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著者	Akimoto Kazumi
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Kazumi Akimoto

ABSTRACT

The distribution of benthic foraminifera in the Northwest Pacific Ocean off the coast of southwest Japan is investigated in order to establish a tool for analyzing paleoenvironments of Miocene strata over the Japanese Islands.

In this study, four areas of the Pacific are investigated; these are Tanegashima, Kumanonada, Enshunada, and Hachijojima areas, and are located in those oceanic regions which are currently under the influence of Kuroshio Current.

The method of Q-mode cluster analysis is applied to the foraminiferal distribution in each area in order to categorize foraminiferal assemblages characteristic of these four areas.

The results obtained are as follows:

1) The Tanegashima and Kumanonada areas each have eight types of benthic foraminiferal assemblages, whereas the Enshunada has five. Six types of assemblages also characterize the Hachijojima area.

2) The distribution of these assemblages is basically controlled by the oceanographic condition of water masses overlying each area.

3) The distribution of 13 species, which are familiar elements among the Miocene foraminiferal fauna of the South Fossa Magna region, is delineated.

Key words: benthic foraminifera, Recent, Pacific, Japan, distribution

CONTENTS

INTRODUCTION

This study intends to establish faunal assemblages and relate their distribution with various environments in order to obtain basic data for zonation and paleoenvironmental analysis by means of fossil benthic foraminifera.

Investigations were made in four areas under the influence of the Kuroshio Current: off Enshunada (EN), off Kumanonada (KU), off Tanegashima Island (TA), and around Hachijojima Island (HA) (Fig. 1). Systematic research has been hitherto made by three workers. Ishiwada (1964) first studied Recent benthic foraminifera around Japan including Tosa Bay. Aoshima

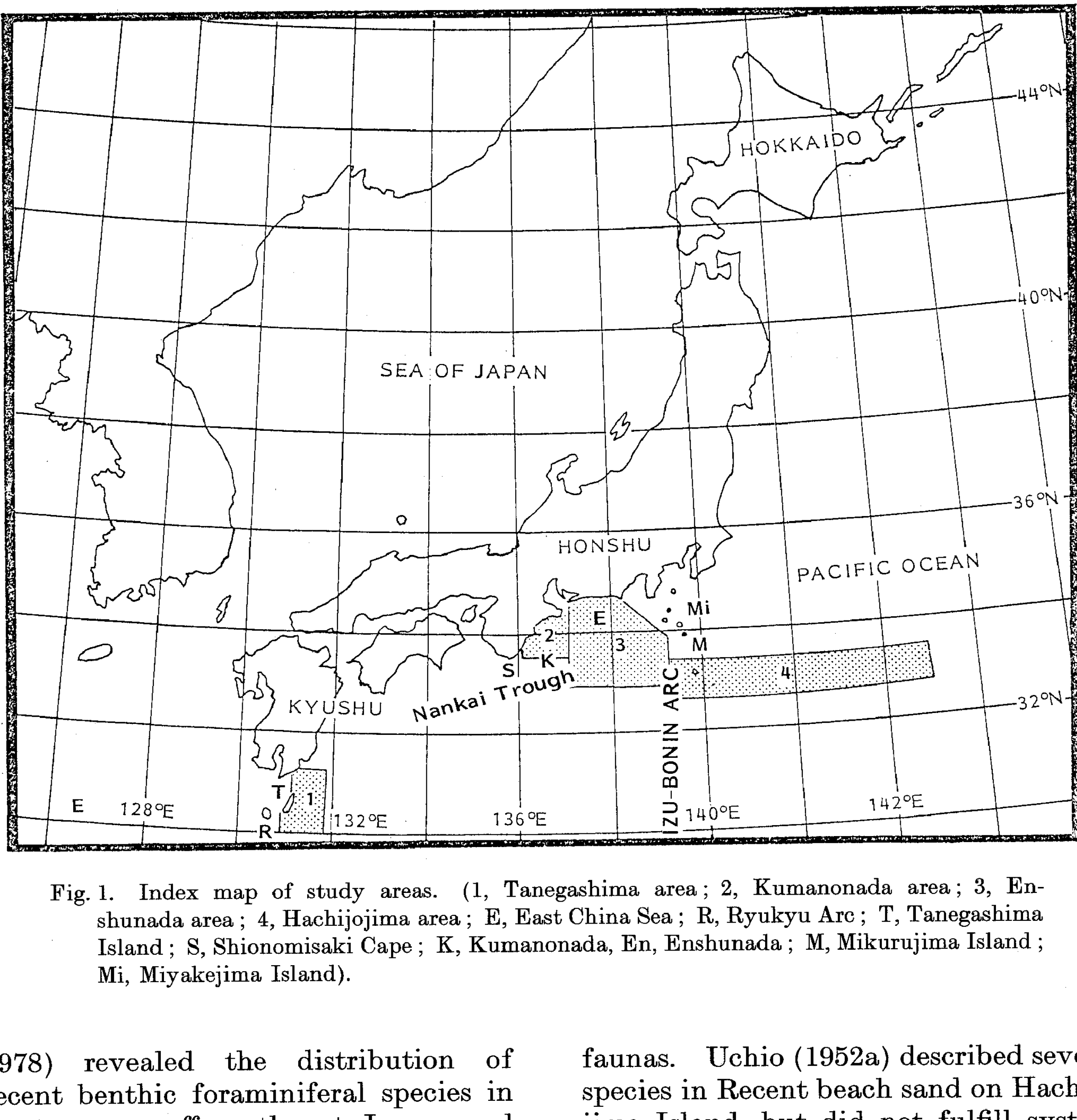

Fig. 1. Index map of study areas. (1, Tanegashima area; 2, Kumanonada area; 3, Enshunada area; 4, Hachijojima area; E, East China Sea; R, Ryukyu Arc; T, Tanegashima Island; S, Shionomisaki Cape; K, Kumanonada, En, Enshunada; M, Mikurujima Island; Mi, Miyakejima Island).

(1978) revealed the distribution of Recent benthic foraminiferal species in five traverses off southwest Japan, and recognized four assemblages on the basis of their depth range. Inoue (1986) reported 11 benthic foraminiferal assemblages at depths from 40 m to 2,000 m in Suruga Bay. Those previous studies, dealing with material taken from up to the middle bathyal zone, do not provide an enough basis for analysis of bathyal faunas. Uchio (1952a) described several species in Recent beach sand on Hachijojima Island, but did not fulfill systematic studies in a traverse. Therefore, it is necessary to make clear the distribution of Recent benthic foraminiferal assemblages in traverses across the Izu-Mariana Arc and southwest Japan for performing a paleoenvironmental study in the South Fossa Magna region.

ACKNOWLEDGEMENTS

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Samples used in this study were provided from the collections of the Ocean Research Institute of the University of Tokyo and the Geological Survey of Japan.

Cluster analysis was processed with NEAC-ACOS Model 77/700 computer in the Tohoku University Computer Center.

METHOD OF STUDY

Field work

Sediment samples were collected at 25 stations in the Tanegashima area (Fig. 2), 14 in the Kumanonada area (Fig. 3), 16 in the Enshunada area (Fig. 4), and 18 in the Hachijojima area (Fig. 5). All samples were taken by various gears such as grab sampler, including Smith-McIntyre sampler piston corer and dredger. The examined samples represent the uppermost 2 cm of collected sediment columns except dredged one. In the Tanegashima, Enshunada (mostly KT sample series), and Hachijojima areas (KT sample series), an approximately 5% solution of neutralized formalin was used. A small amount of sodium carbonate was added to each sample to maintain alkalinity.

Laboratory work

All the samples were washed over a screen with an average opening of 0.063 mm (250-mesh) and rose Bengal stained to detect living specimens (Walton, 1952). The rose Bengal solution was prepared after Matoba (1970).

Kuwano (1956) verified the validity of the rose Bengal staining method, and clarified relations among the concentration of the rose Bengal solution, the time required for staining and conditions of stained specimens. For counting living specimens, he proposed to use a dry method instead of Walton's wet method. After staining, the sediment samples were dried before counting living specimens. Although there may be difficulties and errors in distinguishing between living and dead specimens, dried samples are more handy.

The dried sample was divided by a splitter into aliquot parts of workable size from which approximately 200 specimens of both living and dead benthic foraminifera were counted. All the specimens including planktonic foraminifera were picked from the split-part and counted.

SUBMARINE TOPOGRAPHY

1. Tanegashima area

Figure 2 shows submarine topography in this area. This figure delineates that the continental shelf is widely distributed, extending 30–50 km eastward in the north, but narrow off the southern part of Tanegashima Island. The continental slope develops off the eastern coast of Tanegashima Island, and extends to the Nankai Trough in the east. There are small continental breaks on the slope. Two channel systems such as the Nakatane and Minamitane canyons also develop on the continental slope off Tanegashima Island. Their roots are at the shelf edge, and their tips reach to the Nankai Trough. Terrigenous and shallow water sediments have been displaced down to deep areas through those channels. The Osumi Strait is situated between the Osumi Peninsula and Tanegashima Island, and has a maxi-

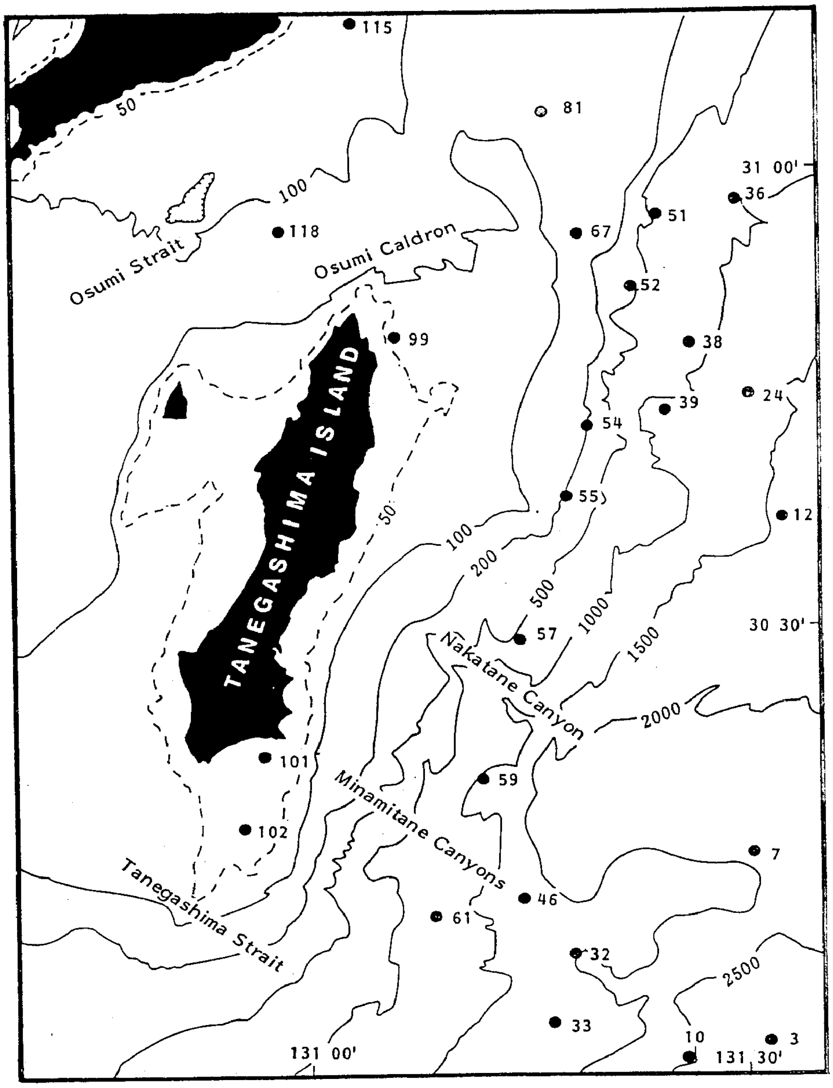


Fig. 2. Stations in the Tanegashima area of foraminiferal samples used in this study. Closed circle, Smith-McIntyre type sampler.

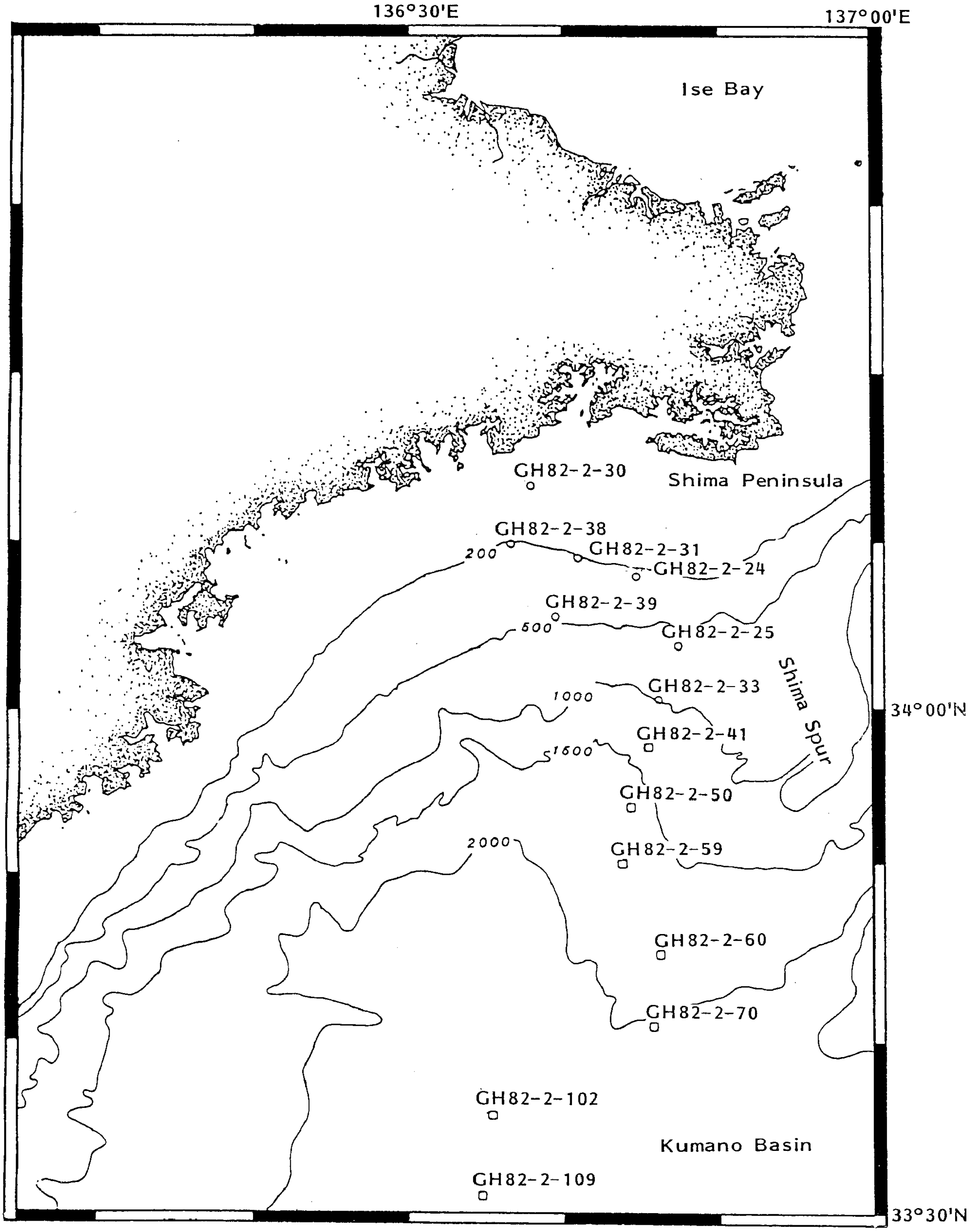


Fig. 3. Stations in the Kumanonada area of foraminiferal samples used in this study. Circle, Smith-McIntyre type sampler ; square, piston corer.

mum depth of about 120 m. The Tanegashima Strait is present in the south off that island.

2. Kumano area

The outline of submarine topography is illustrated in Fig. 3. A remarkable feature is depicted by the Kumano Basin which takes on the character of a forearc basin. This basin extends approximately 100 km in length and about 30 km in width, and its bottom is situated at a depth of about 2,000 m. Thick sediment fills in this basin are revealed on the seismic profiles (GH82-2 Cruise, the Geological Survey of Japan, 1983). The shelf is narrow or absent along the coast between Shima and Owase. The Shima

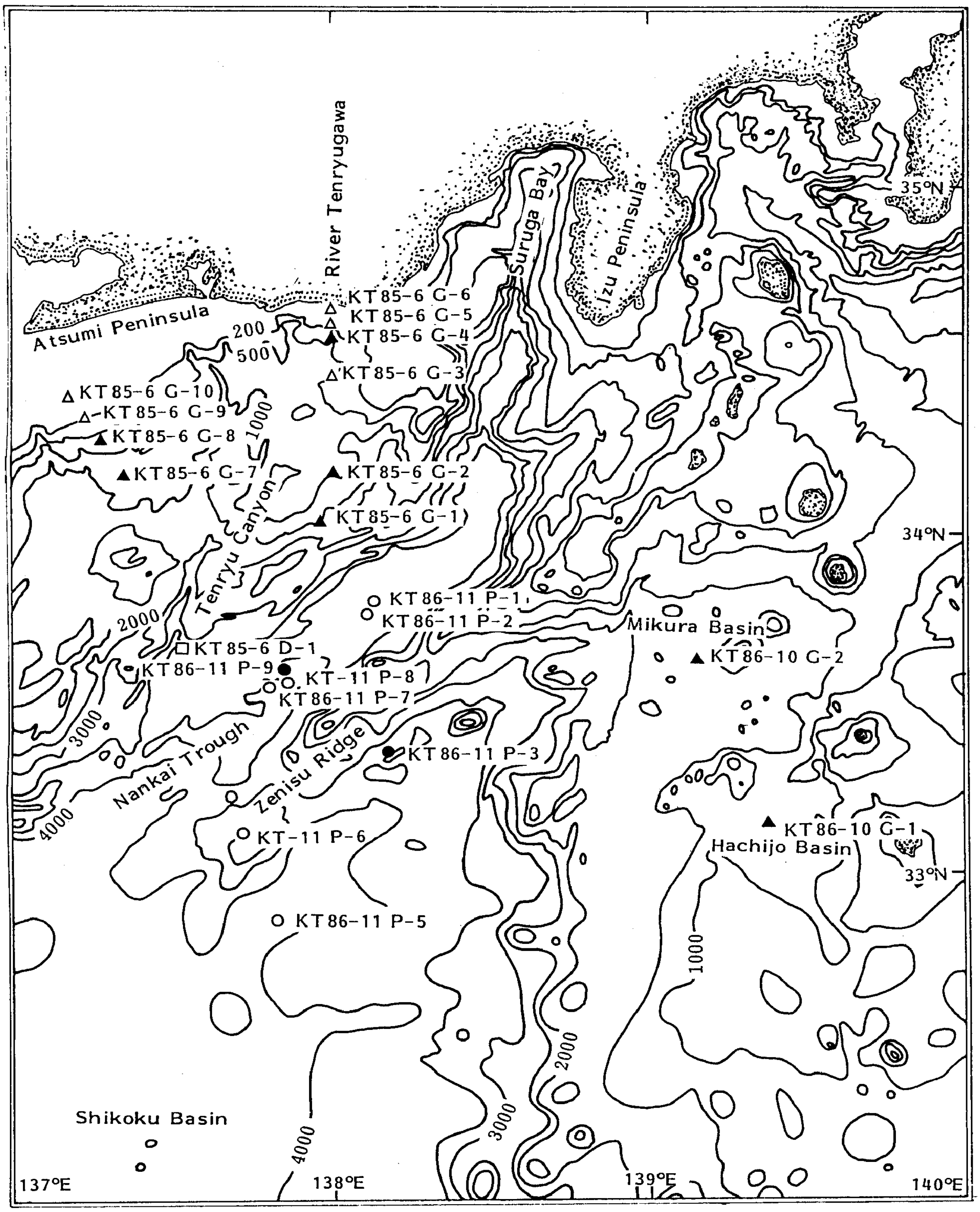


Fig. 4. Stations in the Enshunada area of foraminiferal samples used in this study. Triangle, grab sampler; circle, piston corer; square, dredge; closed mark, material stained.

Spur extends southward from the Shima Peninsula. The ridge deepens southward down to about 1,000 m at its extremity. There are two types of channels as distinguished by their course: one flows directly from its root off the Shima Peninsula into the Kumano Basin; the other runs from the shelf edge off Ise Bay to the Kumano Basin through the foot of the Shima Spur.

3. Enshunada area

The topographic outline of this area is shown in Fig. 4. This figure delineates that the study area is divided into such submarine topography as the Nankai Trough, the Shikoku Basin, and the continental slope. The continental shelf is well developed continuing from the Shima Spur to off west of the River Tenryugawa. The water depth of the shelf edge is between 140 m and 250 m, and the width is between 7 km and 30 km (Nagao *et al.*, 1977). In the western area off the River Tenryugawa, the depth of the shelf edge is deepest and the width is narrowest. The continental shelf is almost obscure along the coast from the River Tenryugawa to east of the Omaezaki Spur. The continental slope off Enshunada corresponds with the inner wall of the Nankai Trough. The slope is divided into the upper and lower slopes by the existence of a forearc basin. Those basins are located along the 2,000 m contour line. A basin in the area around the upper to middle part of the Tenryu Deep Sea Canyon is called the Enshu Trough by Sakurai and Sato (1983). There are nine small submarine canyons on the uppermost continental slope off Enshunada. These submarine canyons meet one another in a small basin at a depth of ca. 1,400 m off Hamamatsu, and come to form the Tenryu Deep Sea Canyon in a downstream direction. The most characteristic topography within the Nankai Trough is the Tenryu Deep Sea Fan. The trough floor is almost flat, with a depth of a little more than 4,000 m in the studied area. The ocean floor is characterized by the Zenisu Ridge and the Shikoku Basin. The Zenisu Ridge is a unique topography, especially from the viewpoint of convergent plate boundary processes (Shimamura, 1988). Although this ridge is located on an outer swell of the Nankai Trough, it attains to relative heights between 1,500 m and 3,000 m. The northern slope of the Zenisu Ridge is smooth, but the southern one is steep (Figs. 4, 27). The Shikoku Basin is wide, and has an average depth of about 4,000 m.

4. Hachijojima area

The Hachijojima Island traverses (A-A′ and B-B′) are located between the Northwest Pacific and the Philippine Sea, and extend from the Izu-Bonin Trench to the Shikoku Basin through near Hachijojima Island across the Shichito Ridge (Fig. 5). The Shinkurose and Kurose Banks are shallow banks on the Shichito Ridge. The summit of the Shinkurose Bank is at about 200 m water depth. A rather large channel extends from near this summit to the Izu-Bonin Trench. The eastern continental slope shows a sharp inflection of inclination, without any slope break. The inflection is recognized on the eastern continental slope at about 5,000 m water depth: below this depth the slope is steeper (Tamaki *et al.*, 1981). A knoll exists at the same depth near GH79-4-D372. This depth corresponds with the boundary of sedimentary rocks: Quaternary sediments lie above and Paleogene-Early Miocene sedimentary rocks below (Yuasa *et al.*, 1982).

The Izu-Bonin Trench has a north-south trend, and attains to water depths of more than 9,000 m. The trench axis is shallower to the north of 32°30′N than in the remaining area.

