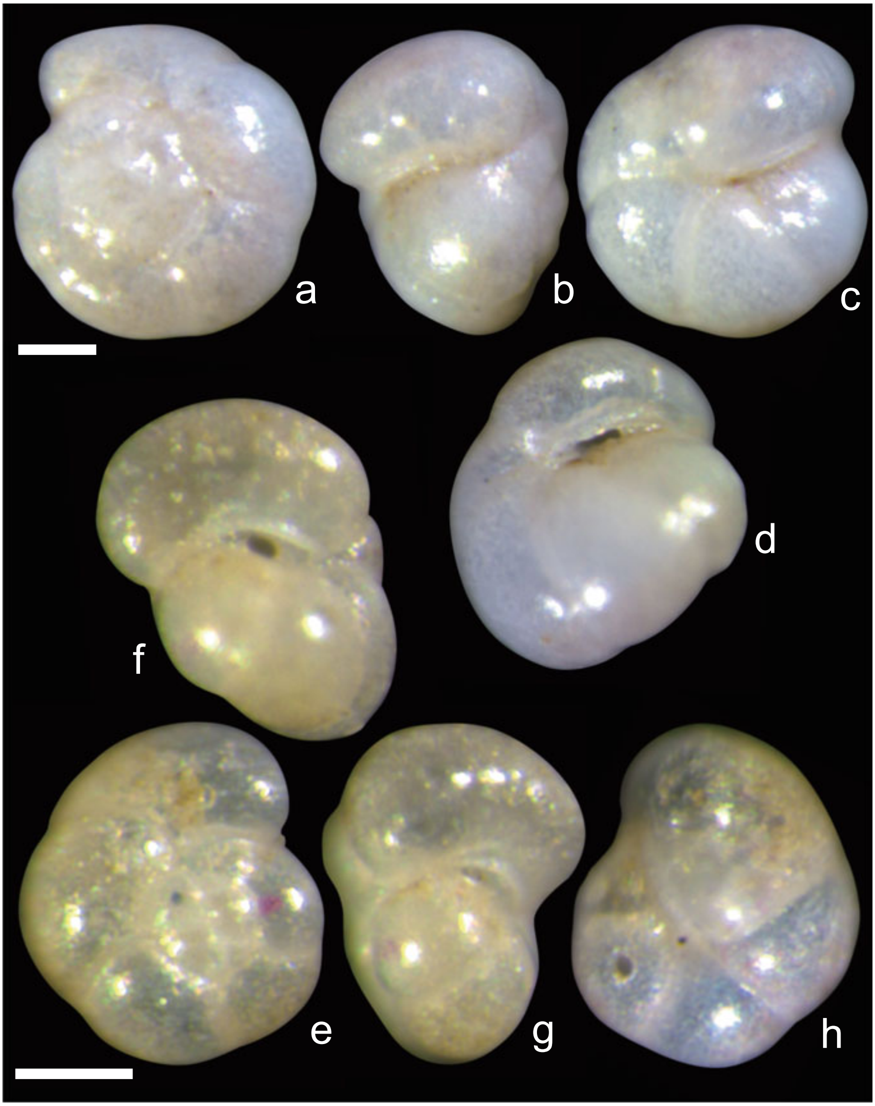

Fig. 50 a–h *Gyroidinoides nipponica* (Ishizaki, 1944), two specimens showing morphological variabilities. **a–d** Same specimen. **e–h** Another specimen. Scale bars = 50 μm

an umbilical apertural flap, umbilical shoulder angular. Sutures radial, very slightly curved. Periphery rounded. Wall calcareous, optically granular, perforate, surface smooth. Aperture a low interiomarginal slit extending from the periphery to the umbilicus.

Remarks
Gyroidinoides nipponica has been identified as *Gyroidina nipponica* in previous Chinese literature from the East China Sea sediment (Wang et al., 1988). It is a common species in the continental shelf of the Yellow Sea and the East China Sea.

Genus *Hanzawaia* Asano, 1944

Hanzawaia convexa **Ho, Hu & Wang, 1965** (Fig. 51)

Hanzawaia convexa Ho, Hu & Wang, 1965, He et al., 1965, p. 96, pl. IX, Fig. 3a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D31-01	470	388	143
D31-02	487	456	138

Occurrence and Ecology
The Yellow Sea (St CJ-02) (31°49′ N, 122°59′ E), water depth 40.00 m, temperature 17.54 °C, salinity 31.59 ‰, abundance 0.07 ind./g sed.

Distribution
Yellow Sea.

Description
Size about 480 μm in length, length:width ratio about 1.1:1. Test trochospiral, planoconvex, very compressed, on average 3:1 flattened laterally. About nine chambers in the final whorl. Sutures limbate, distinctly depressed, thickened and strongly curved back at the periphery. Convex side involute with clear central umbilical boss, flattened side partially evolute. Umbilical apertural flap from each chamber extending over the umbilical region and chambers of earlier whorls, successive flaps may coalesce over the entire umbilical area. Periphery subangular. Wall calcareous, optically granular, fine and transparent, moderately coarsely perforate. Aperture interiomarginal and equatorial, against the periphery of the previous whorl and extending slightly onto the involute side.

Remarks
Hanzawaia convexa Ho, Hu & Wang, 1965 was established by He et al. (1965). This species was discovered from the Quaternary sediments of Jiangsu, South Yellow Sea. This species is characterized by having a large umbilical boss on the convex side. Till now, it was only observed in the Yellow Sea but with low abundance. Likely, it is an endemic species in this sea area. We redescribed and reported it for the first time since it was discovered 50 years ago.

Hanzawaia convexa Ho, Hu &Wang, 1965

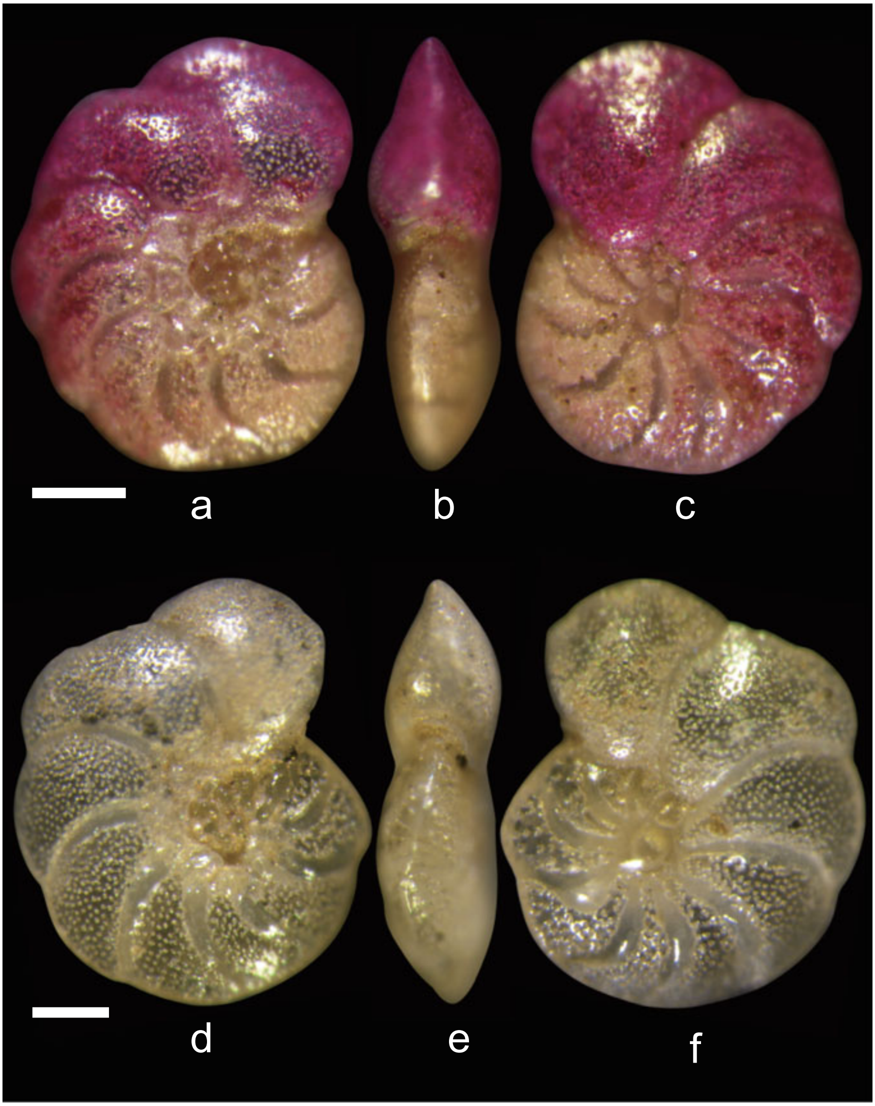

Fig. 51 **a–f** *Hanzawaia convexa* Ho, Hu & Wang, 1965, two specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **b, e** Lateral views. Scale bars = 100 μm

Hanzawaia nipponica **Asano, 1944** (Fig. 52)

Truncatulina midwayensis Plummer, 1926, p. 141, pl. 9, Fig. 7.

Hanzawaia nipponica Asano, 1944, p. 99, pl. 4, Figs. 1–2; Asano, 1951d, p. 16, text Figs. 24–26; Leroy, 1964, p. 46, pl. 9, Figs. 28–29; Matoba & Honma, 1986,

Hanzawaia nipponica Asano, 1944

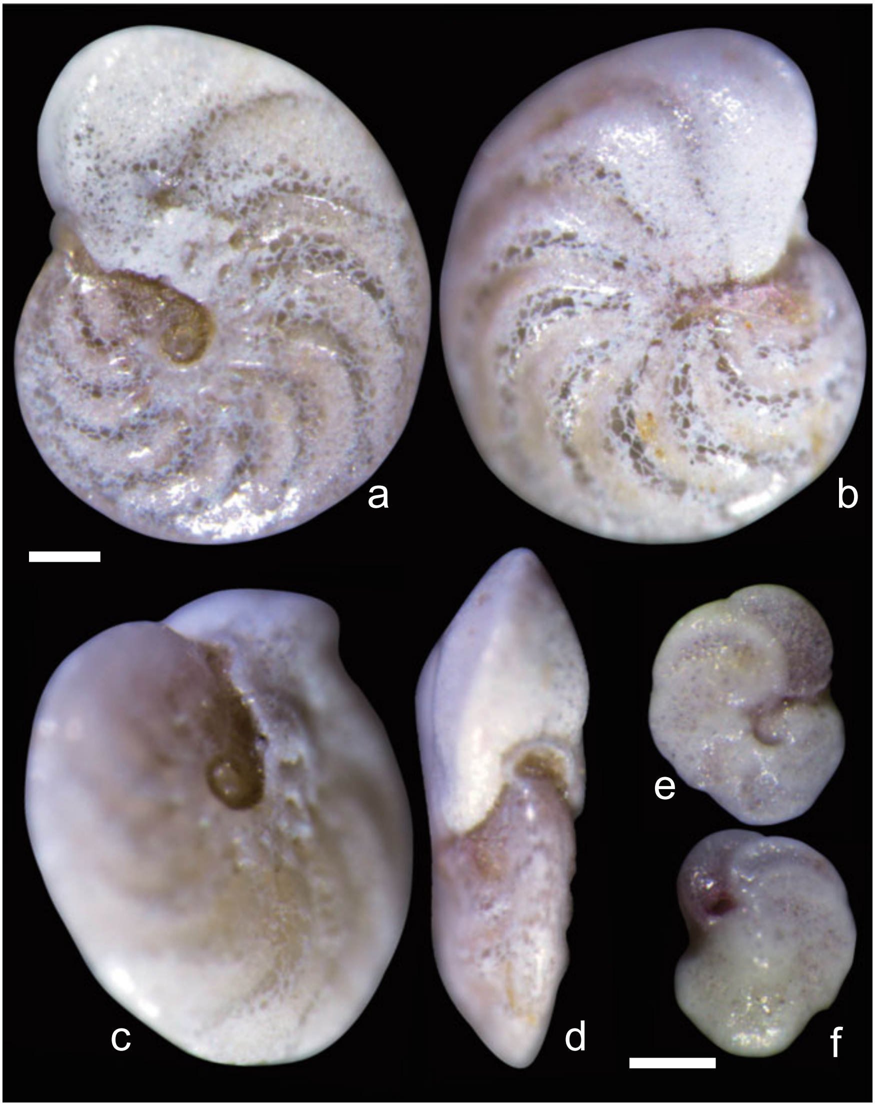

Fig. 52 a–f *Hanzawaia nipponica* Asano, 1944, two specimens showing morphological variabilities. **a–d** An adult specimen with different side of views. **e, f** A juvenile specimen. Scale bars = 100 μm

pl. 4, Fig. 13; Loeblich & Tappan, 1987, p. 639, pl. 719, Figs. 1–4; Wang et al., 1988, p. 178, pl. XXXIII, Figs. 1–5; Ōki, 1989, p. 152, pl. 22, Fig. 3; Inoue, 1989, pl. 20, Fig. 10; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological

Sciences, 1989, p. 135, pl. 163, Fig. 7; Akimoto, 1990, p. 201, pl. 20, Fig. 4; Van Marle, 1991, p. 137, pl. 12, Figs. 5–7; Loeblich & Tappan, 1994, p. 164, pl. 363, Figs. 8–13; Panchang & Nigam, 2014, p. 38, pl. XXXVI, Fig. 3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H36-01	720	585	238
H36-02	707	570	237
H36-03	603	485	240
H36-04 (juvenile)	271	220	141
H36-05 (juvenile)	468	395	198

Occurrence and Ecology

The Yellow Sea (St CJ-06, St 3300-06, St 3400-08, St 3500-08, St 3500-10, St 3600-06, St 3600-08) (32°29′–36°00′ N, 123°00′–125°00′ E), water depth 50.00–81.00 m, temperature 9.12–18.08 °C, salinity 32.41–33.39 ‰, abundance 0.14–1.48 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Japan, South Korea.

Description

Size about 680 μm in length, length:width ratio about 1.2:1. Test trochospiral, planoconvex, compressed, on average 2.3:1 flattened laterally. About ten to eleven chambers in the final whorls. Sutures somewhat limbate, very slightly depressed, sutures thickened and strongly curved back at the periphery. Convex side involute with clear central umbilical boss, flattened side partially evolute, umbilical apertural flap from each chamber extending over the umbilical region and chambers of earlier whorls, successive flaps may coalesce over the entire umbilical area. Periphery rounded to subangular. Wall calcareous, thick, opaque, moderately coarsely perforate, flattened side with a series of fossettes in the inner margin of chambers. Aperture interiomarginal and equatorial, against the periphery of the previous whorl and extending slightly onto the involute side but continuing beneath the umbilical flaps on the flattened side, supplementary openings present at the inner and outer margins of the umbilical flaps.

Remarks

Hanzawaia nipponica has been frequently reported from the East China Sea in previous Chinese literature (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a very common and abundant species in the continental shelf sediments of the China Seas.

Family Trichohyalidae Saidova, 1981

Genus *Buccella* Andersen, 1952

***Buccella inusitata* Andersen, 1952** (Fig. 53)

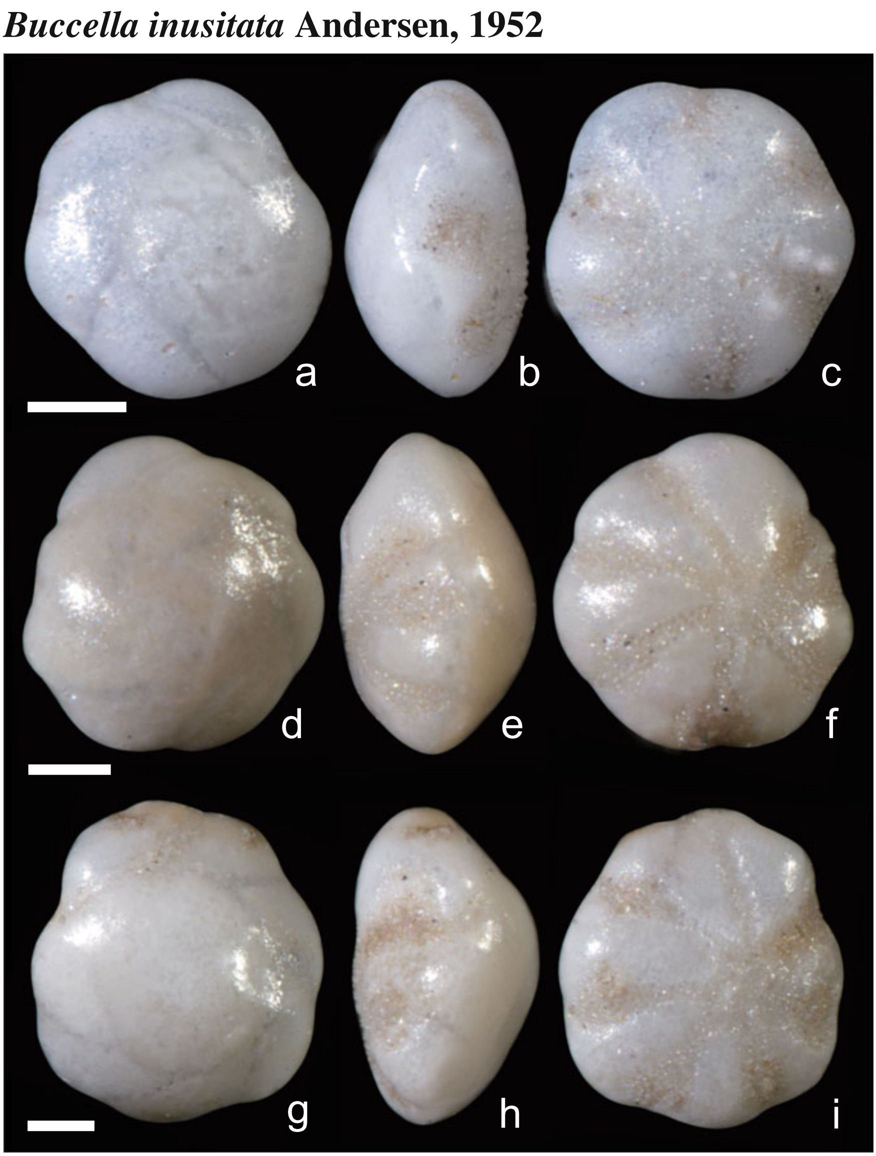

Fig. 53 a–i *Buccella inusitata* Andersen, 1952, three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Eponides frigidus Cushman & Todd (non *Pulvinulina frigida*), 1938, p. 71, pl. 8, Fig. 7.

Buccella inusitata Andersen, 1952, p. 148, Fig. 10; He et al., 1965, p. 92, pl. VIII, Fig. 3a–c; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 83, pl. 154, Fig. 3a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H87-01	326	315	193
H87-02	373	359	230
H87-03	450	417	269

Occurrence and Ecology

The Yellow Sea (St 3400-06, St 3600-05) (33°59′–35°56′ N, 122°30′–123°00′ E), water depth 60.60–66.00 m, temperature 18.40–20.40 °C, salinity 31.50–31.59 ‰, abundance 0.15–1.56 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Canada, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, South Korea, United States, Grand Bank, Scotian Shelf.

Description

Size about 380 μm in length, length:width ratio about 1.1:1. Test planoconvex to lenticular, around 1.6:1 flattened laterally. Test with about three gradually enlarging whorls, six to seven chambers in the final whorl. Sutures obscure, undepressed, oblique, curved back toward the periphery on the spiral side, radial and incised on the umbilical side, umbilical ends of the sutural fissures closed by a deposit of granules. Periphery somewhat subangular, outline smooth. Wall calcareous, opaque, surface smooth. Aperture interiomarginal.

Remarks

Buccella inusitata has been reported from the South Yellow Sea (He et al., 1965) and the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) in previous Chinese literature. It is a common species but usually with low abundance in the Yellow Sea.

***Buccella frigida* (Cushman, 1922)** (Fig. 54)

Pulvinulina frigida Cushman, 1921(1922), p. 12; Parker & Jones, 1865, pl. 14, Figs. 14, 15a–b, 17.

Eponides frigidus Cushman, 1931, p. 45.

Buccella frigida Andersen, 1952, p. 144, Figs. 4–6; He et al., 1965, p. 93, pl. VIII, Fig. 4a–c.

Buccella frigida (Cushman, 1922)

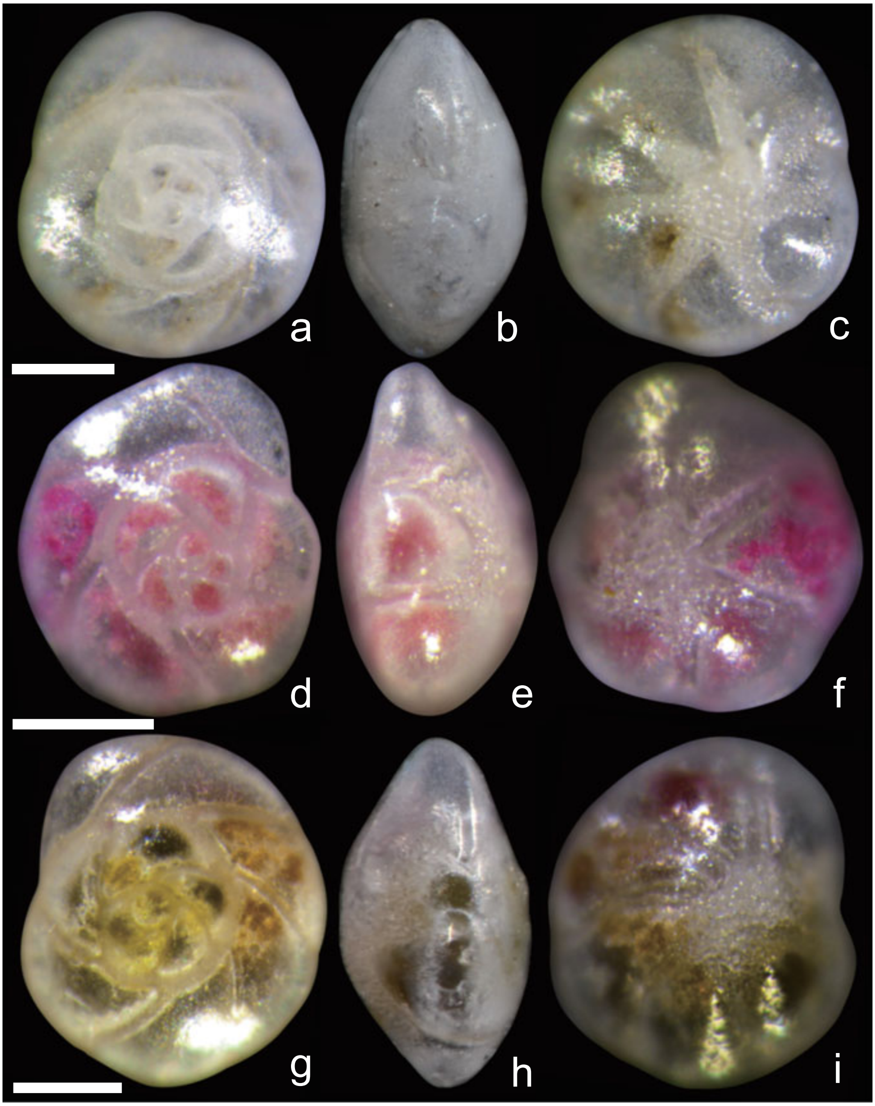

Fig. 54 a–i *Buccella frigida* (Cushman, 1922), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** A live specimen. **g–i** The third specimen. Scale bars = 100 μm

Buccella frigida (Cushman), Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 19, pl. 10, Figs. 8, 11, 12; Micropaleontology Group in Marine Geology Department of

Tongji University, 1978, p. 92, pl. X, Figs. 16–18; Wang et al., 1988, p. 157, pl. XXIII, Figs. 3–4; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 189, pl. 17, Fig. 2; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 83, pl. 154, Fig. 1a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H45=B3-01	323	296	170
H45=B3-02	249	213	135
H45=B3-03	307	280	155

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31) and the Yellow Sea (St CJ-01, St CJ-04, St 3300-04, St 3500-02, St 3500-06, St 3500-10, St 3600-02, St 3600-04, St 3600-08, St 3700-01, St 3800-02, St 3875-01, St 3875-03, St B-03, St B-06) and intertidal flat of the Qingdao Bay (31°40′–39°00′ N, 119°30′–127°00′ E), water depth 0.00–81.00 m, temperature 1.50–26.50 °C, salinity 30.11–38.00 ‰, abundance 0.02–10.06 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Canada, Celtic Sea, Gulf of Saint Lawrence, Japan, North Atlantic Ocean, Norway, South Korea, United States, Grand Bank, Northeast U.S. Continental Shelf, Scotian Shelf, Vineyard Sound, Arctic Ocean, Mediterranean Sea.

Description

Size about 290 μm in length, length:width ratio about 1.1:1. Test lenticular, around 1.7:1 flattened laterally. Test with about two to three gradually enlarging whorls, six to seven chambers in the final whorl. Sutures distinct, undepressed, thickened, oblique, curved back toward the periphery on the spiral side, radial and incised on the umbilical side, umbilical ends of the sutural fissures closed by a deposit of granules. Periphery rounded, outline smooth. Wall calcareous, fine and transparent, surface smooth. Aperture interiomarginal.

Remarks

Buccella frigida has been frequently reported by previous Chinese literature from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), the Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a very common and usually abundant species occurring from intertidal flat to continental shelf sediments in the China Seas.

***Buccella inculta* Ho, Hu & Wang, 1965** (Fig. 55)

Buccella inculta Ho, Hu & Wang, 1965, He et al., 1965, p. 93, pl. VIII, Fig. 2a–c.

***Buccella inculta* Ho, Hu & Wang, 1965**

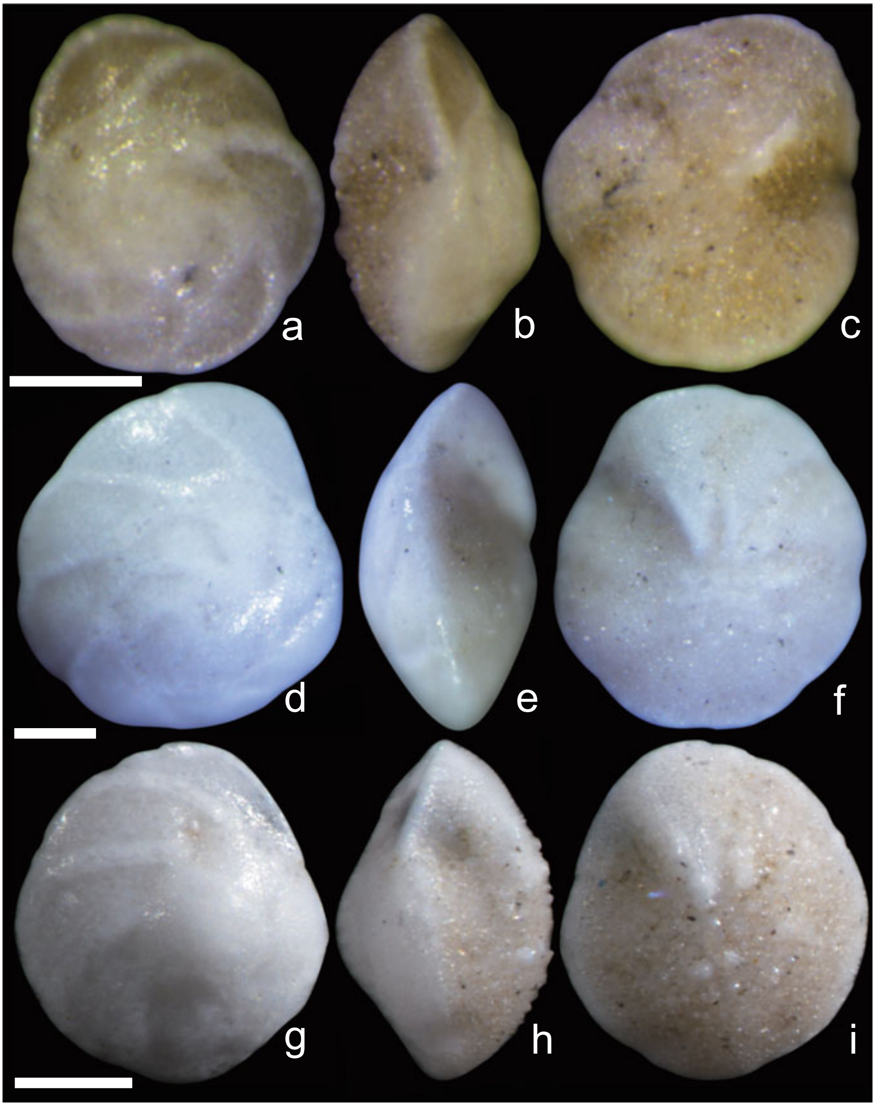

Fig. 55 a–i *Buccella inculta* Ho, Hu & Wang, 1965, three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 µm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B67-01	265	230	151
B67-02	411	384	217
B67-03	289	266	186

Occurrence and Ecology

The Yellow Sea (St 3875-01) (38°44′ N, 121°59′ E), water depth 51.00 m, temperature 7.39 °C, salinity 31.62 ‰, abundance 0.78 ind./g sed.

