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**

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**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

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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; Pfleger, 1964b, pl. 1, Fig. 6; Hofker, 1969, p. 14, Figs. 4–9; Bock, 1971, p. 6, pl. 1, Fig. 11; Lankford & Pfleger, 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

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### 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

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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**

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**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.
**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.

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*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

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**Family Haplophragmoididae Maync, 1952**
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

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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.

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**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), Höglund, 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; Voorhuyssen, 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; 1995, p. 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**

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**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 whors, 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**

*Ammoscalararia 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.

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**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**

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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°

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°
Family Lituolidae de Blainville, 1827 29

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.

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**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.


**Measurement**

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**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**

*Textularia 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**

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**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.
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

**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
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**

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**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

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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 polymorphone 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**

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**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

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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 \(\mu\)m
**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.

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**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**

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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

**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

*Trochammina squamata* Jones & Parker, 1860
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 flattened 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**

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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

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**Arenoparrella asiatica** Polski, 1959

![Image showing morphological variabilities of Arenoparrella asiatica](image)

**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.
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

*Arenoparrella asiatica* Polski, 1959

Order Textulariida Delage et Hérouard, 1896
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**

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**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 indistinct. Wall agglutinated with fine quartz grains. Aperture distintic interiomarginal arch.
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.*

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
*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. 1, 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.


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

**Measurement**

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**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)

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.

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
**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; McLaughlin & Gupta, 1994, p. 86, pl. 1, 4.

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

**Measurement**

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**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.


*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**

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**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)

*Siphotententulium 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

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#### 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,
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.

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
**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. 1, Fig. 7.

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


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

**Measurement**

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**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**


**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**

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<tr>
<td>H42-01</td>
<td>304</td>
<td>156</td>
<td>87</td>
</tr>
<tr>
<td>H42-02</td>
<td>380</td>
<td>185</td>
<td>143</td>
</tr>
</tbody>
</table>

**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 & Ujiie, 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.
Textularia foliacea

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.

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.

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

**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.

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

*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
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.


Measurement

<table>
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<th>Specimens</th>
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<th>Body width (µm)</th>
<th>Body thickness (µm)</th>
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<td>166</td>
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<tr>
<td>H61-02</td>
<td>348</td>
<td>477</td>
<td>313</td>
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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)

*Siphotextularia wairoana* Finlay, 1939

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 \(\mu m\)
*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**

<table>
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<td>B96=D89-01</td>
<td>266</td>
<td>192</td>
<td>125</td>
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</table>

**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**


**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, 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**

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</tr>
<tr>
<td>D40-02</td>
<td>797</td>
<td>280</td>
<td>280</td>
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</tbody>
</table>
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

<table>
<thead>
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<th>Specimens</th>
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<th>Body thickness (μm)</th>
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<tr>
<td>H161-01</td>
<td>772</td>
<td>439</td>
<td>335</td>
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</tbody>
</table>

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)

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

<table>
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<th>Specimens</th>
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<td>H159-01</td>
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<td>443</td>
<td>325</td>
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<tr>
<td>H159-02</td>
<td>771</td>
<td>413</td>
<td>313</td>
</tr>
</tbody>
</table>

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 *Caudryina (Pseudogaudryina) atlantica* (Bailey) var. *pacific* 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

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**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](image-url)
**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

<table>
<thead>
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<th>Specimens</th>
<th>Body length (µm)</th>
<th>Body width (µm)</th>
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<tr>
<td>D10=B74 Holotype</td>
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<td>168</td>
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<tr>
<td>D10=B74 Paratype-01</td>
<td>418</td>
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<td>257</td>
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<tr>
<td>D10=B74 Paratype-02</td>
<td>355</td>
<td>241</td>
<td>211</td>
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<tr>
<td>D10=B74 Paratype-03</td>
<td>257</td>
<td>206</td>
<td>183</td>
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<tr>
<td>D10=B74 Paratype-04</td>
<td>261</td>
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<td>195</td>
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</tbody>
</table>

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)

*Pseudogaudryina wangi* nov. spec.

![Pseudogaudryina wangi](image)

**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

<table>
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<th>Specimens</th>
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<tr>
<td>H22 Paratype-01</td>
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<td>H22 Paratype-02</td>
<td>713</td>
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<td>300</td>
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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

<table>
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<th>Specimens</th>
<th>Body length (µm)</th>
<th>Body width (µm)</th>
<th>Body thickness (µm)</th>
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<tr>
<td>H158 Holotype</td>
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<td>H158 Paratype-01</td>
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<td>H158 Paratype-05</td>
<td>742</td>
<td>496</td>
<td>496</td>
</tr>
</tbody>
</table>

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 huanghaisis 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. huanghaisis 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.
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The Bohai Sea and the Yellow Sea
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