On the contrary, large basins are pres-

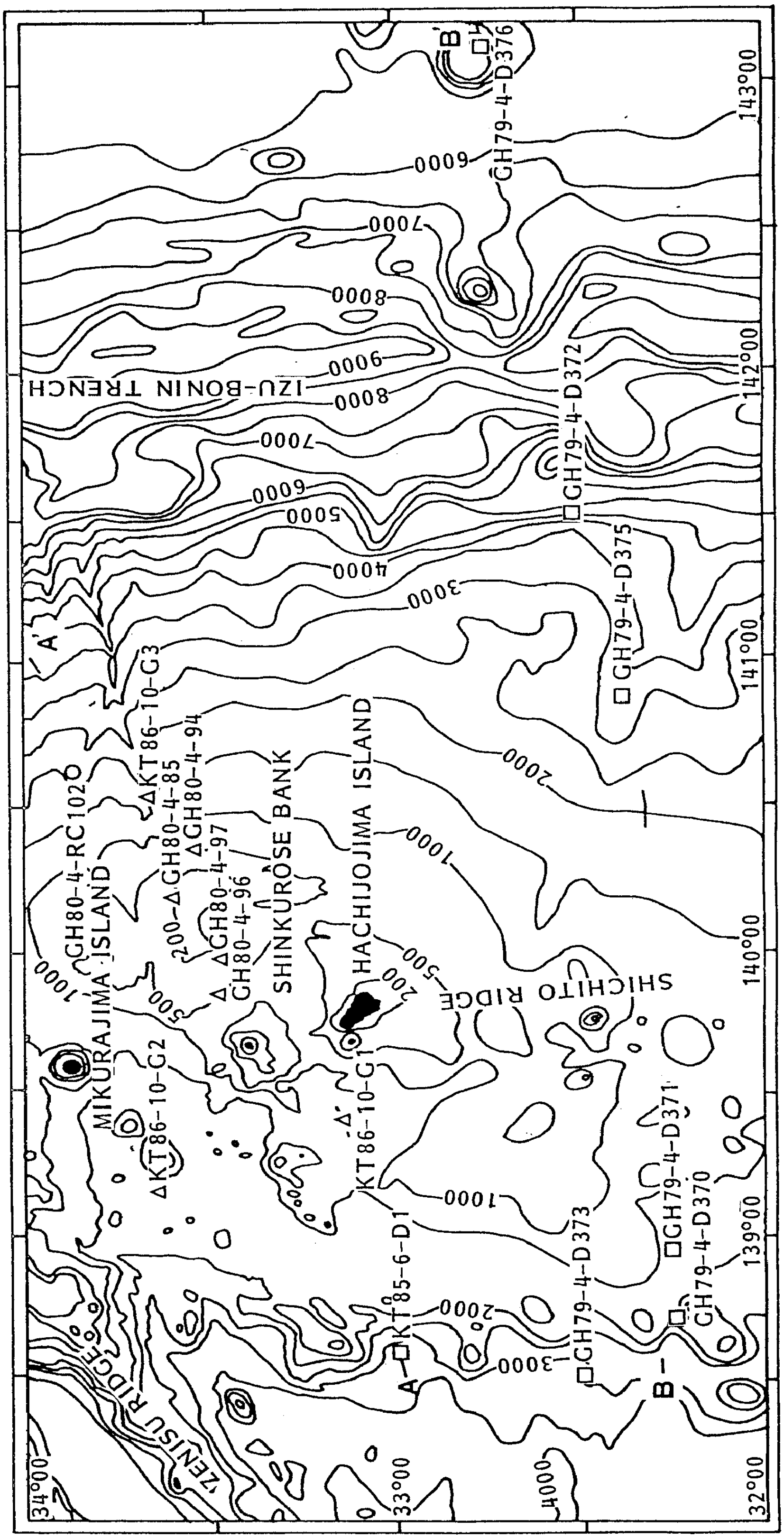


Fig. 5. Stations in the Hachijojima area of foraminiferal samples used in this study. Triangle, grab sampler; square, dredge.

ent in the backarc region of the Izu-Bonin Arc. The Hachijo and Mikura Basins are located on the western slope of the Shichito Ridge. The Mikura Basin is square and extends approximately 100 km in dimension, and its bottom is at about 1,500 m water depth. The Hachijojima Basin is rather small, but the same in shape as the Mikura Basin, and its bottom is located at a depth of 1,000 m. Numerous peaks extend from north to south at about 2,000 m depth where the above-mentioned basins extend southward. The continental slope is steeper between those basins and the Shikoku Basin.

OCEANOGRAPHY

The study area is a portion of the Northwest Pacific off Enshunada, Kumanonada, Tanegashima Island, southwest Japan and around Hachijojima Island on the Izu-Bonin Arc.

The warm Kuroshio Current runs through those areas. The Current flows eastward from the East China Sea to the Pacific across the Ryukyu Arc, around Tanegashima Island. Off Tanegashima Island, this current turns northeastward, and runs along the Japanese coast to Shionomisaki, where it meanders southward (Kuroshio meandering). Consequently, its direction changes to the north and runs along the west side of the Izu-Bonin Arc. Reaching near Mikura Island, this current flows to the east through between this and Miyake islands. On the other hand, the coastal water mass is distributed off Enshunada and Kumanonada.

Illustrated are temperature, salinity, dissolved oxygen, pH, PO_4, SiO_2, NO_2-N, and NO_3-N at Tanegashima Island (Figs. 6, 7), Enshunada (Figs. 8, 9) and Nankai Trough (Fig. 10). Figures 6, 7, 8 and 9 are basic oceanographic data published by the Japan Meteorological Agency. Figure 10 has been constructed on the basis of cruise reports of the *R.V. Bosei II* of Tokai University (Hirota *et al.*, 1986).

1. Tanegashima area

This area lies under the direct influence of the Kuroshio Current and is free from coastal water.

a. Temperature (Fig. 6)

The temperature is constant at the boundary between surface waters and the thermocline, being about 19°C, while surface water (seasonal layer) temperature ranges from 20°C in winter to 27°C in summer. Water temperature rapidly decreases downward from the thermocline, and reaches about 3°C at 1,000 m water depth. The boundary between the thermocline and the underlying deep waters coincides with this depth. The temperature of deep waters is 2°C, being invariable through the water column.

b. Salinity (Fig. 6)

Surface waters have salinities ranging from 33.8‰ in summer to 34.4‰ in winter. Salinities slightly increase downward to 150 m depth. Below this, there is a regular decrease in salinity within the main thermocline down to a little less than 34.3‰ at 800 m depth.

c. Dissolved oxygen (Fig. 6)

Surface waters have an average dissolved oxygen of about 4.9 ml/l in summer. This value regularly decreases downward, and reaches about 1.5 ml/l at 800 m water depth, but slightly increases below 1,000 m. Thus, the upper and lower boundaries of the oxygen minimum zone in this region are at approximately 800 m and 1,000 m water depth, respectively.

d. pH (Fig. 7)

Surface waters have a pH value of 8.4. This value regularly decreases downward to 1,000 m, and is about 7.9 at 1,000 m water depth.

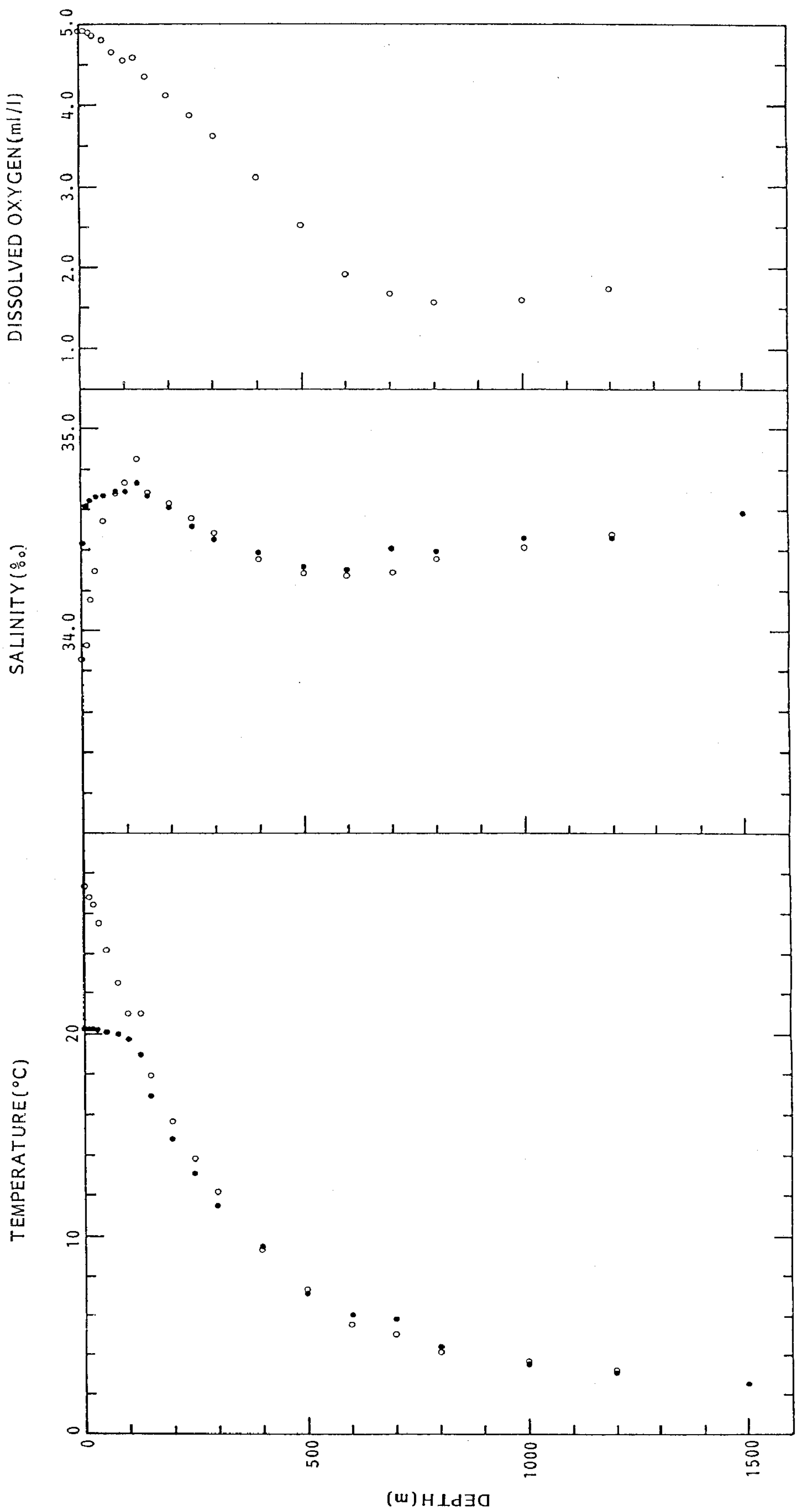


Fig. 6. Vertical distribution of temperature, salinity and dissolved oxygen in the Tanegashima area. (Data from the results of marine meteorological and oceanographical observations, 1906-1981).

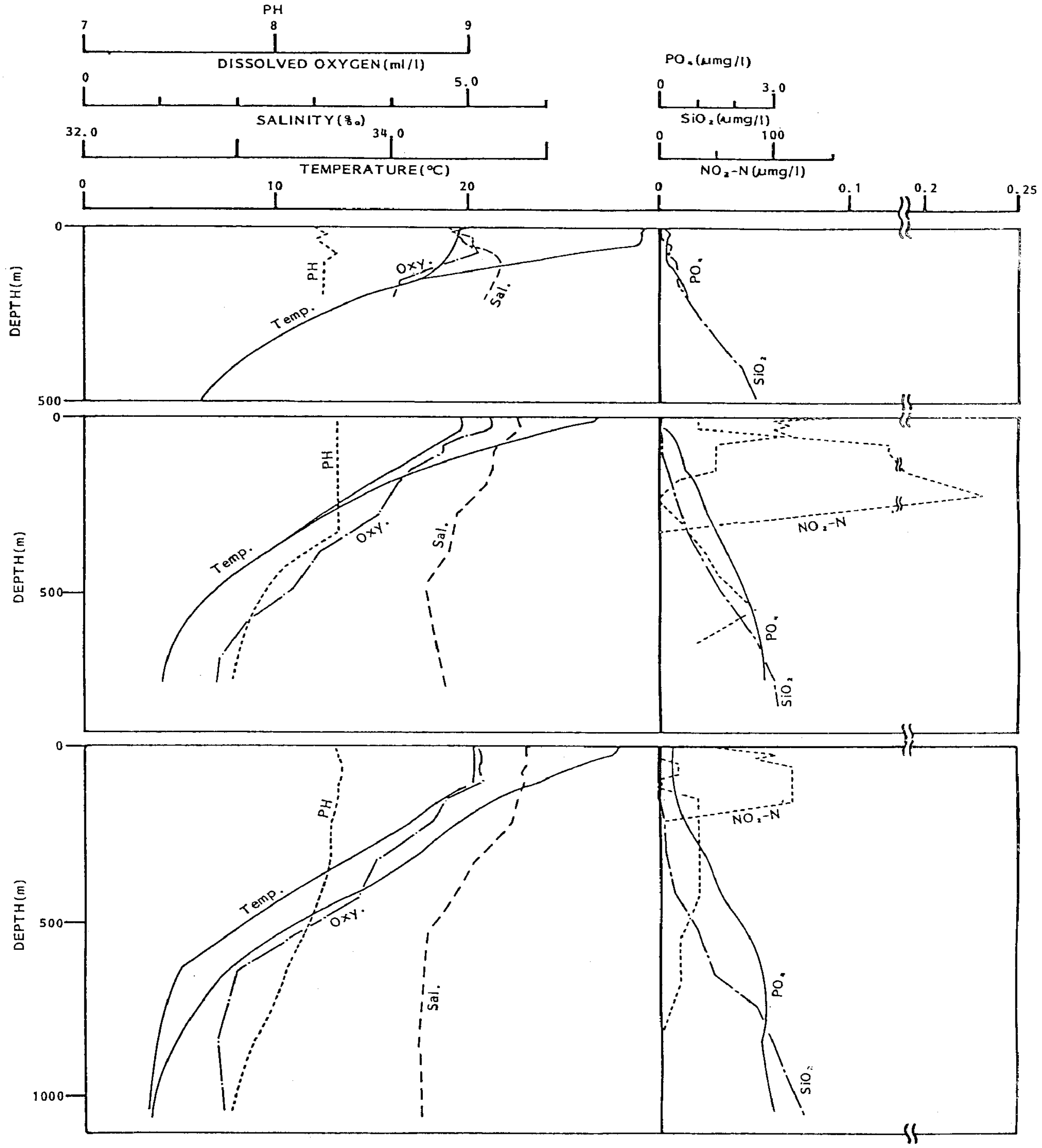


Fig. 7. Vertical distribution of temperature, salinity, dissolved oxygen and nitrogen in the Tanegashima area. (Data from the results of marine meteorological and oceanographical observations, February 14 and August, 1966, and February 9, June 30, July 20 and 30, 1969).

e. Other elements (Fig. 7)

PO_4 is about 0.5 μg/l and regularly increases up to about 2.5 μg/l at 700 m depth. This value at 800 m water depth is a little less than at that depth.

NO_2-N varies with seasons. In summer, the surface water has a maximum NO_2-N value of about 0.08 μg/l below 50 m water depth, which rapidly decreases in the thermocline between 150 m and 200 m. The NO_2-N is absent below 200 m water depth. On the other hand, two characteristics are recognized in winter. The maximum value in winter is 0.025

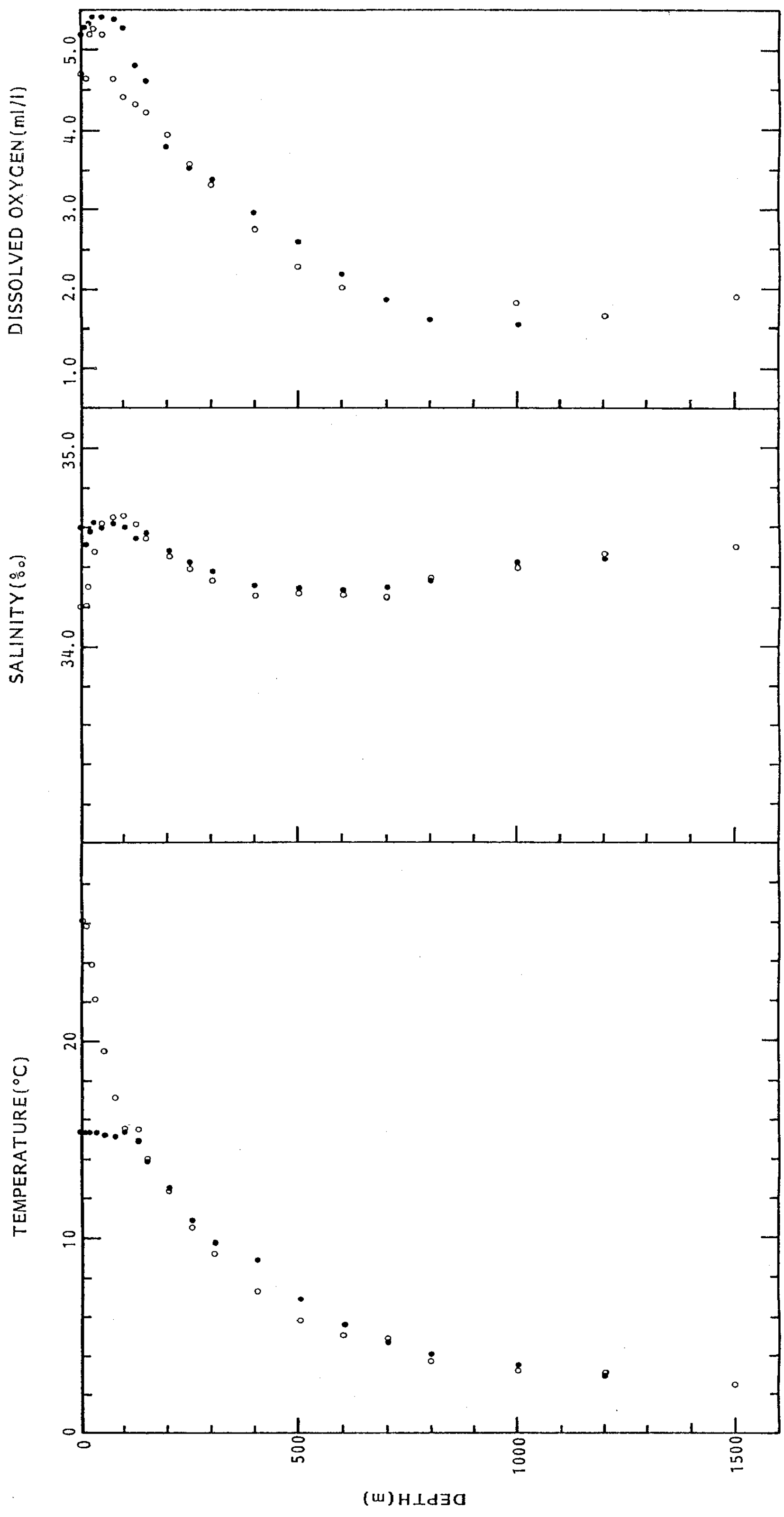


Fig. 8. Vertical distribution of temperature, salinity and dissolved oxygen in the Enshunada area. (Data from the results of marine meteorological and oceanographical observations, 1906-1981).

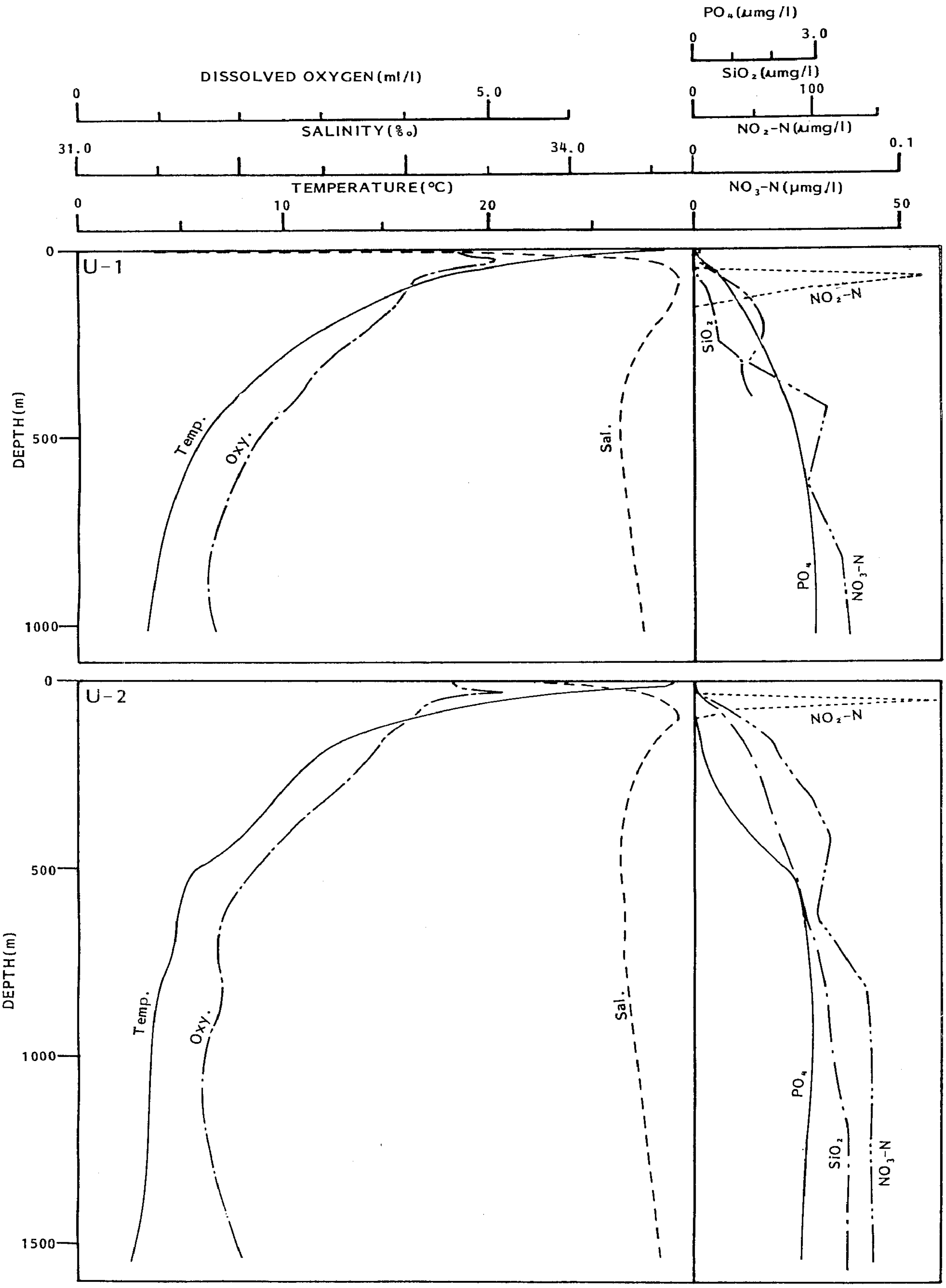


Fig. 9. Vertical distribution of temperature, salinity, dissolved oxygen and nitrogen off Atsumi. (Data from the results of marine meteorological and oceanographical observations, August 3, 1967 and July 31, 1969).

μg/l at 150 m depth ; in winter, NO_2-N is recognizable in a deeper portion of the water column, extending down to 800 m water depth, but its maximum value is confined to the upper part of the thermocline.

SiO_2 is a little in surface waters. This value slightly increases between 100 m and 400 m, and rapidly increases below 400 m water depth.

2. Enshunada area

The coastal water mass is largely distributed in this and the Kumanonada areas. A great volume of fresh water and terrigenous materials flow into Enshunada from the mouth of the River Tenryugawa. Figure 8 shows hydrographic features in the Enshunada area, and Figure 9 illustrates those at two observation points (U-1, U-2) off the Atsumi Peninsula, as constructed on the basis of oceanographic data published in 1971 by the Japan Meteorological Agency. U-1 (137°30′E, 34°19′N) is located more landward than U-2 (137°27′E, 33°59′N).

a. Temperature (Fig. 8)

The temperature range between winter and summer affects only the upper layer of water above approximately 150 m depth. The average temperature is about 27°C in summer and 18°C in winter. The main thermocline extends to 1,000 m depth, where temperature is approximately 3°C. Deep water slightly decreases in temperature with water depth.

b. Salinity (Figs. 8, 9)

Figure 8 shows surface salinities ranging from 34.2‰ to about more than 34.7 ‰, and a marked increase of salinity with depth. The main thermocline has minimum salinity values of less than 34.3‰ at about 600 m depth. The measured salinities are comparable between U-1 and U-2 (Fig. 9). Surface salinities at U-1 are lower than U-2. Considering locations of two points, it is apparent that a considerable amount of runoff freshens coastal marine water in this region.

c. Dissolved oxygen (Fig. 8)

Surface waters have a dissolved oxygen of about 4.8 ml/l, which slightly increases downward up to 5.0 ml/l at 50 m depth. Below this depth, there is a regular decrease in dissolved oxygen within the main thermocline down to a little less than 1.9 ml/l at 900 m depth. This value slightly increases again below 1,200 m. The oxygen minimum zone in this region is approximately between 900 m and 1,200 m water depth.

d. Other elements (Fig. 9)

PO_4 differs between two observation points. At U-1, PO_4 is a little at the surface, and increases downward. On the other hand, it is absent in surface waters, and rapidly increases between 100 and 500 m water depth at U-2. At this point, the maximum value is approximately 2.8 μg/l at about 1,000 m water depth, which slightly decreases with water depth.