Distribution

Yellow Sea.

Description

Size about 320 μm in length, length:width ratio about 1.1:1. Test lenticular, about three gradually enlarging whorls, trochospiral, on average 1.6:1 flattened laterally. Final whorl with about eight chambers, the final chamber triangular in shape. Sutures distinct, thickened, mosaic, upraised, oblique, curved back toward the periphery on the spiral side. On the umbilical side, sutures indistinct, therefore chambers completely obscure, surface covered by granular particles. Periphery carinate. Wall calcareous, thick and coarse, opaque, surface granular on umbilical side. Aperture interiomarginal.

Remarks

Buccella inculta Ho, Hu & Wang, 1965 was established by He et al. (1965). This species was discovered from the Quaternary sediments of Shanghai, the South Yellow Sea. This species is characterized by having the upraised and mosaic sutures, and a triangular shaped final chamber. Till now, it was only occurred in the Yellow Sea and with low abundance. Likely, it is an endemic species in this sea area. This species was redescribed for the first time after it was discovered 50 years ago.

Buccella tunicata **Ho, Hu & Wang, 1965** (Fig. 56)

Buccella tunicata Ho, Hu & Wang, 1965, He et al., 1965, p. 93, pl. 8, Fig. 5a–c; Wang et al., 1988, p. 157, pl. XXIII, Figs. 5–6.

Buccella (?) *tunicata* Zheng et al., 1978, p. 46, pl. 5, Fig. 2a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H46-01	325	292	188
H46-02	352	347	203
H46-03	380	347	227

Buccella tunicata Ho, Hu & Wang, 1965

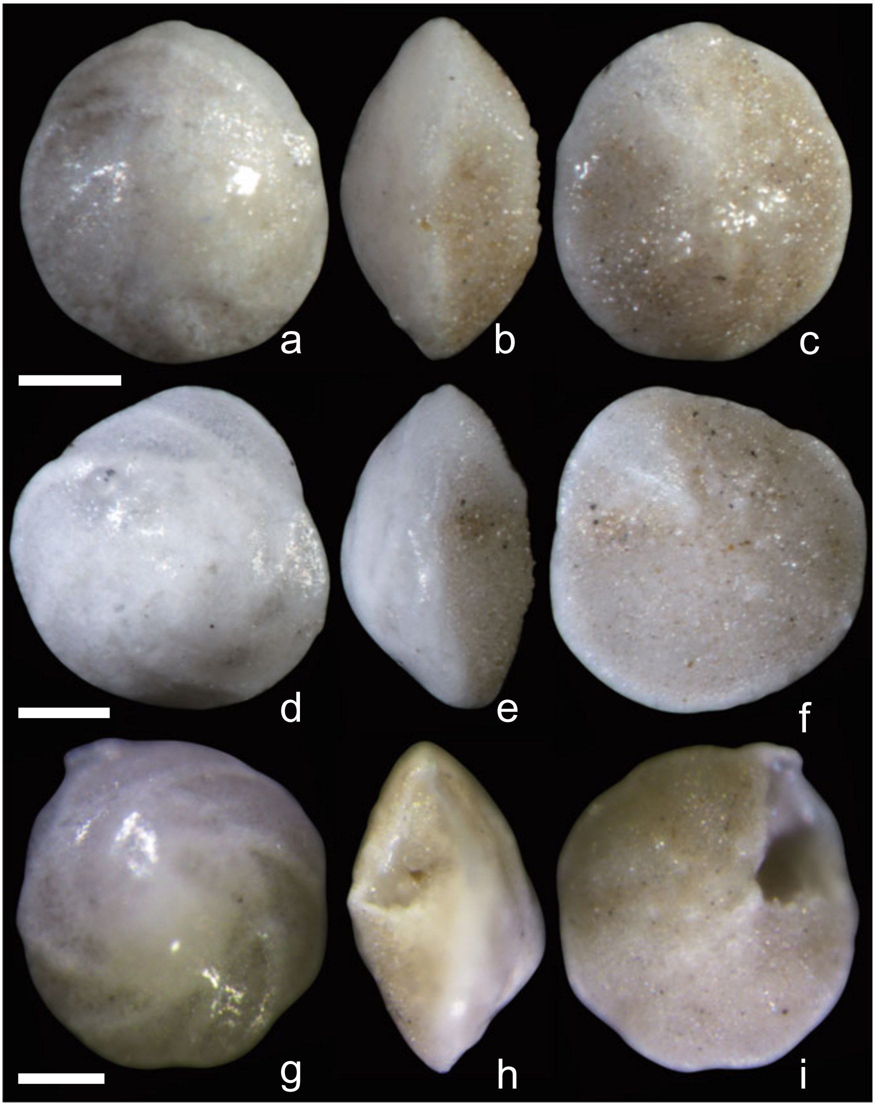

Fig. 56 **a–i** *Buccella tunicata* Ho, Hu & Wang, 1965, three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St 3875-01, St 3875-03) (38°44′ N, 121°59′–127°00′ E), water depth 51.00–55.00 m, temperature 7.39–7.80 °C, salinity 31.62–31.88 ‰, abundance 0.02–1.56 ind./g sed.

Distribution
Bohai Sea, Yellow Sea, East China Sea.

Description
Size about 350 μm in length, length:width ratio about 1.1:1. Test circular in outline, lenticular in side view, about three gradually enlarging whorls, trochospiral, on average 1.6:1 flattened laterally. Seven to eight chambers in the final whorl, the final chamber crescentic in shape. Sutures indistinct, thickened, obscure, highly oblique, curved back toward the periphery on the spiral side. On the umbilical side, sutures totally vague, therefore chambers completely obscure, surface covered with granular particles. Periphery rounded. Wall calcareous, thick and coarse, opaque, fully covered with granular particles on surface of umbilical side. Aperture interiomarginal.

Remarks
Buccella tunicata Ho, Hu & Wang, 1965 was established by He et al. (1965). This species was discovered from the Quaternary sediments of Jiangsu, the South Yellow Sea. This species is characterized by having a circular test shape, a crescentic final chamber, highly oblique and obscure sutures; in addition, its umbilical side was fully covered with granular particles. This species has been reported from the inner continental shelf sediments of the East China Sea (Wang et al., 1988). Its abundance is low in the China Seas.

Family Rotaliidae Ehrenberg, 1839

Genus *Pararotalia* Le Calvez, 1949

***Pararotalia armata* (d'Orbigny, 1826)** (Fig. 57)

Rotalia (*Rotalie*) *armata* d'Orbigny, 1826, p. 273, pl. 3, Fig. 88.

Pararotalia armata (d'Orbigny), Loeblich & Tappan, 1957, p. 9, pl. 5, Fig. 2a–c; He et al., 1965, p. 101, pl. X, Fig. 7; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 93, pl. XI, Figs. 13–18; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 196, pl. 19, Fig. 1.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H55-01	486	407	237
H55-02	456	363	203

Pararotalia armata (d'Orbigny, 1826)

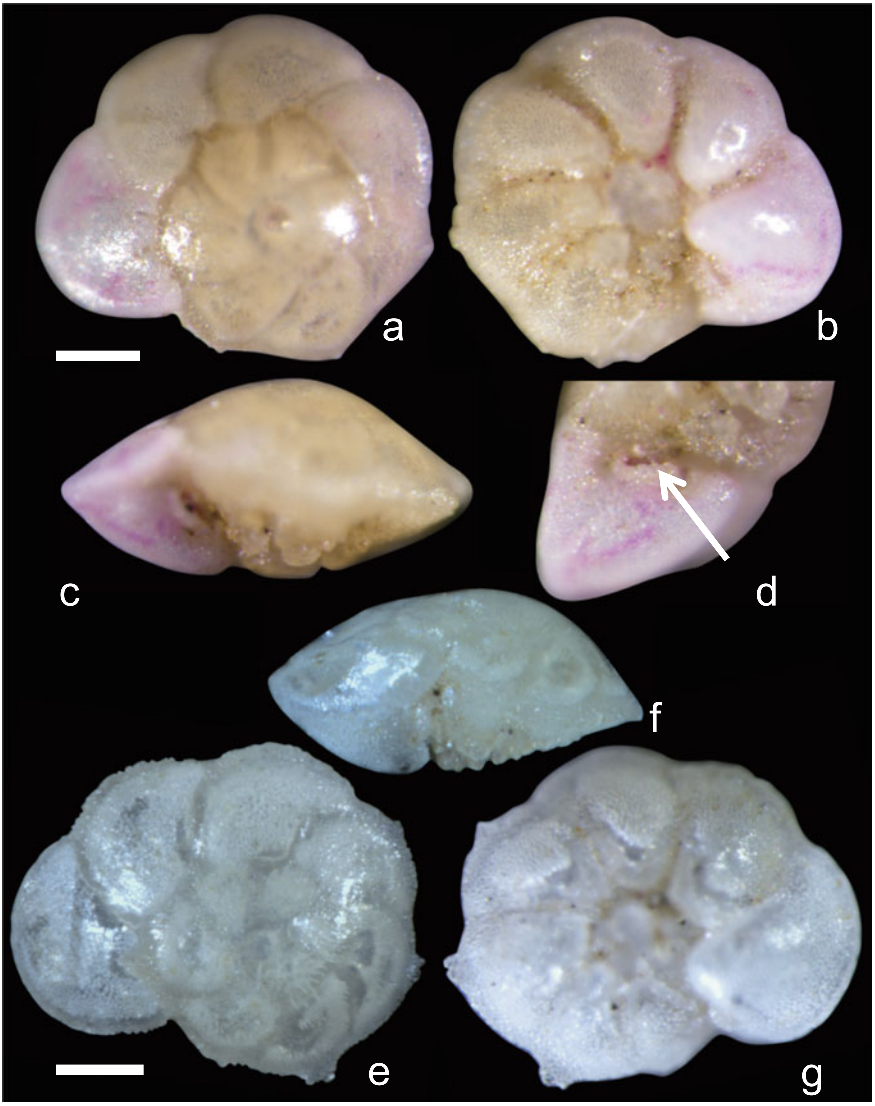

Fig. 57 a–g *Pararotalia armata* (d'Orbigny, 1826), two specimens showing morphological variabilities. **a–d** A live specimen with different side of views. **e–g** A fossil specimen. *Arrow* denote aperture. Scale bars = 100 μm

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-02, St 3500-02) (31°39′–36°00′ N, 120°00′–122° 59′ E) and intertidal flat of the Qingdao Bay, water depth 3.00–40.00 m, temperature 1.50–26.50 °C, salinity 30.31–38.00 ‰, abundance 0.03–7.45 ind./g sed.

Distribution
Yellow Sea, Okinawa Trough.

Description
Size about 480 μm in major axis. Test in a low trochospiral coil, with 2 volutions. Chambers centrally elevated on the spiral side, about seven chambers in the final whorl. Sutures clear and slightly depressed. Periphery carinate, with spinule in each chamber. Umbilical side with a large umbilical plug. Wall calcareous, fairly perforate, surface smooth. Aperture an interiomarginal arch.

Remarks
Pararotalia armata had been reported from sediments of the South Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; He et al., 1965) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing, 1988). The Okinawa Trough population of *P. armata* was smaller than that of the Yellow Sea and its abundance was also low. In our investigation, it was very abundant in intertidal sediments but was rare in continental shelf sediments. *P. armata* is likely a shallow water species presenting littoral environment.

Genus *Ammonia* Brünnich, 1772

***Ammonia aomoriensis* (Asano, 1951)** (Fig. 58)

Rotalia beccarii aomoriensis Asano, 1951, p. 18, Figs. 96–98.

Ammonia aomoriensis (Asano), Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 24, pl. 8, Figs. 10–12; Hayward et al., 2004, p. 262, pl. 2, Fig. T6; pl. 3, Fig. T6; pl. 4, Fig. T6; Debenay, 2012, p. 184; Hayward et al., 2015; Lei & Li, 2015, p. 3, Fig. 1.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H66-01	368	325	187
H66-02	408	361	231
H66-03	233	209	127

Occurrence and Ecology
The Yellow Sea (St CJ-02, St CJ-04, St 3400-08, St 3500-02) and intertidal flat of the Qingdao Bay (31°49′–36°00′ N, 120°00′–124°00′ E), water depth 3.00–80.00 m, temperature 1.50–26.50 °C, salinity 30.82–38.00 ‰, abundance 0.18–25.12 ind./g sed.

Ammonia aomoriensis (Asano, 1951)

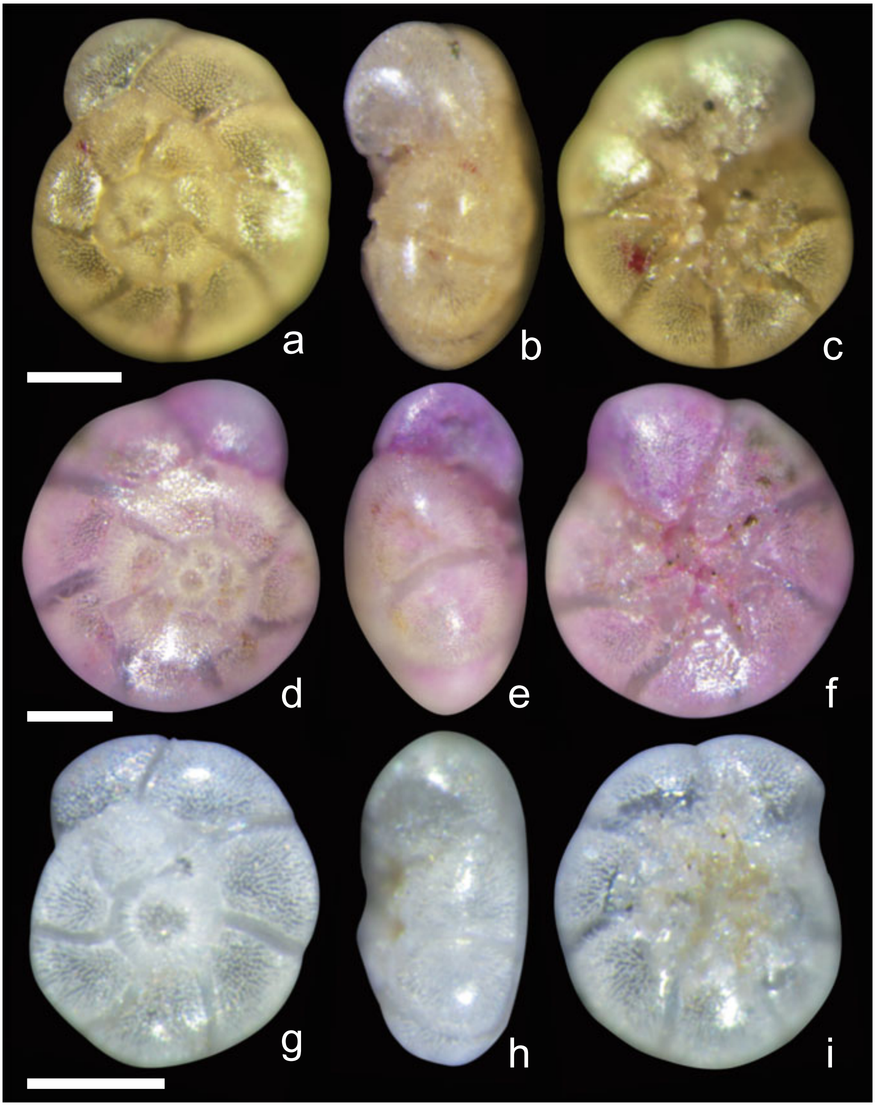

Fig. 58 **a–i** *Ammonia aomoriensis* (Asano, 1951), three specimens with different side of views. **a–c** From same specimen. **d–f** A live specimen. **g–i** The third specimen. Scale bars = 100 μm

Distribution

Bohai Sea, Yellow Sea.

Japan, New Caledonia.

Description

Size about 350 μm in diameter. Test biconvex, with 2–3 volutions. Chambers clear, with six to eight chambers in final whorl. Periphery rounded. Sutures distinct. Umbilical side fissured in center, without umbilical plug. Wall calcareous, optically radial, rather coarsely perforate, surface smooth. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia aomoriensis has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences (1978) and the Yellow Sea (Lei & Li, 2015). This species was easily misidentified with *A. tepida* and *A. beccarii*, but *A. aomoriensis* has a more coarsely perforated test and flat shape, thus was different from the others.

In our investigation, *A. aomoriensis* was very abundant in intertidal sediments, comprising about 22 % foraminiferal relative abundance. With increasing water depth in continental shelf sediments, it decreased to about 0.6–15 % in relative abundance. Obviously, *A. aomoriensis* is a typical shallow water species presenting littoral environment.

Ammonia angulata **(Kuwano, 1950)** (Fig. 59)

Rotalia ketienziensis angulata Kuwano, 1950, p. 312, text Figs. 1a–c, 9.

Ammonia ketienziensis angulata, Huang, 1964, p. 53, pl. 1, Fig. 6; Wang et al., 1988, p. 167, pl. XXVII, Figs. 6–7; Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B92-01	291	256	146
B92-02	293	283	155

Occurrence and Ecology

The Yellow Sea (St CJ-04, St 3400-06, St 3875-03, St B-03, St B-06) (32°10′–38°44′ N, 121°57′–127°00′ E), water depth 41.00–67.80 m, temperature 7.72–17.02 °C, salinity 31.48–32.08 ‰, abundance 0.04–0.24 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan, South Korea.

Description

Size about 300 μm in diameter. Test trochospiral, spiral side less convex, distinct convex in umbilical side, with about three volutions. Chambers clear, with about five to six chambers in final whorl. Periphery with constrictions at sutures. Sutures distinct and slightly depressed in dorsal side, cured and forming angles in ventral side. Umbilical side fissured in center, with umbilical plug. Wall transparent, moderately perforate, smooth in surface. Aperture an interiomarginal extraumbilical arch.

Ammonia angulata (Kuwano, 1950)

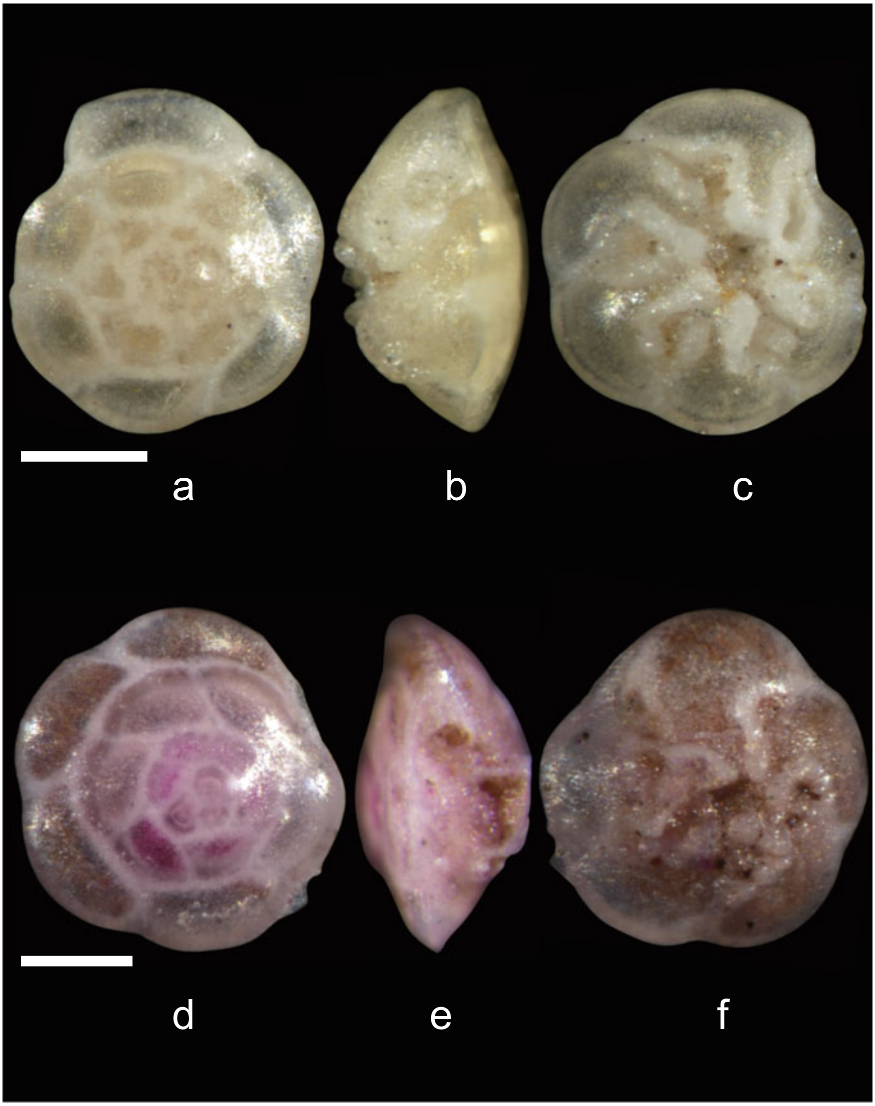

Fig. 59 a–f *Ammonia angulata* (Kuwano, 1950), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another live specimen. Scale bars = 100 μm

Remarks

Ammonia angulata had been identified as the subspecies *Ammonia ketienziensis angulata* (Wang et al., 1988). Hayward et al. (2015) regarded it as an independent species and we agree this point of view. It is a common species in the Bohai Sea, the Yellow Sea and the north part of East China Sea.

***Ammonia beccarii* (Linnaeus, 1758)** (Fig. 60)

Nautilus beccarii Linnaeus, 1758, p. 710, pl. 1, Fig. 1a–c.

Rotalia beccarii (Linné) Brady, 1884, p. 704, pl. 107, Figs. 2–3; Cushman, 1915, p. 67, pl. 30, Fig. 3a–c; 1928b, p. 104, pl. 15, Figs. 1–7.

***Ammonia beccarii* (Linnaeus, 1758)**

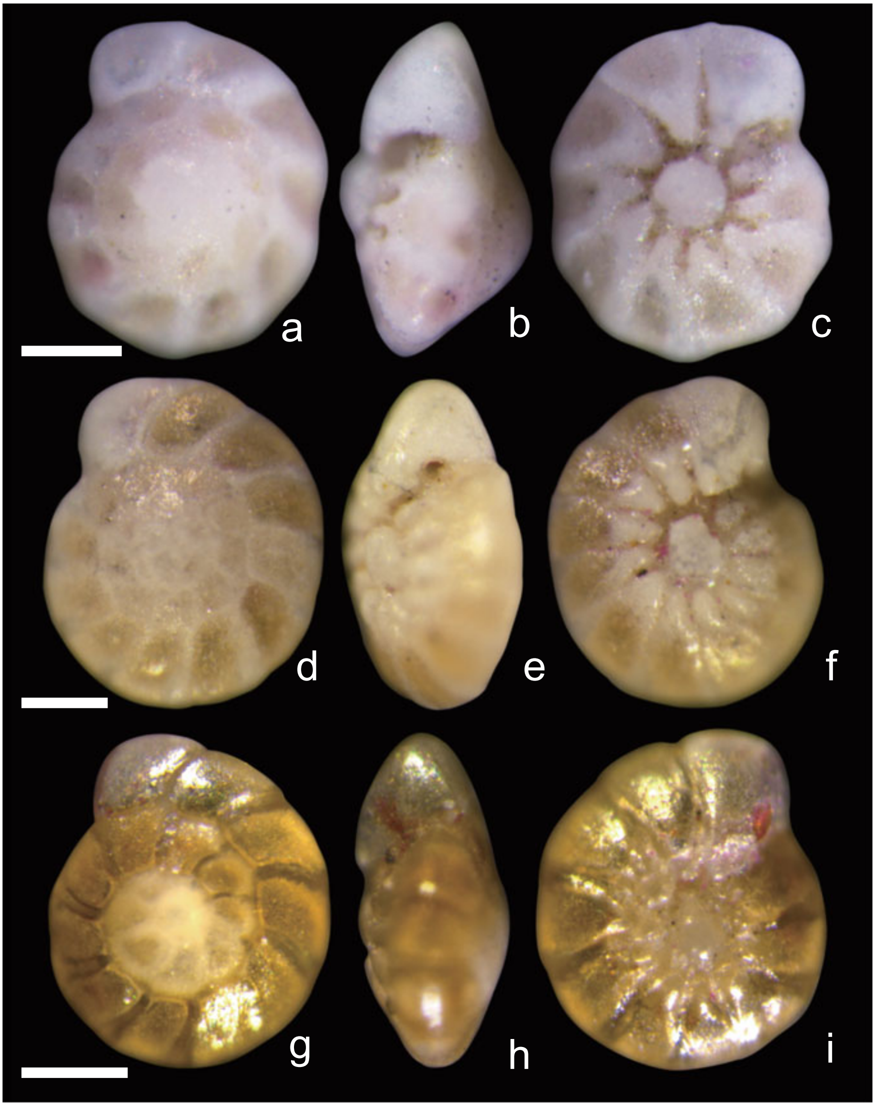

Fig. 60 **a–i** *Ammonia beccarii* (Linnaeus, 1758), three specimens with different side of views. **a–c** A live specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Rotalia beccarii (Linnaeus) var. *tepida* Cushman, 1926, p. 79, pl. 1.

Rotalia beccarii (Linnaeus), Cushman, 1931, p. 58, pl. 12, Figs. 1–7, pl. 13, Figs. 1, 2.

Streblus beccarii (Linné), Hofker, 1951b, p. 492, Figs. 335–342; Todd & Low, 1961, p. 18, pl. 2, Figs. 18, 19.

Ammonia tepida, Banner & Williams, 1973, p. 59, pl. 6, Figs. 1–14; pl. 8, Figs. 1–14; pl. 9, Figs. 1–10; pl. 10, Figs. 1–6.

Ammonia beccarii (Linné) vars., Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 94, pl. XII, Figs. 1–3;13–15; Wang et al., 1980, p. 196, pl. IX, Figs. 1–4.

Ammonia beccarii (Linné) var., Wang et al., 1980, p. 192, pl. I, Figs. 3–4; p. 197, pl. XI, Figs. 8–9; Wang et al., 1988, p. 168, pl. XXVII, Figs. 4–5.

Ammonia beccarii (Linné) Cifelli, 1962, pp. 119–126, pl. 21, 22; Reiss, 1963, pl. 5, Figs. 2, 6, 8; Loeblich & Tappan, 1964, p. 607, Figs. 479, 2-4; He et al., 1965, p. 103, pl. XI, Fig. 2a–c; Belford, 1966, pp. 108–110, pl. 19, Figs. 2–8; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 22, pl. 7, Figs. 2–5; Zheng et al., 1978, p. 220, pl. XXIV, Figs. 9a–c; Loeblich & Tappan, 1987, p. 664, pl. 767, Figs. 1–7; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 195, pl. 19, Fig. 9; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 87, pl. 156, Fig. 2a–c; Lei & Li, 2015, p. 5, Fig. 2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H114-01	319	270	183
H114-02	365	321	172
H114-03	303	256	138
H147-01	292	257	138
H147-02	298	258	140

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 0.00–3.00 m, temperature 1.50–26.50 °C, salinity 31.00–38.00 ‰, abundance 1.92–44.16 ind./g sed.

Distribution

Bohai Sea, Qingdao Bay of the Yellow Sea, East China Sea, Okinawa Trough.
Adriatic Sea.