The presence of NO_2-N slightly differs between the two points. At U-1, the maximum value is 0.12 μg/l at 100 m water depth. NO_2-N is entirely absent at about 200 m water depth. The maximum value at U-2 is 0.13 μg/l at 50 m and the lowest extant value is situated at about 100 m.

NO_3-N increases downward within the water column in this area, but the minimum values were recognized at 300 m and 600 m at U-1, and at 600 m at U-2.

SiO_2 is a little in surface waters. This value regularly increases with water depth.

3. Nankai Trough

Hydrographic observations during October 22–28, 1960 are shown in Fig. 10.

a. Temperature

The upper boundary of the main thermocline in this region is at approximately 100 m to 120 m water depth. However, there is no adequate information on

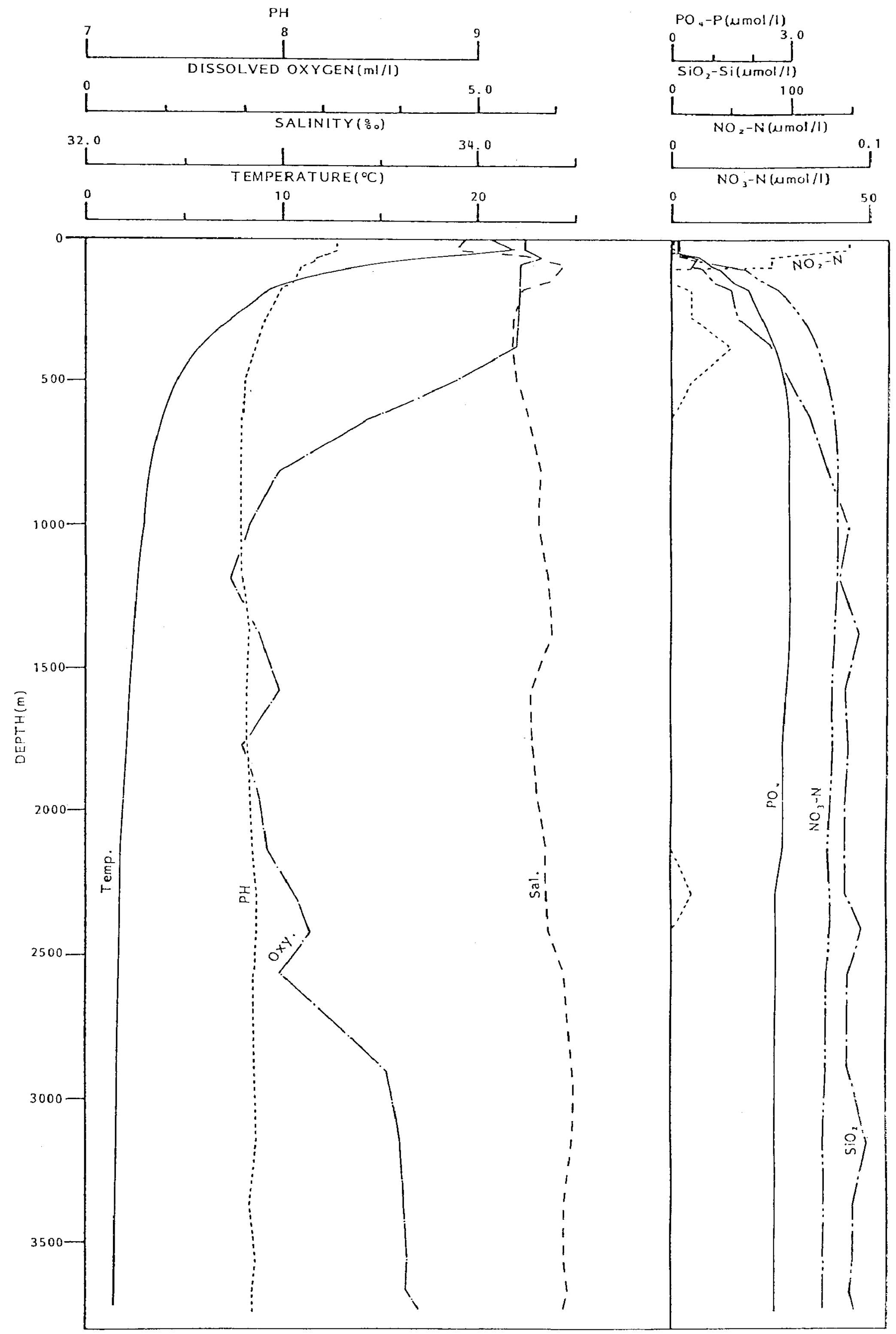


Fig. 10. Vertical distribution of temperature, salinity, dissolved oxygen, pH and nitrogen in Nankai Trough. (Data from the *Bosei II* of Tokai University, October 22-28, 1960).

vertical temperature distribution in this area through years. Thus, seasonal and annual variations of surface water temperature are unknown. The thermocline extends down to 800–1,000 m depth, with the sharpest decline between 100 m and 250 m. The water below 1,000 m is approximately 2°C, and there may be a slight decrease in temperature with water depth.

b. Salinity

Surface waters have a salinity of about 33.9‰ at the surface, which slightly increases downward to 150 m depth.

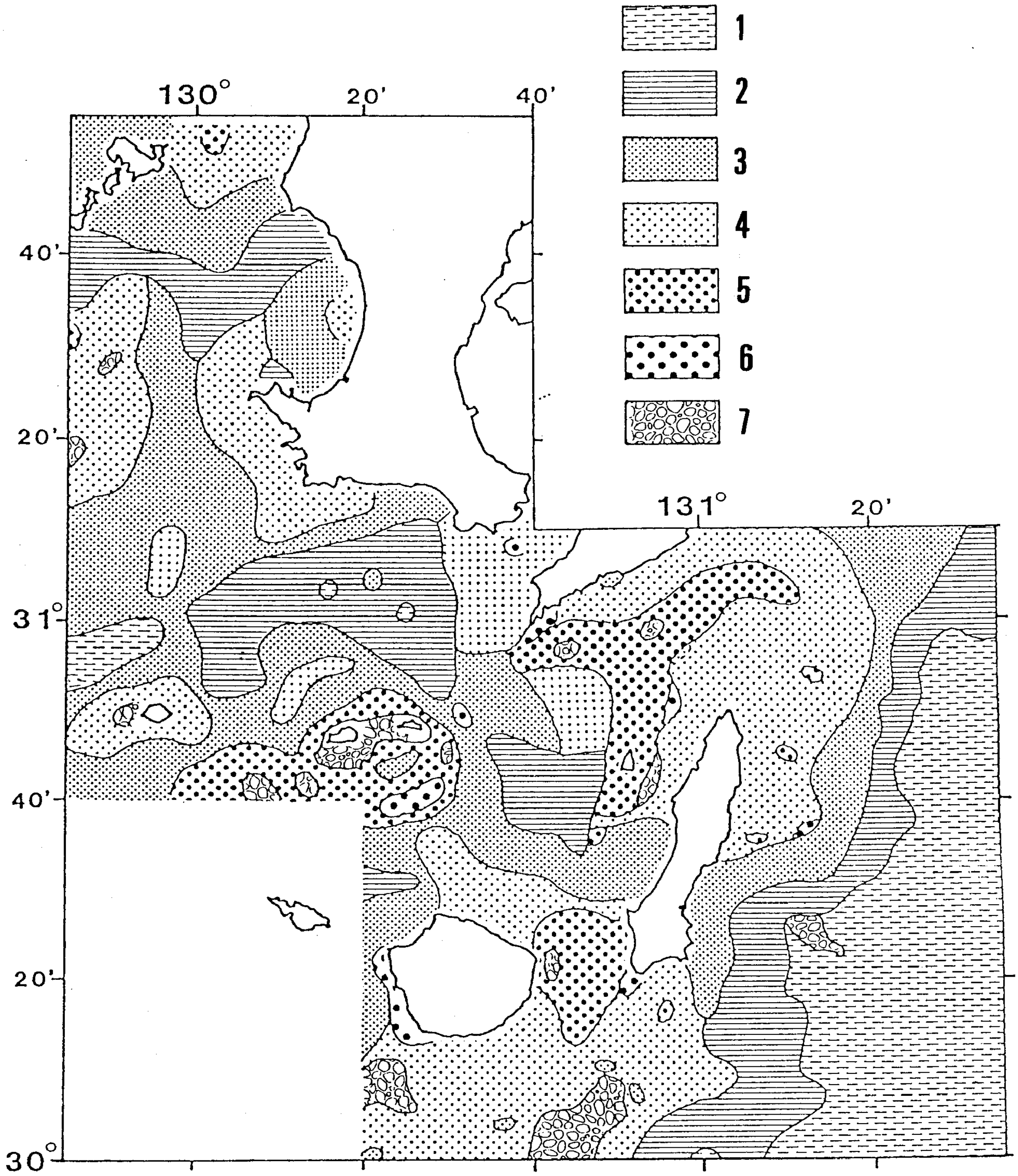


Fig. 11. Distribution of bottom materials around Tanegashima Island. 1, silt; 2, very fine sand; 3, fine sand; 4, medium sand; 5, coarse sand; 6, very coarse sand; 7, gravels or rocks. (after Ikehara, 1985).

The underlying water has a rather constant salinity which ranges from 34.3‰ to 34.4‰ below 200 m depth.

c. Dissolved oxygen

Surface waters have a dissolved oxygen of about 5.6 ml/l at the surface, which is nearly constant down to 250 m water depth. This value regularly decreases downward in the water column, reaching about 1.85 ml/l at 1,200 m water depth, and rapidly increases below 2,500 m, reaching 3.83 ml/l at about 3,000 m water depth. Below 3,000 m water depth, this value slightly increases. The upper and lower boundaries of the oxygen minimum zone in this region are at approximately 1,200 m and 2,500 m water depth, respectively. Dissolved oxygen in this oxygen minimum zone ranges from 1.85 ml/l to more than 2.8 ml/l.

d. pH

Surface waters are pH 8.21. This value regularly decreases downward to 500 m water depth, and is approximately pH 7.80 at 500 m water depth. Below 500 m there may be a slight increase in pH with water depth.

e. Other elements

A small amount of PO_4 exists at the surface 50 m of surface waters. Below 50 m water depth this value increases down to about 550 m water depth. The thermocline and deep waters contain a constant PO_4 value of about 2.7 μmol/l.

NO_2-N rapidly decreases in surface waters, and remarkably changes in the upper thermocline, with a maximum value of about 0.03 μmol/l at 370 m water depth.

NO_3-N rapidly increases down to 600 m water depth, and is constant below this depth.

SiO_2 also increases down to 1,000 m water depth, and nearly constant, ranging from 149 μmol/l to 160 μmol/l.

SEDIMENTS

Sediments bear upon the distribution of marine benthic organisms chiefly in ways that provide different types of substrate for organisms and their hosts, varied amounts and types of food that sediments contain, and various types of shell-constructing material for agglutinated foraminifers.

1. Tanegashima Island

Ikehara (1985) reported the distribution of surface sediments around Tanegashima Island. He showed that medium sand is widely distributed around the Osumi Strait and on the continental shelf off both the northeast part and southern extremity of this island. Coarser grains are recognized within the Osumi and the Tanegashima straits. Those areas where are distributed grains coarser than medium sand are characterized by abundant occurrences of derived fossils. The boundary between areas of fine and medium sand corresponds to the contour of 120 m water depth. This boundary also coincides with the lower limit of erosion by the Kuroshio Current. The lower boundary of fine sand is expressed by mud contents of more than 50%. This boundary roughly corresponds with the 1,000 m contour, and is slightly deeper southward.

2. Kumanonada area

The distribution of surface sediments off Kumanonada is revealed by Honza *et al.* (1983). Figure 12 shows a general tendency for sediments to become finer with water depth, except around the Shima Spur. Sediments on the western slope at the root and the southern extremity of the Shima Spur consist mostly of medium sand. This kind of grains is largely composed of planktonic foraminiferal tests.

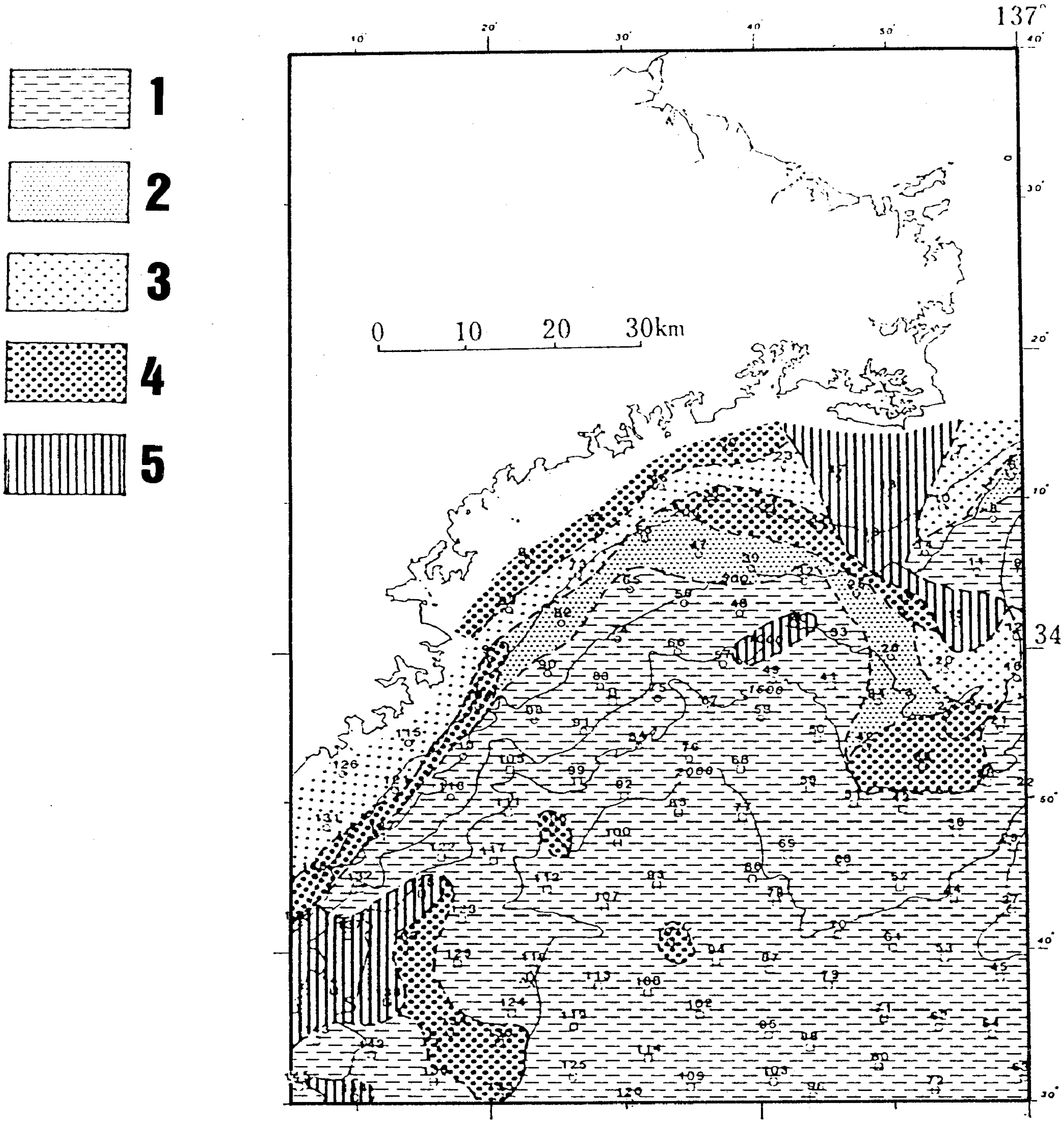


Fig 12. Distribution of bottom materials in the Kumanonada area. 1, silt; 2, very fine sand; 3, fine sand; 4, medium sand; 5, basements. (after Honza *et al.*, 1983).

3. Hachijojima area

Inouchi (1981) reported the distribution of surface sediments around the Shinkurose Bank. He divided the sea bottom into five types such as rocky, gravelly, sandy, muddy sand and muddy bottoms, and showed their distribution. According to him, the rocky bottom is exposed largely at the top of the Shinkurose, Kitakurose and Nakakurose banks, east of the "Kurose Hole" and north and east of Hachijojima Island. The areas of rocky bottoms around the Shinkurose and Nakakurose banks and to the east of Hachijojima Island are surrounded by gravelly bottoms. Two types of gravelly bottom are chiefly composed of calcareous and volcanic gravels.

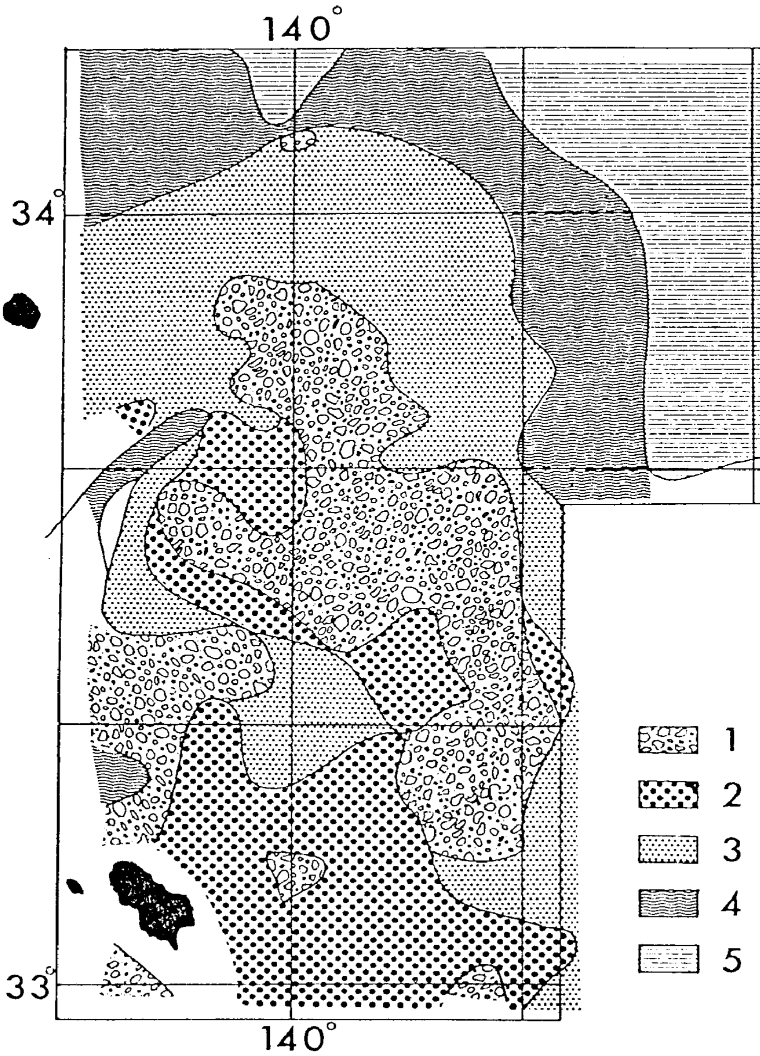


Fig. 13. Distribution of bottom materials around the Shinkurose Bank in the Hachijojima area. 1, rocks; 2, gravels; 3, sand; 4, muddy sand; 5, mud. (after Inouchi, 1981).

Around rocky and gravelly areas of the banks are fine to coarse-graind sandy areas. The sediments are well sorted in general. Sand is chiefly of volcanic and biogenic origin with subordinate quantities of clastic grains. Muddy sand areas are distributed around the sandy area. Muddy bottoms are widely distributed on the continental slope of the Shichito Ridge.

The distribution of sediments is delineated in the "Geological map of the northern Ogasawara Arc" (Honza *et al.*, 1982). This map shows that the geologic ages and characteristics of sediments differ between the east and west sides of the Shichito Ridge. In the west are Quaternary sediments and volcanic rocks dominant. Basaltic rocks are distributed on the western slope of the Shichito Ridge. On the other hand, the sediments on the eastern continental slope of this ridge are mainly of three different geologic ages. Pliocene sediments are distributed at a depth ranging from about 3,000 m to 5,000 m. The continental slope below 5,000 m is covered by sediments of Paleogene and Early Miocene ages.

MUD CONTENTS

Mud contents were measured by a dried weight percentage of particles smaller than 0.063 mm in diameter relative to the total treated sample.

1. Tanegashima area

The mud contents roughly show a zonal distribution in this area. The values are more than 50% at most points below 1,000 m water depth. At points between 500 m and 1,000 m the values range from 30% to 50%. A point with less than 10% was recognized in an area under the influence of the Kuroshio Current (Fig. 14).

2. Kumanonada area

In two areas on the summit of the

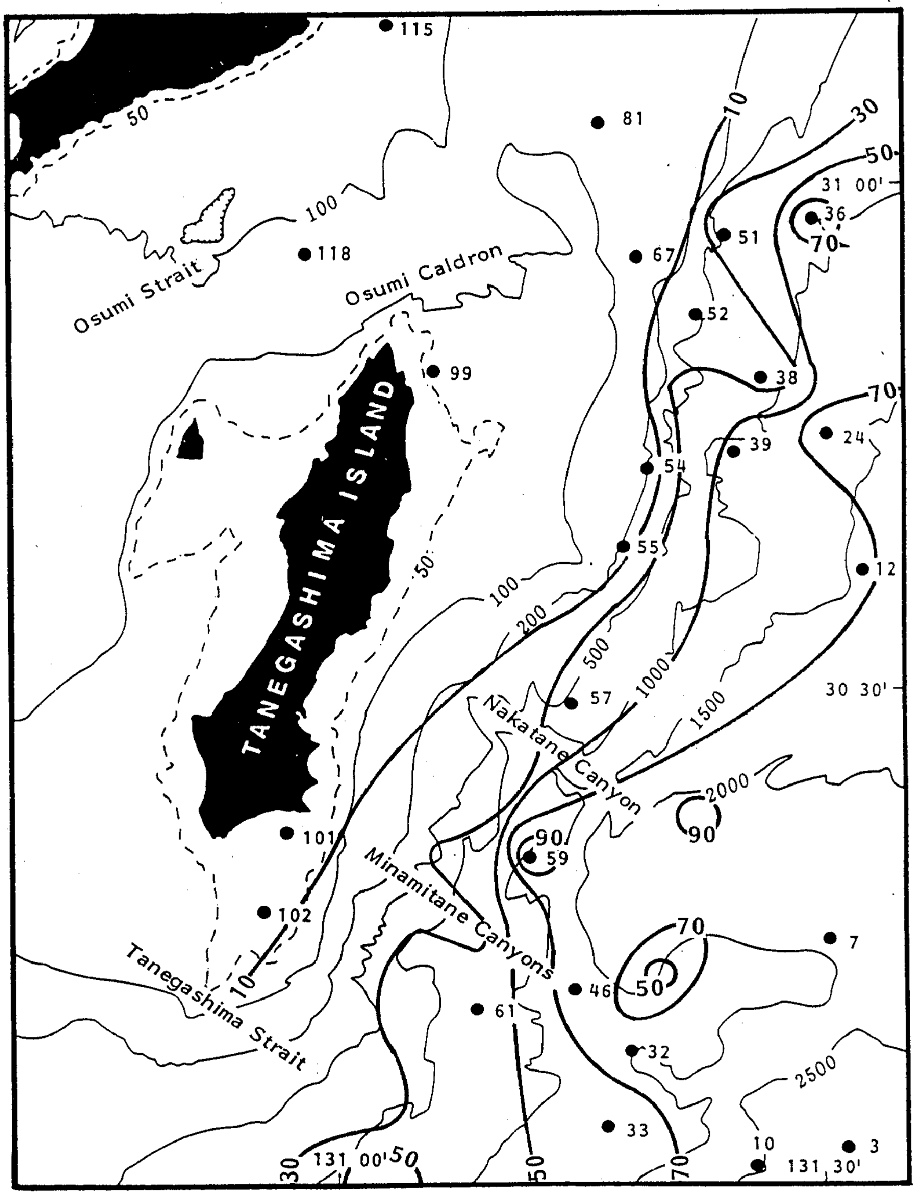


Fig. 14. Distribution of mud contents (%) off Tanegashima Island.