Description
Size about 350 μm in diameter. Test more convex in spiral side, with about 3–4 volutions. Chambers clear, with 10–12 chambers in final whorl. Periphery rounded. Sutures distinct. Umbilical side with a distinct umbilical plug. Wall calcareous, moderately perforate, smooth in surface. Aperture an interiomarginal extraumbilical arch.

Remarks
Ammonia beccarii was frequently reported by many studies from the Bohai Sea, the Yellow Sea, the East China Sea and Okinawa Trough (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978; Wang, 1980; Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989; Lei & Li, 2015). In our investigation, *A. beccarii* comprised about 39 % of foraminiferal relative abundance in intertidal zone. But with increasing water depth in continental shelf region, it decreased to 5.7 % in <20 m water depth, and continuously reduced to 1.38 % in >20 m water depth (Lei & Li, 2015).

***Ammonia falsobeccarii* (Rouvillois, 1974)** (Fig. 61)

Pseudoeponides falsobeccarii Rouvillois, 1974, Gross, 2001; Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B17-01	520	475	279
B17-02	398	357	212
B17-03	403	360	221

Occurrence and Ecology
The Bohai Sea (St A8, St 6, St 19, St 11, St 36, St 31) and the Yellow Sea (St 3600-08, St 3800-02, St 3875-01) (36°00′–38°44′ N, 120°04′–123°59′ E), water depth 25.00–78.00 m, temperature 2.25–9.12 °C, salinity 30.11–33.31 ‰, abundance 0.02–0.64 ind./g sed.

Distribution
Bohai Sea, Yellow Sea.

Bay of Biscay, English Channel, North Atlantic Ocean, Mediterranean Sea.

Ammonia falsobeccarii (Rouvillois, 1974)

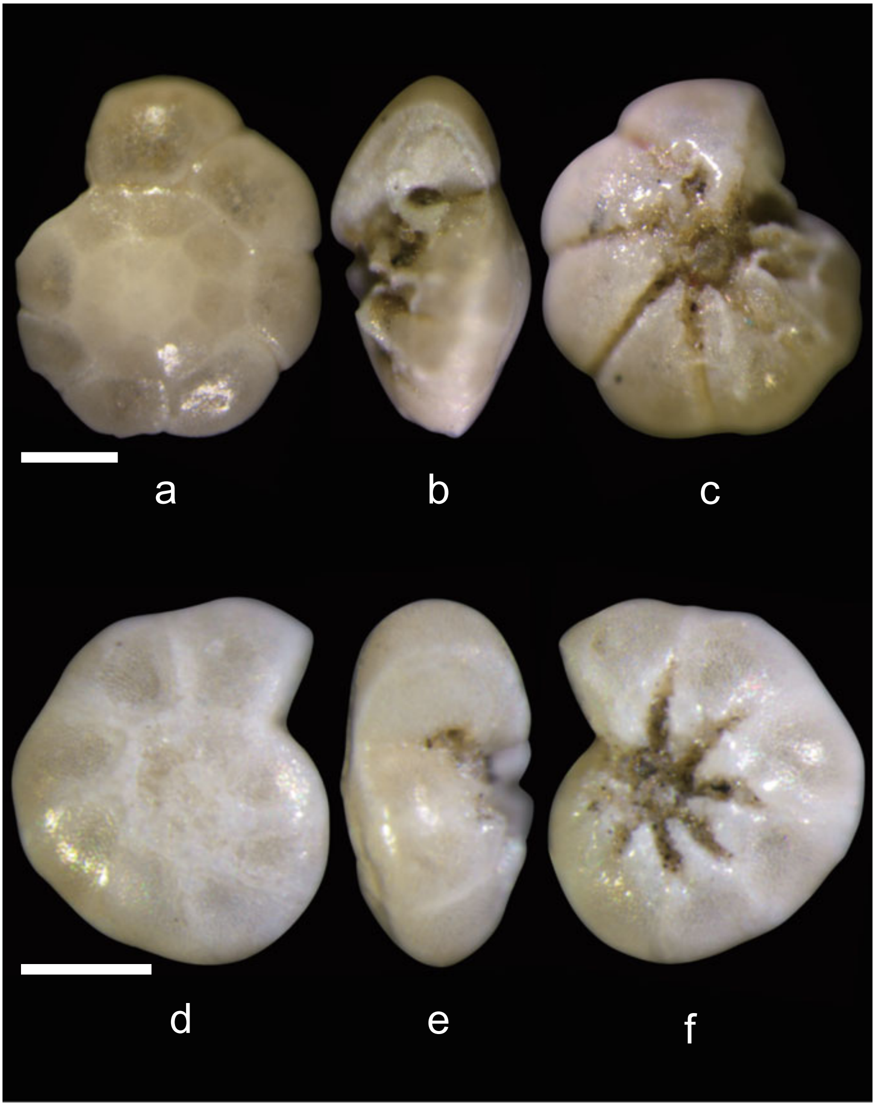

Fig. 61 **a–f** *Ammonia falsobeccarii* (Rouvillois, 1974), two specimens with different side of views. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 150 µm

Description

Size about 450 µm in diameter. Test biconvex, with about three to four volutions. Chambers clear, with seven to eight chambers in final whorl, the final chamber patulous in shape. Periphery with constrictions at sutures. Sutures distinct, flush with test surface in spiral side and distinct depressed in umbilical side. Umbilical side fissured in center, with umbilical plug. Wall calcareous, rather thick, less perforate, smooth in surface. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia falsobeccarii is a new record to China Sea. This species is easily misidentified as *A. beccarii*. However, it is characterized by thick wall and the patulous shaped final chamber. It is a common species with moderate abundance in the Bohai Sea and the Yellow Sea.

***Ammonia ketienziensis* (Ishizaki, 1943)** (Figs. 62, 63)

Streblus ketienziensis Ishizaki, 1943, p. 59, pl. 1, Fig. 5a–c; Ishizaki, 1948, p. 59, pl. 1, Fig. 2a–c.

Ammonia ketienziensis (Ishizaki) Huang, 1964, pl. 1, Fig. 13; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 96, pl. XII, Figs. 22–27; Wang et al., 1980, p. 196, pl. IX, Figs. 11–13; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 196, pl. 19, Fig. 2; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 87, pl. 156, Fig. 4a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D17=B77-01	375	341	178
D17=B77-02	539	511	270
D17=B77-03	345	325	167
D17=B77-04	300	281	149
D17=B77-05	310	285	149
D17=B77-06	361	340	157
D17=B77-07	345	309	190

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 31) and the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3400-08, St 3500-02, St 3500-06, St 3500-08, St 3500-10, St 3600-02, St 3600-04, St 3700-01, St 3875-01, St B-06) (31°39′–39°00′ N, 119° 30′–125°00′ E), water depth 25.00–81.00 m, temperature 2.25–18.08 °C, salinity 30.11–33.39 ‰, abundance 0.08–10.56 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Japan, South Korea.

Ammonia ketienziensis (Ishizaki, 1943)

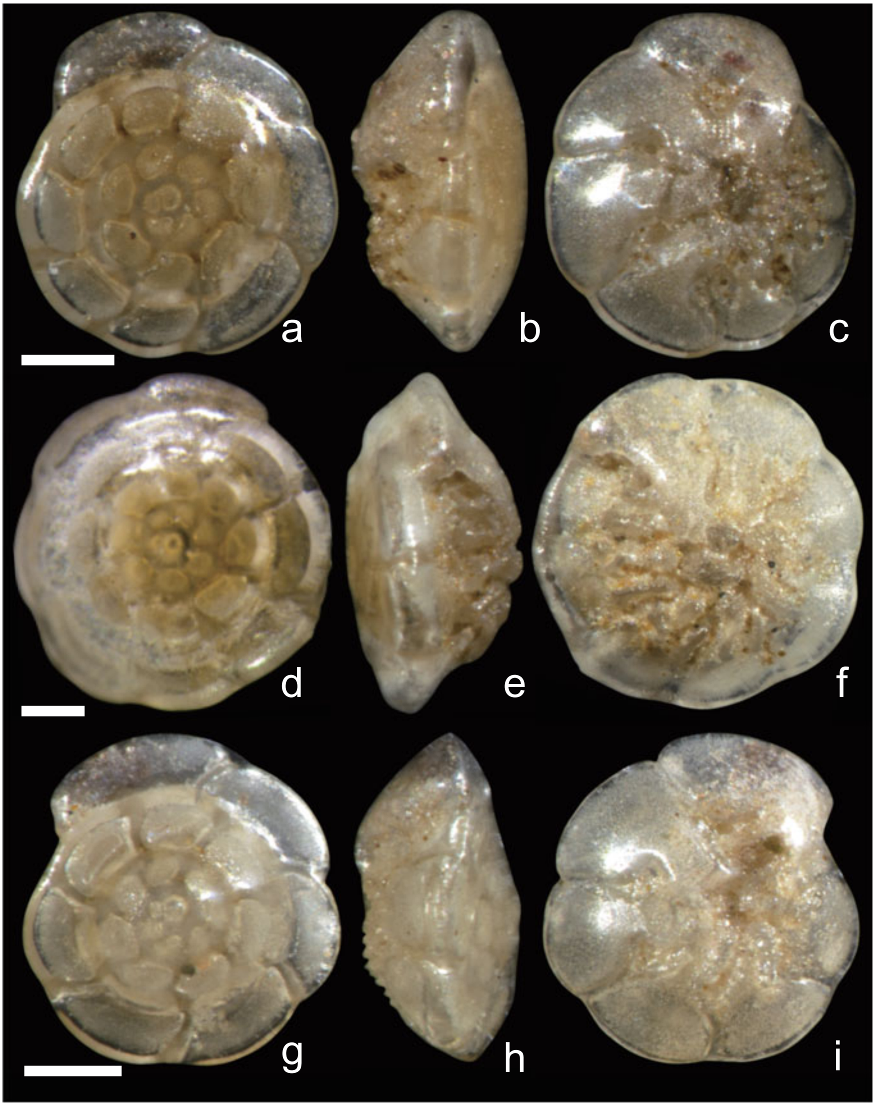

Fig. 62 a–i *Ammonia ketienziensis* (Ishizaki, 1943), three specimens showing morphological variabilities. **a–c** The same specimen with different side of views. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Description

Size about 370 μm in diameter. Test usually yellowish, biconvex, distinctly convex and uplifted in ventral side but flat in dorsal side, with about four to five volutions. Chambers distinct, fattened in shape, with seven to eight chambers in final whorl.

Ammonia ketienziensis (Ishizaki, 1943)

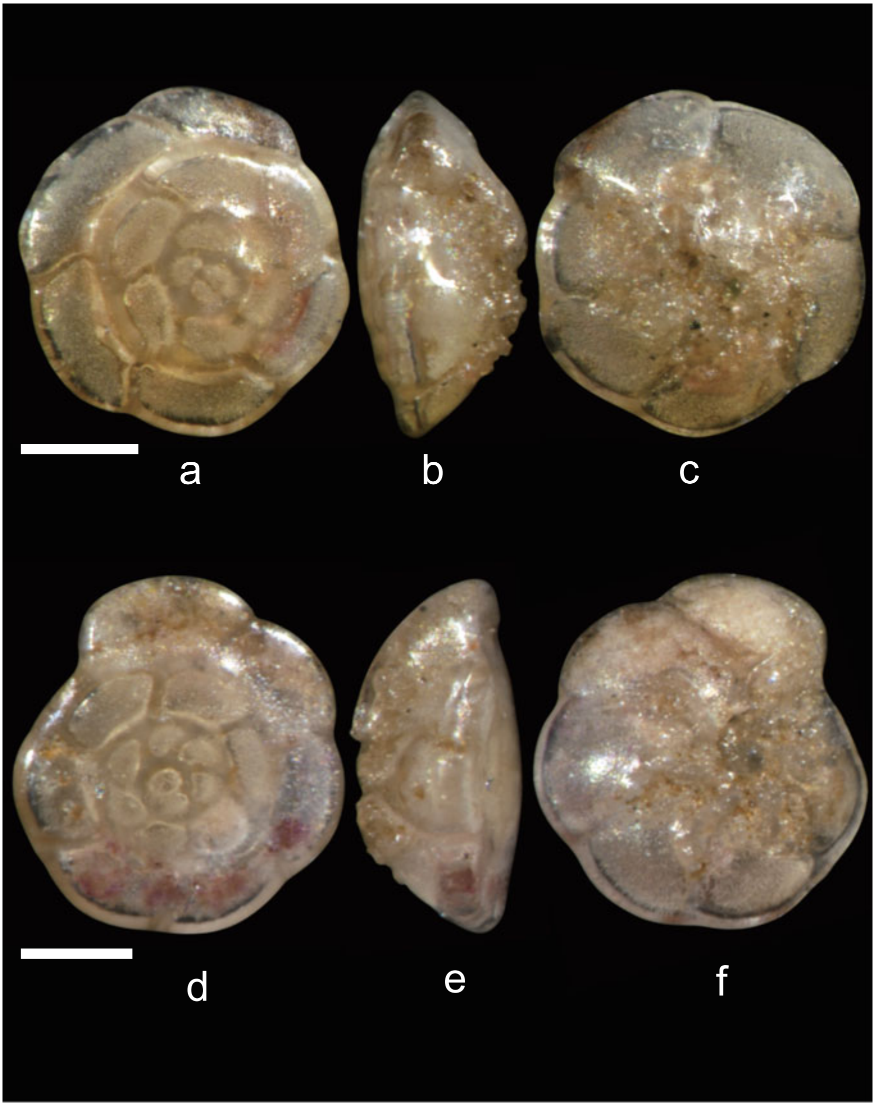

Fig. 63 **a–f** *Ammonia ketienziensis* (Ishizaki, 1943), two specimens showing different side of views. **a–c** From same specimen. **d–f** A live specimen. Scale bars = 100 μm

Periphery rimmed, with slight constrictions at sutures. Sutures clear, radial in dorsal side, converged in ventral center. Umbilical side with umbilical plug. Wall calcareous, transparent, fine and thin, moderate perforate, smooth in surface. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia ketienziensis has been frequently reported by many studies from the Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980), the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a very common and usually dominant species in continental shelf sediments of the Yellow Sea and the East China Sea.

***Ammonia maruhasii* (Kuwano, 1950)** (Fig. 64)

Rotalia maruhasii Kuwano, 1950, p. 314, tf. 2, 8.

Ammonia maruhasii (Kuwano), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 95, pl. XII, Figs. 4–6; Wang et al., 1980, p. 200, pl. XVI, Fig. 12; Wang et al., 1988, p. 166, pl. XXVI, Figs. 14–15; pl. XXVII, Fig. 11.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H16=B13-01	385	350	153
H16=B13-02	358	323	167
H16=B13-03	357	339	181

Occurrence and Ecology

The Bohai Sea (St 6, St 19, St 11, St 36, St 22, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St 3300-04, St 3400-05, St 3400-06, St 3400-08, St 3500-02, St 3500-06, St 3500-08, St 3500-10, St 3600-02, St 3600-04, St 3600-08, St 3700-01, St 3800-02, St 3875-01, St B-06) (31°39′–38°44′ N, 120°00′–124° 00′ E) and intertidal flat of the Qingdao Bay, water depth 3.00–81.00 m, temperature 7.39–26.80 °C, salinity 31.00–38.00 ‰, abundance 0.02–3.59 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 370 μm in diameter. Test biconvex, with four to five volutions. Chambers distinct, with seven to eight chambers in final whorl. Sutures distinct, radial to slightly curved in dorsal side, converged in ventral center. Periphery without rim, slight depressed at sutures. Umbilical area closed, without umbilical plug. Wall calcareous, optically radial, moderate perforate, surface smooth. Aperture an interiomarginal extraumbilical arch.

Ammonia maruhasii (Kuwano, 1950)

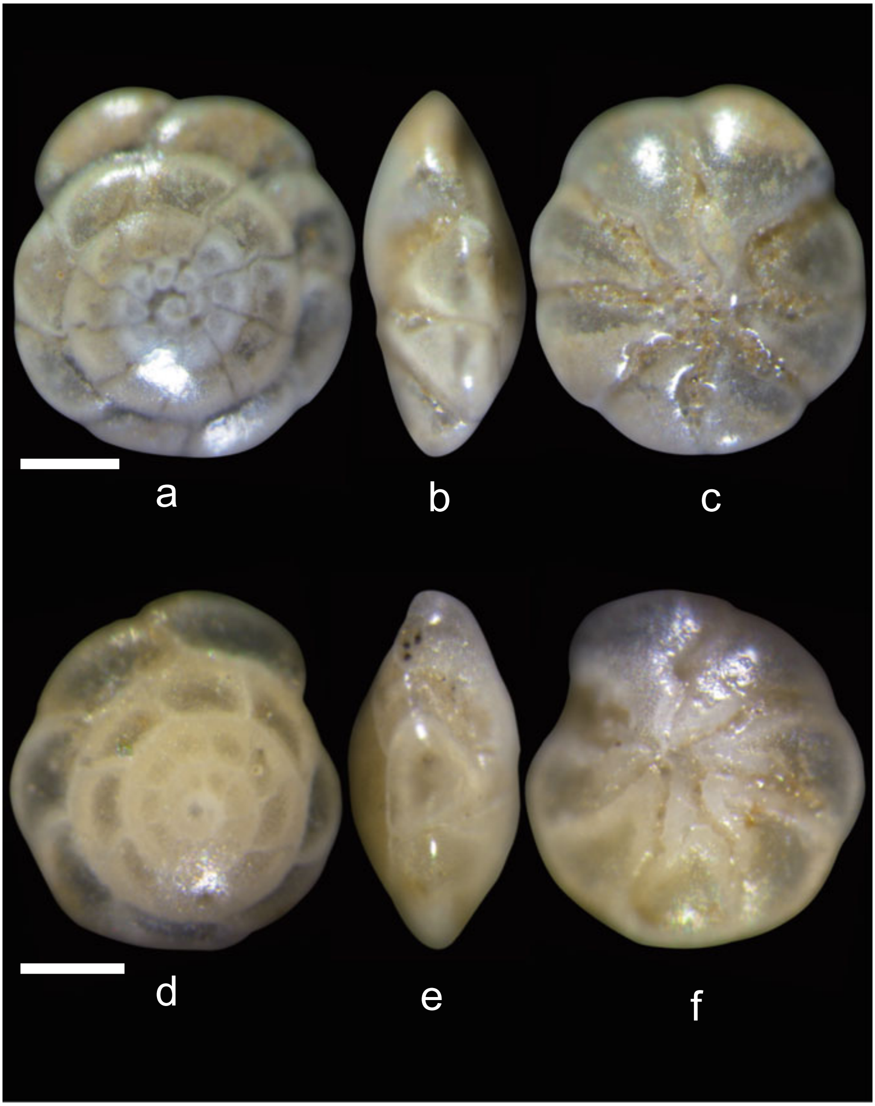

Fig. 64 a–f *Ammonia maruhasii* (Kuwano, 1950), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 100 μm

Remarks

Ammonia maruhasii has been reported by studies from the Yellow Sea (Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and the East China Sea (Research Party of Marine Geology, Ministry of

Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). This species is characterized by closed umbilical area and without umbilical plug. It is a common species in the Yellow Sea and the East China Sea.

***Ammonia pauciloculata* (Phleger & Parker, 1951)** (Fig. 65)

"*Rotalia*" *pauciloculata* Phleger & Parker, 1951, p. 23, pl. 12, Figs. 8–9.

Ammonia nantongensis, He et al., 1965, p. 104, pl. 11, Fig. 5a–c.

Ammonia pauciloculata (Phleger & Parker), He et al., 1965, p. 105, pl. XI, Fig. 6a–c; Wang et al., 1980, pl. XII, Figs. 6–7; pl. 17, Fig. 9; Wang et al., 1984, p. 329, pl. 34, Fig. 9; Wang et al., 1988, p. 166, pl. XXVII, Figs. 8–10; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 87, pl. 157, Fig. 1a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B25-01	243	220	117
B25-02	260	217	113

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 36, St 22, St 14, St 31), the Yellow Sea (St 3500-02) and intertidal flat of the Qingdao Bay (35°00′–36°00′ N, 120°00′–120°30′ E), water depth 0.00–30.00 m, temperature 2.25–17.20 °C, salinity 30.00–38.00 ‰, abundance 0.04–0.80 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Gulf of Mexico.

Description

Size about 250 μm in diameter. Test biconvex, more convex in dorsal side, with three to four solutions. Chambers clear, with eleven to twelve chambers in final whorl. Sutures distinct, radial. Periphery rounded. Umbilical side fissured in center, without umbilical plug. Wall calcareous, optically radial, moderate perforate, surface smooth. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia pauciloculata had been reported from the Yellow Sea (He et al., 1965; Wang et al., 1980) and the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in the China Seas.

Ammonia pauciloculata (Phleger & Parker, 1951)

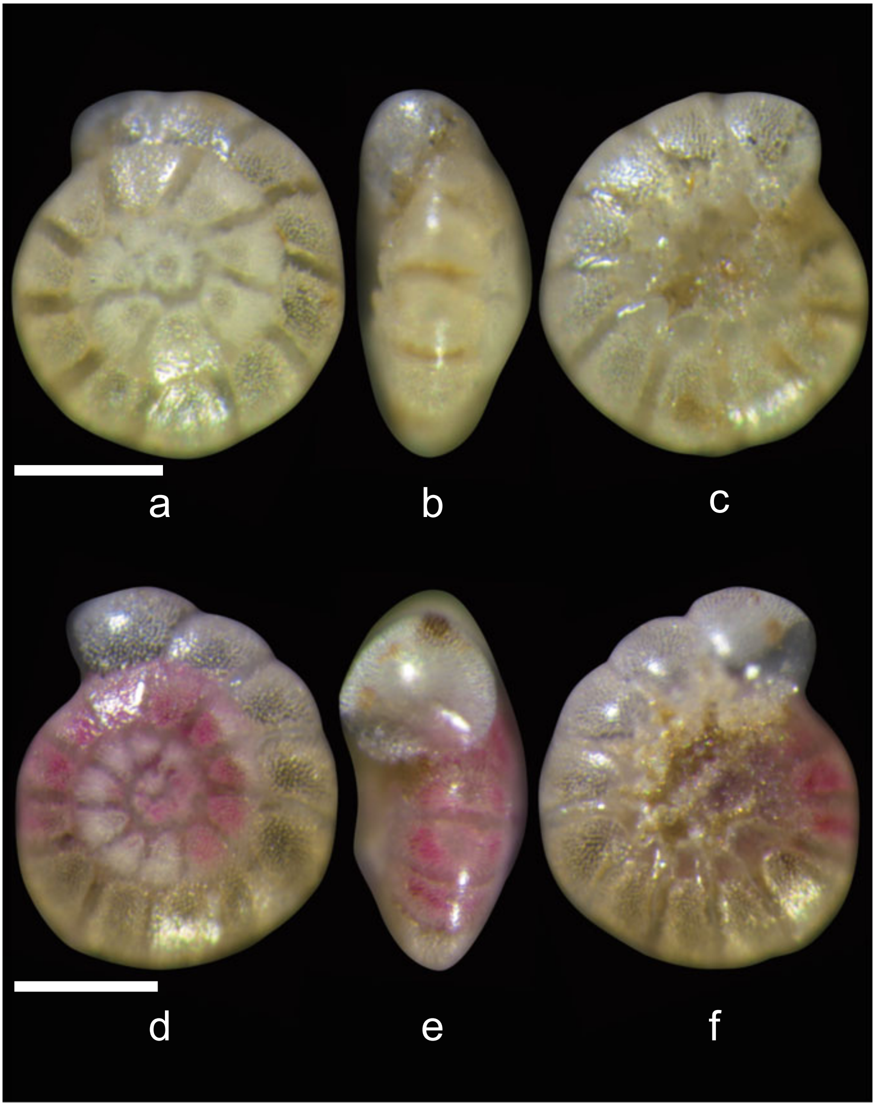

Fig. 65 a–f *Ammonia pauciloculata* (Phleger & Parker, 1951), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** A live specimen. Scale bars = 100 µm

***Ammonia sobrina* (Shupack, 1934)** (Fig. 66)

Rotalia beccarii var. *sobrina* Shupack, 1934, p. 6, Figs. a–c.

Streblus beccarii var. *sobrina*, Bermudez, 1949, p. 233, pl. 15, Figs. 46–48; Todd & Bronnimann, 1957, p. 38, pl. 10, Figs. 1, 2.

Ammonia sobrina (Shupack, 1934)

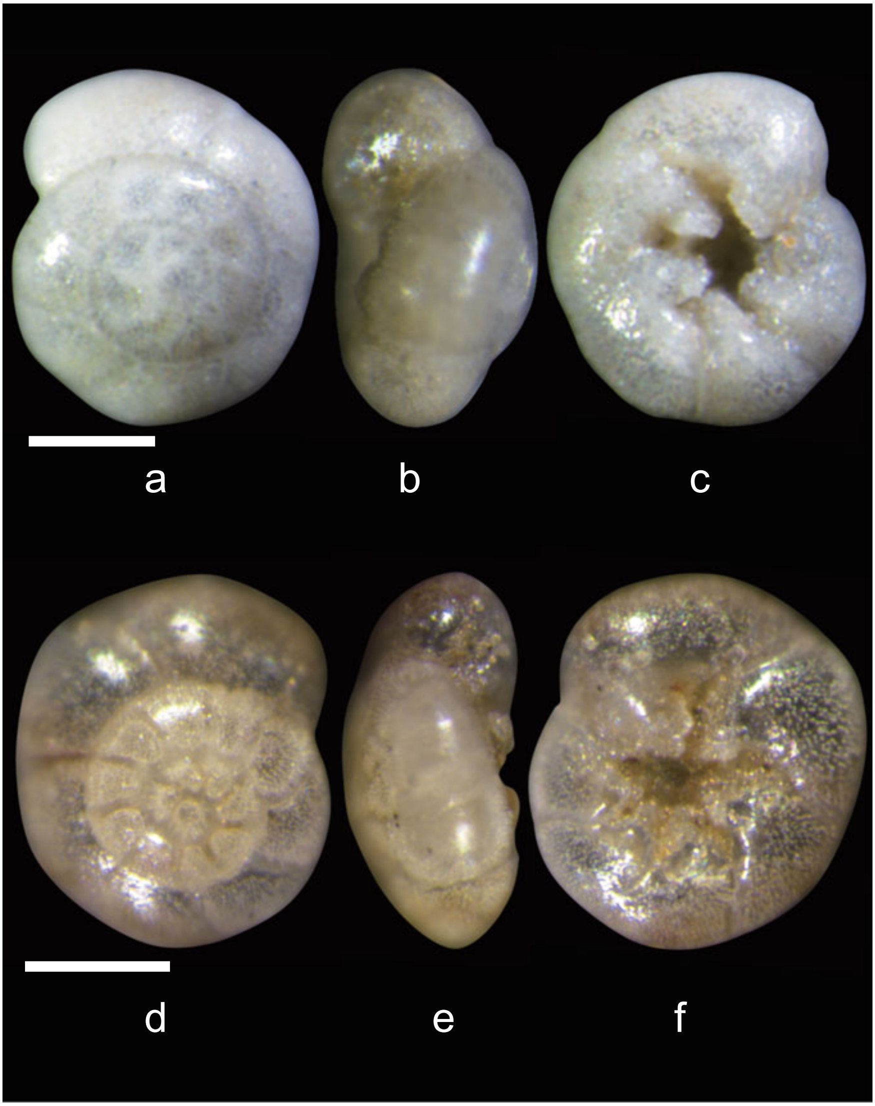

Fig. 66 a–f *Ammonia sobrina* (Shupack, 1934), two specimens with different side of views. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 100 μm

Ammonia sobrina (Shupack), Seibold, 1971, p. 46, pl. 6, Figs. 4–6; pl. 7, Figs. 1, 2; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 23, pl. 8, Figs. 3, 4.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H37-01	255	233	137
H37-02	261	218	121

Occurrence and Ecology

The Yellow Sea (St CJ-01, St CJ-04, St 3400-05, St 3400-06, St 3500-02, St 3600-02, St 3800-02) and intertidal flat of the Qingdao Bay (31°39′–38°00′ N, 120°00′–124°00′ E), water depth 3.00–67.80 m, temperature 8.35–22.80 °C, salinity 30.31–32.08 ‰, abundance 0.08–1.92 ind./g sed.

Distribution

Yellow Sea, East China Sea.