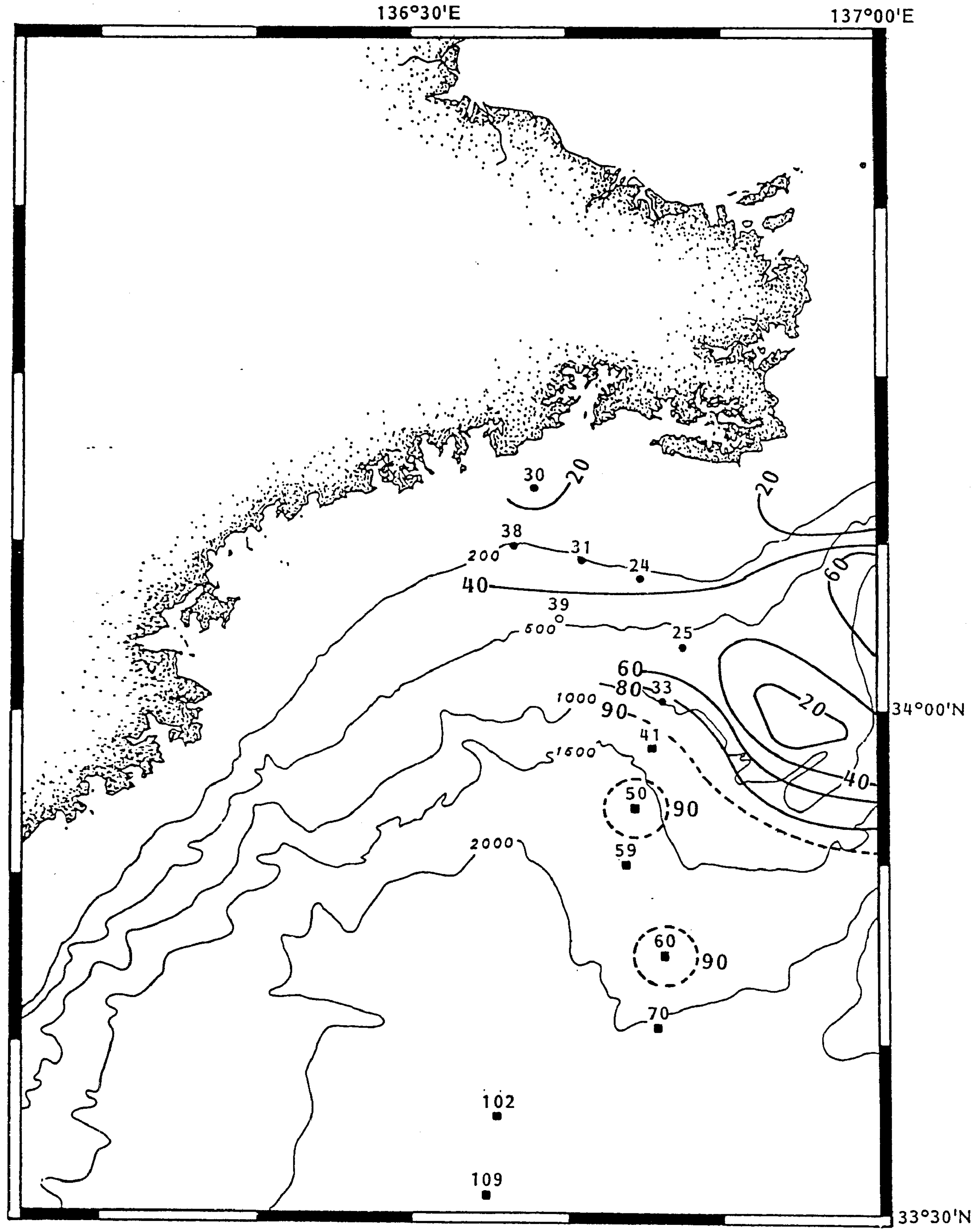


Fig. 15. Distribution of mud contents (%) in the Kumanonada area.

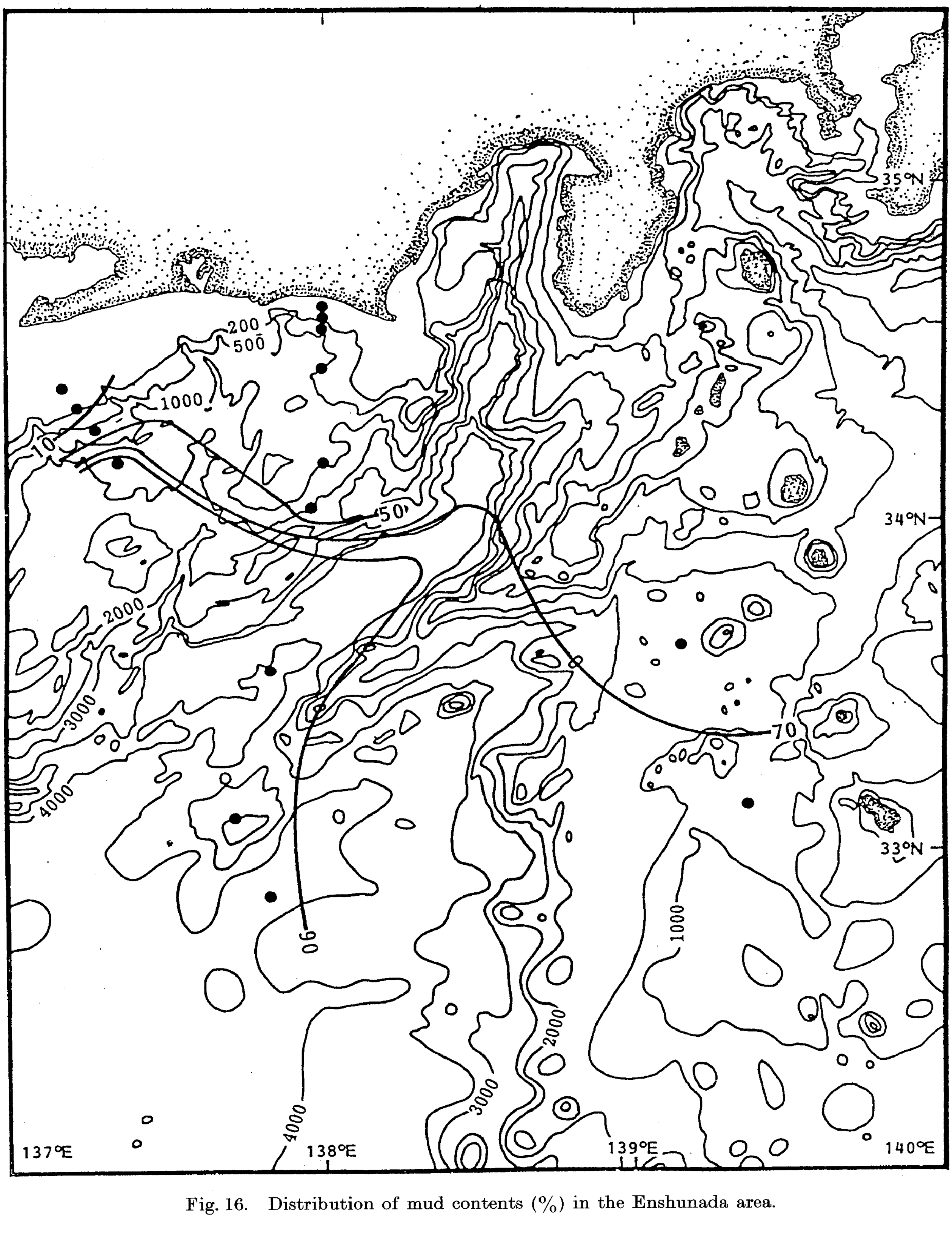


Fig. 16. Distribution of mud contents (%) in the Enshunada area.

Shima Spur and the coastal area around the Shima Peninsula, the mud contents are less than 20%. On the contrary, the highest value was recognized at points on the bottom floor of the Kumano Basin (more than 90%). The isoplethes are mostly parallel to the contour lines of submarine topography (Fig. 15).

3. Enshunada area

Sediments in this area are divided into two groups by mud contents. On the continental slope and shelf are rather low frequencies (less than 70%) except in KT85-6-G7. Off the mouth of the River Tenryugawa is a higher percentage of mud content than off Atsumi. On the contrary, in the Nankai Trough, Shikoku Basin and Zenisu Ridge frequencies are more than 70% (Fig. 16).

4. Hachijojima area

The frequency generally increases with depth in this area. Rather low values (less than 10%) are distributed on the Shinkurose Bank. Silty sediments containing more than 50% of mud are present on the continental slope. Frequencies over 90% were only recognized at GH80-4-RC102 on the eastern continental slope of the Shichito Ridge (Figs. 30 and 31).

In a summary, 1) mud contents are rather low on the continental slope and shelf; 2) highest frequencies over 90% are distributed in the Nankai Trough, Shikoku Basin and Kumano Basin; 3) rather coarse sediments accumulated on a projected topography. On the contrary, finer grains settled in topographic depression.

FAUNAL STATISTICS

This study intends to delineate faunal statistics in the Tanegashima, Kumanonada, Enshunada and Hachijojima areas. Planktonic foraminiferal numbers and benthic foraminiferal numbers stand respectively for the number of individuals of planktonic and benthic foraminifera contained in 1g of dry sediments. A/T and P/T ratios show the ratio of agglutinated foraminifera to the total benthic foraminifera and the ratio of planktonic foraminifera to the total foraminifera, respectively.

1. Tanegashima area

a. Planktonic foraminiferal numbers (Fig. 17)

The numbers regularly increase with depth down to about 900 m water depth, and slightly decrease below 1,700 m water depth. Large numbers (more than 1,000) are generally confined to a depth ranging from 1,000 m to 1,700 m. The maximum value is at GH84-3-61, running up to more than 4,000 individuals. The number is less than 100 in the sublittoral zone. In the lower bathyal zone (below 2,000 m), the value ranges from 100 to a little more than 1,000.

b. Benthic foraminiferal numbers (Figs. 17, 18)

The numbers regularly increase with depth down to about 900 m water depth, and decrease below 1,000 m water depth. They are rather small (less than 1,000) at most points, with the maximum value at GH84-3-38 (Fig. 18), and numbers range from 10 to 100 below 2,000 m water depth (Fig. 17). Sample points with small numbers less than 10 are in the surface water region around Tanegashima Island (GH84-3-57, 81, 99, 102, 118). These points are mostly within the distribution of low mud contents and under the erosive influence of the Kuroshio Current. Points with rather small values on the continental slope are located within the canyon (GH84-3-24, 32, 59).

c. A/T ratio (Fig. 19)

This value regularly increases with depth in this area. Most of the points

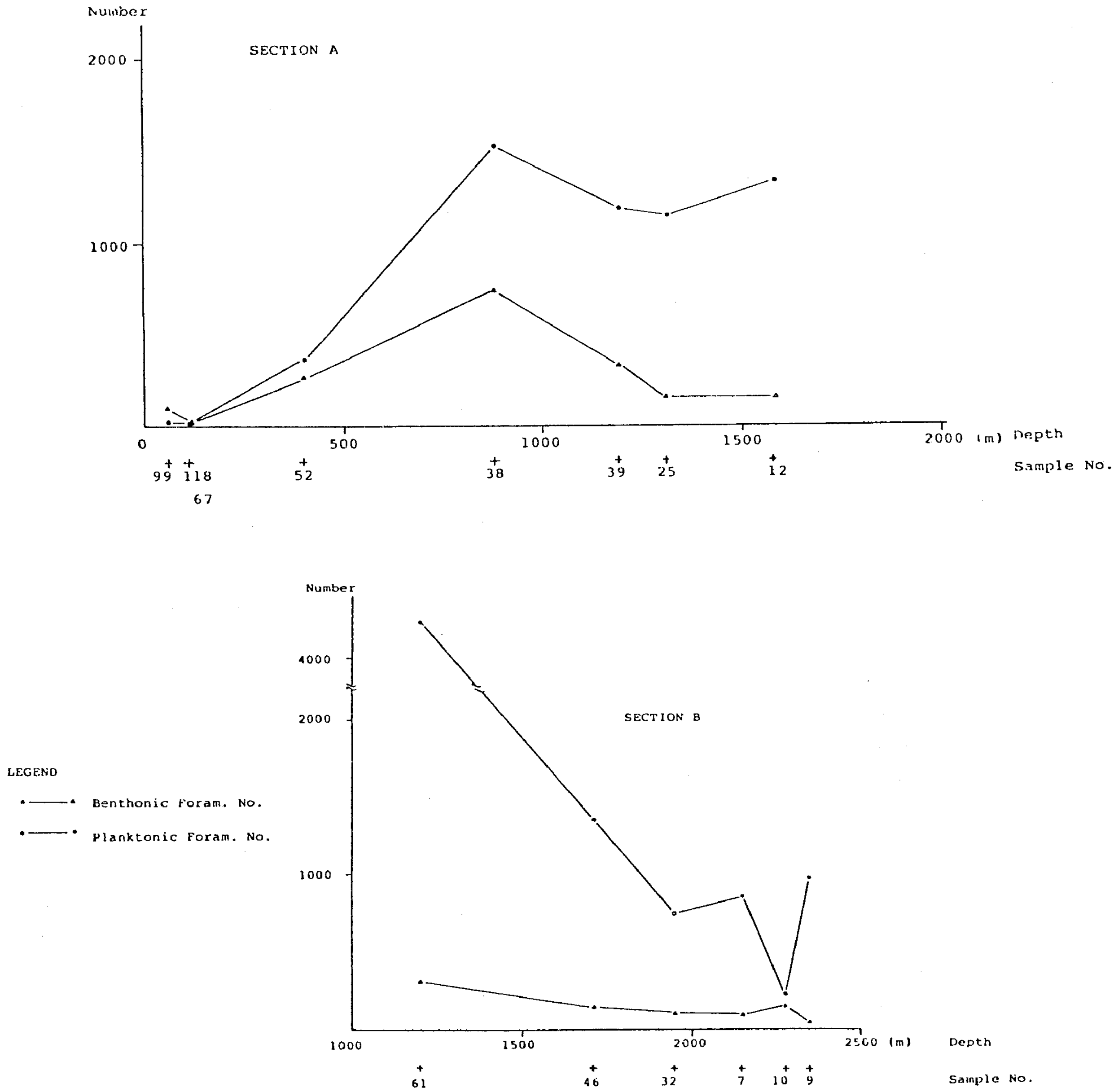


Fig. 17. Distribution of planktonic foraminiferal number and benthic foraminiferal number around Tanegashima Island.

on the continental slope below 1,500 m show values of more than 10%. Below 2,000 m water depth, the values are over 30%. In a shallow water area, the value is 0 or very small.

d. P/T ratio (Fig. 20)

This value rapidly increases with depth down to about 1,200 m water depth, and is constant down to 2,200 m and then slightly decreases deepward. Points marked over 50% are below about 400 m water depth. Sample points with low values of less than 10% are under surface waters around Tanegashima Island.

2. Kumanonada area

a. Planktonic foraminiferal numbers (Fig. 21)

The largest numbers range from 200 m to 1,000 m water depth. The number basically increases with depth down to

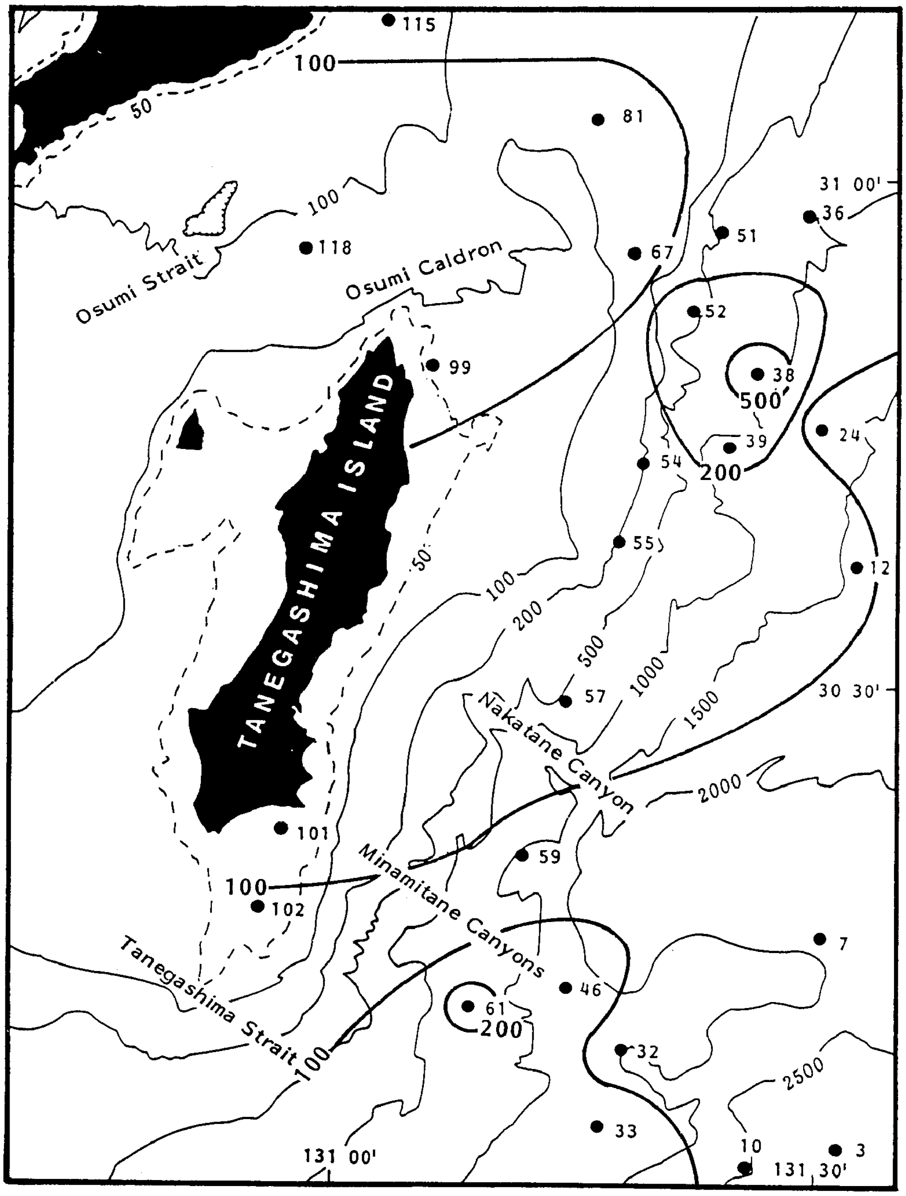


Fig. 18. Distribution of benthic foraminiferal number around Tanegashima Island.

about 1,000 m water depth, except for GH82-2-50. This point, located beneath the west side of the Shima Spur, has maximum values of more than 4,200. On the bottom of the Kumano Basin are rather low numbers, ranging from 50 to 100.

b. Benthic foraminiferal numbers (Fig. 22)

The numbers fundamentally decrease with depth below 250 m water depth. Points with large numbers are located on a narrow shelf. The maximum number is 2,313 at GH82-2-31. The point beneath the southern extremity of the Shima Spur bore a rather large number of 655. The points on the bottom of the Kumano Basin yielded numbers less than 100.

c. A/T ratio (Fig. 23)

This ratio in this area is generally low. Most of the points show values of less than 10%, except for GH82-2-30 and 41.

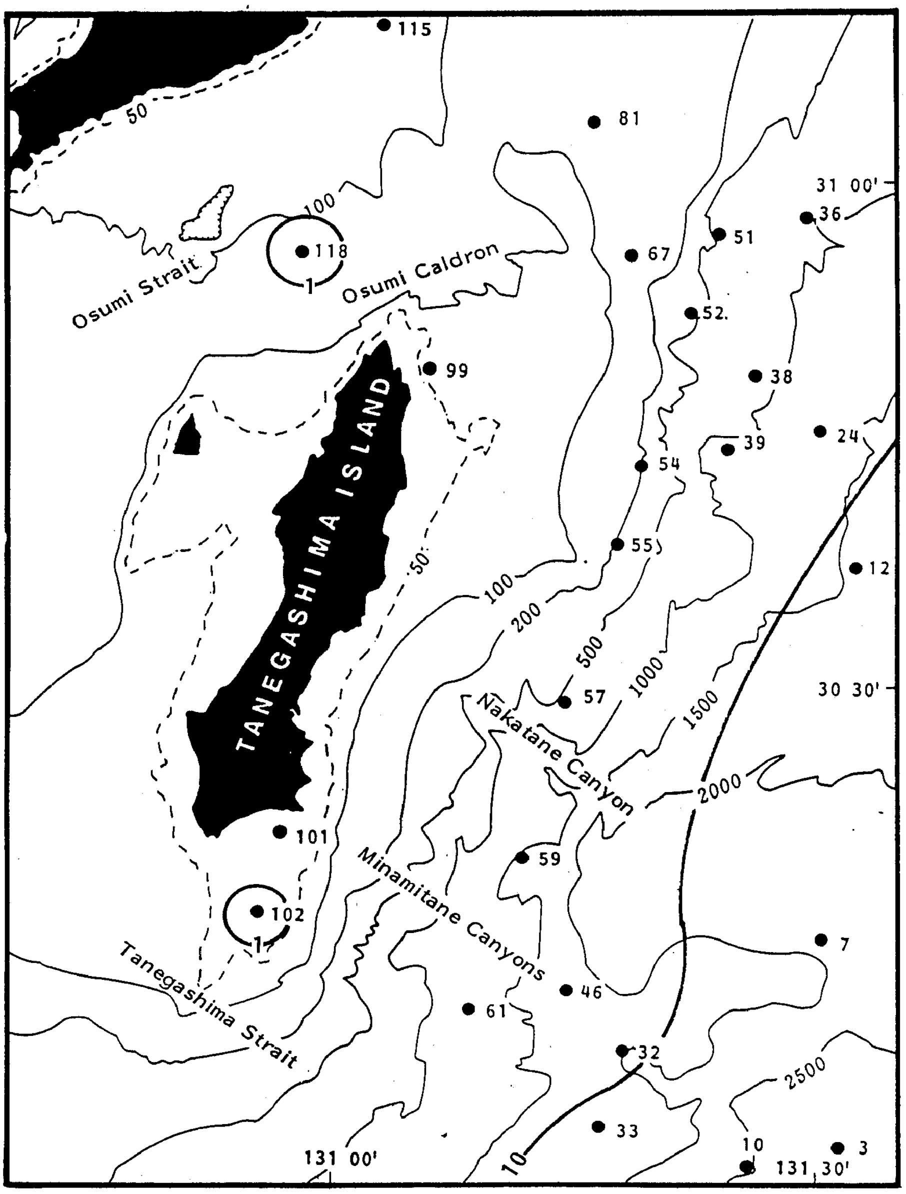


Fig. 19. Distribution of agglutinated foraminifer/total benthic foraminifer ratio (%) around Tanegashima Island.

d. P/T ratio (Fig. 24)

This value regularly increases with depth down to about 500 m water depth. A rather high value was recognized at the points on the continental slope which ranges in water depth from 500 m to 1,600 m. The points on the bottom of the Kumano Basin show values of more than 30%.

3. Enshunada area

a. Planktonic foraminiferal numbers (Fig. 29)

The points on the continental slope bear rather large numbers (KT85-6-G1, 3). The numbers are mostly null in three areas such as off the mouth of the River Tenryugawa, within the Nankai Trough and the Shikoku Basin. One of the peaks in this number is on the Zenisu Ridge.