Description

Size about 250 μm in diameter. Test biconvex, distinct convex in dorsal side, with about three to four volutions. Chambers moderate clear, centrally elevated on spiral side, with about six chambers in final whorl. Periphery rounded, with constrictions in the final chamber. Sutures moderate distinct, not depressed. Umbilical side fissured in center, with cavity-like depression, without umbilical plug. Wall calcareous, moderately perforate, smooth in surface. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia sobrina has been reported from the East China Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978). This species is characterized by the convex dorsal shape, indistinct sutures and a cavity-like depression in umbilical area. In the Yellow Sea, it is a common and abundant species.

***Ammonia takanabensis* (Ishizaki, 1948)** (Fig. 67)

Streblus takanabensis Ishizaki, 1948, p. 57, pl. 1, Fig. 5.

Streblus nakamurai Ishizaki, 1948, p. 62, pl. 1, Fig. 4a–c.

Rotalia takanabensis (Ishizaki), Asano, 1951c, p. 16, Figs. 124–126.

Ammonia takanabensis (Ishizaki), Huang, 1964, p. 56, pl. 1, Fig. 2; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 22, pl. 7, Fig. 1; Takayanagi and others, 1987, p. 130, pl. 17, Fig. 3; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 88, pl. 157, Figs. 3a–c, 4a–c; Akimoto, 1990, p. 191, pl. 15, Fig. 15; Loeblich & Tappan, 1994, p. 166, pl. 370, Figs. 10–13; Debenay, 2012, p. 185.

Ammonia takanabensis (Ishizaki, 1948)

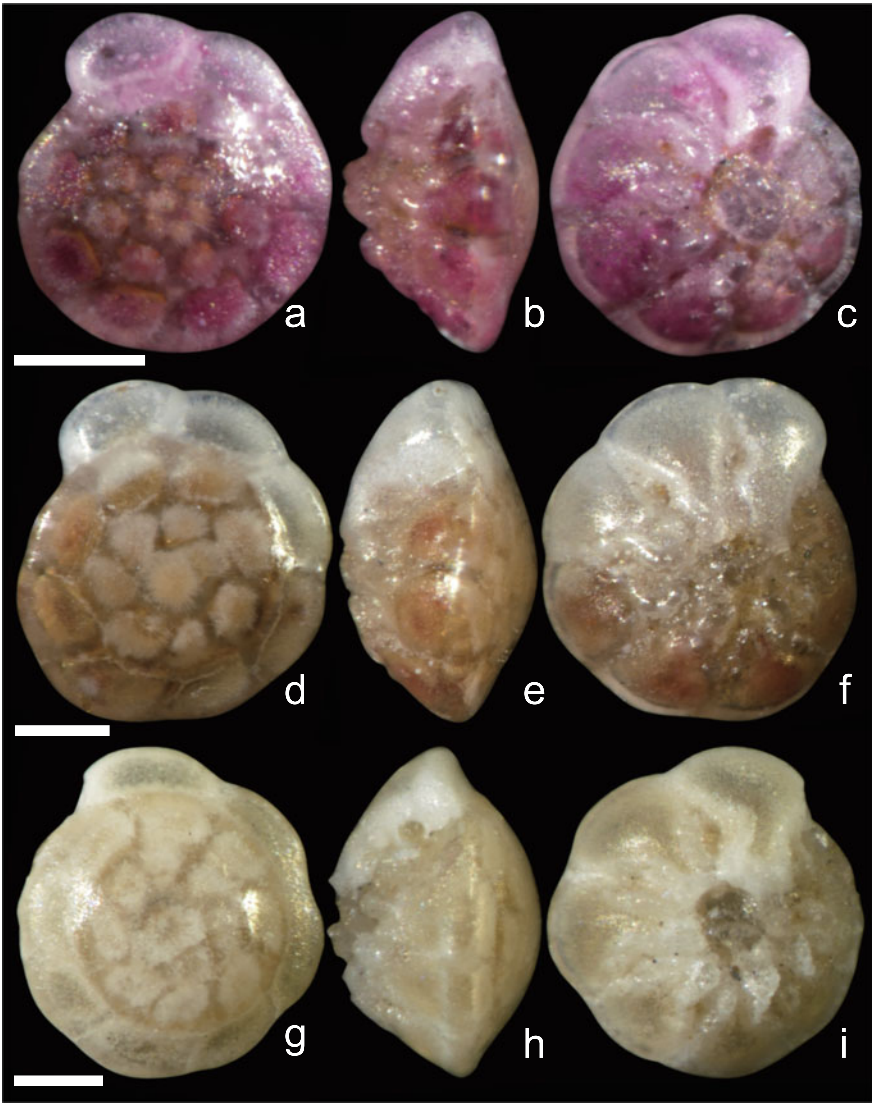

Fig. 67 a–i *Ammonia takanabensis* (Ishizaki, 1948), three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** Another live specimen. **g–i** The third specimen. Scale bars = 100 μm

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H68-01	263	240	153
H68-02	381	330	218
H68-03	373	333	225
H68-04	340	309	277
H68-05	329	305	203

Occurrence and Ecology

The Yellow Sea (St 3400-06, St 3600-06, St 3600-08) (33°59′–36°00′ N, 123°00′–123°59′ E), water depth 67.80–78.00 m, temperature 9.13–12.00 °C, salinity 31.91–33.31 ‰, abundance 0.16–1.98 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan, South Korea, New Caledonia, Sahul Shelf.

Description

Size about 350 μm in diameter. Test biconvex, with about three to four volutions. Chambers clear, with eight to nine chambers in final whorl; chamber shape rounded in inter whorls, shape slightly elongated in final whorl but the ratio of length to width is usually less than 2:1. Sutures distinct, radial. Periphery outline smooth, with slight constrictions at sutures. Umbilical side fissured and forming angles, with a distinct large umbilical plug in center. Wall calcareous, transparent, moderate perforate, surface smooth. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia takanabensis has been reported from the Bohai Sea (research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) and the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). This species is characterized by transparent wall, round chambers, and a big umbilical plug. It is a common species in the Yellow Sea.

***Ammonia tepida* (Cushman, 1926)** (Fig. 68)

Rotalia beccarii (Linné) var. *tepida* Cushman, 1926c, p. 79, pl. 1; Cushman, 1931b, p. 61, pl. 13, Fig. 3a–c; Leroy, 1941c, p. 117, pl. 2, Figs. 25–27.

Streblus beccarii (Linné) var. *tepida* (Cushman), Todd, 1957, p. 290, pl. 91, Fig. 5; Leroy, 1964, p. F-38, pl. 4, Figs. 16, 17; Todd, 1965, p. 29, pl. 6, Fig. 1; pl. 7, Fig. 2.

Ammonia beccarii (Linné) var. *tepida* (Cushman), Chiji & Lopez, 1968, p. 104, pl. 12, Figs. 3, 4.

Ammonia tepida (Cushman, 1926)

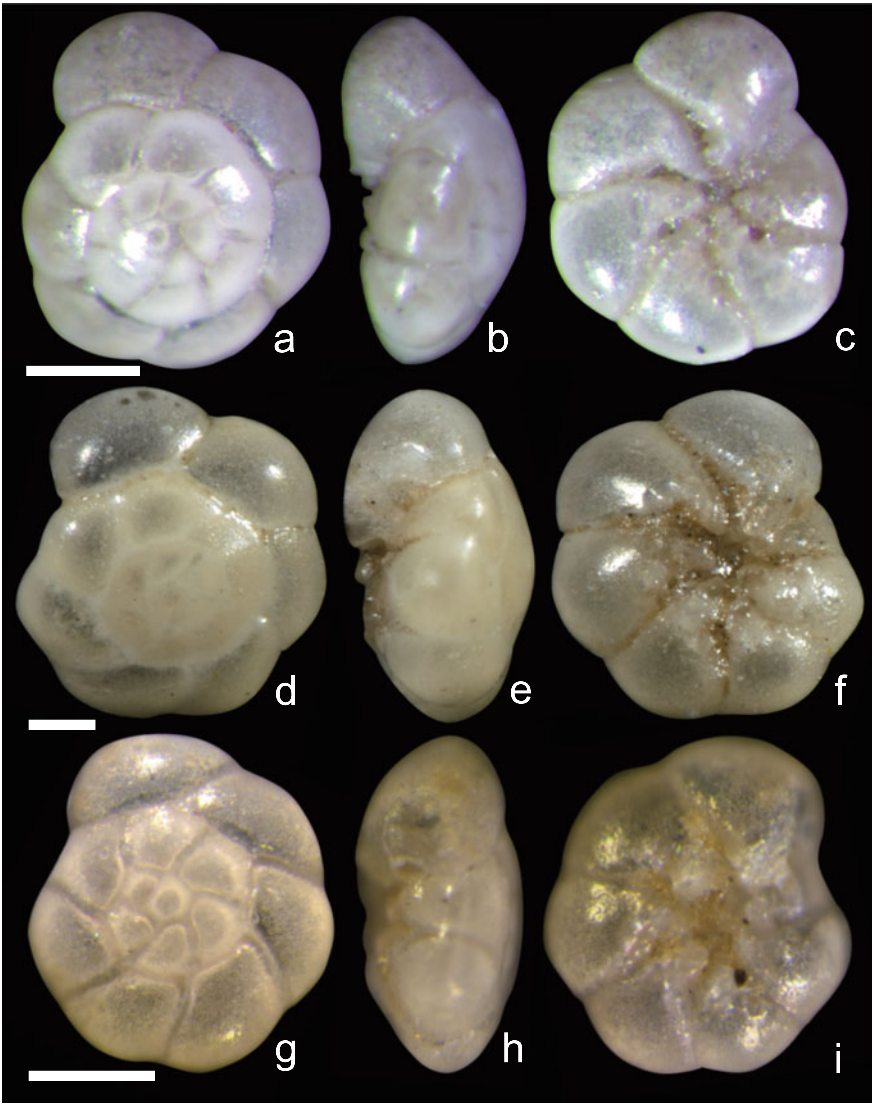

Fig. 68 a–i *Ammonia tepida* (Cushman, 1926), three specimens showing morphological variabilities. **a–c** Form same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Discorbis tepida, Seibold, 1971, p. 44, pl. 5, Figs. 4–6; pl. 6, Figs. 1–3.

Ammonia (?) *tepida* (Cushman), Baccaert, 1987, p. 233, pl. 94, Fig. 7; pl. 95, Figs. 1–3.

Ammonia tepida (Cushman), Banner & Williams, 1973, pp. 49–69, pl. 2, Figs. 3, 6; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 21, pl. 8, Figs. 6–8; Zheng et al., 1978, p. 221, pl. XXIV, Figs. 10a–c, 11a–c; pl. XXXII, Fig. 7; South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981, p. 124, pl. 57, Figs. 1–3; Wang et al., 1980, p. 193, pl. IV, Figs. 9–12; Hayward et al., 2004, p. 262, pl. 2, Fig. T; pl. 3, Fig. T; pl. 4, Fig. T; Loeblich & Tappan, 1994, p. 166, pl. 371, Figs. 1–10; Debenay, 2012, pp. 185, 186.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D29-01	306	276	132
D29-02	515	465	283
D29-03	280	242	123
B12-01	661	590	280
B12-02	486	420	227

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St 3300-04, St 3500-02, St 3600-02, St 3700-01) and intertidal flat of the Qingdao Bay (31°39′–39°00′ N, 119°30′–124°00′ E), water depth 3.00–40.00 m, temperature 1.50–17.54 °C, salinity 30.11–36.00 ‰, abundance 0.12–2.52 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, South China Sea.

Japan, Micronesia, Norway, South Korea, New Caledonia, Gulf of Mexico, Mediterranean Sea.

Description

Size about 450 μm in diameter. Test biconvex, with two to three volutions. Chambers clear, with six to eight chambers in final whorl. Sutures distinct, slightly oblique and depressed. Periphery with constriction at sutures. Umbilical side fissured in center, without umbilical plug. Wall calcareous, optically radial, moderate perforate, surface smooth. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia tepida had been frequently reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978; Zheng et al., 1978), the Yellow Sea (Wang et al., 1980), the South China Sea (South China Sea Branch of Oil Exploration Co. of P. R. China et al., 1981). It is a common species in continental shelf sediments of the China Seas but the abundance is usually low.

***Ammonia rupta* nov. spec.** (Figs. 69, 70)

Diagnosis

Size about 500 μm in diameter. Test biconvex in both ventral and dorsal sides, with about four to five volutions. Chambers flat and elongated rectangular in shape, with

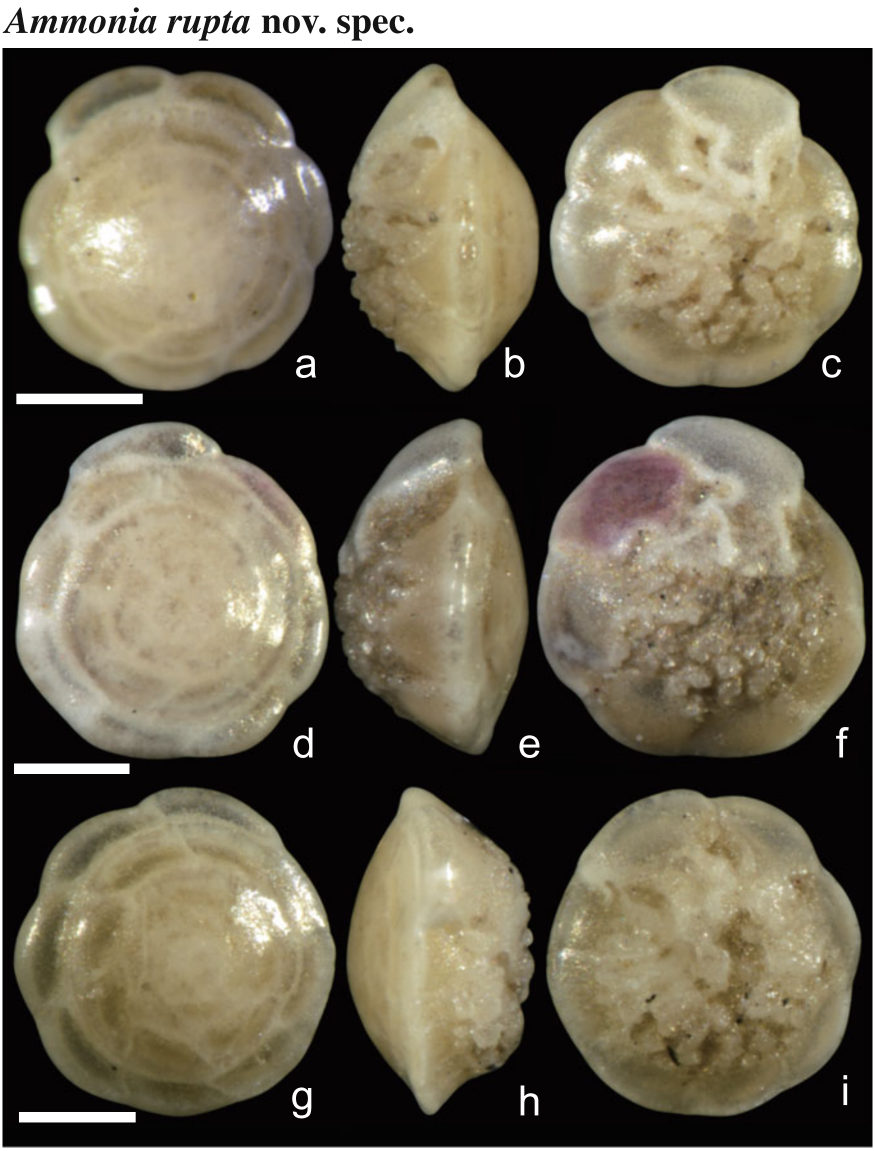

Fig. 69 **a–i** *Ammonia rupta* nov. spec. **a–c** The holotype specimen showing different side of views. **d–f** The paratype-01 specimen. **g–i** The paratype-02 specimen. Scale bars = 200 μm

Ammonia rupta nov. spec.

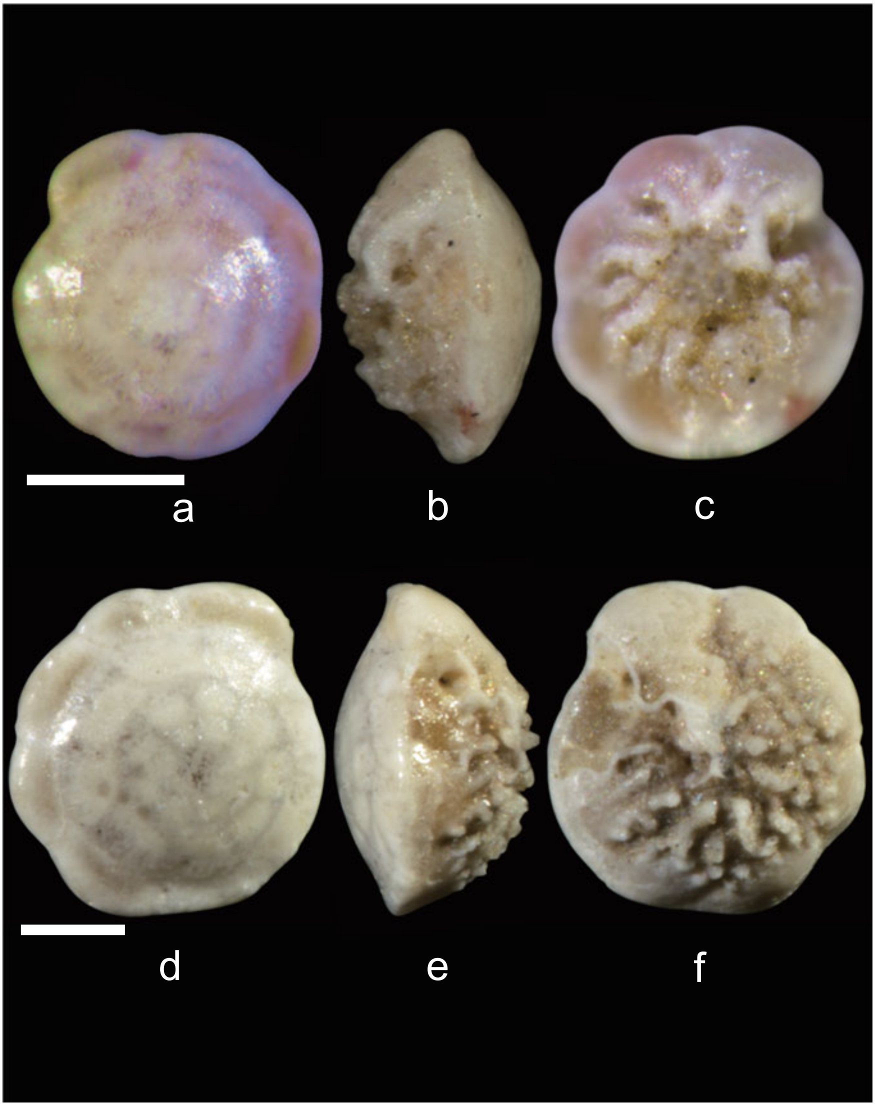

Fig. 70 **a–f** *Ammonia rupta* nov. spec. **a–c** The paratype-03 specimen. **d–f** The paratype-04 specimen. Scale bars = 200 µm

a length:width ratio of about 3:1; blurred in spiral side, with seven to eight chambers in final whorl. Suture indistinct in early whorls but distinct in final whorls, radial and straight. Periphery outline smooth, with slight constriction at sutures. Umbilical side ruptured, or cracked forming many angles. Umbilical plug indistinct. Wall calcareous, opaque in optical view, less perforate, rather thick, surface smooth. Aperture an interiomarginal extraumbilical arch.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H59 Holotype	531	495	327
H59 Paratype-01	562	538	323
H59 Paratype-02	565	553	316
H59 Paratype-03	420	388	233
H59 Paratype-04	668	589	365
H59 Paratype-05	489	452	287
H59 Paratype-06	472	460	293
H59 Paratype-07	453	408	269
H59 Paratype-08	559	537	340

Etymology
The Latin adjective *rupta* refers to the character of ruptured sutures on umbilical side.

Type Material
Holotype (IOCA H59 Holotype) and two paratypes (IOCAS H59 Paratype-01; IOCAS H59 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). In addition, 6 paratypes are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Occurrence and Ecology
The Yellow Sea (St CJ-06, 3500-08, 3600-06, 3600-07, 3600-08) (32°29′–34°59′ N, 122°59′–125°00′ E), water depth 55.20–78.00 m, temperature 9.00–22.20 °C, salinity 31.50–33.20 ‰, abundance 0.15–2.78 ind./g sed.

Distribution
Yellow Sea.

Description
Size about 500 μm in diameter. Test distinctly biconvex in both ventral and dorsal sides, with about four to five volutions. Chambers flat and elongated rectangular in shape, with a length:width ratio of about 3:1; distinctly elevated in spiral side, usually blurred in spiral side or only obscure in central part, with seven to eight chambers in final whorl. Suture indistinct in early whorls, usually only visible in final one to two whorls, radial and straight. Periphery outline smooth, with slight constrictions at sutures. Umbilical side ruptured, or cracked forming many angles. Umbilical plug indistinct. Wall calcareous, opaque in optical view, less perforate, rather thick, surface smooth. Aperture an interiomarginal extraumbilical arch.

Remarks

Ammonia rupta is rather distinct from most of the congeners by having very convex lenticular side view, opaque thick wall, blurred, and elongated rectangular chambers and ruptured umbilical side. Within the genus of *Ammonia*, only *A. angulata* (Kuwano, 1950), *A. takanabensis* (Ishizaki, 1948) and *A. ketienziensis* (Ishizaki, 1943) are something that resemble *A. rupta* and could be compared. However, the former two species usually have clear and roundish chambers and transparent wall structure. In addition, *A. angulata* also has relatively less chambers and *A. takanabensis* has a very distinct and big umbilical plug, thus is easily to be distinguished. As to *A. ketienziensis* (Ishizaki, 1943), which has a rimed periphery and closed umbilical side, distinctly differs from *A. angulata*.

Ammonia rupta has been observed only in stations of the Yellow Sea in several sampling cruises during 2008–2014, but not found in the other sea areas in China. We supposed it might be an endemic species of the Yellow Sea.

Genus *Pseudorotalia* Reiss & Merling, 1958

***Pseudorotalia indopacifica* (Thalmann, 1935)** (Fig. 71)

Rotalia papillosa Brady, 1899, p. 332, pl. 76, Fig. 2.

Rotalia indopacifica Thalmann, 1935, p. 605, pl. 73, Fig. 1a–c.

Pseudorotalia indopacifica (Thalmann), Huang Tunyow, 1964, p. 60, pl. 1, Fig. 7; pl. 3, Fig. 4; Lin et al., 1978, p. 91, pl. 21, Fig. 6; Wang et al., 1980, p. 193, pl. IV, Figs. 1–4; Wang et al., 1988, p. 165, pl. XXVI, Fig. 16; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 89, pl. 158, Fig. 3a–c.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D128-01	1561	1448	841

Occurrence and Ecology

The Yellow Sea (St 3000-02) (29°59′ N, 123°00′ E), water depth 42.77 m, temperature 22.33 °C, salinity 34.27 ‰, abundance 0.27 ind./g sed.

Distribution

Yellow Sea, East China Sea, South China Sea.

South Korea.

Description

Size about 1500 μm in diameter. Test subconical in shape, trochospiral with four gradually enlarging whorls. Spiral side elevated and umbilical side flat. Chambers

Pseudorotalia indopacifica (Thalmann, 1935)

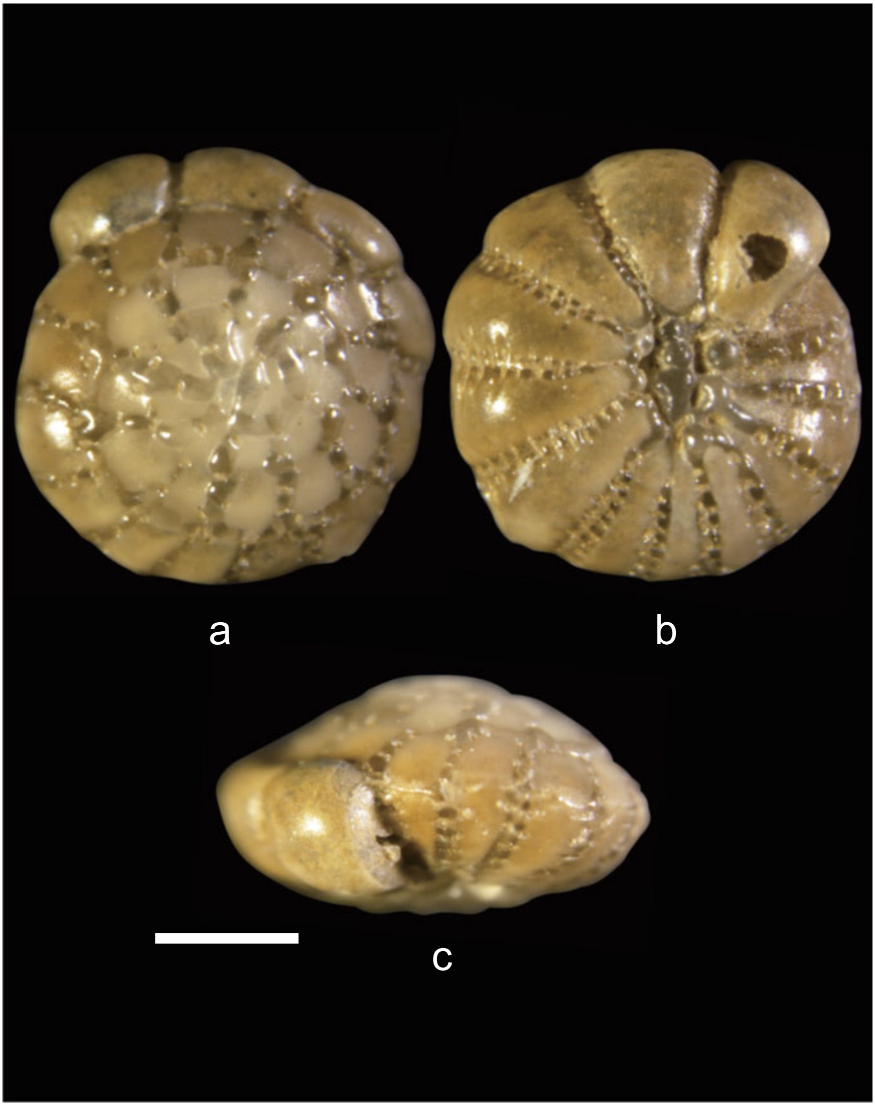

Fig. 71 a–c *Pseudorotalia indopacifica* (Thalmann, 1935), same specimen with dorsal (**a**), ventral (**b**) and side (**c**) views. Scale bar = 500 μm

rounded, with thirteen chambers in the final whorl. Sutures straight and radial on both spiral and umbilical sides, elevated and limbate, broken into beads. Periphery smooth but slightly depressed at sutures, without keels. Wall calcareous, rather thick, surface smooth. Aperture interiomarginal on umbilical side.

Remarks

Pseudorotalia indopacifica has been frequently reported from the East China Sea (Wang et al., 1980, 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a warm water species and commonly occurred with high abundance in the East China Sea and the South China Sea. We found it first time in the Yellow Sea but with low abundance.

Genus *Rotalidium* Asano, 1936

***Rotalidium annectens* (Parker & Jones, 1865)** (Fig. 72)

Rotalia beccarii var. *annectens* Parker & Jones, 1865, p. 387, pl. 19, Fig. 11a–c.
Streblus annectens, Ishizaki, 1940, p. 49, pl. 3, Figs. 12a–b, 13a–b.
Ammonia annectens (Parker & Jones), He et al., 1965, p. 103, pl. XI, Fig. 3a–c; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 21, pl. 7, Figs. 11–13; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 95, pl. XII, Figs. 7–9; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 195, pl. 19, Figs. 5–6; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 86, pl. 156, Fig. 5a–c.
Cavarotalia annectens (Parker & Jones), Wang et al., 1988, p. 168, pl. XXVII, Figs. 12–13.
Rotalidium annectens (Parker & Jones), Loeblich & Tappan, 1987, p. 667, pl. 772, Figs. 1–7.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H10=B104-01	503	448	317
H10=B104-02	537	470	339
H10=B104-03	479	396	296
H10=B104-04	416	383	253

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14), the Yellow Sea (St CJ-02, St CJ-04, St 3300-04, St 3500-02, St 3700-01) and intertidal flat of the Qingdao Bay (31°49′–39°00′ N, 119°30′–124°00′ E), water depth 3.00–42.00 m, temperature 2.25–26.5 °C, salinity 30.30–38.00 ‰, abundance 0.18–1.68 ind./g sed.