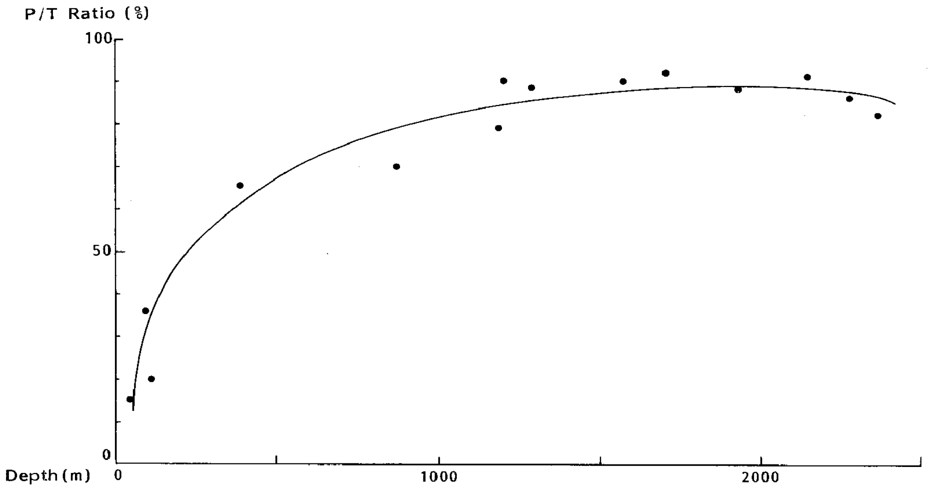


Fig. 20. Distribution of planktonic foraminifer/total foraminifer ratio(%) around Tanegashima Island.

b. Benthic foraminiferal numbers (Figs. 25, 29)

The numbers are small (less than 10) at samples from the Nankai Trough. However, points with rather large numbers are on the continental slope and shelf off Enshunada. For example, the points off the mouth of the River Tenryugawa contained an almost constant number ranging from about 20 to a little over 100, and the points on the continental slope off the Atsumi Peninsula yielded large numbers of more than 100. Two points in the Shikoku Basin and on the Zenisu Ridge bore less than 50.

c. A/T ratio (Fig. 26)

The value fundamentally increases deepward on the continental slope. The points on the Zenisu Ridge and bottom of the Shikoku Basin generally represent high values, especially more than 60% at KT86-11-PP5.

d. P/T ratio (Fig. 27)

This value is 0% on the shelf, and regularly increases on the continental slope. No planktonic foraminifera occur in surface sediments within the Nankai Trough and on the bottom of the Shikoku Basin below about 4,000 m water depth. On the other hand, at the summit of the Zenisu Ridge the value is about 60%.

4. Hachijojima area

a. Planktonic foraminiferal numbers (Fig. 31)

Samples on the Shichito Ridge are marked by rather high numbers, which gradually decrease deepward. For instance, two western points on the Shichito Ridge yielded more than 4,000 individuals. On the contrary, samples near the summit of the Shinkurose Bank contained a rather low number, ranging from 170 to 530, except for GH80-4-94 (a little less than 2,800). These differences in number among samples are attributed to water depth.

b. Benthic foraminiferal numbers (Figs. 30, 31)

The points in the bathyal zone yielded rather large numbers of individuals. The maximum value is about 2,100 at KT86-10-G3. Surface sediments under surface waters and deep water below 3,200 m contained rather small numbers (less than 100).

c. A/T ratio (Figs. 30, 31)

At the points on the Shichito Ridge below 3,200 m water depth the values are more than 20%. This value runs up to

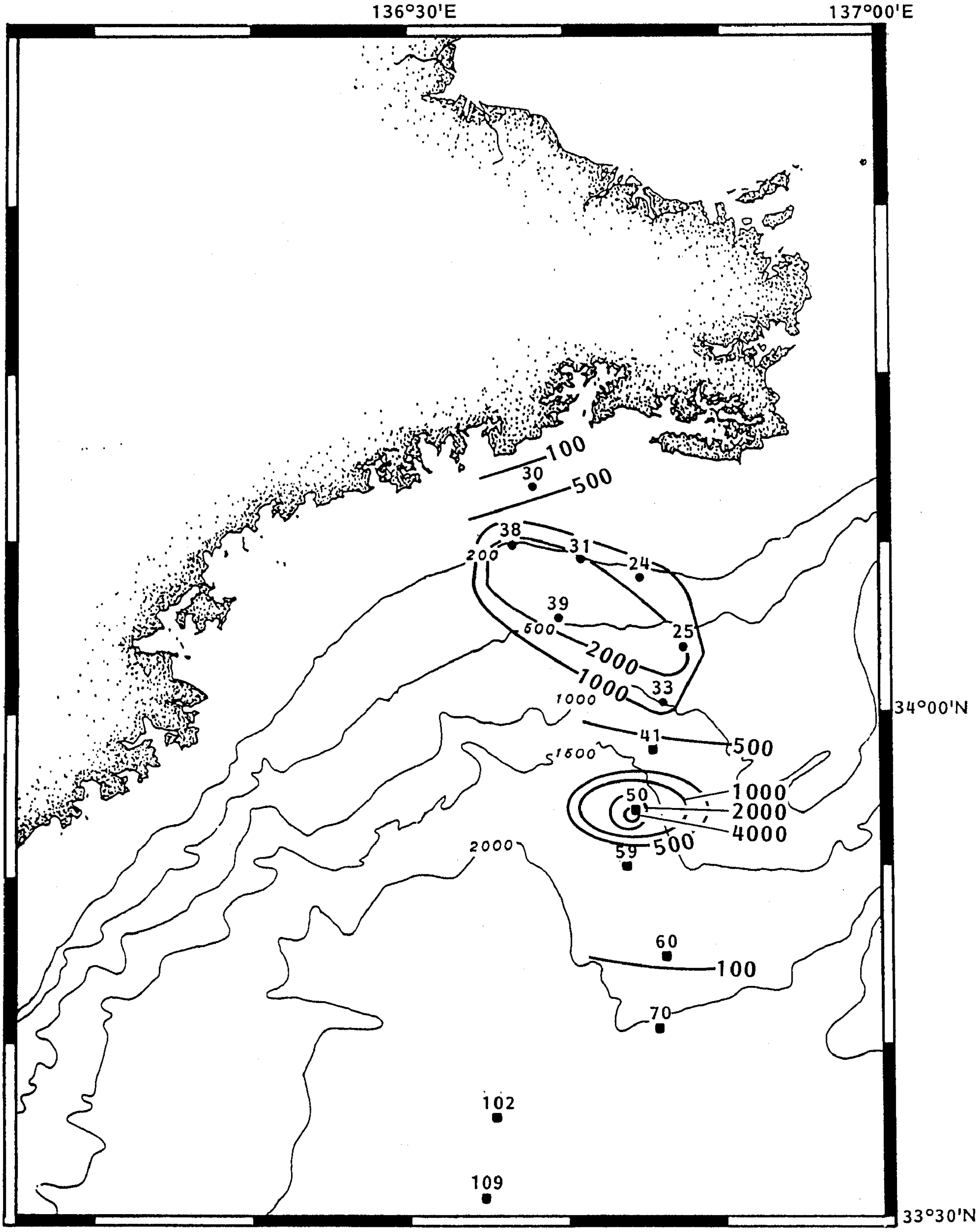


Fig. 21. Distribution of planktonic foraminiferal number in the Kumanonada area.

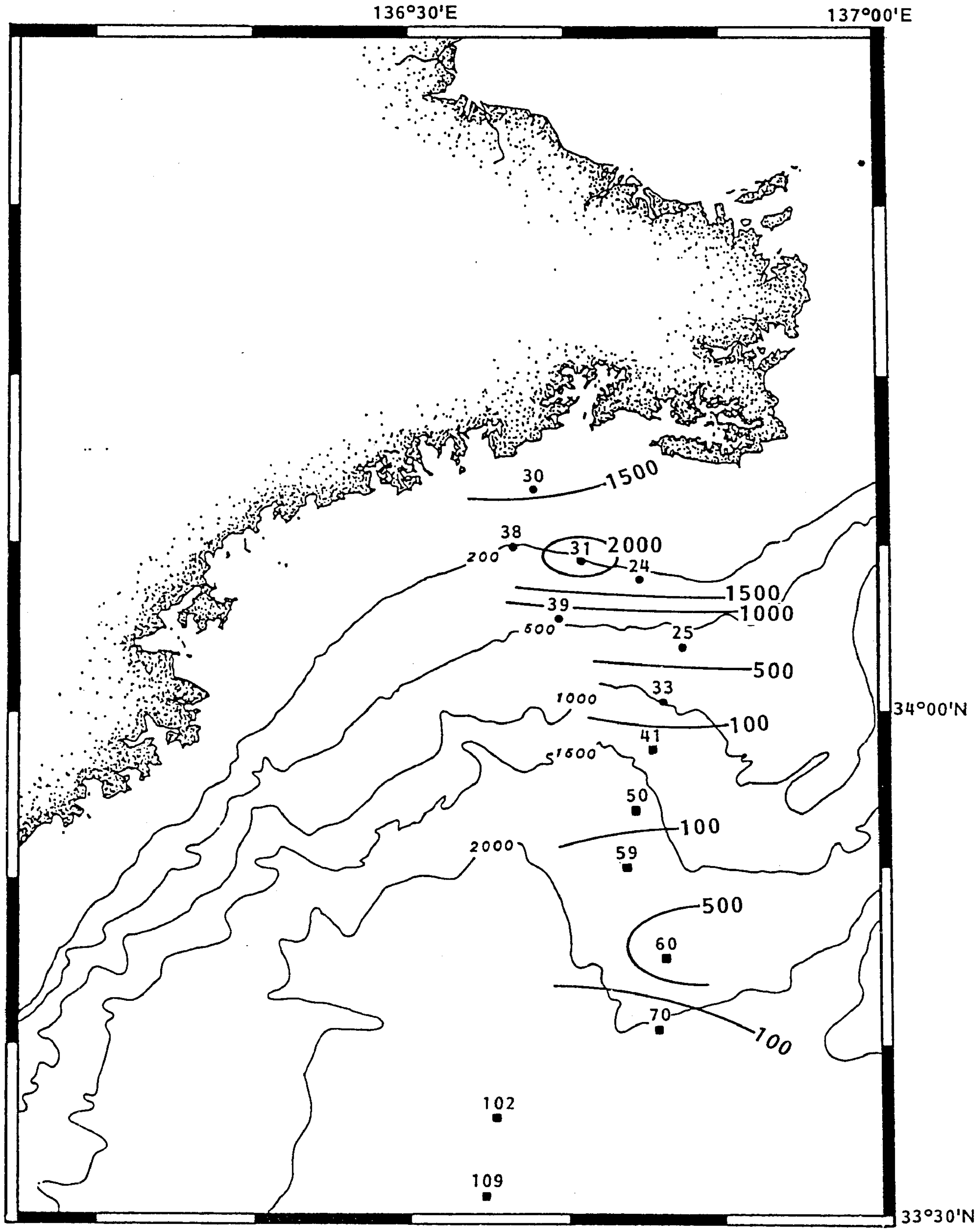


Fig. 22. Distribution of benthic foraminiferal number in the Kumanonada area.

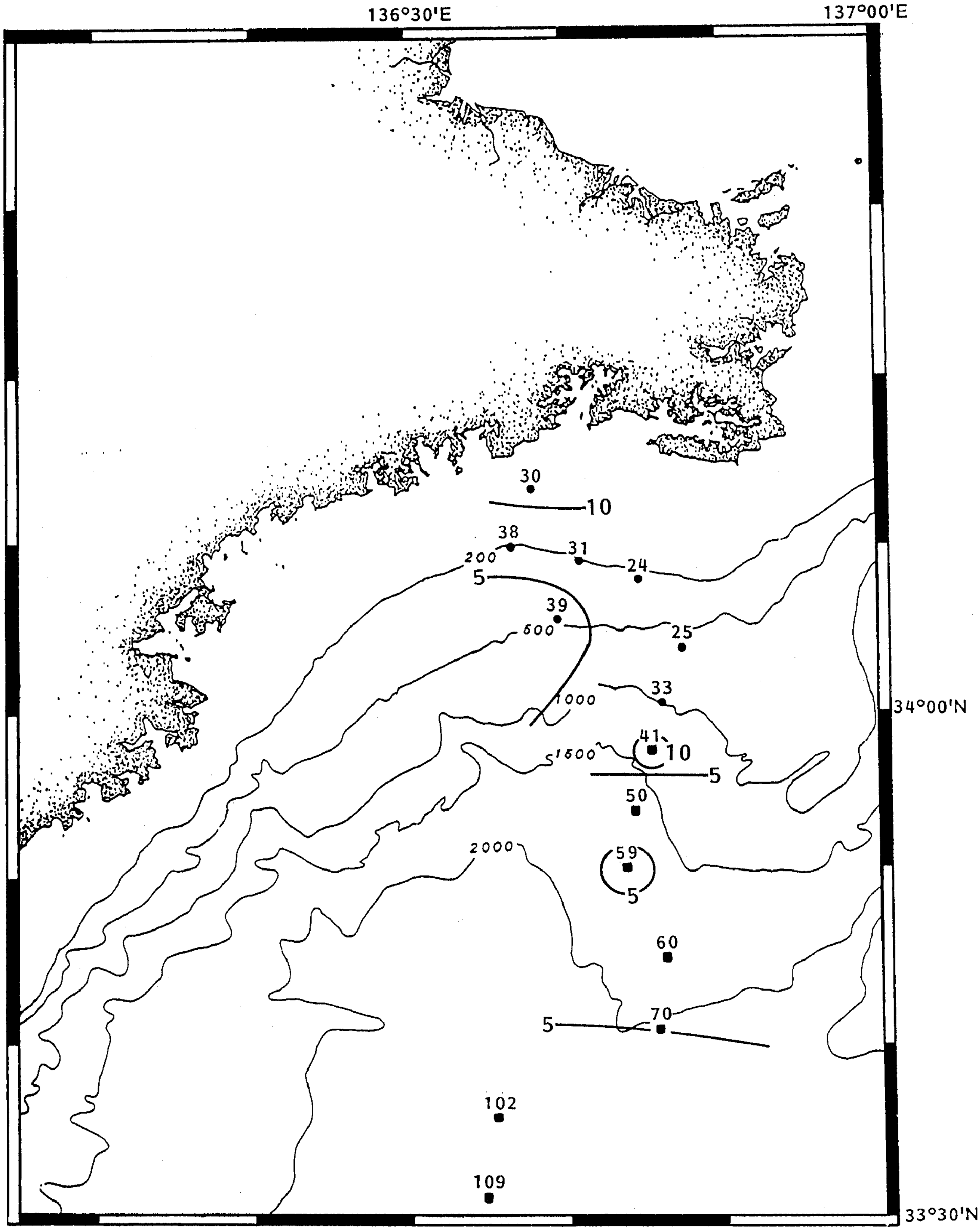


Fig. 23. Distribution of agglutinated foraminifer/total benthic foraminifer ratio (%) in the Kumanonada area.

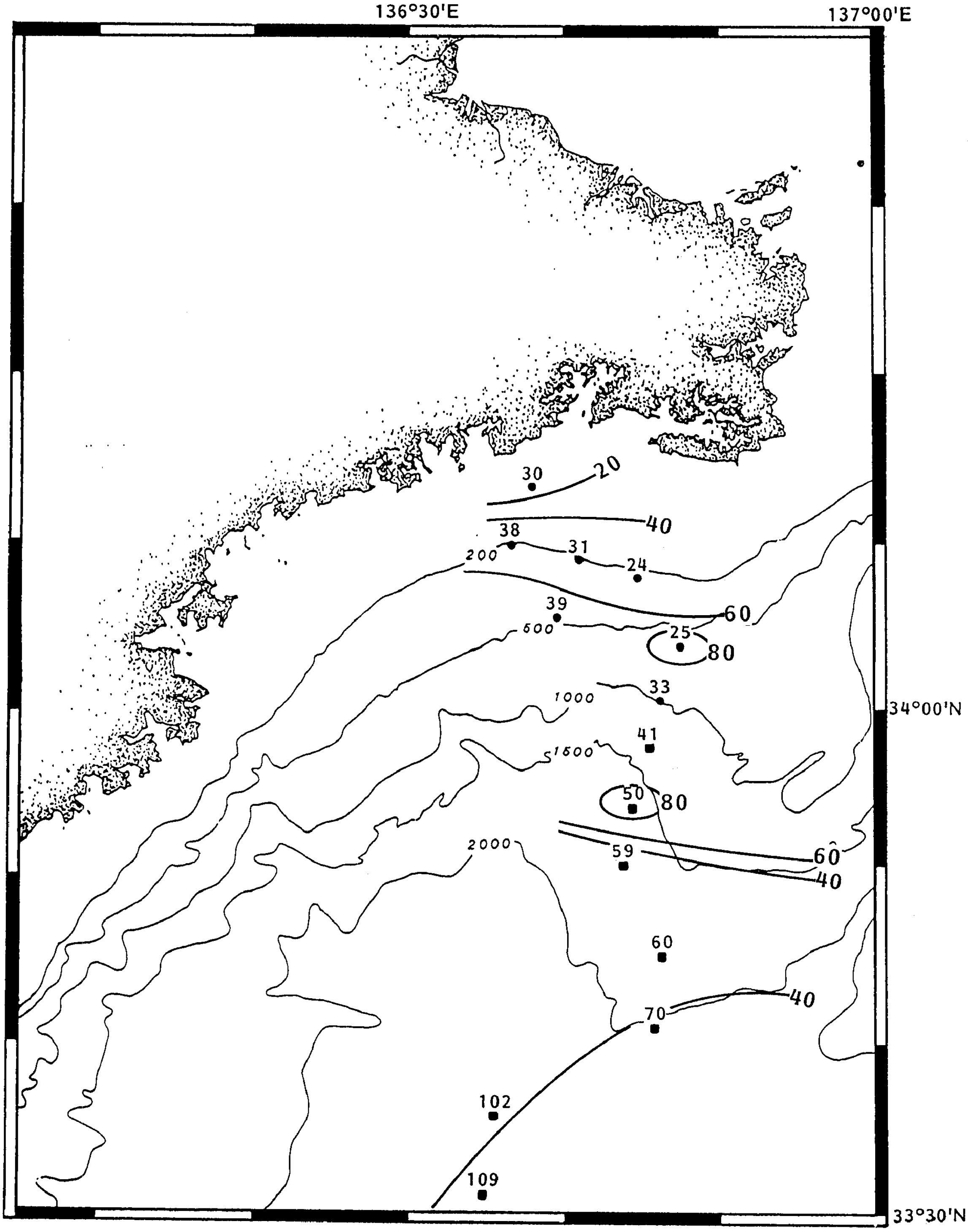


Fig. 24. Distribution of planktonic foraminifer/total foraminifer ratio (%) in the Kumanonada area.

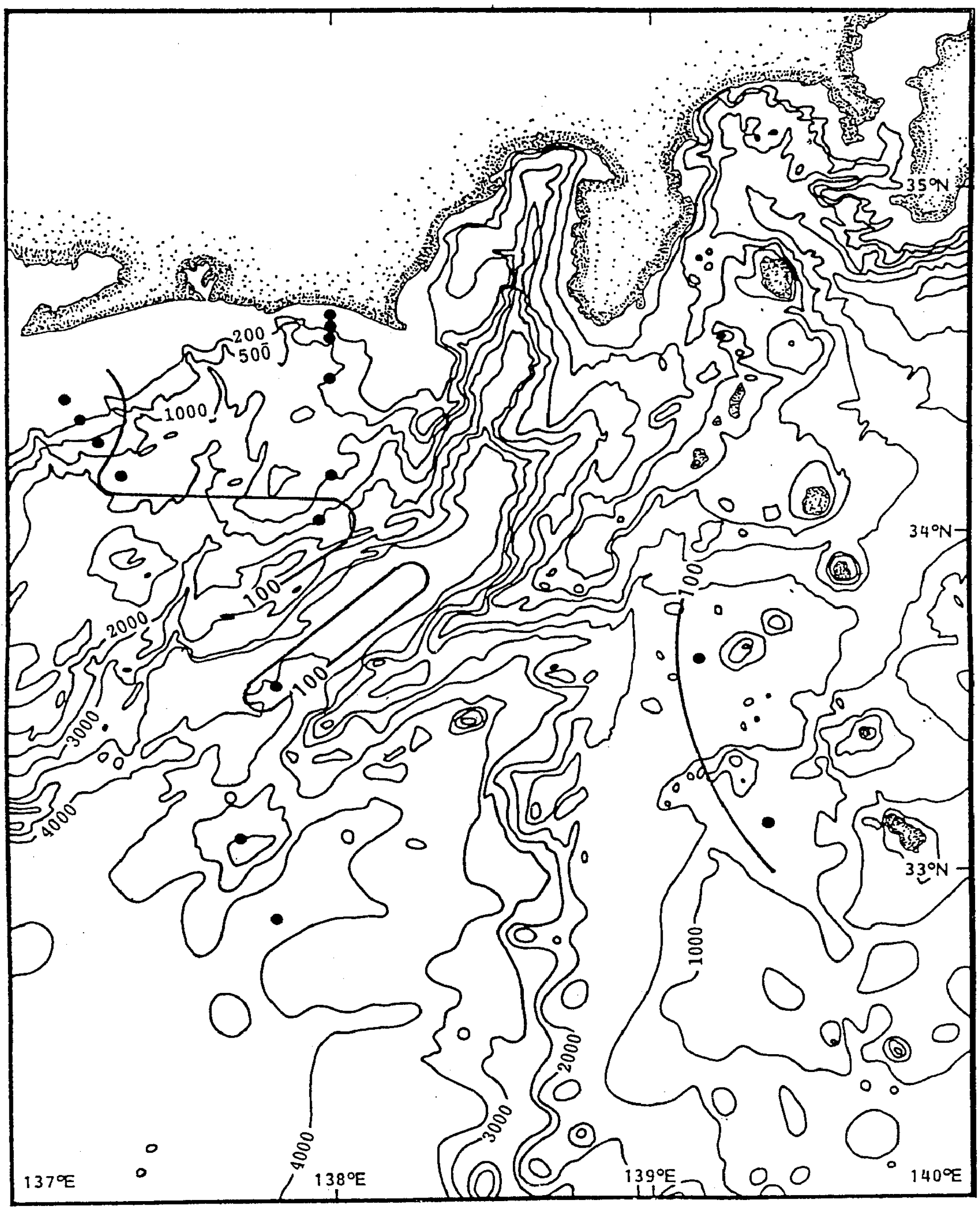


Fig. 25. Distribution of benthic foraminiferal number in the Enshunada area.