Rotalidium annectens (Parker & Jones, 1865)

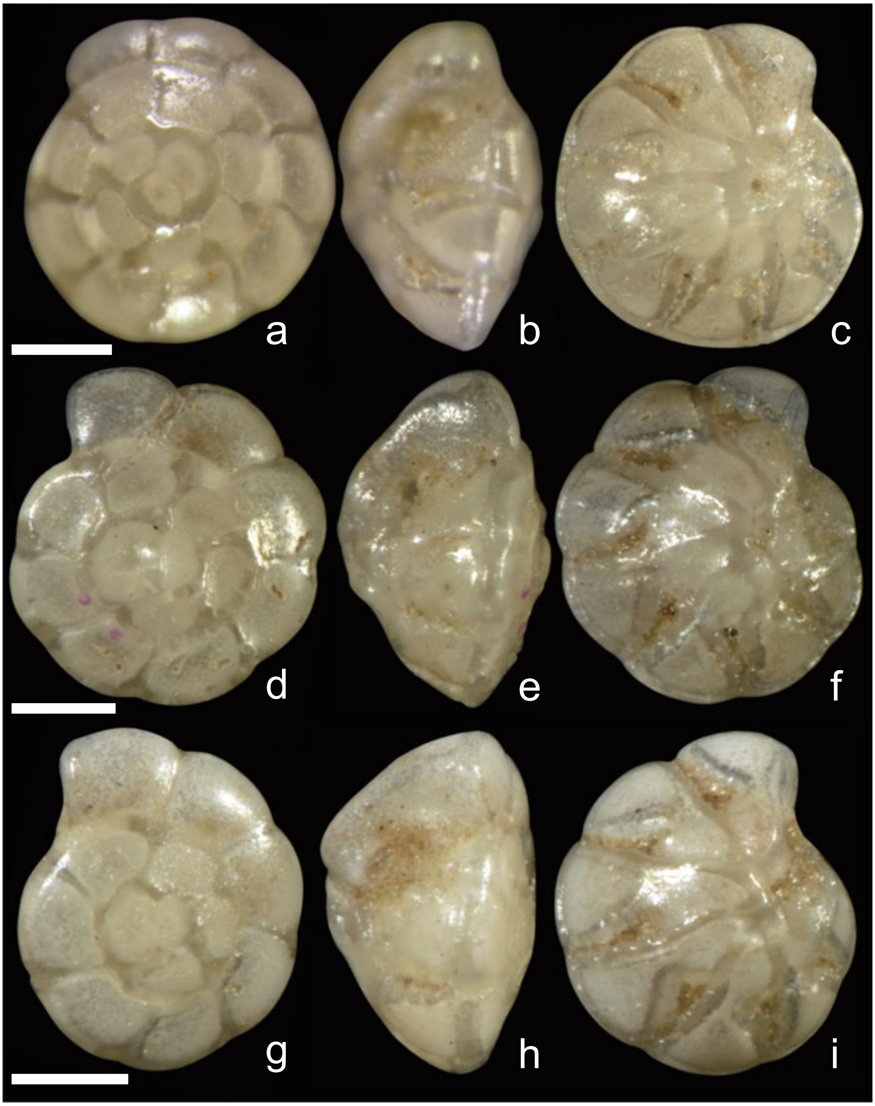

Fig. 72 a–i *Rotalidium annectens* (Parker & Jones, 1865), three specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 150 μm

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.
South Korea.

Description

Size about 500 μm in diameter. Test lenticular, trochospiral, about three to four slowly enlarging whorls. Chambers rounded, with eight to nine chambers in final whorls. Sutures limbate, straight and radial. Spiral canal present in umbilical side, broad, covered by umbilical extensions of the chambers. Umbilical side with smooth surface, without umbilical plug. Wall calcareous, fine perforate, surface smooth. Aperture an interiomarginal arch between the umbilical margin and periphery.

Remarks

Rotalidium annectens has been identified as *Cavarotalia annectens* in Chinese literature (Wang et al., 1988). The Genus *Rotalidium* was established by Asano, 1936, and *R. pacificum* is the type species. Billman et al. (1980) suggested that *Rotalidium pacificum* and *Rotalia japonica* belong to *Cavarotalia* Müller-Merz, 1980, but Loeblich & Tappan (1987) deemed the older name *Rotalidium* has priority. We agreed with the later view.

Rotalidium annectens has been frequently reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), the Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989), the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species in the continental shelf sediments of the China Seas.

Genus *Rotalinoides* Saidova, 1975

***Rotalinoides compressiuscula* (Brady, 1884)** (Fig. 73)

Rotalia papillosa var. *compressiuscula* Brady, 1884, p. 708, pl. 108, Fig. 1; Cushman, 1921, p. 347, pl. 72, Fig. 2a–c.

Ammonia compressiuscula (Brady), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 95, pl. XII, Figs. 16–21; Wang et al., 1980, p. 196, pl. IX, Figs. 5–8; p. 196, pl. IX, Figs. 5–8; Wang et al., 1988, p. 167, pl. XXVII, Fig. 3.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D81-01	886	808	586
D81-02	763	615	473
D81-03	818	747	535

Rotalinoides compressiuscula (Brady, 1884)

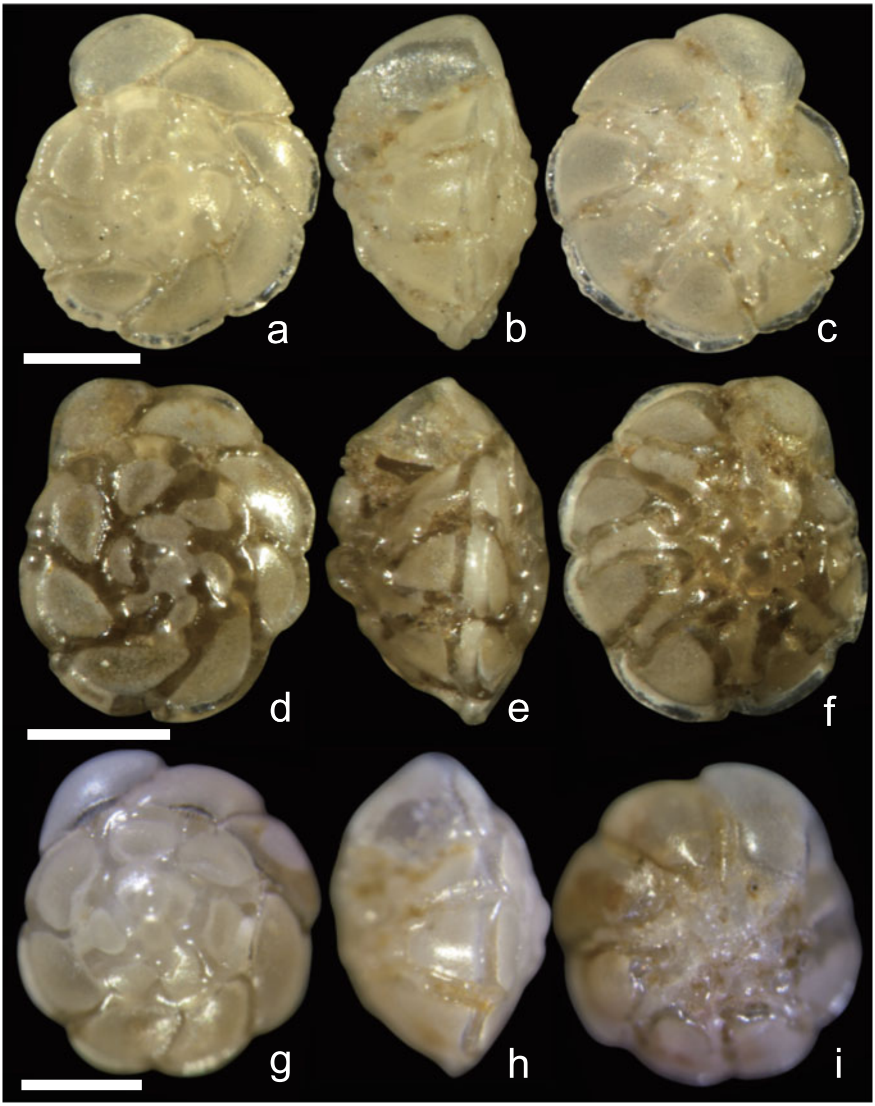

Fig. 73 **a–i** *Rotalinoides compressiuscula* (Brady, 1884), three specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 300 μm

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3400-06, St 3500-02, St 3600-02, St 3600-04, St 3700-01) and intertidal flat of the Qingdao Bay (31°39′–39°00′ N, 119°30′–125°00′ E), water depth 0.00–67.80 m, temperature 1.50–24.50 °C, salinity 30.31–32.74 ‰, abundance 0.02–45.16 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan.

Description

Size about 850 μm in diameter. Test conical, distinct convex in ventral side and spiral side less convex; trochospiral, about three volutions, about eight chambers in the final whorl. Sutures oblique and curved back at the periphery, slightly depressed, with elevated poreless rims that later fuse to appear as beaded sutures, the inflational beads progressively larger toward the umbo. Sutures radial, strongly incised and feathered on the umbilical side. Periphery with imperforate keel interrupted by sutural incisions of the outer margin. Wall calcareous, thick, finely perforate but sutures, beads, pillars, and keel imperforate. Aperture an interiomarginal arch between the umbilical margin and periphery.

Remarks

Rotalinoides compressiuscula had been identified as *Ammonia compressiuscula* in Chinese literature (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980, 1988). This species is characterized by owing rims in periphery and with beads at sutures, in addition, umbilical areas having imperforate inflational beads. It has been frequently reported from the Yellow Sea and East China Sea. It is a common species in these sea areas.

Subfamily Ammoniinae Saidova, 1981

Genus *Hemirotalia* nov. gen

Diagnosis

Rotaliidae with sutures stopping at quarter to half of the umbilical side, forming a radial ring-like pattern in ventral view.

Test trochospiral, biconvex to planoconvex, all chambers visible on the spiral side, only those of the final whorl visible on the umbilical side. Sutures imperforate, flat or elevated, radial or oblique, and curved back at the periphery on the spiral side; on the umbilical side, sutures deeply incised and stopped at about quarter to half place, forming a radial ring-like pattern in ventral view. Umbilicus with a pit at centum or with a series of scattered pits. Periphery may round and smooth, or with imperforate keel interrupted by sutural incisions of the outer margin. Wall calcareous, optically radial, surface smooth or pustulose, perforate except for sutures, the imperforate peripheral margin, pustules and umbilical pits. Aperture an indistinct interiomarginal slit.

Type Species

Hemirotalia calvifacta Lei & Li, 2016

Etymology

Composite of the Greek word *hemi* (half) and the Latin noun *rotalia* (wheel), meaning sutures stopping at the half of the place on ventral side. Feminine gender.

Remarks

Family Rotaliidae Ehrenberg, 1839 comprises the following four subfamilies: (1) Subfamily Cuvillierininae Loeblich & Tappan, 1964, containing 8 genera of fossil only (U. Cretaceous to Miocene); (2) Subfamily Pararotaliinae Reiss, 1963, containing two genera (U. Cretaceous to Holocene); (3) Subfamily Rotaliinae Ehrenberg, 1839, containing 17 genera. Except to the genus *Rotalia* Lamarck, 1804 (U. Cretaceous to Holocene), the other 16 genera of this subfamily are fossil only; (4) Subfamily *Ammoniinae* Saidova, 1981, containing the following 9 genera from L. Miocene to Holocene: *Ammonia* Brünnich, 1772, *Asanoina* Finlay, 1939, *Asiarotalia* Nguyen Ngoc, 1986, *Asteroammonia* Voloshinova, 1970, *Asterorotalia* Hofker, 1950, *Challengerella* Billman, Hottinger & Oesterle, 1980, *Pseudorotalia* Reiss & Merling, 1958, *Rotalidium* Asano, 1936, *Rotalinoides* Saidova, 1975.

The genus *Hemirotalia* should be a new member of the subfamily *Ammoniinae* Saidova, 1981. Therefore the subfamily *Ammoniinae* should contained 10 genera so far. The population united in the new genus are characterized by owning a typical "Rotaliidae" body shape but whose sutures stop at quarter to half of the umbilical side, forming a radial ring-like pattern in ventral view. This feature is rater conspicuous and thus easily to be distinguished from the other genera within the same family.

***Hemirotalia calvifacta* nov. spec.** (Figs. 74, 75)

Diagnosis

Size about 600 µm in diameter. Test biconvex, with about three volutions. Chambers rounded in shape, about eight to nine in the final whorl. Sutures radial to slightly oblique, flat in spiral side, but deeply incised and stopped at about half place of the umbilical side. Periphery smooth and basically rounded, sometimes slightly depressed by sutural incisions of the outer margin. Umbilicus with a pit at centum, without plug. Wall calcareous, surface smooth, perforate except for sutures and umbilical pit. Aperture an indistinct interiomarginal slit.

Measurement

Specimens	Body length (µm)	Body width (µm)	Body thickness (µm)
B94 Holotype	681	613	440
B94 Paratype-01	552	513	327
B94 Paratype-02	702	638	423
B94 Paratype-03	720	687	449
B94 Paratype-04	596	571	382
B94 Paratype-05	600	583	395

Hemirotalia calvifacta nov. spec.

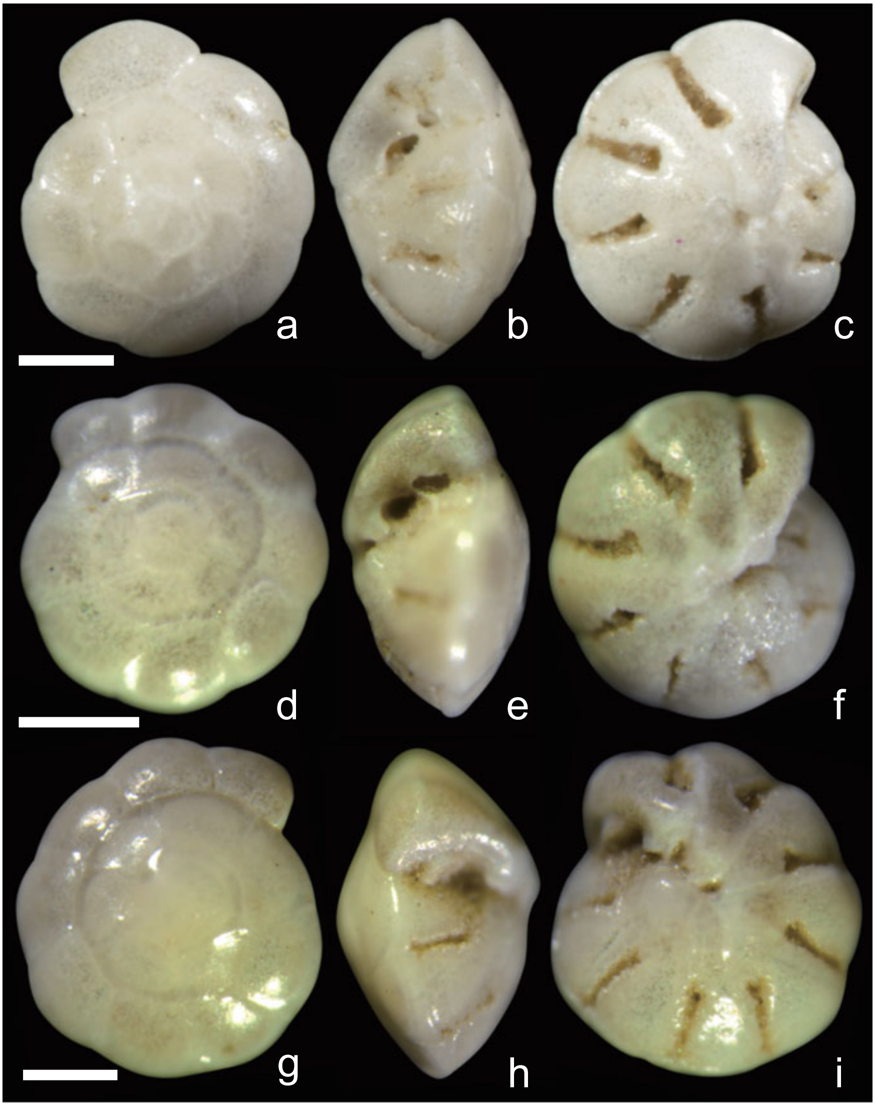

Fig. 74 **a–i** *Hemirotalia calvifacta* nov. spec. **a–c** The holotype specimen showing different side of views. **d–f** The paratype-01 specimen. **g–i** The paratype-02 specimen. Scale bars = 200 μm

Etymology

The Latin adjective *calvifactus* refers to the glossy test wall.

Hemirotalia calvifacta nov. spec.

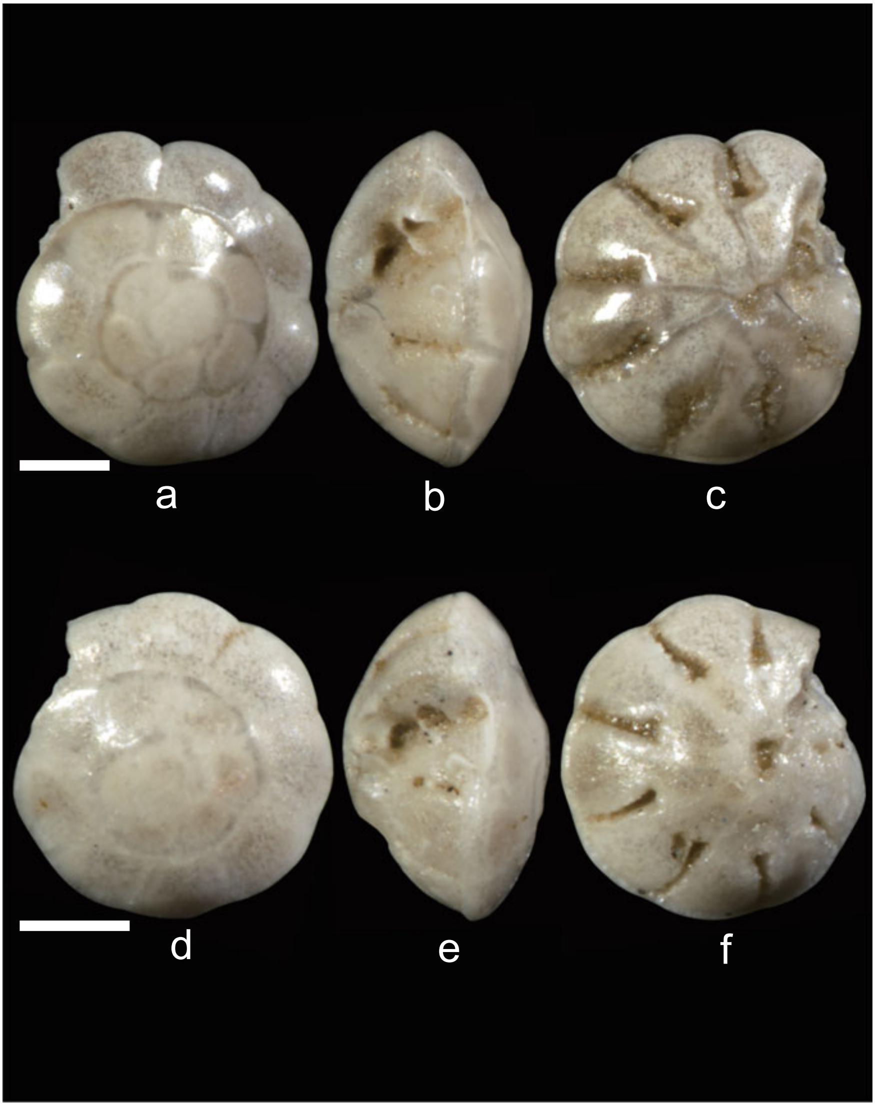

Fig. 75 a–f *Hemirotalia calvifacta* nov. spec. **a–c** The paratype-03 specimen. **d–f** The paratype-04 specimen. Scale bars = 200 μm

Type Material

Holotype (IOCA B94 Holotype) and two paratypes (IOCAS B94 Paratype-01; IOCAS B94 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). In addition, three paratypes are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Type Locality

The Bohai Sea (St 11, 2-4 cm and 6-8 cm sediments; St 22, 10-11.5 cm sediment; St 36, 4-6 cm and 8-10 cm sediments) (38°21′–38°23′ N, 120°06′–120°08′ E), water depth 26.00–27.00 m, temperature 2.36–3.46 °C, salinity 30.30–30.71 ‰, abundance 0.08–0.64 ind./g sed.

Distribution

Bohai Sea.

Description

Size about 600 μm in diameter. Test biconvex, with about three volutions. Chambers rounded in shape, about eight to nine in the final whorl. Sutures radial to slightly oblique, flat in spiral side, but deeply incised and stopped at about half place of the umbilical side, forming a radial ring-like pattern in ventral view. Periphery smooth and basically rounded, sometimes slightly depressed by sutural incisions of the outer margin. Umbilicus with a pit at centum, without plug. Wall calcareous, surface fine and smooth, glossy, perforate except for sutures and umbilical pit. Aperture an indistinct interiomarginal slit.

Remarks

Hemirotalia calvifacta has been found in 2–11.5 cm sediment layers in the Bohai Sea from three stations, but no living individual has been found. Likewise, we never observed this species from the other sea areas in China during several years' sampling. In the Bohai Sea, it has a low abundance of 0.08–0.64 ind./g sed. Probably it is an endemic species of the Bohai Sea.

***Hemirotalia foraminulosa* nov. spec.** (Figs. 76, 77)

Diagnosis

Size about 750 μm in diameter. Test trochospiral, planoconvex, with 2–3 volutions in adults. Chambers rounded in shape, about seven to eight chambers in the final whorl. Sutures oblique and curved back at the periphery on the spiral side, while deeply incised and stopping at about quarter of the umbilical side. Periphery with rims, depressed by sutural incisions of the outer margin. Umbilicus with multiple scattered pits, without plug. Wall calcareous, surface smooth. Aperture an indistinct interiomarginal slit.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H148 Holotype	832	755	556
H148 Paratype-01	795	718	572
H148 Paratype-02	577	493	432
H148 Paratype-03	682	623	527
H148 Paratype-04	670	597	545
H148 Paratype-05	717	680	513
H148 Paratype-06	706	623	506
H148-08 (juvenile)	359	331	296

Hemirotalia foraminulosa nov. spec.

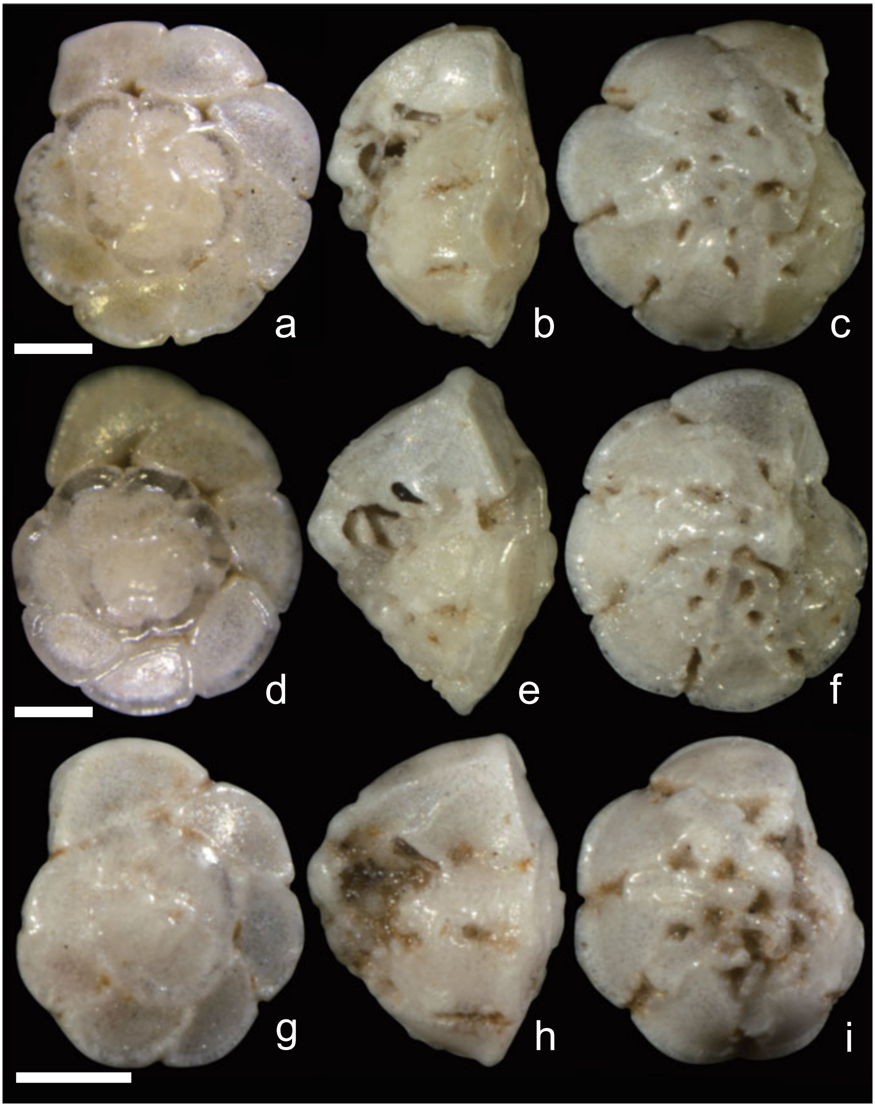

Fig. 76 **a–i** *Hemirotalia foraminulosa* nov. spec. **a–c** The holotype specimen showing different side of views. **d–f** The paratype-01 specimen. **g–i** The paratype-02 specimen. Scale bars = 200 μm

Etymology

The Latin adjective *foraminulosa* refers to multiple pits on umbilical side.

Hemirotalia foraminulosa nov. spec.

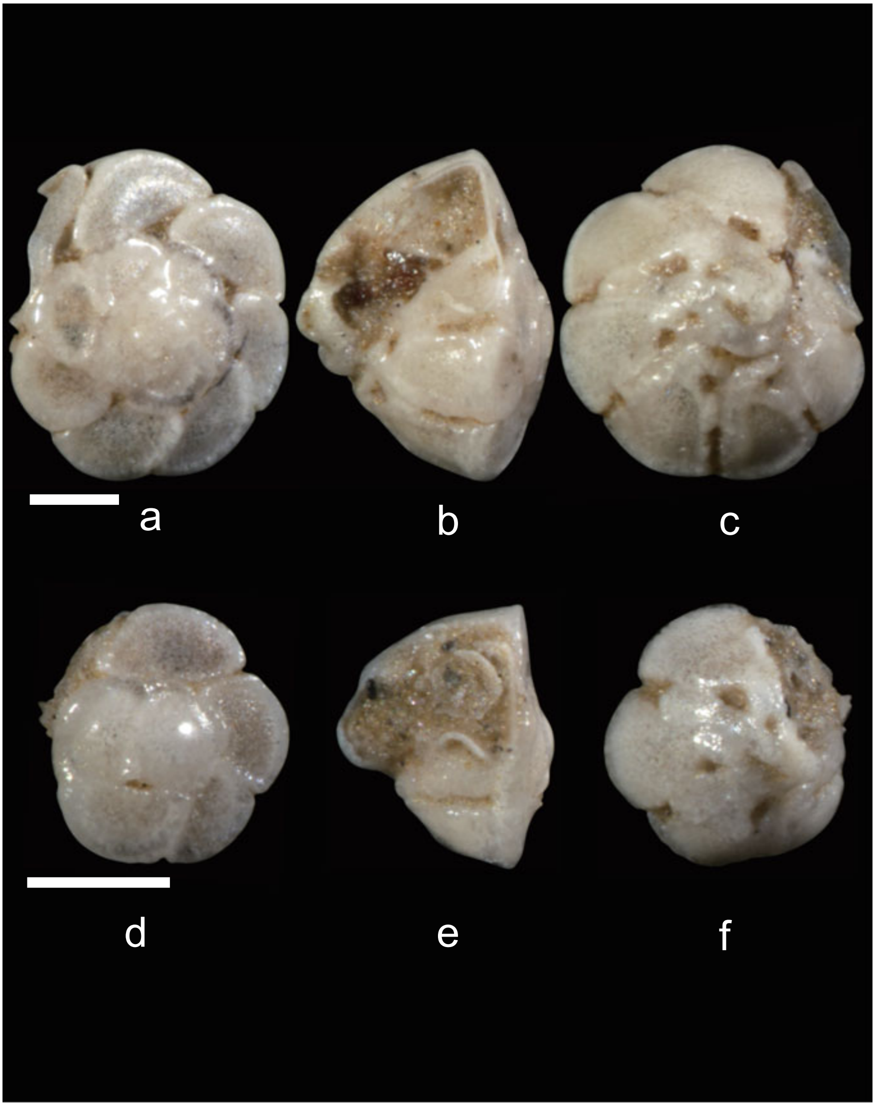

Fig. 77 **a–f** *Hemirotalia foraminulosa* nov. spec., an adult (**a–c**) and a juvenile (**d–f**) specimens. **a–c** The paratype-03 specimen. **d–f** A juvenile specimen. Scale bars = 200 μm

Type Material

Holotype (IOCA H148 Holotype) and two paratypes (IOCAS H148 Paratype-01; IOCAS H148 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). In addition, four paratypes and a voucher specimen (H148-08) are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Occurrence and Ecology
The Yellow Sea (St CJ-06, St 3300-04, St 3600-02, St 3600-04, St 3700-01) (32°30′–37°00′ N, 120°59′–124°59′ E), water depth 30.00–58.00 m, temperature 18.30–21.10 °C, salinity 30.70–31.30 ‰, abundance 0.12–14.30 ind./g sed.