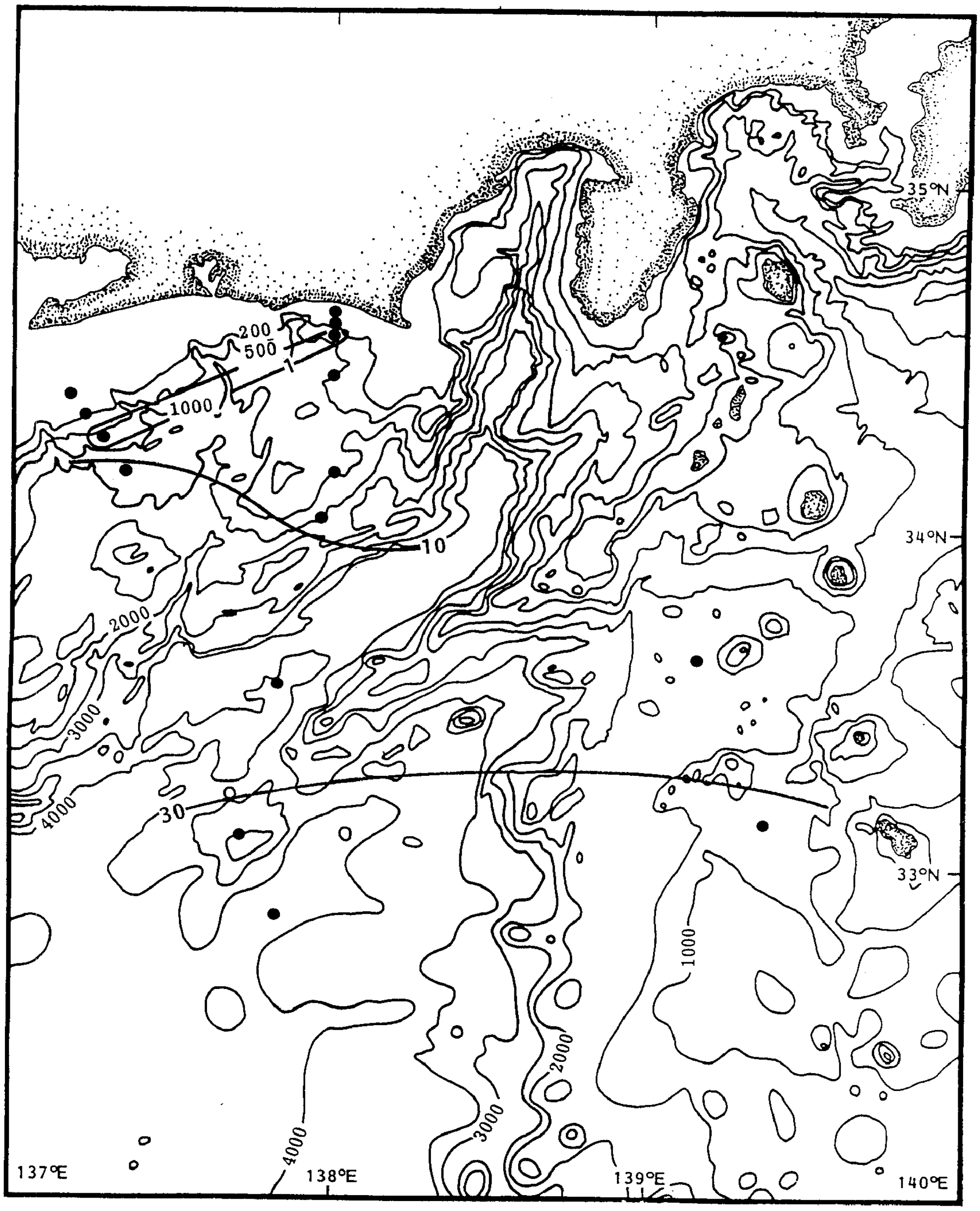


Fig. 26. Distribution of agglutinated foraminifer/total benthic foraminifer ratio (%) in the Enshunada area.

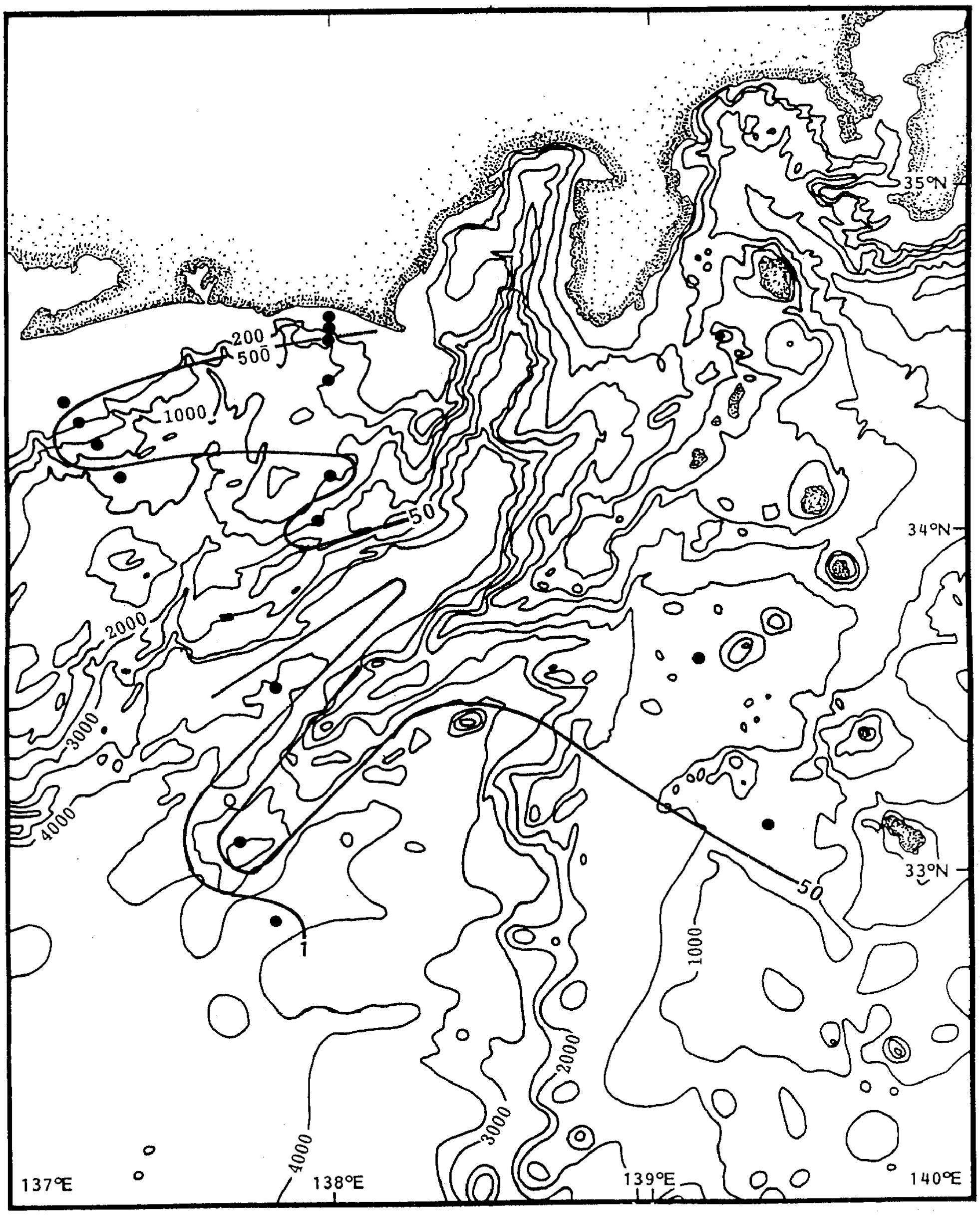


Fig. 27. Distribution of planktonic foraminifer/total foraminifer ratio (%) in the Enshunada area.

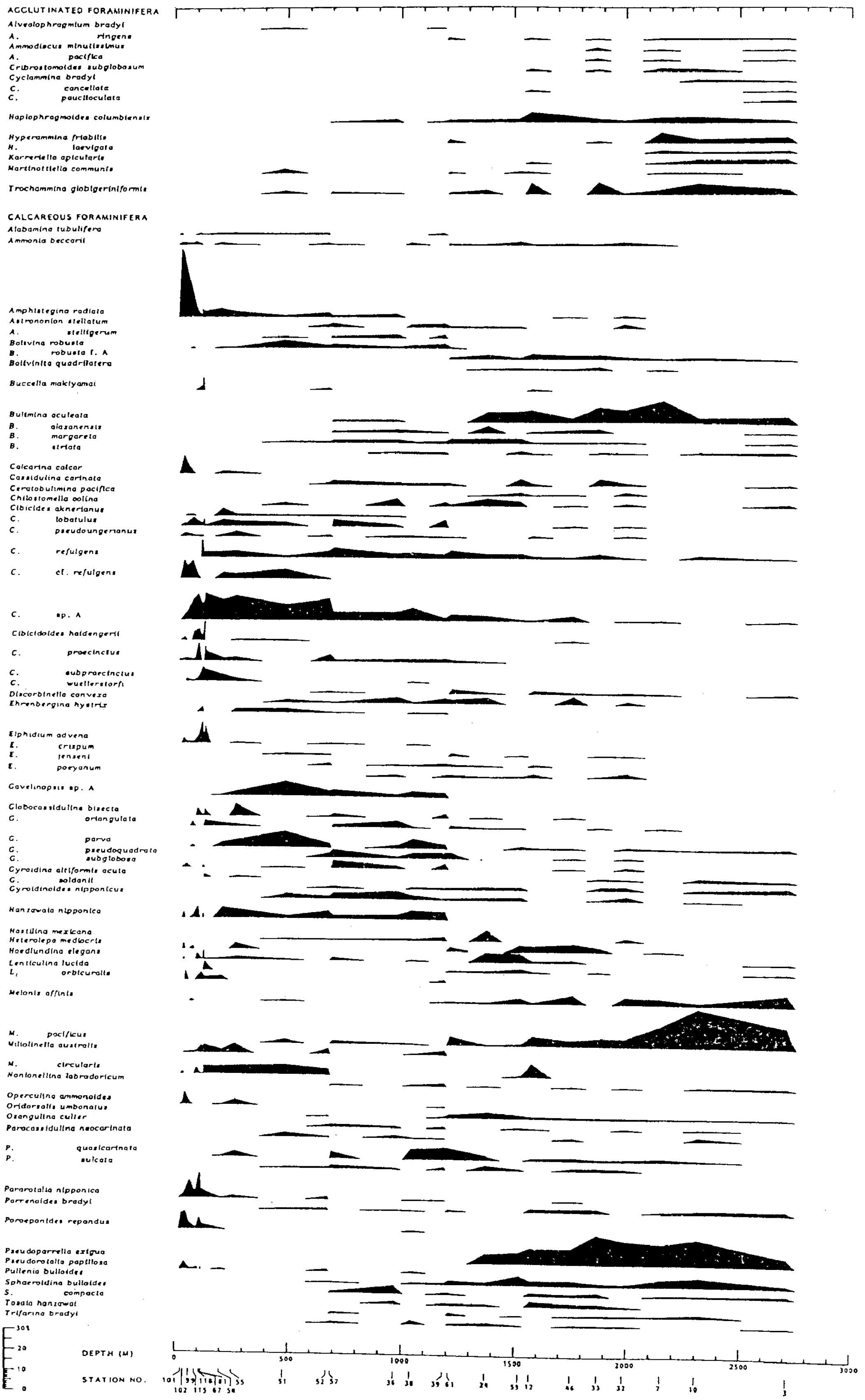


Fig. 28. Depth distribution of important benthic foraminifera off Tanegashima Island.

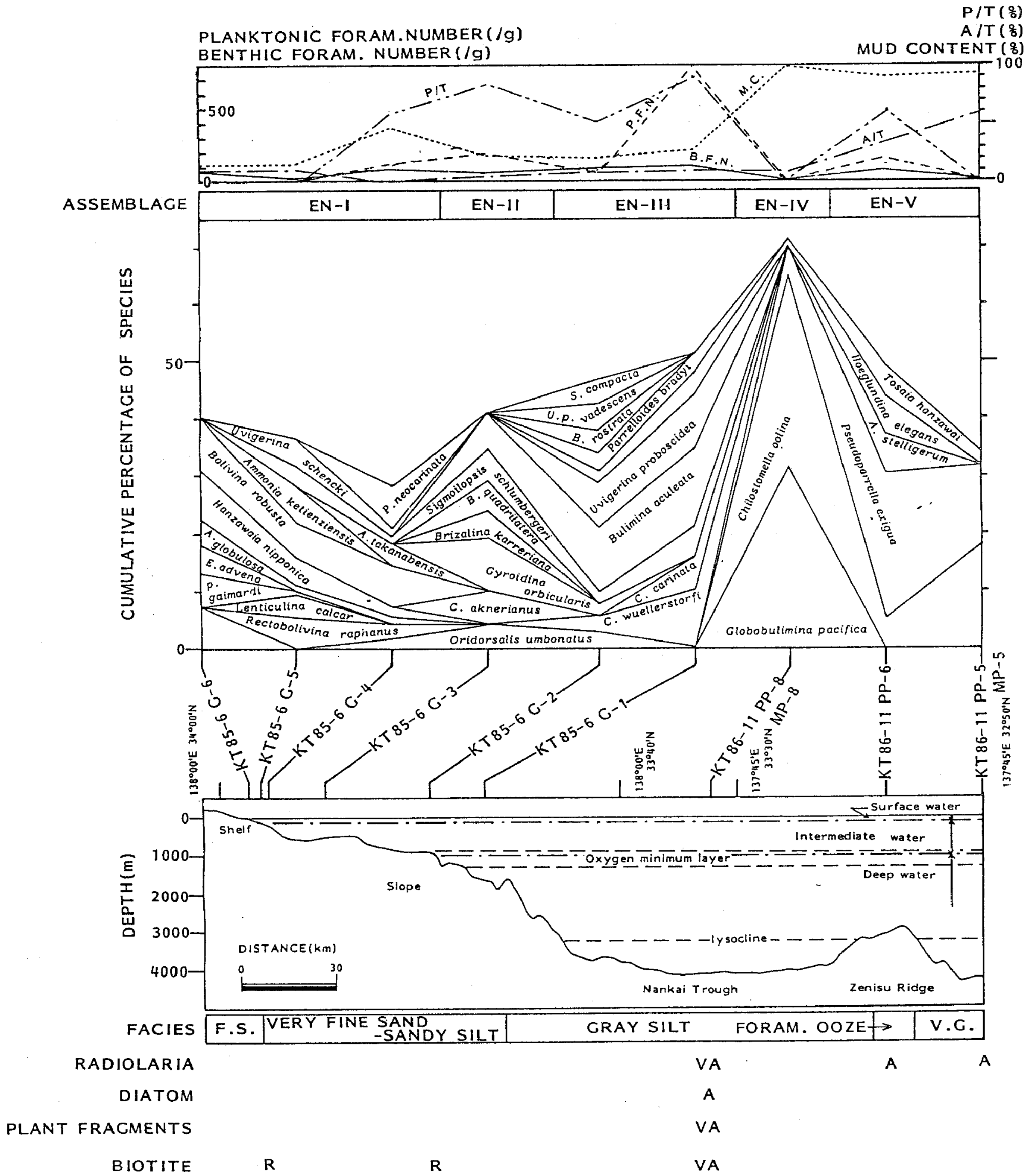


Fig. 29. Bathymetry along 138° E in the Enshunada area, with projected sample locations, cumulative frequency of benthic foraminiferal species, microfaunal statistics (PFN, planktonic foraminiferal numbers; BFN, benthic foraminiferal numbers; A/T, agglutinated foraminifer/ total benthic foraminifer ratio; and P/T, planktonic foraminifer/total foraminifer ratio), substrata (F.S., fine sand; V.G., volcanic glass), M.C., mud contents, selected grains (R, rare; A, abundant; VA, very abundant).

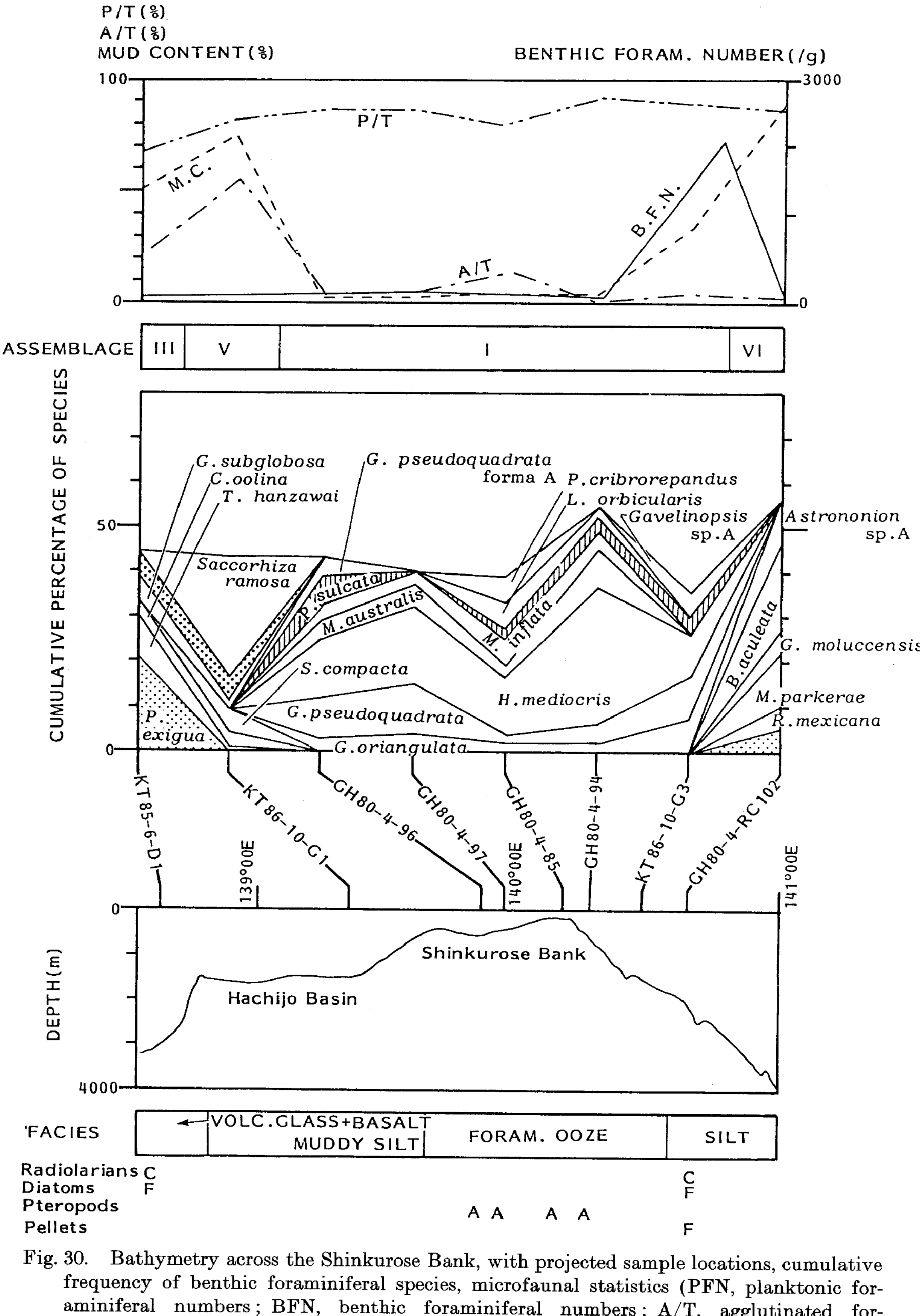


Fig. 30. Bathymetry across the Shinkurose Bank, with projected sample locations, cumulative frequency of benthic foraminiferal species, microfaunal statistics (PFN, planktonic foraminiferal numbers; BFN, benthic foraminiferal numbers; A/T, agglutinated foraminifer/total benthic foraminifer ratio; P/T, planktonic foraminifer/total foraminifer ratio), substrates, M.C., mud contents, and selected grains (F, few; C, common; A, abundant).

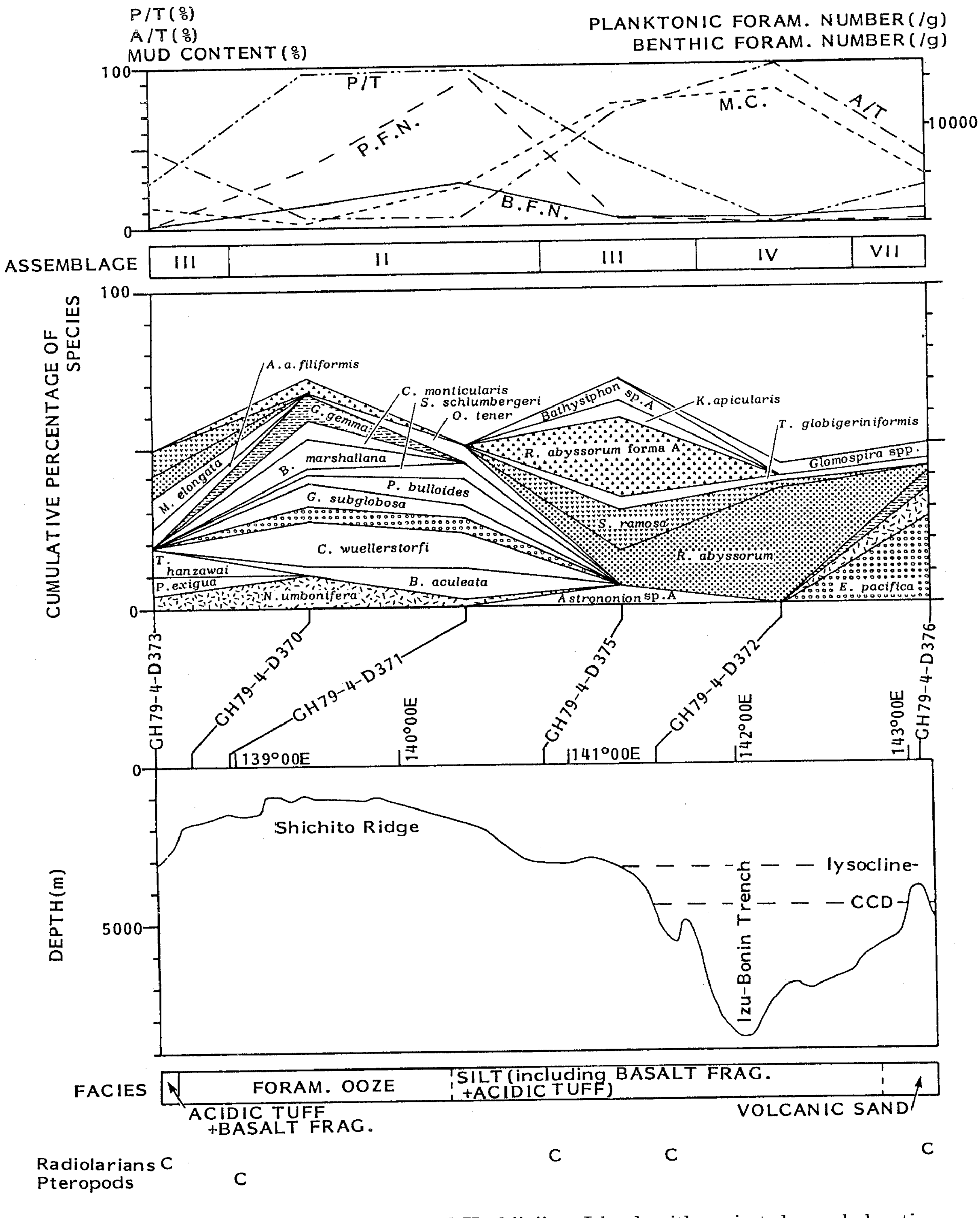


Fig. 31. Bathymetry along 33°N around Hachijojima Island, with projected sample locations, cumulative frequency of benthic foraminiferal species, microfaunal statistics (PFN, planktonic foraminiferal numbers; BFN, benthic foraminiferal numbers; A/T, agglutinated foraminifer/total benthic foraminifer ratio; and P/T, planktonic foraminifer/total foraminifer ratio), substrates, M.C., mud contents, and selected grains (C, common).