Distribution
Yellow Sea.

Description
Size about 750 μm in diameter. Test trochospiral, planoconvex, coniform in side view, more convex at ventral side while slightly convex at spiral side, with about three volutions in adults. Chambers rounded in shape, about seven to eight chambers in the final whorl. Sutures imperforate, flat to slightly elevated, oblique, and curved back at the periphery on the spiral side, while deeply incised and stopped at quarter of the umbilical side. Periphery with rims, depressed by sutural incisions of the outer margin. Umbilicus with multiple scattered pits, without plug. Wall calcareous, optically radial, surface smooth, perforate except for sutures, the imperforate peripheral margin and umbilical pits. Aperture an indistinct interiomarginal slit.

Remarks
Hemirotalia foraminulosa has been found only from the Yellow Sea during several cruises of sampling in the China Seas. It is characterized by having many pits on the umbilical side and a rimed periphery. *H. foraminulosa* differs from its congener, *H. calvifacta*, by having multiple scattered pits (vs. only one pit) and rimed periphery (vs. without rim in periphery). In addition, the former sutures stopped at quarter part of the umbilical side (vs. half of the umbilical side).

Family Elphidiidae Galloway, 1933

Genus *Cribroelphidium* Cushman & Brönnimann, 1948

***Cribroelphidium frigidum* (Cushman, 1933) nov. comb.** (Fig. 78)

Elphidium frigidum Cushman, 1933, Smiths. Misc. Coll., Vol. 89, No. 9, p. 5, pl. 1, Fig. 8.

Cribrononion frigidum (Cushman, 1933), He et al., 1965, p. 114, pl. XIV, Fig. 1a, b; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 103, pl. XV, Figs. 15–18; Wang et al., 1988, p. 169, pl. XXVIII, Figs. 8–9.

Cribroelphidium frigidum (Cushman, 1933) nov. comb.

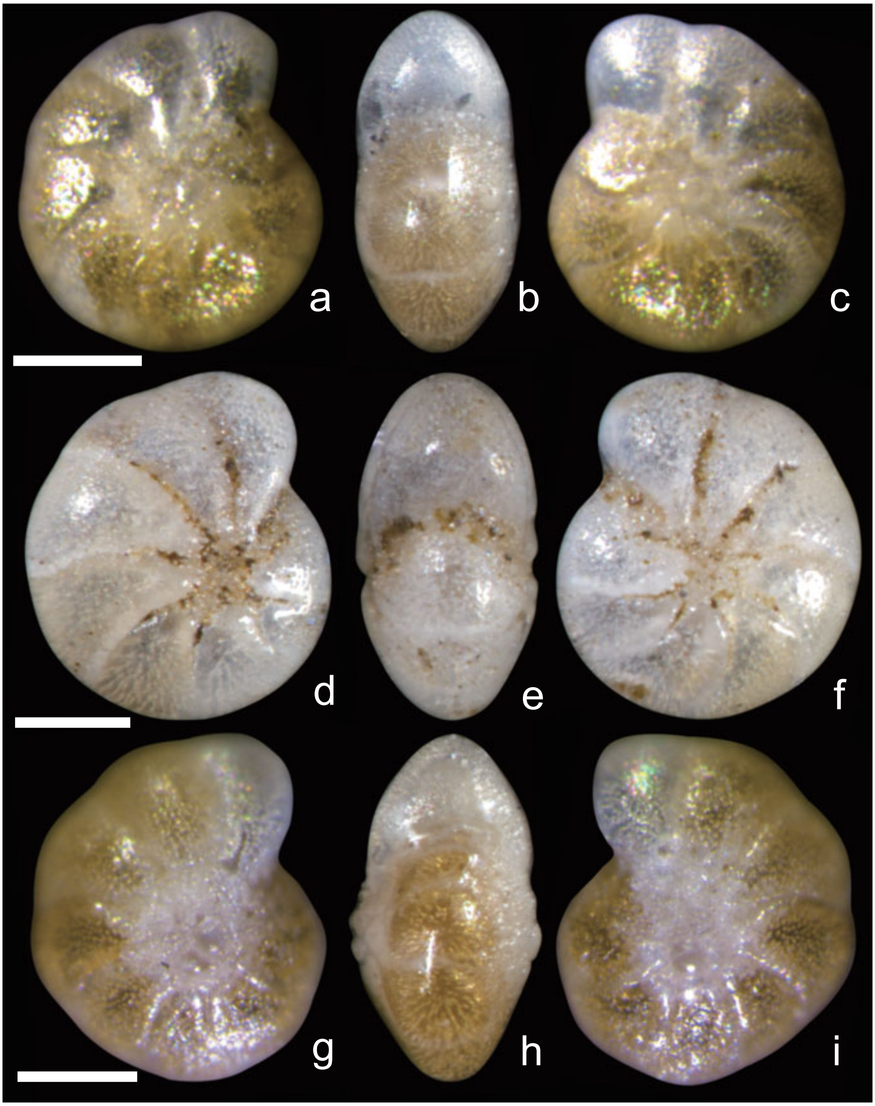

Fig. 78 a–i *Cribroelphidium frigidum* (Cushman, 1933) nov. comb., three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

Diagnosis

Size about 290 μm in length, length:width ratio about 1.2:1. Test planispiral and involute, lateral view rod-shaped to fusiform, about 1.8:1 flattened laterally. About eight to nine chambers in the final whorl. Sutures nearly radial to gently curved, slightly depressed. Periphery rounded to slightly petaloid. Ponticuli absent. Umbilicus with small boss. Wall calcareous, perforate, umbilical area sometime with small pustules. Aperture interiomarginal multiple pores.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H27-01	276	238	128
H27-02	301	263	151
H27-03	288	252	145
H27-04	308	269	143

Etymology

The Latin adjective *frigidus* (cold) refers to the old water environment this species inhabited.

Occurrence and Ecology

The Yellow Sea (St 3500-06, St 3500-10, St 3600-02, St 3600-04, St 3600-06, St 3600-08) (34°59′–36°00′ N, 121°00′–123°59′ E), water depth 33.80–81.00 m, temperature 9.12–12.31 °C, salinity 31.11–33.39 ‰, abundance 0.16–10.56 ind./g sed.

Distribution

Yellow Sea, East China Sea.
Japan.

Description

Size about 290 μm in length, length:width ratio about 1.2:1. Test usually somewhat yellowish, planispiral and involute, lateral view rod-shaped to fusiform, not depressed in the center portion, about 1.8:1 flattened laterally. About eight to nine chambers in the final whorl. Sutures nearly radial to gently curved, slightly depressed. Periphery rounded to slightly petaloid, outline smooth. Ponticuli absent. Umbilicus with small boss. Wall calcareous, perforate, umbilical area sometime with many small pustules. Aperture interiomarginal multiple pores.

Remarks

Cribroelphidium frigidum has been identified as *Cribrononion frigidum* in Chinese pervious literature from the Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978) and the East China Sea (Wang et al., 1988). This species is characterized by the following features: (1) periphery is rounded to slightly petaloid; (2) ponticuli are absent; (3) umbilicus has small boss. These features match well with the Genus *Cribroelphidium* but not the Genus *Elphidium*, the later genus is characterized by having distinct ponticuli and carinate periphery. It is a common and abundant species in the Yellow Sea and the East China Sea, water depth of 33.80–81.00 m.

***Cribroelphidium magellanicum* (Heron-Allen & Earland, 1932)** (Fig. 79)

Elphidium (*Polystomella*) *magellanicum* Heron-Allen & Earland, 1932, p. 550, pl. 16, Figs. 26–28.

***Cribroelphidium magellanicum* (Heron-Allen & Earland, 1932)**

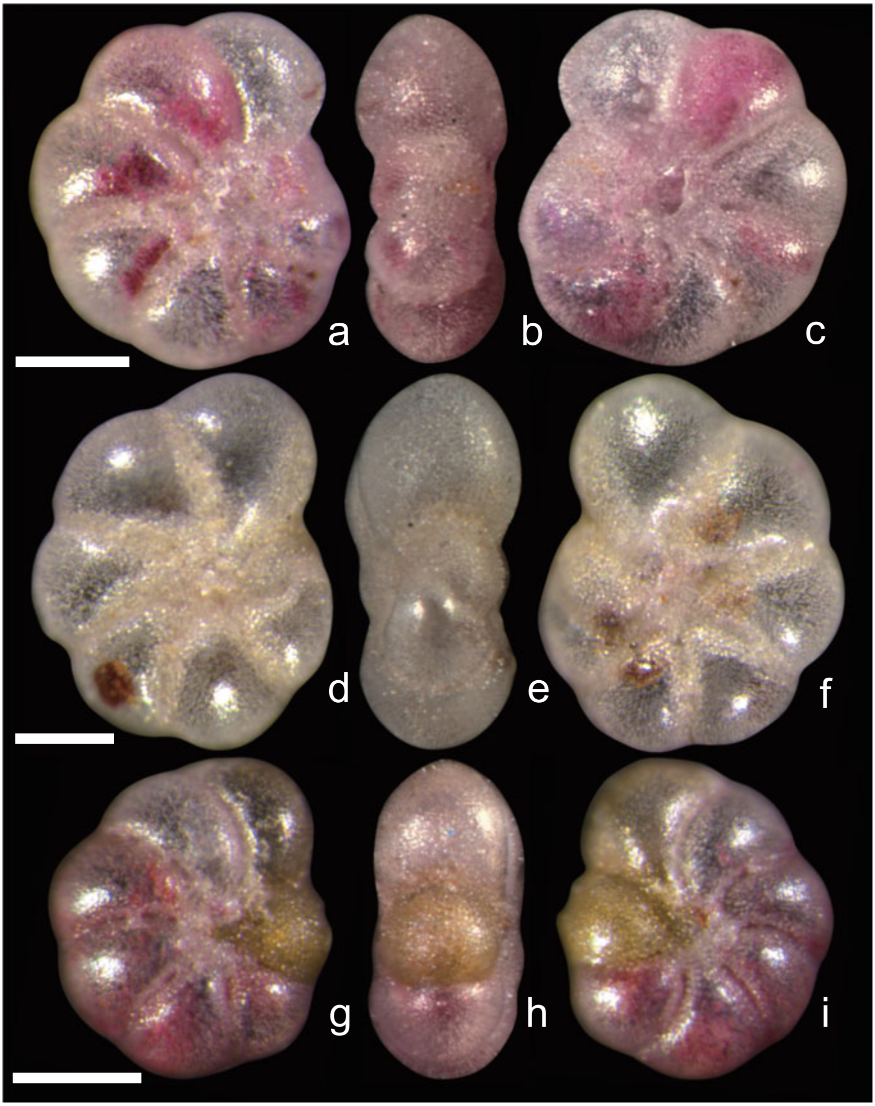

Fig. 79 a–i *Cribroelphidium magellanicum* (Heron-Allen & Earland, 1932), three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. **g–i** Another live specimen. Scale bars = 100 μm

Elphidium magellanicum Heron-Allen & Earland, Cushman, 1939, p. 62, pl. 17, Fig. 17; Haynes, 1973, p. 202, pl. 22, Fig. 5; pl. 24, Figs. 5, 6; pl. 26, Fig. 11; pl. 28, Figs. 5–7; Wang et al., 1980, p. 198, pl. XI, Fig. 16; p. 200, pl. XVI, Fig. 8; p. 202, pl. XVIII, Fig. 12; Wang et al., 1988, p. 169, pl. XXVIII, Fig. 5, 10–13.

Cribroelphidium magellanicum (Heron-Allen & Earland, 1932), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B5-01	322	288	150
B5-02	351	307	156
B5-03	265	222	139

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3400-05, St 3400-08, St 3500-02, St 3500-06, St 3500-10, St 3600-02, St 3800-02, St 3875-01, St 3875-03, St B-03, St B-06) and intertidal flat of the Qingdao Bay (31°39′–39°00′ N, 119°30′–125°00′ E), water depth 0.00–81.00 m, temperature 1.5–26.50 °C, salinity 30.11–38.00 ‰, abundance 0.08–20.26 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Bay of Biscay, Celtic Sea, English Channel, Irish Sea and St. George's Channel, North Atlantic Ocean, Norway.

Description

Size about 310 μm in length, length:width ratio about 1.2:1. Test planispiral and involute, lateral view somewhat dumbbell-shaped, depressed in center portion, on average 1.8:1 flattened laterally. About six to eight chambers in the final whorl. Sutures nearly radial to gently curved, slightly depressed. Periphery petaloid, outline smooth, depressed at sutures. Ponticuli absent. Umbilicus without plug. Wall calcareous, perforate, umbilical area covered with numerous granules, which also extended along sutures. Aperture interiomarginal multiple pores.

Remarks

Cribroelphidium magellanicum has been identified as *Elphidium magellanicum* in previous Chinese literature (Wang et al., 1980, 1988). This species has a typical feature that umbilical area covered with numerous granules; in addition, it has no ponticuli and umbilical plug. Therefore, it undoubtedly should be attributed to the Genus *Cribroelphidium.* It is a common and abundant species in the Bohai Sea, the Yellow Sea and the East China Sea.

Genus *Cribrononion* Thalmann, 1947

***Cribrononion gnythosuturatum* Ho, Hu & Wang, 1965** (Fig. 80)

Cribrononion gnythosuturatum Ho, Hu & Wang, 1965, He et al., 1965, p. 115, pl. XIV, Fig. 5a, b; Research Institute of petroleum exploration and development in

***Cribrononion gnythosuturatum* Ho, Hu & Wang, 1965**

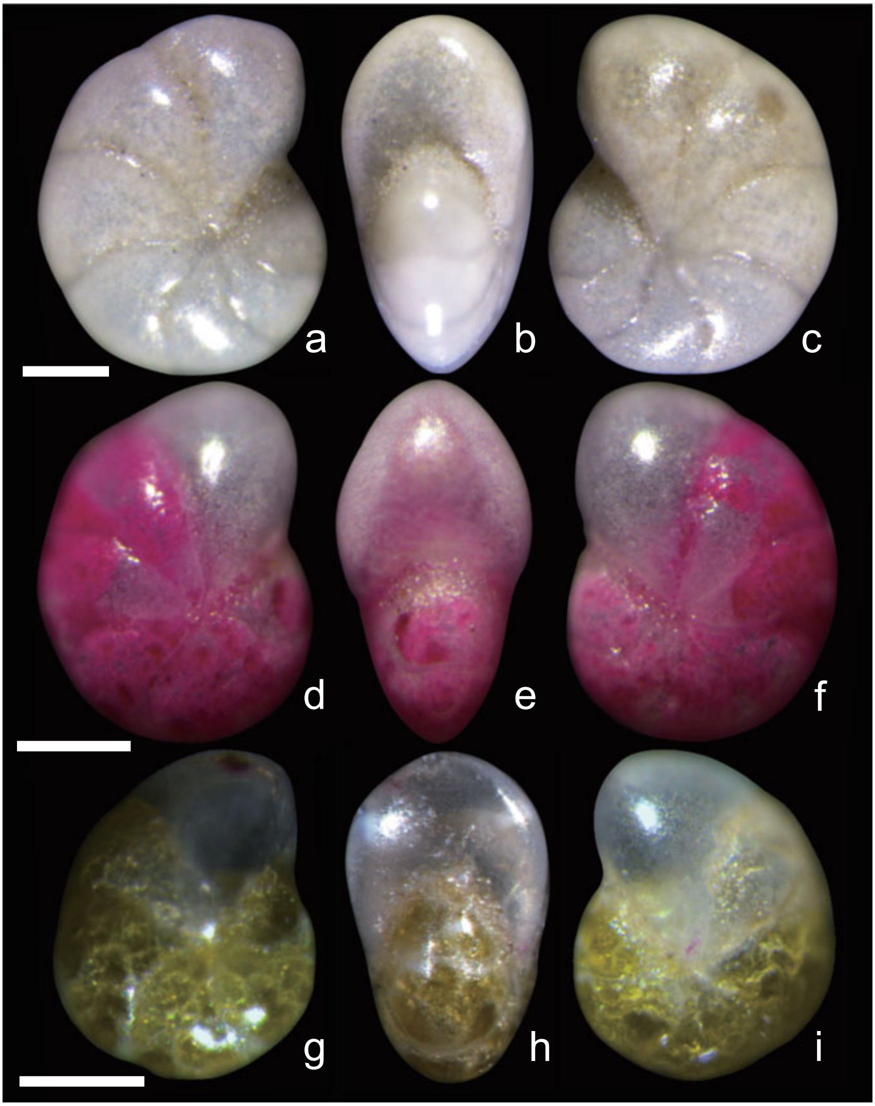

Fig. 80 **a–i** *Cribrononion gnythosuturatum* Ho, Hu & Wang, 1965, three specimens showing morphological variabilities. **a–c** From same specimen. **d–f** A live specimen. **g–i** Another live specimen. Scale bars = 100 µm

the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 35, pl. 6, Figs. 1, 2.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H2-01	399	323	208
H2-02	315	245	163
H2-03	268	203	155

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3300-06, St 3400-05, St 3500-02, St 3600-02, St 3600-04, St 3700-01, St 3800-02, St 3875-01, St B-06) and intertidal flat of the Qingdao Bay (31°39′–38°44′ N, 120°00′–125°00′ E), water depth 0.00–59.00 m, temperature 2.25–18.08 °C, salinity 30.11–32.74 ‰, abundance 0.16–11.86 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Description

Size about 330 μm in length, length:width ratio about 1.3:1. Test planispiral and involute, lateral view clavate, on average 1.5:1 flattened laterally. About six to seven chambers in the final whorl. Sutures nearly radial to gently curved, forming a continuous and depressed line starting from the umbilical center to the periphery margin. Periphery rounded to slightly petaloid, outline smooth. Ponticuli absent. Umbilicus without boss or plug. Wall calcareous, surface very fine and smooth. Aperture a low short interiomarginal slit bordered by a thickened rim.

Remarks

Cribrononion gnythosuturatum Ho, Hu & Wang, 1965 was established by He et al. (1965). It was discovered from South Yellow Sea sediment. Later, it was reported from Bohai Sea sediment (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978). This species is characterized by having continuous, line-like sutures, without ponticuli and without umbilical boss or plug. It is a common species in the Yellow Sea.

Cribrononion subincertum **(Asano, 1951)** (Fig. 81)

Elphidium subincertum Asano, 1951, p. 10, Figs. 56–57.

Cribrononion subincertum (Asano), Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 103, pl. XV, Figs. 13–14, 19–20;

Cribrononion subincertum (Asano, 1951)

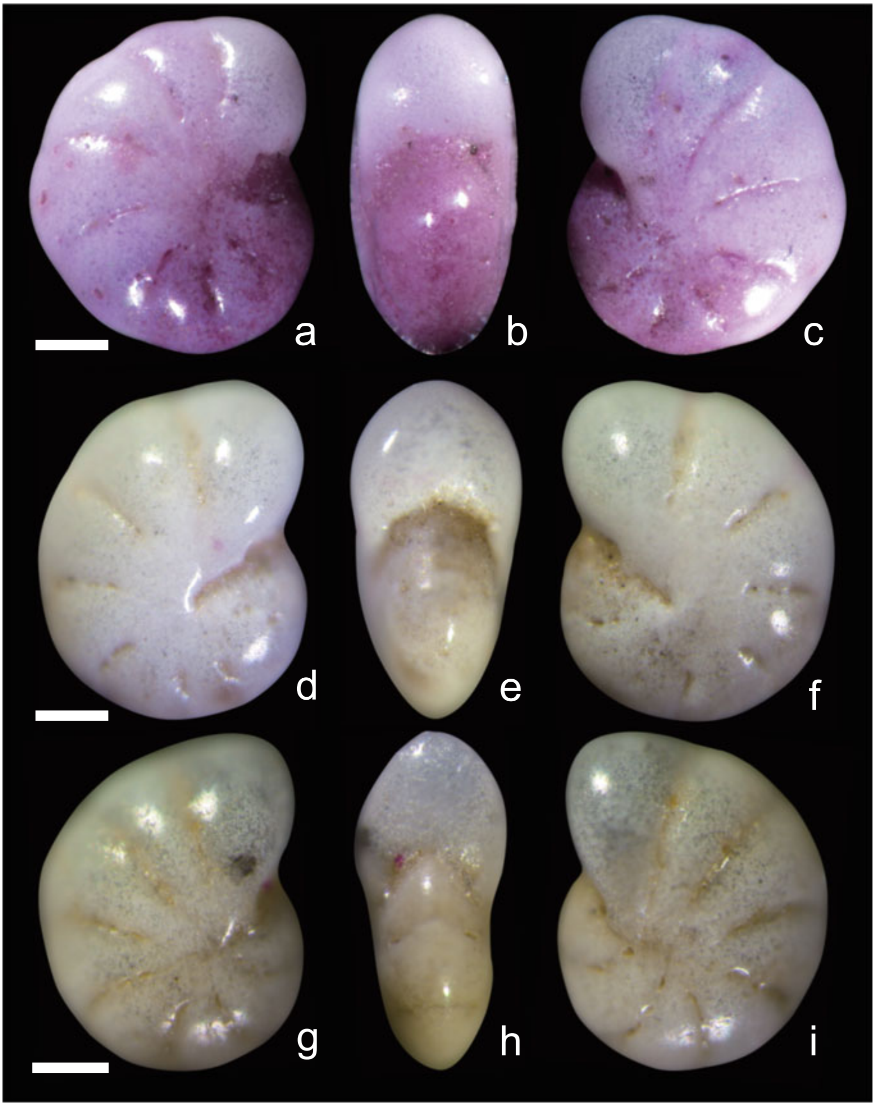

Fig. 81 **a–i** *Cribrononion subincertum* (Asano, 1951), three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. **g–i** The third specimen. Scale bars = 100 μm

Wang et al., 1980, p. 196, pl. IX, Figs. 22–23; p. 198, pl. XI, Figs. 13–14; p. 202, pl. XVIII, Fig. 11; Wang et al., 1988, p. 168, pl. XXVIII, Figs. 1–4; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 197, pl. 20, Fig. 1.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H41-01	473	397	235
H41-02	439	375	231
H41-03	418	343	191

Occurrence and Ecology

The Yellow Sea (St 3300-06, St 3600-02, St 3600-04, St 3700-01, St 3875-01, St B-06) (33°00′–37°51′ N, 121°00′–123°58′ E), water depth 29.00–50.00 m, temperature 7.39–17.00 °C, salinity 30.31–32.41 ‰, abundance 0.14–2.64 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Okinawa Trough.

Description

Size about 440 μm in length, length:width ratio about 1.2:1. Test planispiral and involute, lateral view clavate, on average 1.7:1 flattened laterally. About seven to eight chambers in the final whorl. Sutures nearly radial to gently curved, depressed, a series fossettes forming a discontinuous line but basically disappeared in the test center parts near umbilical region. Periphery rounded to slightly petaloid, outline smooth. Ponticuli absent. Umbilicus without boss or plug. Wall calcareous, surface very fine and smooth. Aperture a low short interiomarginal slit bordered by a thickened rim.

Remarks

Cribrononion subincertum has been reported by Chinese previous literature from the South Yellow Sea sediments (Micropaleontology Group in Marine Geology Department of Tongji University, 1978; Wang et al., 1980), the East China Sea sediments (Wang et al., 1988) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a common species in the Yellow Sea and the East China Sea, water depth of 29.00–50.00 m.

Genus *Elphidium* de Montfort, 1808

***Elphidium advenum* (Cushman, 1922)** (Fig. 82)

Polystomella advena Cushman, 1922a, p. 56, pl. 9, Figs. 11, 12.

Elphidium advena (Cushman), Graham & Militante, 1959, p. 73, pl. 11, Figs. 7, 8; Chiji, 1963, p. 60, pl. 6, Fig. 1; Chiji & Lopez, 1968, p. 106, pl. 13, Fig. 1; Akimoto, 1990, p. 197, pl. 17, Fig. 1.

Elphidium cf. *E. advenum* (Cushman), Hottinger et al., 1993, p. 146, pl. 207, Figs. 1–7.