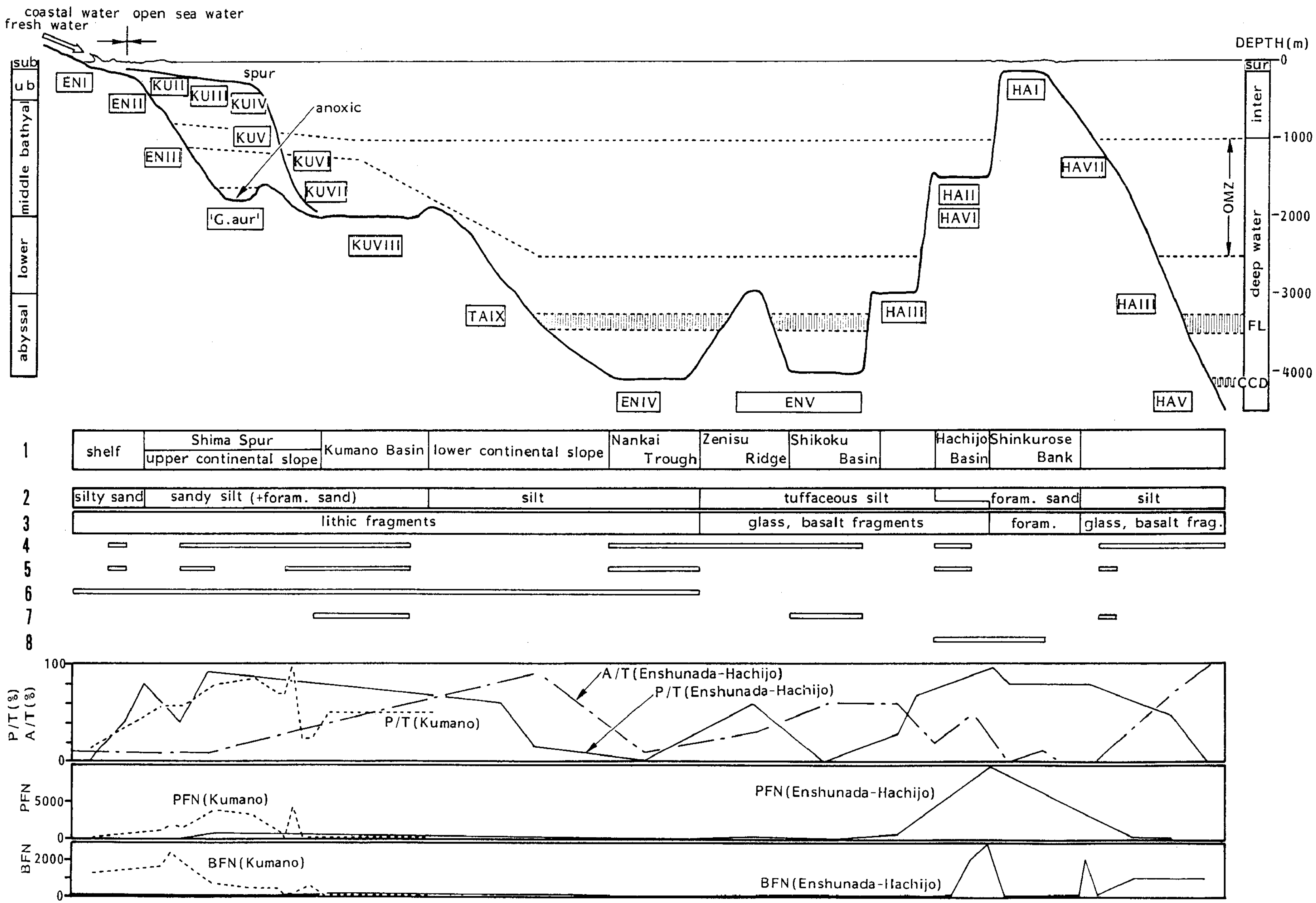


Fig. 32. Significant microfaunal and sedimentologic trends across a schematic littoral to abyssal bathymetric gradient along with associated major physical oceanographic boundaries which are based on the Kumanonada, Enshunada and Hachijojima areas. Letters in blocks below the surface of profile stand for Recent benthic foraminiferal assemblages defined in this paper. sub, sublittoral zone; ub, upper bathyal zone; lower, lower bathyal zone; sur, surface water; OMZ, oxygen minimum zone; FL, foraminiferal lysocline; 'G. aur', *Globobulimina auriculata* assemblage; 1, marine topographic division; 2, sediment types; 3, major grains; 4, radiolarians; 5, diatoms; 6, plant fragments; 7, fecal pellets; 8, pteropods; A/T, agglutinated foraminifer/total benthic foraminifer ratio; P/T, planktonic foraminifer/total foraminifer ratio; PFN, planktonic foraminiferal numbers; BFN, benthic foraminiferal numbers.

100% between 4,000 m and 5,000 m.

d. P/T ratio (Figs. 30, 31)

Samples around Hachijojima Island are marked by rather high values, which gradually decrease deepward. Sample points with large values (more than 80%) are on the continental slope of the Shichito Ridge above 2,000 m water depth.

In a summary, the above mentioned facts lead to the following lines: 1) Planktonic foraminiferal numbers regularly increase with depth under intermediate waters and decrease below about 1,500 m water depth. The maximum value runs up to more than 4,000 individuals off Enshunada and 15,000 around Hachijojima Island. The number is less than 100 in samples under surface waters. 2) Benthic foraminiferal numbers regularly increase with depth down to about 900 m water depth, and decrease below 1,000 m water depth. They are rather small (less than 1,000) at most points. 3) The A/T ratio fundamentally increases deepward on the continental slope. Two peaks of this ratio were recognized at about 3,200 m and 4,100 m. This value becomes 100% at about 4,100 m in the Hachijojima and Enshunada areas. From the A/T ratio, the author estimates the CCD to be at about 4,100 m water depth. 4) The P/T ratio rapidly decreases between 3,000 m and 3,500 m water depth, and becomes 0 at approximately 3,500 m in the Hachijojima and Enshunada areas. The foraminiferal lysocline was estimated at about 3,200 m water depth.

DESCRIPTION OF BENTHIC FORAMINIFERAL ASSEMBLAGE

Foraminiferal assemblages in the four studied areas were determined by Q-mode cluster analysis based on the distribution of foraminifera in each area.

The computer program used in this study has been written by Dr. Shiro Hasegawa to process the similarities of Horn's index of overlap (Horn, 1966) through a weighted pair group method.

1. Tanegashima area

The author examined 25 samples collected by the GH84-3 cruise from off Tanegashima Island. Eight assemblages were recognized and named TA I to TA VIII in accordance to the depth range in this area. The constituent species and distribution of those assemblages are as follows:

1) TA-I assemblage

Abundant species: *Amphistegina radiata*, *Pararotalia nipponica*, *Cibicidoides mediocris*.

Subordinate species: *Calcarina calcar*, *Elphidium advena*.

Depth range: 28–65 m.

Water depth zone: surface water.

Topographic setting: continental shelf at the eastern and southern margins of Tanegashima Island.

Sediment: poorly-sorted calcareous coarse sand, consisting mainly of coral fragments.

Occurrence: GH84-3-99, GH84-3-101, GH84-3-102.

This assemblage contains a considerable number of ill-preserved *Elphidium crispum* and *Miliolinella circularis*. Those specimens may have been winnowed out by the Kuroshio Current, and then were excluded from further analysis.

2) TA-II assemblage

Abundant species: *Cibicidoides mediocris*, *Hanzawaia nipponica* and *Miliolinella circularis*.

Depth range: 88–119 m.

Water depth zone: surface water.

Topographic setting: continental shelf off the Osumi Peninsula and the Osumi strait.

Sediment: well-sorted medium sand composed mostly of quartz grains.

Occurrence: GH84-3-67, GH84-3-81, GH84-3-115 and GH84-3-118.

Apparently derived specimens are absent in those samples. However, foraminiferal tests have been sorted into medium grain size.

3) TA-III assemblage

Abundant species: *Cibicidoides mediocris* and *Miliolinella circularis*.

Subordinate species: *Miliolinella australis*.

Depth range: 196–254 m.

Water depth zone: intermediate water.

Topographic setting: continental slope edge.

Sediment: fine sand.

Occurrence: GH-84-3-54 and GH84-3-55.

4) TA-IV assemblage

Abundant species: *Cibicidoides mediocris*, *Gavelinopsis* sp. A and *Globocassidulina parva*.

Subordinate species: *Nonionellina labradorica*.

Depth: 477 m.

Water depth zone: intermediate water.

Topographic setting: continental slope.

Sediment: sandy silt.

Occurrence: GH84-3-51.

5) TA-V assemblage

Abundant species: *Cibicidoides mediocris*.

Subordinate species: *Paracassidulina quasicarinata*.

Depth range: 676–1,185 m.

Water depth zone: intermediate water to deep water.

Topographic setting: small slope break.

Sediment: sandy silt.

Occurrence: GH84-3-38, GH84-3-39, GH84-3-52 and GH84-3-57.

6) TA-VI assemblage

Abundant species: *Paracassidulina quasicarinata*.

Subordinate species: *Cibicidoides mediocris*.

Depth range: 970–1,213 m.

Water depth zone: deep water (oxygen minimum zone).

Topographic setting: within valley on continental slope.

Sediment: sandy silt.

Occurrence: GH84-3-36 and GH84-3-61.

7) TA-VII assemblage

Abundant species: *Bulimina aculeata*, *Hoeglundina elegans* and *Pseudoparrella exigua*.

Subordinate species: *Haplophragmoides columbiensis* and *Trochammina globigeriniformis*.

Depth range: 1,371–1,520 m.

Water depth zone: deep water (oxygen minimum zone).

Topographic setting: continental slope.

Sediment: sandy silt.

Occurrence: GH84-3-24 and GH84-3-59.

8) TA-VIII assemblage

Abundant species: *Melonis pacificus* and *Pseudoparrella exigua*.

Subordinate species: *Bulimina aculeata*, *Rhabdammina abyssorum* and *Trochammina globigeriniformis*.

Depth range: 1,500–2,710 m.

Water depth zone: deep water (above foraminiferal lysocline).

Topographic setting: continental slope with a small slope break.

Sediment: sandy silt.

Occurrence: GH84-3-3, GH84-3-7, GH84-3-10, GH84-3-12, GH84-3-32, GH84-3-33 and GH84-3-36.

This assemblage is recognized in the lower middle bathyal to abyssal zone. *Bulimina aculeata* rapidly decreases under the foraminiferal lysocline.

9) TA-IX assemblage

Abundant species: *Rhabdammina abyssorum*.

Subordinate species: *Reophax difflugiformis*, *Rhizammina algaeformis* and *Saccorhiza ramosa*.

Depth : *ca*. 3,200 m.
Water depth zone : deep water (below foraminiferal lysocline).
Topographic setting : lower continental slope off Tosa Bay.
Sediment : silt.
Occurrence : KT87-10-PP5.

This assemblage was recognized offshore Tosa Bay, where are additional occurrences of several calcareous benthic foraminifera, mostly of *Tosaia hanzawai*.

2. Kumanonada area

The author examined 14 samples collected by the GH82-2 cruise from off Kumanonada. Eight assemblages were recognized and named KU-I to KU-VIII in accordance to the depth range in this area. The constituent species and distribution of those assemblages are as follows :

1) KU-I assemblage
Abundant species : *Gyroidinoides nipponicus*, *Hanzawaia nipponica*, *Miliolinella circularis* and *Quinqueloculina akneriana*.
Subordinate species : *Textularia* spp., *Bulimina marginata*, *Cibicides subhaidingerii*, *Gavelinopsis* sp. A, *Gyroidina cushmani*, *Hoeglundina elegans* and *Rosalina vilardeboana*.
Depth : 100 m.
Water depth zone : surface water.
Topographic setting : top of continental slope (rarely on continental shelf).
Sediment : medium sand.
Occurrence : GH82-2-24.

2) KU-II assemblage
Abundant species : *Bolivina robusta*, *Bulimina marginata*, *Cibicides aknerianus*, *Gavelinopsis* sp. A, *Globocassidulina subglobosa*, *Gyroidinoides nipponicus*, *Cibicidoides mediocris*, *Hoeglundina elegans* and *Planulina ariminensis*.
Subordinate species : *Spiroplectammina higuchii*, *Elphidium advena* and *Uvigerina vadescens* var.
Depth range : 186–238 m.
Water depth zone : intermediate water.
Topographic setting : continental slope at western root of Shima Spur.
Sediment : fine sand.
Occurrence : GH82-2-24, GH82-2-31 and GH82-2-38.

3) KU-III assemblage
Dominant species : *Gyroidinoides nipponicus*, *Bolivina robusta* and *Uvigerina hispidocostata*.
Depth : 465 m.
Water depth zone : intermediate water.
Topographic setting : continental slope at western root of Shima Spur.
Sediment : fine sand.
Occurrence : GH82-2-39.

4) KU-IV assemblage
Abundant species : *Bulimina aculeata* and *Bulimina marginata*.
Subordinate species : *Bolivina robusta* forma A and *Uvigerina hispidocostata*.
Depth : 607 m.
Water depth zone : intermediate water.
Topographic setting : at western root of Shima Spur.
Sediment : coarse sand (foraminiferal sand).
Occurrence : GH82-2-25.

5) KU-V assemblage
Abundant species : *Bulimina rostrata*, *Chilostomella oolina*, *Nonionellina labradorica*, *Pseudoparrella exigua*, *Rutherfordoides mexicanus* and *Sphaeroidina compacta*.
Subordinate species : *Bulimina aculeata*, *Bulimina striata*, *Oridorsalis umbonatus*, *Pullenia salisburyi*, *Uvigerina hispidocostata* and *Uvigerina vadescens*.
Depth : 982 m.
Water depth zone : intermediate water (oxygen minimum zone).
Topographic setting : continental slope beneath western root of Shima Spur.
Sediment : silt.

Occurrence : GH82-2-33.

6) KU-VI assemblage

Abundant species : *Bulimina aculeata* and *Chilostomella oolina*.

Subordinate species : *Alveolophragmium subglobosum*, *Pseudoparrella exigua*, *Rutherfordoides mexicanus* and *Uvigerina hispidocostata*.

Depth : 1,492 m.

Water depth zone : deep water.

Topographic setting : western slope of Shima Spur.

Sediment : silt.

Occurrence : GH82-2-41.

7) KU-VII assemblage

Abundant species : *Bulimina aculeata* and *Cassidulina carinata*.

Subordinate species : *Bolivinita quadrilatera*.

Depth : 1,642 m.

Water depth zone : deep water.

Topographic setting : western slope of Shima Spur.

Sediment : silt.

Occurrence : GH82-2-50.

8) KU-VIII assemblage

Abundant species : *Pseudoparrella exigua*, *Uvigerina hispidocostata* and *Bulimina aculeata*.

Subordinate species : *Martinottiella communis*, *Chilostomella oolina*, *Melonis parkerae* and *Uvigerina proboscidea*.

Depth range : 1,872–2,082 m.

Water depth zone : deep water (above foraminiferal lysocline).

Topographic setting : basin floor of Kumano Basin.

Sediment : sandy silt.

Occurrence : GH82-2-59, GH82-2-60, GH82-2-70, GH82-2-102 and GH82-2-103.

3. Enshunada area

The author examined 10 samples collected by the KT85-6 cruise from off Enshunada and six samples by the KT86-11 cruise in the Nankai Trough. Five assemblages were recognized and named EN-I to EN-V in accordance to the depth range in this area. The constituent species and distribution of those assemblages are as follows :

1) EN-I assemblage

Abundant species : *Bolivina robusta*, *Hanzawaia nipponica* and *Cibicidoides mediocris*.

Subordinate species : *Ammonia ketienziensis*, *Ammonia takanabensis*, *Rectobolivina raphanus* and *Uvigerina schencki*.

Depth range : 48–198 m.

Water depth zone : surface water.

Topographic setting : on continental shelf.

Sediment : silty fine sand.

Occurrence : KT85-6-G4, KT85-6-G5, KT85-6-G6, KT85-6-G9 and KT85-6-G10.

This assemblage is subdivided into two groups : one is distributed off the mouth of the River Tenryugawa, and includes abundant *A. ketienziensis* ; the other is off Ise Bay, and consists mainly of *Cibicidoides mediocris*.

2) EN-II assemblage

Abundant species : *Gyroidina orbicularis* and *Bulimina aculeata*.

Subordinate species : *Bolivinita quadrilatera*, *Cibicides aknerianus* and *Oridorsalis umbonatus*.

Depth range : 495–587 m.

Water depth range : intermediate water.

Topographic setting : on continental slope.

Sediment : sandy silt.

Occurrence : KT85-6-G3 and KT85-6-G8.

3) EN-III assemblage

Abundant species : *Bulimina aculeata* and *Uvigerina proboscidea*.

Subordinate species : *Cibicides wuellerstorfi* and *Parrelloides bradyi*.

Depth range : 1,000–1,500 m.

Water depth zone : intermediate water (oxygen minimum zone).

Topographic setting : continental

slope.
Sediment: sandy silt.
Occurrence: KT85-6-G1, KT85-6-G2 and KT85-6-G7.

4) EN-IV assemblage
Abundant species: *Globobulimina pacifica* and *Chilostomella oolina*.
Depth: 4,047 m.
Water depth zone: deep water (above CCD).
Topographic setting: Nankai Trough.
Sediment: silt.
Occurrence: KT86-11-P8.

5) EN-V assemblage
Abundant species: *Pseudoparrella exigua* and *Chilostomella oolina*.
Subordinate species: *Tosaia hanzawai*.
Depth range: 3,000–4,050 m.
Water depth zone: deep water (around foraminiferal lysocline).
Topographic setting: bottom floor of Shikoku Basin and summit of Zenisu Ridge.
Sediment: silt, volcanic glass and basalt fragments.
Occurrence: KT86-11-PP5 and KT86-11-PP6.

4. Hachijojima Island area

The author examined 18 samples collected by the GH79-4, GH80-4, KT86-10 and 11 cruises from around Hachijojima Island. Six assemblages were recognized and named HA-I to HA-VI in accordance to the depth range in this area. The constituent species and distribution of those assemblages are as follows:

1) HA-I assemblage
Abundant species: *Cibicidoides mediocris*.
Subordinate species: *Globocassidulina pseudoquadrata*.
Depth range: 150–500 m.
Water depth zone: intermediate water.
Topographic setting: summit of Shinkurose Bank.
Sediment: calcareous sand containing foraminiferal tests and molluscan valves.
Occurrence: GH80-4-85, GH80-4-94, GH80-4-96, GH80-4-97 and KT86-10-G3.

This assemblage includes *Miliolinella australis*, *Miliolinella circularis*, *Poroeponides cribrorepandus* and *Robulus orbicularis* at shallower depths. The constituent species of this assemblage resemble those of TA-II or III, but no *Amphistegina* spp. are present in this assemblage.

2) HA-II assemblage
Abundant species: *Cibicides wuellerstorfi*.
Subordinate species: *Rhabdammina abyssorum*.
Depth range: 1,500–1,700 m.
Water depth zone: intermediate water (oxygen minimum zone).
Topographic setting: continental slope on back arc side of Shichito Ridge.
Sediment: calcareous sand (mainly foraminiferal sand).
Occurrence: GH79-4-D370 and GH79-4-D371.

This assemblage includes *Bulimina aculeata*, *Burseolina marshallana*, *Globocassidulina gemma*, *Globocassidulina subglobosa* and *Ehrenbergina pacifica*. *Nuttallides umbonifera* is abundant at only three points on the western continental slope.

Similar assemblages were also recognized at the same depth in the Tanegashima and Kumanonada areas. Comparison shows that the constituent *Cassidulina* species of the assemblages differ among areas: *Paracassidulina quasicarinata* is present in TA: *Cassidulina carinata* in KU.

3) HA-III assemblage
Abundant species: *Rhabdammina abyssorum* and *Pseudoparrella exigua*.
Subordinate species: *Saccorhiza ramosa*, *Chilostomella oolina*,

Globocassidulina subglobosa and *Tosaia hanzawai*.
Depth range : ca. 2,900–3,600 m.
Water depth zone : deep water (about foraminiferal lysocline).
Topographic setting : small basin on continental slope on backarc side of Shichito Ridge.
Sediment : silt, volcanic glass and basalt fragments.
Occurrence : GH79-4-D373, GH79-4-D375 and KT85-6-D1.

The assemblage at KT85-6-D1 resembles EN-V in the Enshunada area, but the latter assemblage does not include *Rhabdammina abyssorum*. The last two samples, collected at about the same depth on the east and west sides of the Shichito Ridge, contain nearly the same species composition, which implies that the deep water mass does not fundamentally differ on both sides of the ridge.

4) HA-IV assemblage
Abundant species : *Rhabdammina abyssorum*.
Subordinate species : *Glomospira* spp.
Depth : 5,200 m.
Water depth zone : deep water (below CCD).
Topographic setting : small basin on continental slope of Izu-Bonin Arc.
Sediment : silt including basalt fragments and acidic tuff.
Occurrence : GH79-4-D371.

5) HA-V assemblage
Abundant species : *Saccorhiza ramosa*
Subordinate species : *Rhabdammina abyssorum* and *Sphaeroidina compacta*.
Depth : 1,500 m.
Water depth zone : intermediate water (oxygen minimum zone).
Topographic setting : basin bottom of Hachijo Basin.
Sediment : silt.
Occurrence : KT86-10-G1.

This assemblage is characterized by an abundant occurrence of *Saccorhiza ramosa*. This species occurs in abundance at KT85-6-7 off Atsumi in the Enshunada area, while *Uvigerina proboscidea* is abundant at KT85-6-G7, even though both points are situated at the same depth.

6) HA-VI assemblage
Abundant species : *Bulimina aculeata* and *Melonis parkerae*
Subordinate species : *Rutherfordoides mexicanus* and *Pseudoparrella exigua*.
Depth : 2,169 m.
Water depth zone : deep water (oxygen minimum zone).
Topographic setting : small basin on continental slope of Izu-Bonin Arc.
Sediment : silt including basalt fragments and acidic tuff.
Occurrence : GH80-4-RC102.

Although *Pseudoparrella exigua* is rather meager, this assemblage is almost identical with TA-VIII in the Tanegashima area. The species composition of KU-VIII in the Kumanonada area is likely what *Uvigerina hispidocostata* is added on to HA-VI.

The sum of the above descriptions is as follows :

1) Although water depth is equivalent, the assemblages of the Nankai Trough and Shikoku Basin differ from each other, as expressed by EN-V and EN-VI. This difference may be attributed to dissimilarities in the nature of sediments, resulted from distinctive submarine topography.

2) Where wide hinterlands exist, the following forms become dominant with water depth : *Ammonia ketienziensis*, *Bolivina robusta*, *Uvigerina* spp. (*U. proboscidea* and *U. hispidocostata*) and *Rhabdammina abyssorum*.

3) Where narrow or no hinterlands are present, assemblages are dominated by *Miliolinella circularis* — *M. australis*, *Cibicidoides mediocris*, *Globocassidulina* spp. — *Paracassidulina* spp., *Pseudoparrella exigua* — *Bulimina aculeata* and *Rhabdammina abyssorum* by turns in deepening order.

4) *Rhabdammina abyssorum* usually

occurs in abundance below the foraminiferal lysocline, but subordinate species differ among assemblages: for example, *Bulimina aculeata* and *Melonis pacificus* in TA-VIII, *Reophax difflugiformis* in TA-IX and *Glomospira* spp. in HA-V.

5) The deep water assemblage does not fundamentally differ on both the east and west sides of the Shichito Ridge.

DISTRIBUTION OF SELECTED SPECIES

The following 16 species, each can be traced back to the Neogene, were selected on the basis of principal components scores for facilitating paleoenvironmental analysis. Fugure 33 shows their distribution in the water column off southwest Japan on the basis of Figs. 28-31.

Bathysiphon sp.: In all traverses, usually less than 3% of the fauna; only occurs below 1,000 m.

Alveolophragmium subglobosum (G.O. Sars): In all traverses, usually less than 3% of the fauna; occurs below 1,000 m. A sample off Ito, under anaerobic conditions, yielded a few specimens of this species, and no other agglutinated species.

Rhabdammina abyssorum M. Sars: Present in all traverses, running up to more than 9% only on the continental slope below the foraminiferal lysocline. This species is absent within the Nankai Trough and Shikoku Basin, located below the lysocline. The mud content of sediments containing this species is approximately 70%.

Trochammina globigeriniformis (Parker and Jones): Present in all traverses, being usually less than 3% of the fauna. The mud content of sediments containing this species is approximately 70%.

Ammonia ketienziensis (Ishizaki): Sporadic down to over 200 m, most characteristic at depths between 80 m and 200 m; abundant in shallow water and fine sandy sediments off the mouth of the River Tenryugawa.

Ammonia takanabensis (Ishizaki): Most characteristic in a depth range narrower than *A. ketienziensis*, spanning from 100 m and 200 m. The distribution of this species is also regional. It is abundant in shallow water and fine sandy sediments off the mouth of the River Tenryugawa.

Cibicides aknerianus (d'Orbigny): Occurs from a few points in two traverses (6% or less); in the traverse off Kumanonada approximately 6% at 215 m; in the traverse off the River Tenryugawa 6% at 150 m; ranges from 80 to 1,000 m in water depth.