Elphidium advenum (Cushman, 1922)

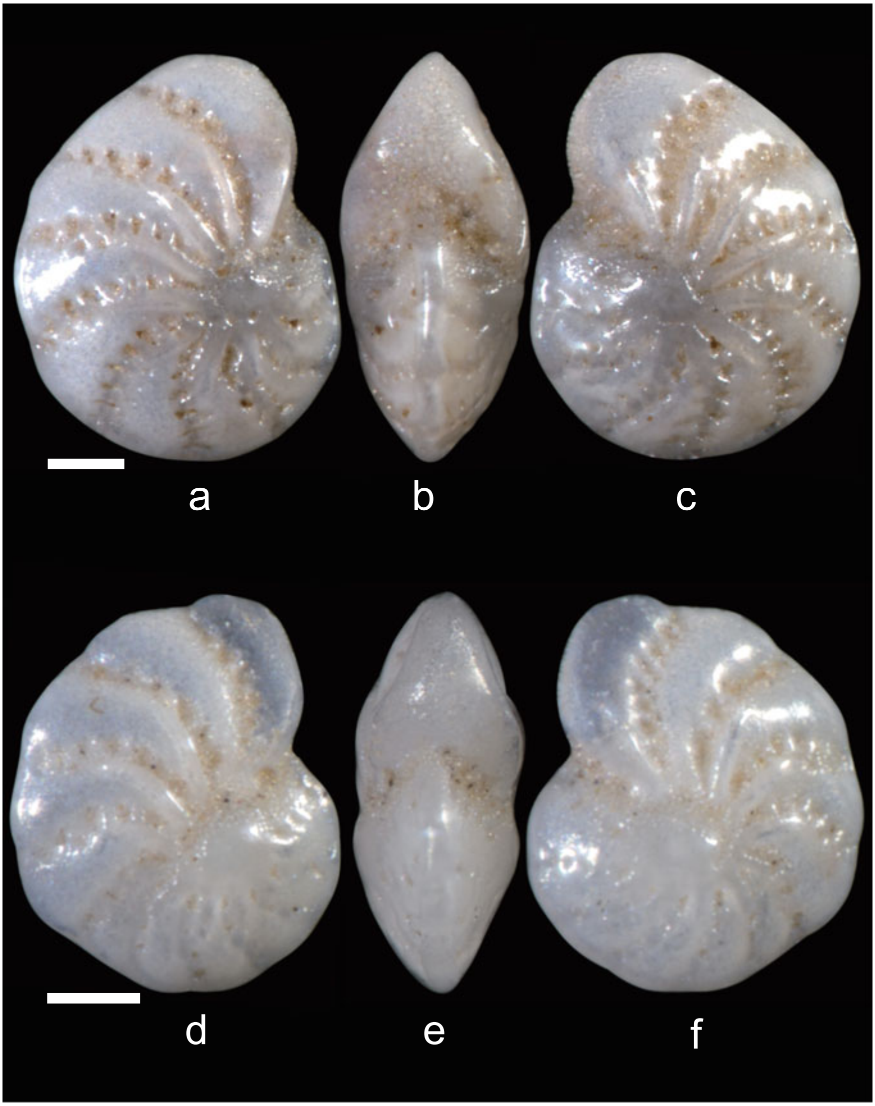

Fig. 82 a–f *Elphidium advenum* (Cushman, 1922), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 100 μm

Elphidium advenum Cushman, 1930, p. 25, pl. 10, Fig. 1; Cushman, 1933c, p. 50, pl. 12, Figs. 1–3; Cushman, 1939a, p. 60, pl. 16, Figs. 31–35; Asano, 1960, p. 196, pl. 22, Fig. 3; He et al., 1965, p. 128, pl. XVI, Fig. 4a, b; Hansen & Lykke-Andersen, 1976, p. 7, pl. 2, Figs. 10–12; pl. 3, Fig. 1; Micropaleontology

Group in Marine Geology Department of Tongji University, 1978, p. 99, pl. XIV, Figs. 1–5; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 27, pl. 3, Figs. 21, 22; Wang et al., 1980, p. 196, pl. IX, Fig. 28; p. 201, pl. XVII, Fig. 13; p. 202, pl. XVIII, Fig. 8; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 197, pl. 20, Figs. 3; Wang et al., 1988, p. 170, pl. XXIX, Figs. 1–3; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 90, pl. 158, Fig. 6a, b; Inoue, 1989, pl. 20, Fig. 5; Ōki, 1989, p. 133, 173, pl. 16, Fig. 2; Van Marle, 1991, p. 214, pl. 23, Fig. 6; Hatta & Ujiié, 1992b, p. 203, pl. 49, Figs. 3, 4; Loeblich & Tappan, 1994, p. 168, pl. 379, Figs. 1–4; Yassini & Jones, 1995, p. 176, Figs. 1026–1029, 1034–1036; Debennay, 2012, p. 218; Panchang & Nigam, 2014, p. 40, pl. XXXVIII, Figs. 3, 4.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H112-01	537	428	247
H112-02	439	361	180
H112-03	275	240	129

Occurrence and Ecology

The Yellow Sea (St 3000-02, St CJ-01, St 3300-04, St 3600-02, St 3700-01) and the Jiaozhou Bay (St B2, St C1, St A3, St D3, St C4, St D7, St C3, St D6) (29°59′–37°00′ N, 120°10′–123°00′ E), water depth 4.40–50.00 m, temperature 13.80–22.40 °C, salinity 30.76–34.27 ‰, abundance 0.06–12.19 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea, Okinawa Trough.

Bay of Biscay, Bay of Fundy, Celtic Sea, Japan, Micronesia, New Zealand, North Atlantic Ocean, South Korea, United States, New Caledonia, Scotian Shelf, Southeast U.S. Continental Shelf, Vineyard Sound, Gulf of Mexico, Mediterranean Sea.

Description

Size about 400 μm in length, length:width ratio about 1.2:1. Test lenticular, planispirally enrolled, biumbonate, on average 1.9:1 flattened laterally, each side has a distinct large umbilical plug. About ten chambers in the final whorl. Sutures deeply incised and curved, externally ponticuli span the sutures. Periphery carinate and bordered. Wall calcareous, optically radial, surface with ridge along the sutures.

Remarks

Elphidium advenum has been frequently reported by Chinese literature from the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology

Department of Tongji University, 1978; Wang et al., 1980), the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), the East China Sea (Wang et al., 1988; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). It is a very common and abundant species in the China Seas of water depth 4.40–50.00 m.

***Elphidium clavatum* Cushman, 1930** (Fig. 83)

Elphidium incertum (Williamson) var. *clavatum* Cushman, 1930, p. 20, pl. 7, Fig. 10.

Elphidium incertum Phleger, 1952, p. 83, pl. 14, Fig. 7.

Elphidium clavatum Cushman, Loeblich & Tappan, 1953, p. 83, pl. 19, Figs. 8–10; He et al., 1965, p. 126, pl. XV, Fig. 14a, b; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 28, pl. 4, Figs. 1–3; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989, p. 91, pl. 159, Fig. 4a, b.

Elphidium excavatum subsp. *clavatum* Cushman, 1930; Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H131-01	382	351	175
H131-02	263	216	115

Occurrence and Ecology

The Yellow Sea (St 3300-04, St 3400-08) and intertidal flat of the Qingdao Bay (33°59′–36°00′ N, 120°30′–123°58′ E), water depth 3.00–80.00 m, temperature 1.50–10.01 °C, salinity 32.94–36.00 ‰, abundance 0.12–0.36 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea Cenozoic sediment.

Australia, Japan, New Zealand, South Pacific Ocean, New Caledonia, Gulf of Mexico, North Atlantic Ocean.

Description

Size about 320 μm in length, length:width ratio about 1.2:1. Test planispirally enrolled, lateral view rod-like, about 1.9:1 flattened laterally. Each side of the test has a distinct large umbilical plug, about ten to fourteen chambers in the final whorl.

Elphidium clavatum Cushman, 1930

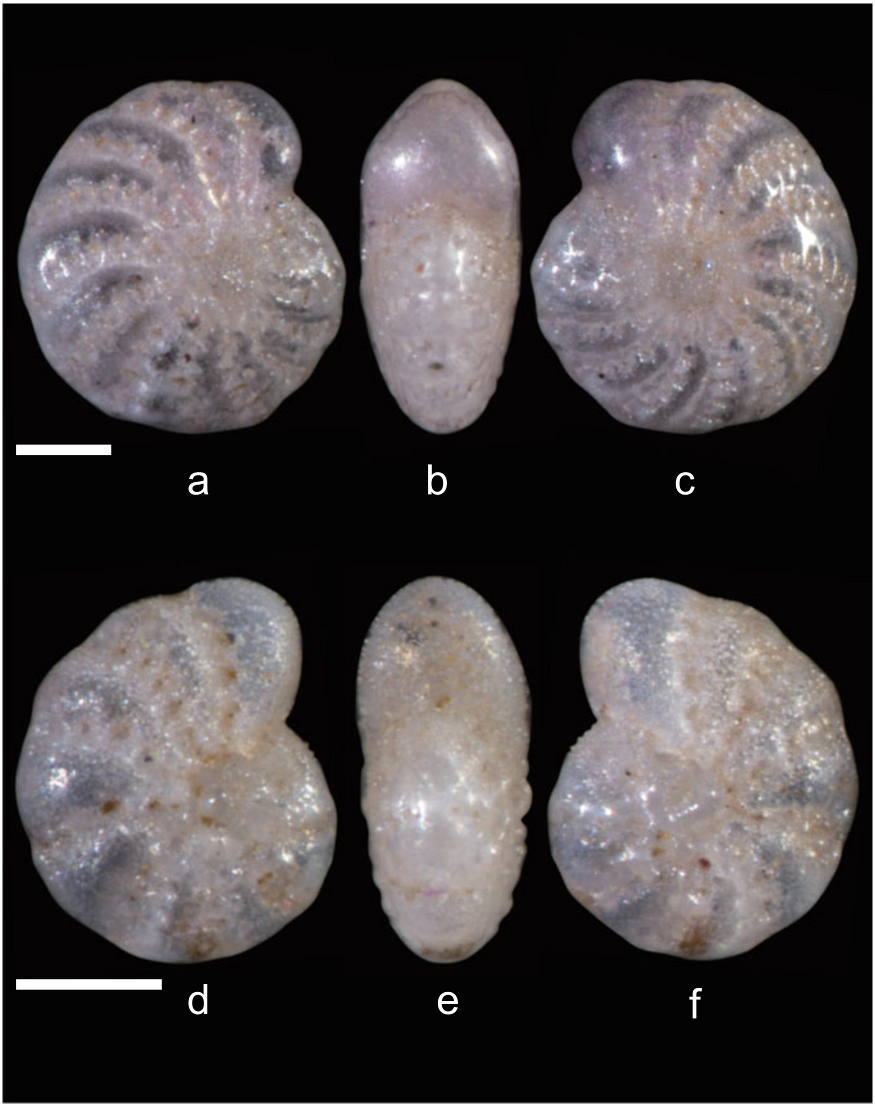

Fig. 83 a–f *Elphidium clavatum* Cushman, 1930, two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 100 μm

Sutures moderately incised and gently curved, externally ponticuli span the sutures. Periphery carinate but not bordered. Wall calcareous, optically radial, surface with pustules in the umbilical plug area.

Remarks

Elphidium clavatum has been reported from the South Yellow Sea (He et al., 1965), the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978), and the Cenozoic sediment of the East China Sea (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Institute of Geology, Chinese Academy of Geological Sciences, 1989). It is a common species in the Yellow Sea.

***Elphidium crispum* (Linnaeus, 1758)** (Fig. 84)

Nautilus crispus Linné, 1758, p. 709; Linné, 1767, p. 1162.

Polystomella crispus (Linné), Lamarck, 1822, p. 625.

Polystomella crispa (Linné), Brady, 1884, p. 736, pl. 110, Figs. 6, 7.

Elphidium crispum (Linné), Cushman, 1933c, p. 47, pl. 41, Fig. 4; Cushman, 1939a, p. 50, pl. 13, Figs. 17–21; Graham & Militante, 1959, p. 74, pl. 11, Fig. 13; Asano, 1960, p. 197, pl. 22, Fig. 6; He et al., 1965, p. 126, pl. XVI, Fig. 1a, b; Chiji & Lopez, 1968, p. 106, pl. 13, Fig. 2; Bhalla, 1970, p. 158, pl. 21, Fig. 1; Hansen & Lykke-Andersen, 1976, p. 6, pl. 1, Figs. 10–12; pl. 2, Figs. 1, 2; Matoba & Honma, 1986, pl. 4, Fig. 14; Loeblich & Tappan, 1987, p. 674, pl. 786, Figs. 8–9; pl. 787, Figs. 1–5; Inoue, 1989, pl. 30, Fig. 5; Ōki, 1989, p. 134, pl. 16, Fig. 4; Azazi, 1992, pl. 1, Figs. 11, 12; Hatta & Ujiié, 1992b, p. 203, pl. 49, Fig. 5; Loeblich & Tappan, 1994, p. 168, pl. 378, Figs. 4–6; Parker, 2009, p. 575, Fig. 406a–h; Debenay, 2012, p. 219.

Elphidium crispum (Linnaeus), Cushman & Grant, 1927, p. 73, pl. 7, Fig. 3a–b; Barker, 1960, pl. 110, Figs. 6–7; Rögl & Hansen, 1984, p. 37, pl. 8, Fig. 7, text Fig. 10; Jones, 1994, p. 109, pl. 110, Figs. 6–7; Holbourn et al., 2013, p. 236; Panchang & Nigam, 2014, p. 40, pl. XXXVIII, Figs. 6, 7.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H117-01	687	635	378
H117-02	495	441	293

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), the Yellow Sea, water depth 3.00 m, temperature 1.50–8.00 °C, salinity 34.00–38.00 ‰, abundance 0.21–0.36 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea.

Bay of Biscay, English Channel, Irish Sea and St. George’s Channel, Japan, Maldives, Micronesia, New Zealand, North Atlantic Ocean, South Korea, United States, Indo-Pacific, New Caledonia, France, Gulf of Mexico, Mediterranean Sea.

Elphidium crispum (Linnaeus, 1758)

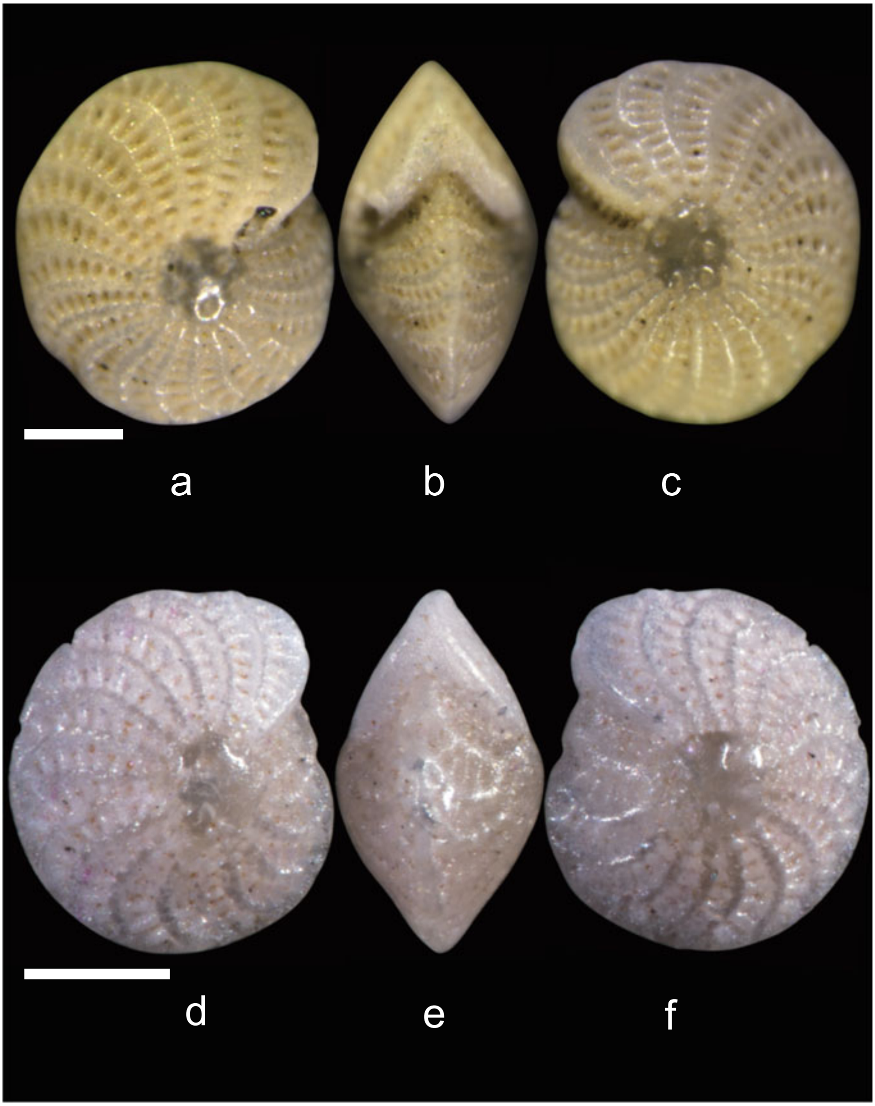

Fig. 84 a–f *Elphidium crispum* (Linnaeus, 1758), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 200 μm

Description

Size about 600 μm in length, length:width ratio about 1.1:1. Test planispirally enrolled, lateral view fusiform to rhomboid, about 1.6:1 flattened laterally. Each side of the test has big umbilical plug, about 18–21 chambers in the final whorl.

Sutures deeply incised and greatly curved, ponticuli well-developed. Periphery rounded to slightly carinate, accurate, and bordered. Wall calcareous, optically radial, surface with several pits in the umbilical plug area. Aperture several interiomarginal pores.

Remarks

Elphidium crispum has been reported from the Quaternary sediment of the South Yellow Sea (He et al., 1965). In the Yellow Sea, it occurred in intertidal flat of the Qingdao Bay but its abundance was low.

***Elphidium excavatum* (Terquem, 1875)** (Fig. 85)

Polystomella excavate Terquem, 1875, p. 25, pl. 2, Fig. 2a–f; Terquem, 1875, p. 429, pl. 2, Fig. 2a, b.

Elphidium excavatum (Terquem), Cushman, 1930, p. 21, pl. 8, Figs. 1–7; Lévy et al., 1975, p. 174, pl. 3, Figs. 1, 2; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 28, pl. 3, Figs. 25, 26; Hayward et al., 1997, p. 77, pl. 9, Figs. 15–18, not Figs. 9–14; Debenay, 2012, p. 219.

Cribroelphidium excavatum (Terquem, 1875), Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H123-01	281	231	118
H123-02	371	303	166
H123-03	286	237	140

Occurrence and Ecology

The Yellow Sea (St 3600-04) and intertidal flat of the Qingdao Bay (32°59′–36° 00′ N, 120°30′–121°59′ E), water depth 0.00–44.00 m, temperature 2.00–24.50 °C, salinity 30.70–38.00 ‰, abundance 0.16–1.07 ind./g sed.

Distribution

Bohai Sea, Yellow Sea.

Bay of Biscay, Bay of Fundy, Canada, Celtic Sea, English Channel, Gulf of Saint Lawrence, Irish Sea and St. George's Channel, Japan, New Zealand, North Atlantic Ocean, Norway, South Africa, South Korea, Southern Ocean, United States, Chesapeake Bay, Grand Bank, New Caledonia, Northeast U.S. Continental Shelf, Scotian Shelf, Vineyard Sound, Gulf of Mexico.

Description

Size about 310 μm in length, length:width ratio about 1.2:1. Test planispirally enrolled, lateral view rod-like to somewhat fusiform, about 1.8:1 flattened laterally. Each side of the test has umbilical plug, about 14–15 chambers in the final whorl.

Elphidium excavatum (Terquem, 1875)

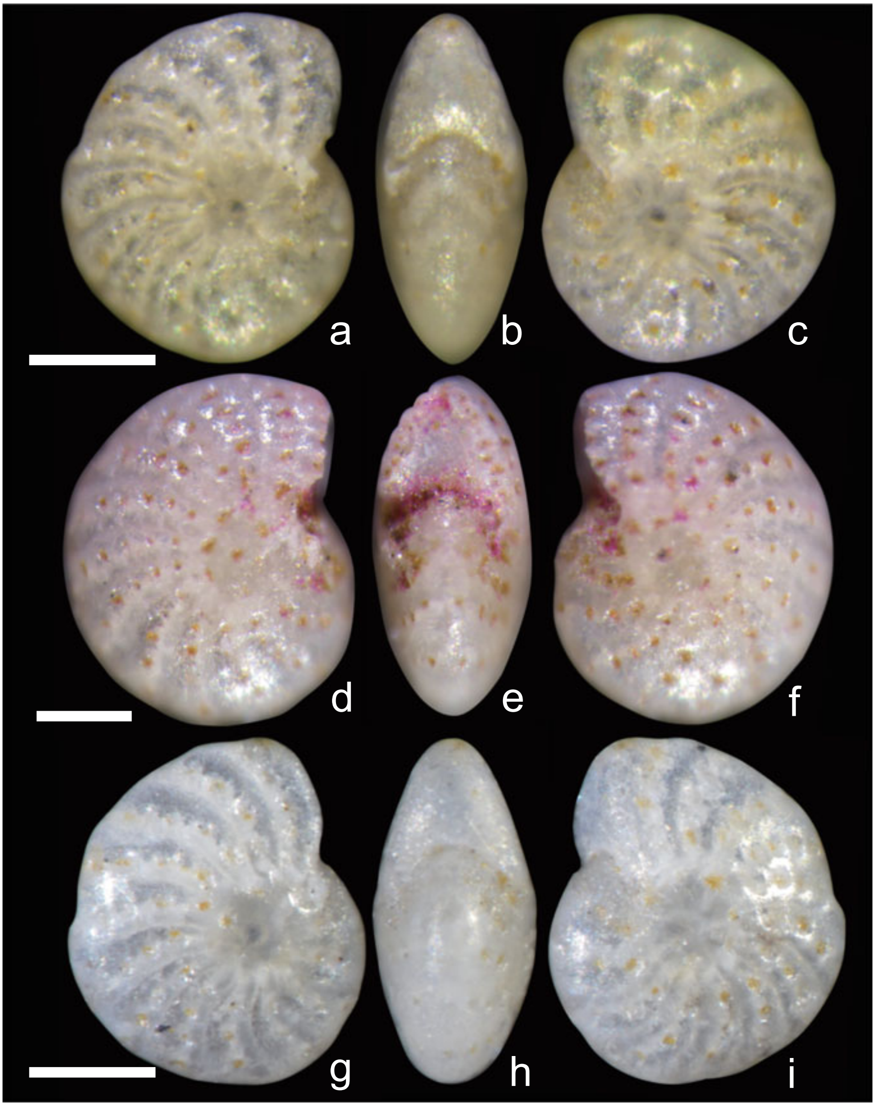

Fig. 85 **a–i** *Elphidium excavatum* (Terquem, 1875), three specimens showing morphological variabilities. **a–c** A fossil specimen. **d–f** A live specimen. **g–i** The third specimen. Scale bars = 100 μm

Sutures moderately incised and gently curved, externally ponticuli span the sutures. Periphery somewhat carinate to rounded, not bordered. Wall calcareous, optically radial, surface with pustules in the umbilical plug area. Aperture several interiomarginal pores.

Remarks

Elphidium excavatum has been reported from the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978). In the Yellow Sea, it occurred from intertidal flat in Qingdao Bay to continental shelf sediments, water depth 0–44 m.

***Elphidium hispidulum* Cushman, 1936** (Fig. 86)

Elphidium hispidulum Cushman, 1936, p. 83, pl. 14, Fig. 13; Todd & Bronnimann, 1957, p. 39, pl. 7, Fig. 1; He et al., 1965, p. 125, pl. XV, Fig. 13a, b; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 27, pl. 3, Fig. 3; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 100, pl. XIV, Figs. 12–15; Wang et al., 1980, p. 196, pl. IX, Fig. 27; p. 202, pl. XVIII, Fig. 9; Wang et al., 1988, p. 170, pl. XXIX, Figs. 16–17.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H81-01	279	246	172
H81-02	373	316	193
H81-03	302	259	150

Occurrence and Ecology

The Yellow Sea (St CJ-04) and intertidal flat of the Qingdao Bay (32°10′–36°00′ N, 120°30′–124°00′ E), water depth 0.00–42.00 m, temperature 1.50–17.02 °C, salinity 32.08–36.00 ‰, abundance 0.10–0.36 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Japan, South Korea, New Caledonia, West Pacific.

Description

Size about 320 μm in length, length:width ratio about 1.2:1. Test planispirally enrolled, lateral view elliptical, about 1.6:1 flattened laterally. Each side of the test has big umbilical plug, about eight to nine chambers in the final whorl. Sutures slightly incised and gently curved, ponticuli not clear. Periphery basically rounded, slightly carinated only in the last two or three chambers, outline mostly smooth, not bordered. Wall calcareous, optically radial, surface with many tiny ring-like grooves, several pustules in the umbilical plug area. Aperture interiomarginal.

Remarks

Elphidium hispidulum has been frequently reported in Chinese literature from the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology

Elphidium hispidulum Cushman, 1936

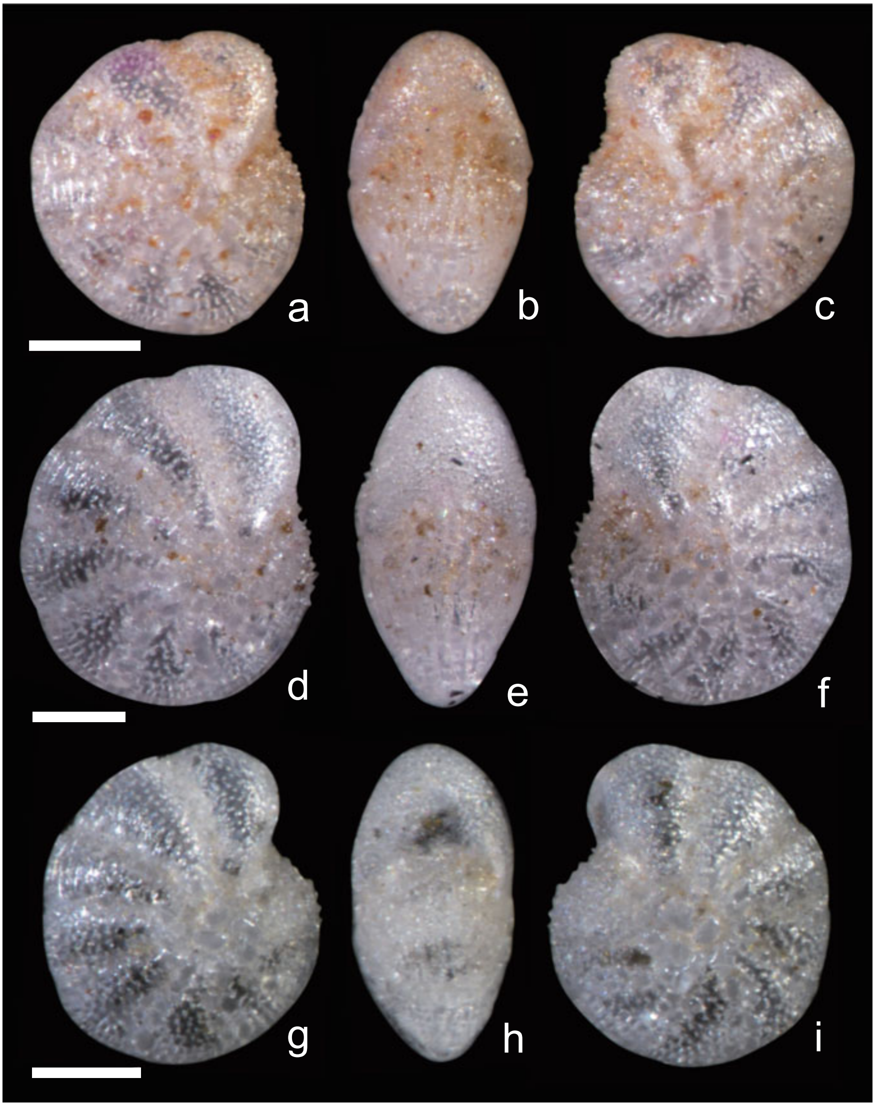

Fig. 86 **a–i** *Elphidium hispidulum* Cushman, 1936, three specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. **g–i** The third specimen. Scale bars = 100 μm

Department of Tongji University, 1978; Wang et al., 1980), the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) and the East China Sea

(Wang et al., 1988). It is a common species in the Yellow Sea and the East China Sea but usually with low abundance.

Elphidium incertum **(Williamson, 1858)** (Fig. 87)

Polystomella umbilicatula var. *incerta* Williamson, 1858, p. 44, pl. 3, Fig. 82a.

Elphidium incertum **(Williamson, 1858)**

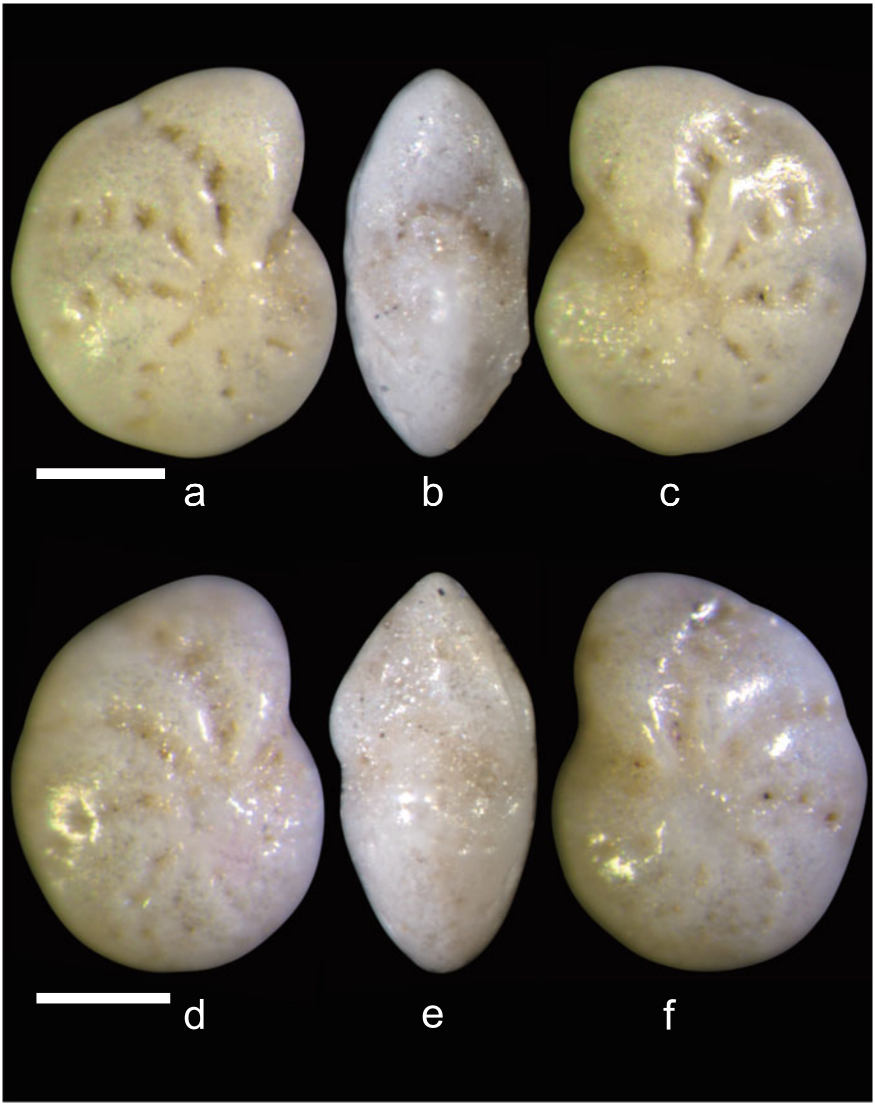

Fig. 87 **a–f** *Elphidium incertum* (Williamson, 1858), two specimens showing morphological variabilities. **a–c** The same specimen. **d–f** Another specimen. Scale bars = 100 μm

Elphidium incertum (Williamson), Cushman, 1930, p. 18, pl. 7, Fig. 6; Cushman, 1939, p. 57, pl. 15, Figs. 22–23; He et al., 1965, p. 127, pl. XVI, Fig. 3a, b; Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978, p. 28, pl. 3, Fig. 27; Micropaleontology Group in Marine Geology Department of Tongji University, 1978, p. 100, pl. XIV, Figs. 6, 9; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 197, pl. 20, Fig. 6.

Cribroelphidium incertum Williamson, 1858, Hayward et al., 2015.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
B89-01	277	250	113
B89-02	266	227	130

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 36, St 22, St 14, St 31), the Yellow Sea (St 3500-02, St 3600-02, St 3600-04, St 3875-01) and intertidal flat of the Qingdao Bay (35°00′–39°00′ N, 119°30′–122°00′ E), water depth 0.00–51.00 m, temperature 2.25–10.68 °C, salinity 30.11–31.62 ‰, abundance 0.06–9.32 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Okinawa Trough.

Celtic Sea, Irish Sea and St. George's Channel, Japan, North Atlantic Ocean, Norway, United States, Black Sea.

Description

Size about 270 μm in length, length:width ratio about 1.1:1. Test planispirally enrolled, lateral view somewhat fusiform, about 2:1 flattened laterally. Each side of the test has indistinct umbilical plug, about seven to eight chambers in the final whorl. Sutures deeply incised and gently curved, externally ponticuli span the sutures. Periphery somewhat carinate. Wall calcareous, optically radial, surface with ridges along sutures. Apertural several interiomarginal pores.

Remarks

Elphidium incertum has been frequently reported from the South Yellow Sea (He et al., 1965; Micropaleontology Group in Marine Geology Department of Tongji University, 1978), the Bohai Sea (Research Institute of petroleum exploration and development in the Ministry of petroleum exploration and development & Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 1978) and the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). This species has the following features: (1) sutures deeply incised; (2) ponticuli distinct present. Since those features match well with the diagnosis of the Genus *Elphidium*, it certainly should be a member of this genus.

Elphidium jenseni **(Cushman, 1924)** (Fig. 88)

Elphidium jenseni (Cushman, 1924)

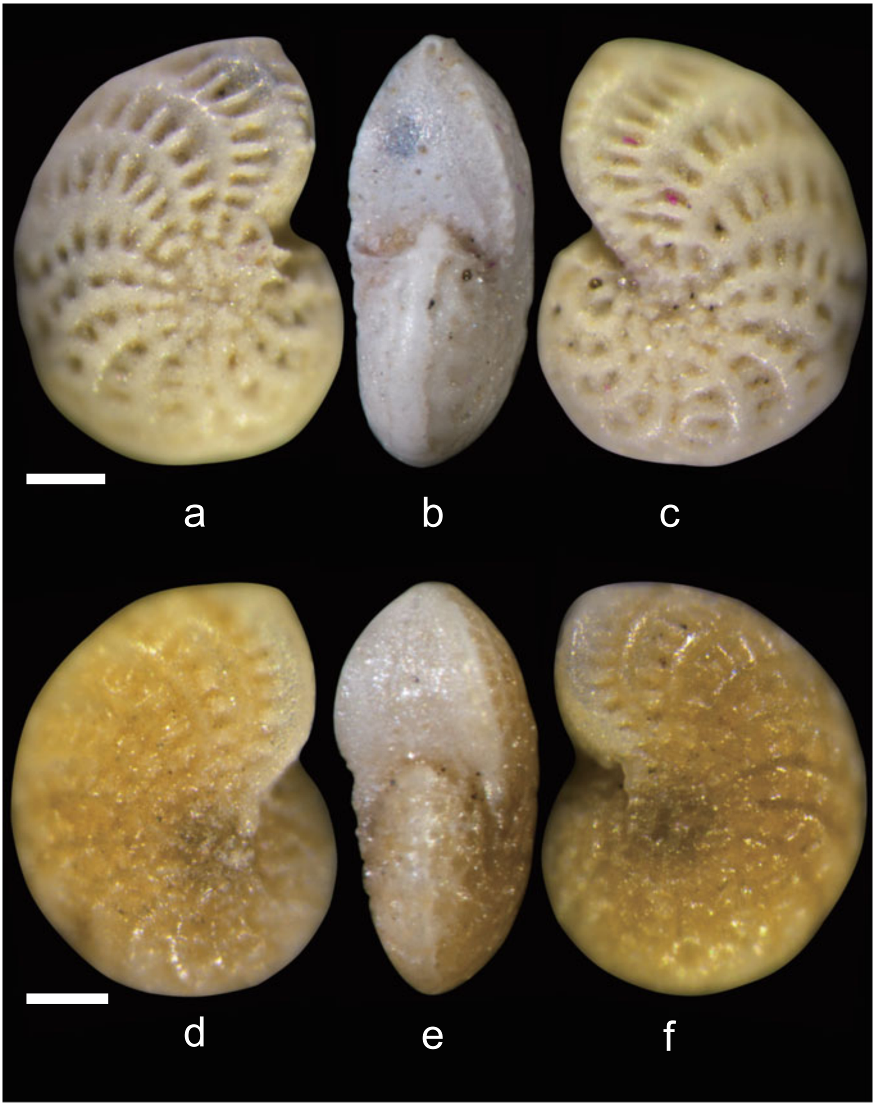

Fig. 88 **a–f** *Elphidium jenseni* (Cushman, 1924), two specimens showing morphological variabilities. **a–c** From same specimen. **d–f** Another specimen. Scale bars = 100 μm

Polystomella jenseni Cushman, 1924, p. 49, pl. 16, Fig. 6.

Cribroelphidium jenseni (Cushman), Ujiie, 1956, p. 273, pl. 15, Figs. 1, 2.

Elphidium jenseni Cushman, 1933c, p. 48, pl. 11, Figs. 6, 7; Cushman, 1939a, p. 62, pl. 17, Figs. 14, 15; Asano, 1950e, p. 9, Figs. 48, 49; Cushman, Todd & Post, 1954, p. 346, pl. 86, Fig. 32; Takayanagi, 1955, p. 43, pl. 1, Fig. 28; Asano, 1960, p. 199, pl. 22, Fig. 5; Chiji, 1963, p. 62, pl. 6, Figs. 5, 6; Matsunaga, 1963, pl. 36, Fig. 11; Leroy, 1964, p. F-28, pl. 10, Figs. 8, 9; Chiji & Lopez, 1968, p. 106, pl. 13, Fig. 5; Albani, 1968, p. 112, pl. 10, Fig. 8; Wang et al., 1988, p. 171, pl. XXIX, Figs. 10–11; Inoue, 1989, p. 155, pl. 30, Fig. 2; Ōki, 1989, p. 135, pl. 16, Fig. 6; Hatta & Ujiié, 1992b, p. 203, pl. 49, Fig. 6; Loeblich & Tappan, 1994, p. 169, pl. 381, Figs. 1–5.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H116-01	522	409	202
H116-02	477	387	175

Occurrence and Ecology

Intertidal flat of the Qingdao Bay (36°00′ N, 120°30′ E), water depth 3.00 m, temperature 1.50–17.20 °C, salinity 32.00–38.00 ‰, abundance 0.22–1.42 ind./g sed.

Distribution

Qingdao Bay of the Yellow Sea, East China Sea Late Pleistocene sediment.

Gulf of Aqaba, Japan, Micronesia, Mediterranean Sea, North Atlantic Ocean.

Description

Size about 500 μm in length, length:width ratio about 1.3:1. Test reniform, planispirally enrolled, lateral view fusiform, about 2:1 flattened laterally. Each side has indistinct umbilical plug, about 15–16 chambers in the final whorl. Sutures deeply incised and greatly curved, ponticuli well-developed. Periphery outline smooth, bordered. Wall calcareous, optically radial, surface with ridges along sutures, and with several pits in umbilical plug area. Apertural face with multiple pores.

Remarks

Elphidium jenseni has been reported from Late Pleistocene sediment of the East China Sea (Wang et al., 1988). In the Yellow Sea, it occurred in intertidal flat of the Qingdao Bay with low abundance.

***Elphidium jiani* nov. spec.** (Fig. 89)

Diagnosis

Size about 480 μm in length, length:width ratio about 1.1:1. Test planispirally enrolled, with rather thin and carinate margin, lateral view fusiform with tapered

Elphidium jiani nov. spec.

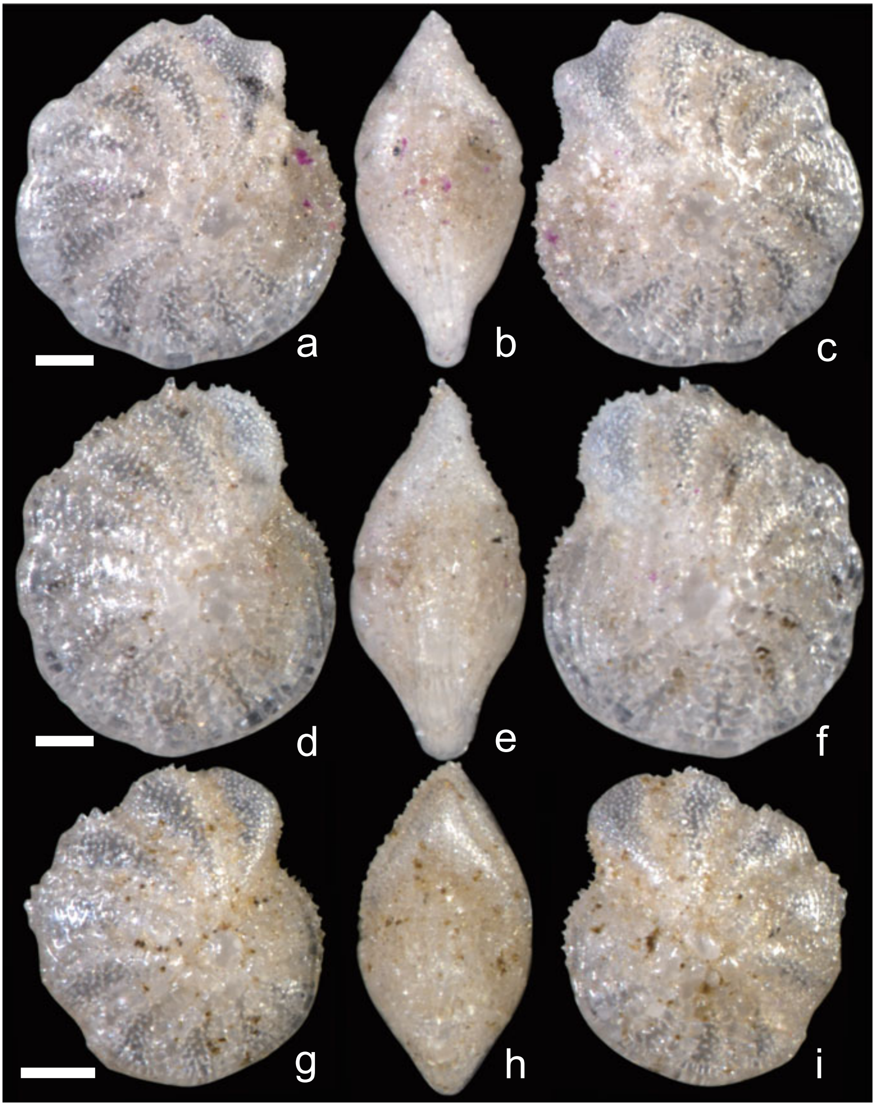

Fig. 89 **a–i** *Elphidium jiani* nov. spec., three specimens with different side of views showing morphological variabilities. **a–c** Holotype specimen. **d–f** The paratype-01 specimen. **g–i** The paratype-02 specimen. Scale bars = 100 μm

ends, about 1.8:1 flattened laterally. Each side of the test has big umbilical plug, about eleven to thirteen chambers in the final whorl. Sutures slightly incised and gently curved, ponticuli not clear. Periphery distinctly carinate, bordered in margin.

Wall calcareous, surface with many tiny ring-like grooves, several pustules in the umbilical plug area. Aperture interiomarginal.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H75 Holotype	615	563	295
H75 Paratype-01	646	543	300
H75 Paratype-02	427	393	230
H75 Paratype-03	401	370	208
H75 Paratype-04	317	278	161
H75 Paratype-05	451	406	213

Etymology

Named in honor of Professor Dr. Zhimin Jian (School of Ocean and Earth Science, Tongji University, China), who has made an outstanding contribution in paleoceanography field and training young scientist in China.

Type Material

Holotype (IOCA H75 Holotype) and two paratypes (IOCAS H75 Paratype-01; IOCAS H75 Paratype-02) are lodged in the Marine Biological Museum of Chinese Academy of Sciences (MBMCAS). In addition, 3 paratypes are lodged in the Department of Marine Organism Taxonomy & Phylogeny, Institute of Oceanology, Chinese Academy of Sciences (IOCAS).

Type Locality

The Yellow Sea (St 3300-04, St 3400-06) and the Jiaozhou Bay (St A3, St B2, St C1, St C4, St D7) (33°00′–36°00′ N, 120°10′–123°00′ E), water depth 4.40–67.80 m, temperature 12.00–20.00 °C, salinity 30.77–31.91 ‰, abundance 0.17–0.24 ind./g sed.

Distribution

Yellow Sea.

Description

Size large, about 480 μm in length, length:width ratio about 1.1:1. Test planispirally enrolled, with rather thin and carinate margin, lateral view fusiform with tapered ends, about 1.8:1 flattened laterally. Each side of the test has big umbilical plug, about eleven to thirteen chambers in the final whorl. Sutures slightly incised and gently curved, ponticuli not clear. Periphery distinctly carinate, bordered in margin. Wall calcareous, optically radial, surface with many tiny ring-like grooves, several pustules in the umbilical plug area. Aperture interiomarginal.

Remarks

Till now, more than 50 valid species existed within the Genus *Elphidium* (Hayward et al., 2015). *Elphidium jiani* differs from most of the congeners by having a rather thin and carinate test margin, a carinate and bordered periphery, and bearing

ring-like grooves in test surface. In addition, *E. jiani* is rather easily identifiable by its large size, usually up to 600 μm.

At first glance, the general morphology of *E. jiani* resembles *E. hispidulum* in having ring-like grooves in the test surface. However, the later species is distinctly smaller in size (on average 480 vs. 320 μm), in addition, the later species does not have thin, very carinate and bordered test margin, therefore their lateral views were quite different (fusiform with tapered ends vs. elliptical).

In the Yellow Sea, *E. jiani* distributed in sediments from the Jiaozhou Bay to continental shelf stations with low abundance, water depth 4.40–67.80 m.

Elphidium limpidum **Ho, Hu & Wang, 1965** (Fig. 90)

Elphidium ibericum (Schrodt) *limpidum* Ho, Hu & Wang, 1965, He et al., 1965, p. 129, pl. XVI, Fig. 7a, b.

Elphidium limpidum Ho, Hu & Wang, Wang et al., 1988, p. 170, pl. XXVIII, Figs. 14–16.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
H1=B10-01	320	282	130
H1=B10-02	342	286	135
H1=B10-03	397	350	150

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St 3400-05, St 3500-02, St 3600-02, St 3600-04, St 3700-01, St B-06), the Jiaozhou Bay (St B2, St C1, St A3, St D3, St C4, St A5, St D7, St C3, St D6) and intertidal flat of the Qingdao Bay (31°39′–39°00′ N, 119° 30′–122°59′ E), water depth 0.00–44.00 m, temperature 1.50–26.50 °C, salinity 30.11–38.00 ‰, abundance 0.04–7.60 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, East China Sea.

Description

Size about 350 μm in length, length:width ratio about 1.2:1. Test planispirally enrolled, lateral view somewhat fusiform, about 2.2:1 flattened laterally. Each side of the test has a flat umbilical plug, about ten chambers in the final whorl. Sutures nearly radial to gently curved, slightly depressed. Ponticuli present but small. Periphery rounded to slightly petaloid, outline smooth. Wall calcareous, optically radial, fine and transparent, surface smooth except for the sutures and the umbilical plug region. Apertural interiomarginal multiple pores.

Remarks

Elphidium limpidum has been established as a subspecies *Elphidium ibericum limpidum* Ho, Hu & Wang, 1965 by He et al. (1965). This species was discovered

Elphidium limpidum Ho, Hu & Wang, 1965

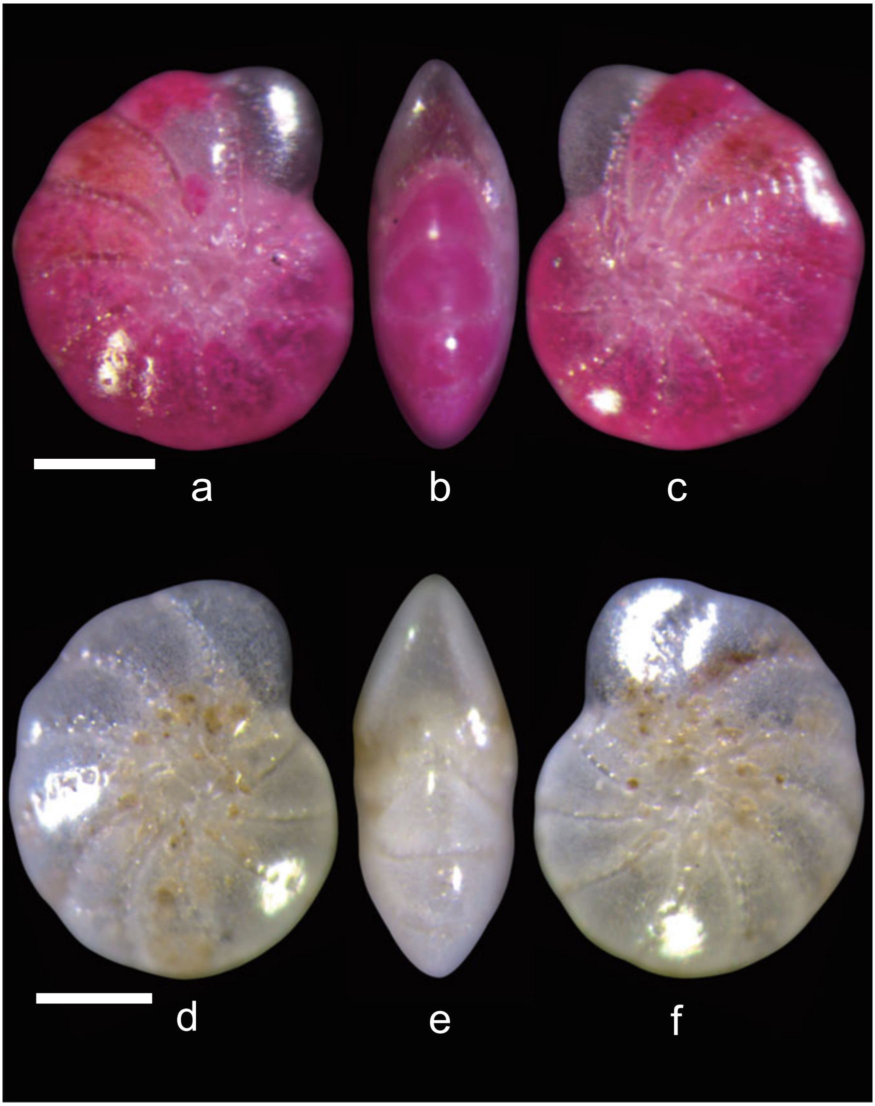

Fig. 90 **a–f** *Elphidium limpidum* Ho, Hu & Wang, 1965, two specimens showing morphological variabilities. **a–c** A live specimen. **d–f** A fossil specimen. Scale bars = 100 μm

from Quaternary sediment of the South Yellow Sea. It was also found from modern sediments in inner continental shelf of the East China Sea (Wang et al., 1988). This species is characterized by having a flat umbilical area and small ponticuli. It is a common species in the Yellow Sea occurring from intertidal flat to continental shelf sediments, water depth 0–44 m.

***Elphidium macellum* (Fichtel & Moll, 1798)** (Fig. 91)

Nautilus macellum, Fichtel & Moll, 1798, p. 66, pl. 10, Figs. e–g.
Nautilus macellus var. beta Fichtel & Moll, 1798, p. 66, pl. 5, Figs. h, i, k.

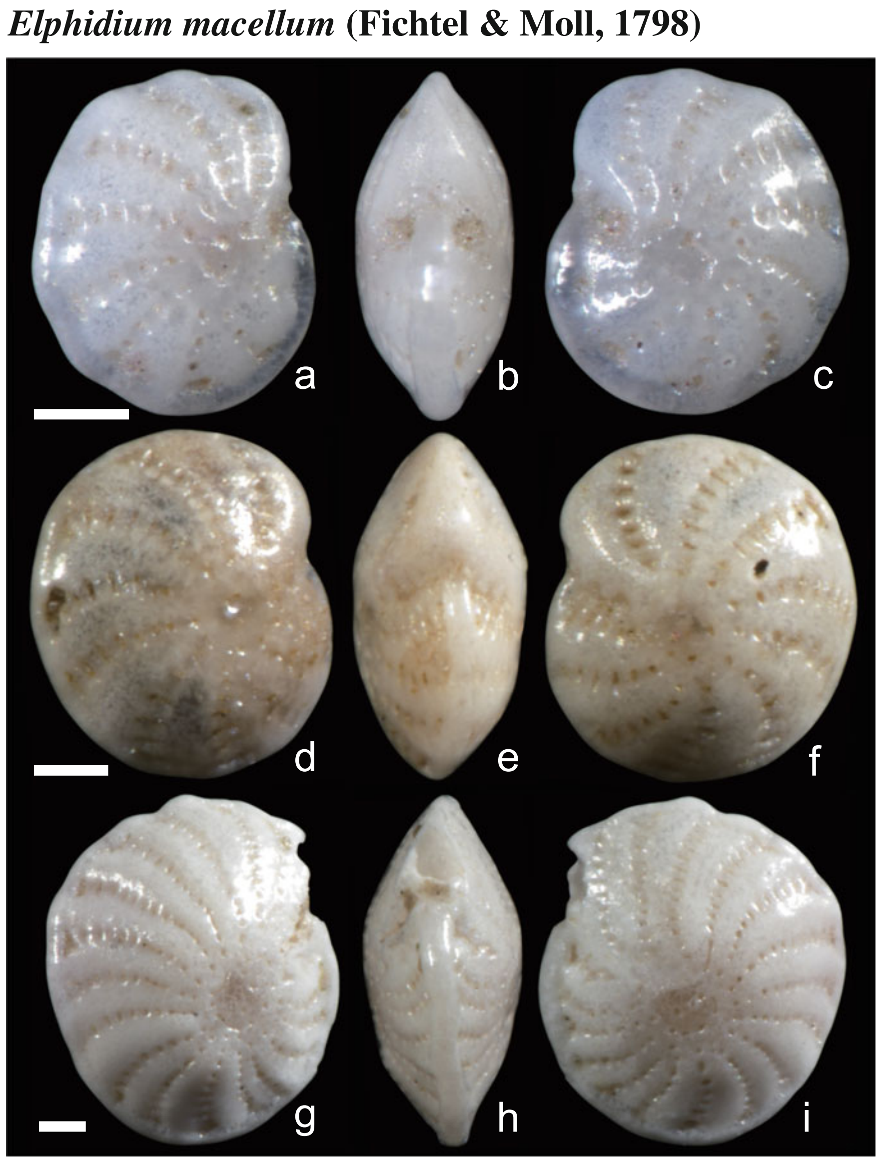

Fig. 91 **a–i** *Elphidium macellum* (Fichtel & Moll, 1798), three specimens showing morphological variabilities. **a–c** Same specimen. **d–f** Another specimen. **g–i** The third specimen. Scale bars = 100 μm

?*Nautilus strigilatus* var. alpha Fichtel & Moll, 1798, p. 49, pl. 5, Figs. c–e.

Nautilus strigilatus var. beta Fichtel & Moll, 1798, p. 50, pl. 5, Figs. f–g.

Vorticialis marginata Lamarck, 1816, p. 14, pl. 470, Fig. 3a–b.

Polystomella macella (Fichtel & Moll), Brady, 1884, p. 737, pl. 110, Figs. 8, 11 (not Figs. 9–10).

Elphidium macellum (Fichtel & Moll), Barker, 1960, p. 109, pl. 110, Figs. 8, 11; Zheng et al., 1978, p. 224, pl. XXVIII, Fig. 4a–b; Loeblich & Tappan, 1987, p. 674, pl. 786, Figs. 6–7; pl. 789, Figs. 1–5; Rögl & Hansen, 1984, p. 39, pl. 9, Figs. 3–4, text Fig. 12; Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988, p. 197, pl. 20, Fig. 2; Hayward et al., 1997, p. 84, pl. 13, Figs. 9, 10; Jones, 1994, p. 109, pl. 110, Figs. 8, 11; Debenay, 2012, p. 220; Holbourn et al., 2013, p. 238; Panchang & Nigam, 2014, p. 40, pl. XXXVIII, Fig. 10.

Measurement

Specimens	Body length (μm)	Body width (μm)	Body thickness (μm)
D46-01	370	303	162
D46-02	467	400	238
D46-03	735	613	333
D46-04	373	352	180
D46-05	377	366	205

Occurrence and Ecology

The Bohai Sea (St 26, St A8, St 6, St 19, St 11, St 36, St 22, St 14, St 31), the Yellow Sea (St CJ-01, St CJ-02, St CJ-04, St CJ-06, St 3300-04, St 3400-05, St 3400-06, St 3400-08, St 3500-02, St 3500-06, St 3600-02, St 3600-04, St 3600-06, St 3700-01, St 3875-01, St B-06) and intertidal flat of the Qingdao Bay (31°39′–38° 44′ N, 120°00′–125°00′ E), water depth 0.00–80.00 m, temperature 1.50–26.50 °C, salinity 30.11–38.00 ‰, abundance 0.07–6.19 ind./g sed.

Distribution

Bohai Sea, Yellow Sea, Okinawa Trough.

Bay of Biscay, Japan, South Korea, South Pacific Ocean, New Caledonia, Mediterranean Sea, North Atlantic Ocean.

Description

Size about 460 μm in length, length:width ratio about 1.1:1. Test planispirally enrolled, lateral view somewhat fusiform, about 1.8:1 flattened laterally. Each side of the test has umbilical plug, about 10–17 chambers in the final whorl. Sutures deeply incised and gently curved, externally ponticuli span the sutures. Periphery somewhat carinate to rounded, bordered. Wall calcareous, optically radial, surface with ridges along sutures. Apertural not clear.

Remarks

Elphidium macellum has been reported from the Okinawa Trough (Research Party of Marine Geology, Ministry of Geology and Mineral Resources & Chinese University of Geosciences (Beijing), 1988). The test morphology of this species is rather variable. It is a common and abundant species occurring from intertidal flat to continental shelf sediments in the Yellow Sea, water depth 0–80 m.

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