Cibicides wuellerstorfi (Schwager): Recorded at a depth ranging from 200 m to 4,000 m; in the traverse off the River Tenryugawa approximately 10% at about 1,400 m water depth; occurs most frequently in the traverse around Hachijojima, between 1,500 m and 1,700 m, being as high as 15%. The mud content of samples containing large individuals is about 70%. Not widely distributed in other traverses.

Chilostomella oolina Schwager: Present in all traverses in abundance below 800 m water depth. Numerous living individuals were found within the Nankai Trough. Aside from this trough, it varies in abundance from sample to sample within limited ranges of water depth and area. The mud content of samples containing large numbers is more than 90%.

Cibicidoides mediocris (Finlay): At many stations in all traverses more than 3% of the total population; commonly over 9% between 100 m and 700m, with a maximum of 20% at about 500 m water depth; no records from more than about 2,000 m water depth.

Elphidium crispum (Linné): At a few stations shallower than 250 m in several traverses it is less than 1% of the total population.

Globobulimina auriculata (Bailey): Occurs in low abundance between 1,000 m and 2,200 m water depth in the oxygen minimum zone. A unique sample off Ito, apparently under anoxic conditions, yielded abundant specimens of this species (more than 90%). Thus, this species is related with dissolved oxygen content.

Gyroidina orbicularis d'Orbigny: At many stations in all traverses it is less than 1% of the total population.

Melonis parkerae (Uchio): Occurs in most samples from all traverses and at all depths above the CCD, with highest frequencies (commonly about 3%) between 1,000 m and 2,200 m.

Robulus orbicularis d'Orbigny: At a few stations in all traverses its frequency is usually 3% or less; In the traverse around Hachijojima Island approximately 6% at 195 m. The lower depth limit is probably 500 m.

Uvigerina proboscidea Schwager: Occurs between 1,000 m and 2,200 m water depth off southwest Japan; abundant in samples of sandy silt bottom under deep waters; Nothing was found on the continental slope around Hachijojima and Tanegashima islands.

COMPARISON WITH PREVIOUS STUDY

Several previous workers who investigated modern NW Pacific faunas off southwest Japan mentioned the relationship between the faunas and oceanographic conditions (Ishiwada, 1964; Aoshima, 1978; Inoue, 1986). The characteristics of assemblages and their mutual relations reported by previous workers from the NW Pacific are briefly mentioned below. Papers referred to here are those by Ishiwada (*op. cit.*) and Aoshima (*op. cit.*) in Tosa Bay; Aoshima (*op. cit.*) off Ogasa, Atsumi, Kumano and Miyazaki; and Inoue (*op. cit.*) in Suruga Bay, all in the NW Pacific off southwest Japan. Figure 33 shows the benthic foraminiferal assemblages which were distinguished by previous workers, assemblages in the four areas mentioned above, and relations between those assemblages and water depth. Comparison between the assemblages established by previous studies and those of the present author is also shown in this figure.

Inoue (1986) described 12 assemblages based on dominant species, including three assemblages recognized in the Enshunada area. The *Bolivinita quadrilatera* Assemblage is distributed at 245 m to 485 m water depth off the Oigawa, and includes *Cassidulina carinata* and *Hyalinea balthica*. This assemblage is similar to EN-II assemblage in this study. The *Bolivina robusta* Assemblage is characterized by abundant occurrences of *B. robusta* and *Cassidulina carinata*, and is confined to 265 m to 660 m water depth on the western slope of Suruga Bay. The *Rectobolivina raphanus* Assemblage contains *Brizalina karrerianum*, *Quinqueloculina* spp. and *Hanzawaia nipponica* in shallow water off Omaezaki. The both assemblages correspond to EN-I off the mouth of the River Tenryugawa in this study.

Aoshima (1978) reported four assemblages in relation to water masses off southwest Japan. The species association of those four assemblages has not been described in his paper, but among the species six types of distribution are recognized relative to water masses. Those types almost coincide with the result of the present author.

Ishiwada (1964) described a benthic

assemblage off Tosa together with assemblages from other areas off the Pacific coast of Japan. The Tosa fauna includes four biofacies: *Bolivina robusta*, *Rectobolivina raphanus* and *Pseudorotalia papillosa*, accompanied by *Ammonia ketienziensis* in shallow water (Facies IA; 50-80 m water depth); *Bolivina robusta*, *Bulimina marginata* and *Uvigerina proboscidea vadescens* (Facies IB; 100-280 m water depth); *Bulimina nipponica* with *Uvigerina peregrina dirupta* (Facies IIA; 400 to 680 m); and *Bulimina nipponica* associated with *Martinottiella communis* and *Cibicides wuellerstorfi* (IIB; 900 m water depth). Although his studied area differs geographically, Facies IA and IB are similar to assemblage EN-1 off the River Tenryugawa.

Thus, it is considered that assemblages assorted by the present author in the Enshunada and Kumanonada areas are widely distributed off southwest Japan. On the contrary, assemblages around Hachijojima Island and the Tanegashima area differ from those off southwest Japan, but no comparison is made

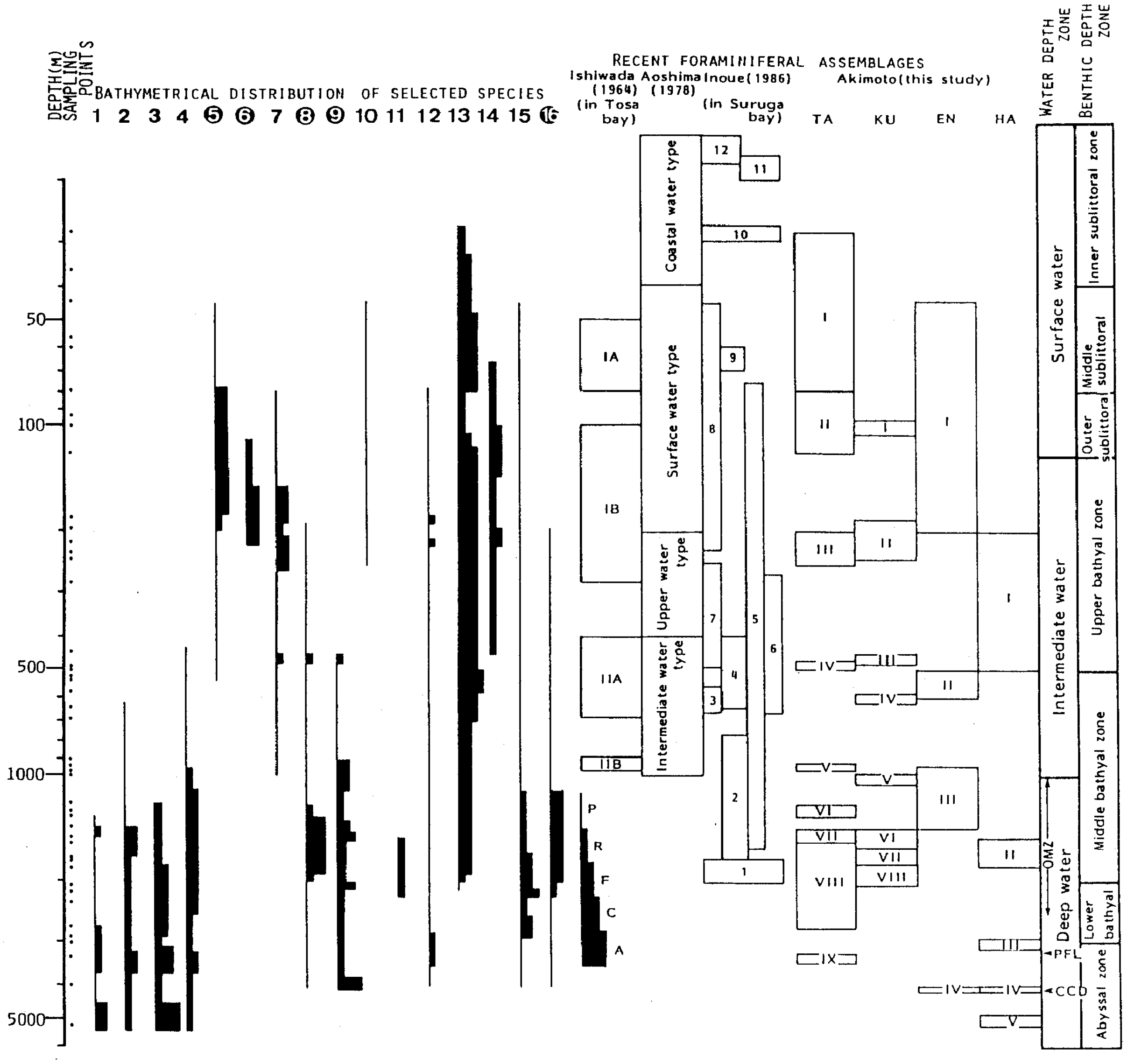


Fig. 33.

because of lack of data for deeper water assemblages.

FAUNAL STRUCTURE

Gibson and Buzas (1973) studied diversity of Recent benthic foraminifera distributed off along the eastern margin of North America, and revealed paleoenvironments of the Miocene sequence distributed along the east coast by comparison with Recent assemblages.

The present author incidentally investigated diversity of Recent benthic foraminiferal assemblages distributed off southwest Japan, in connection with water masses, sediment characteristics, and submarine topography.

Benthic foraminiferal diversity and equitability are expressed by Shannon-Weaver's information function as somewhat revised by Buzas and Gibson (1969). Those two parameters are given in the following formulae :

$$H(s) = -\sum_{i=1}^{S} p_i \ln p_i, \text{ and } E = e^{H(s)}/S$$

where p_i stands for the proportion of the ith species in a sample, and S the num-

Fig. 33. Bathymetric distribution and frequency of selected species, and comparison of established assemblages by Ishiwada (1964), Aoshima(1978) and Inoue (1986) with those of Recent benthic foraminifera in the Pacific Ocean off southwest Japan, determined by the present author. Numbers indicate the following selected species :

1. *Bathysiphon* sp.
2. *Alveolophragmium subglobosa* (G.O. Sars)
3. *Rhabdammina abyssorum* M. Sars
4. *Trochammina globigeriniformis* (Parker and Jones)
5. *Ammonia ketienziensis* (Ishizaki)
6. *Ammonia takanabensis* (Ishizaki)
7. *Cibicides aknerianus* (d'Orbigny)
8. *Cibicides wuellerstorfi* (Schwager)
9. *Chilostomella oolina* Schwager
10. *Elphidium crispum* (Linné)
11. *Globobulimina auriculata* (Bailey)
12. *Gyroidina orbicularis* d'Orbigny
13. *Cibicidoides mediocris* (Finlay)
14. *Lenticulina orbicularis* (d'Orbigny)
15. *Melonis parkerae* (Uchio)
16. *Uvigerina proboscidea* Schwager

White numbers in solid circles indicate species whose frequencies vary from area to area. TA, off Tanegashima Island ; KU, off Kumanonada ; EN ; off Enshunada ; HA, around Hachijojima Island.

Numbers for Recent assemblages established by Inoue (1986) in Suruga Bay stand for as follows :

1. *Bulimina aculeata* Assemblage
2. *Nonionellina labradorica* Assemblage
3. *Stainforthia exilis tenuata* Assemblage
4. *Bulimina aculeata-Stainforthia exilis tenuata* Assemblage
5. *Eggerella scabra* Assemblage
6. *Bolivinita quadrilatera* Assemblage
7. *Bolivina robusta* Assemblage
8. *Cibicides* spp. Assemblage
9. *Siphogenerina raphanus* Assemblage
10. *Pararotalia nipponica* Assemblage
11. *Ammobaculites exiguus-Ammonia japonica* Assemblage
12. *Pseudononion japonicum-Ammonia beccarii* Assemblage

ber of species. The latter equation equals the formulation, $H(s)=\ln(S\cdot E)$. By this formula, the relationships among the three parameters, diversity, equitability and number of species in a sample can be expressed simultaneously.

1. Tanegashima area

The above-mentioned three parameters are shown in Fig. 34 for 24 samples. Six clusters of points may be interpreted in relation to water depth and topographic features. Clusters of the bathyal zone are characterized by high values of diversity, equitability and number of species. On the contrary, clusters of the sublittoral zone show moderate values of diversity, equitability and number of species.

2. Kumanonada area

Figure 35 shows the three parameters for all 16 samples. All points are grouped into six clusters based on their topographic features and water depth. Groups 1 and 2 (sublittoral zone), group 3 (upper bathyal zone) and group 4 (upper middle bathyal zone) are relatively high in number of species, moderate in diversity and equitability. Samples of the lower bathyal zone are grouped under two categories based on equitability: groups 5 and 6 are represented by rather low equitability, diversity and number of species; group 6 is characterized by much less equitability values. Those two groups stand for different topography in this area: group 5 is located on the upper continental slope and group 6 on the bottom floor of the Kumano Basin.

3. Enshunada area and Shinkurose Bank

Figure 36 shows the three parameters for all 18 samples. These points are grouped into seven clusters based on their topographic features and water depth. Group 1 on the Shinkurose Bank bears large numbers of species, moderate in diversity and equitability. On the other hand, group 4 off Enshunada in the same water depth as group 1 is characterized by moderate values of diversity, equitability and

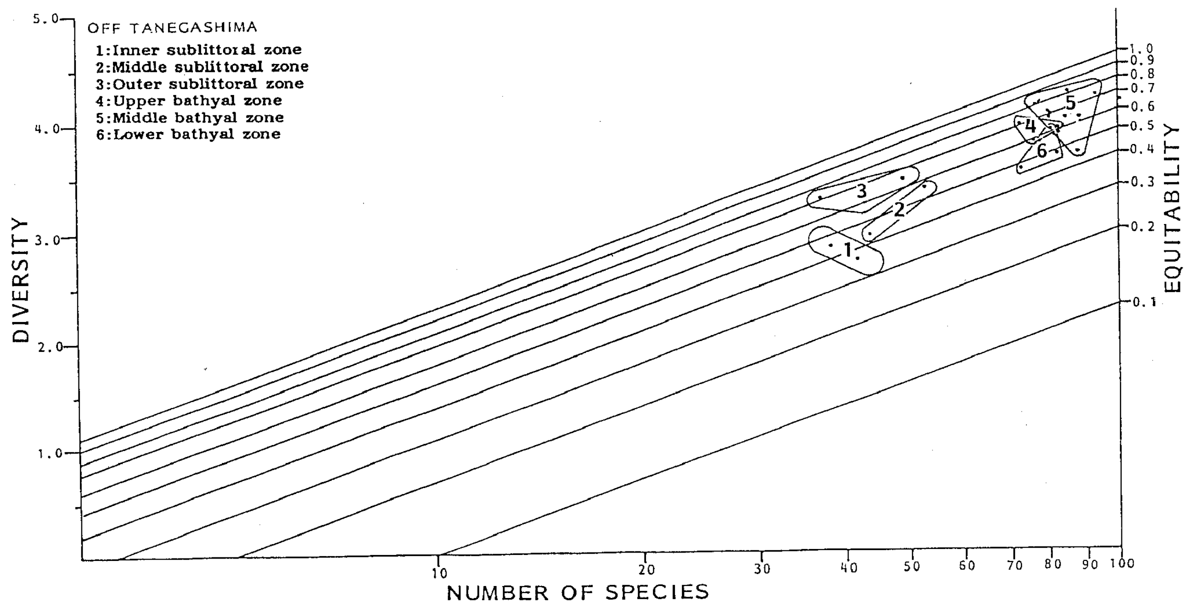


Fig. 34. Diagram showing species diversity, equitability, and number of species of samples from off Tanegashima Island.

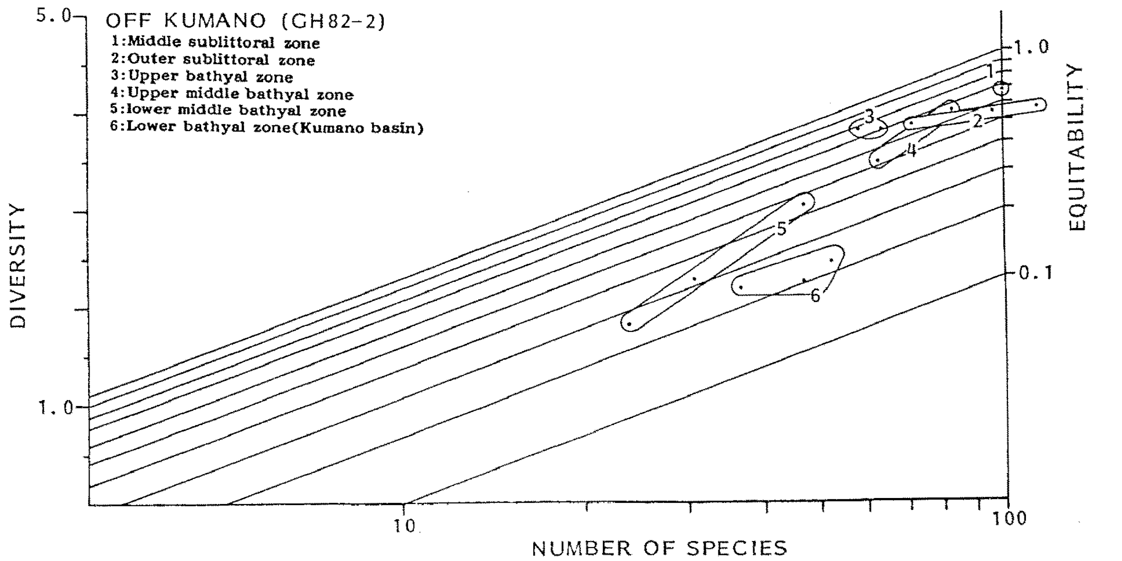


Fig. 35. Diagram showing species diversity, equitability, and number of species of samples in the Kumanonada area.

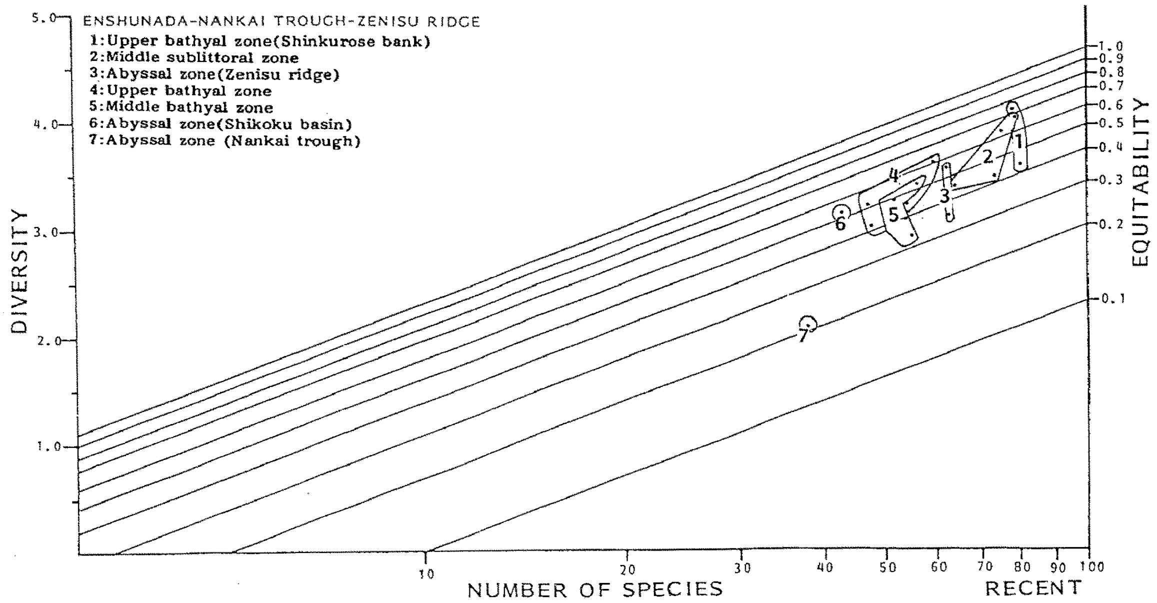


Fig. 36. Diagram showing species diversity, equitability, and number of species of samples in the Enshunada area.

number of species. Points belonging to group 5 are located in the middle bathyal zone, and exhibit the same values as in group 4. Two groups (group 2 in the middle sublittoral zone off Enshunada and group 3 in the abyssal zone on the Zenisu Ridge) take intermediate numbers of species between group 1 and groups 4–5, with moderate other parameters. Points in the abyssal zone are grouped under two clusters. Group 6 on the bottom floor of the Shikoku Basin is represented by moderate values of diversity, equitability and number of species. A point of group 7, which represents the Nankai Trough, shows a lower value of equitability than that in the abyssal zone.

In a summary, these figures (Fig. 34–36) lead to the following lines: 1) Points in the Nankai Trough and Kumano Basin are characterized by a rather low value of equitability (about 0.2). 2) The bathyal zone sample is marked by moderate values of diversity, equitability and number of species. 3) The three parameters of points in the sublittoral zone vary from locality to locality. Especially, those values in the Tanegashima area are extraordinarily low in comparison with other areas. This may be attributed to the influence of the Kuroshio Current.

FAUNAL REFERENCE LIST

Benthic foraminiferal species from the Enshunada, Kumanonada, Tanegashima and Hachijojima areas are alphabetically listed below. Selected species are illustrated with micrographs taken with the scanning electron microscope (Plates 11 to 24). The original references are given for each of the species.

Adercotryma glomeratum (Brady) ....Pl. 11, fig. 1
Lituola glomerata Brady, 1878, p. 433, pl. 20, fig. 1. (*fide* Ellis and Messina, 1940 *et seq.*).
Adercotryma glomeratum (Brady). Loeblich and Tappan, 1952, p. 141, figs. 1–4. (*fide* Loeblich and Tappan, 1953).

Alabamina tubulifera (Heron-Allen and Earland)..Pl. 15, fig. 17; Pl. 24, fig. 2
Truncatulina tubulifera Heron-Allen and Earland, 1915, p. 710, pl. 52, figs. 37–40.
Alabamina tubulifera (Heron-Allen and Earland). Hofker, 1951, p. 392, figs. 271–273.

Allomorphina pacifica Hofker
Allomorphina pacifica Hofker, 1951, p. 139, fig. 86.

Alveolophragmium bradyi (Cushman)
Cribrostomoides bradyi Cushman, 1910, p. 108, text-fig. 167.
Alveolophragmium bradyi (Cushman). Barker, 1960, p. 70, pl. 34, fig. 9.

Alveolophragmium kosterense (Höglund)
Labrospira kosterensis Höglund, 1947, p. 139, 147, pl. 11, fig. 4, text-figs. 130, 131.
Alveolophragmium kosterense (Höglund). Graham and Militante, 1959, p. 24, pl. 1, fig. 11.

Alveolophragmium ringens (Brady) ....Pl. 11, fig. 9
Trochammina ringens Brady, 1879, p. 57, pl. 5, fig. 12.
Alveolophragmium ringens (Brady). Parker, 1954, p. 487.

Alveolophragmium scitulum (Brady)
Haplophragmium scitulum Brady, 1881, p. 20.
Alveolophragmium scitulum (Brady). Parker, 1954, p. 487.

Alveolophragmium subglobosum (G.O. Sars) .... Pl. 11, fig. 3; Pl. 13, fig. 10; Pl. 14, fig. 2
Haplophragmium subglobosa G.O. Sars, 1868, p. 250. (*fide* Ellis and Messina, 1940 *et seq.*).
Alveolophragmium subglobosa (G.O. Sars). Barker, 1960, p. 70, pl. 34, figs. 7, 8, 10 (not 14).

Alveolophragmium wiesneri (Parr)
Labrospira wiesneri Parr, 1950, p. 272. (*fide* Ellis and Messina, 1940 *et seq.*).
Alveolophragmium wiesneri (Parr). Barker, 1960, p. 82, pl. 40, figs. 14, 15.

Ammobaculites agglutinans (d'Orbigny) ....Pl. 12, fig. 4
Spirolina agglutinans d'Orbigny, 1846,

p. 137, pl. 7, figs. 10-12.
Ammobaculites agglutinans filiformis Earland .... Pl. 12, fig. 3
Ammobaculites agglutinans filiformis Earland, 1934, p. 92, figs. 11-13.
Ammobaculites americanus Cushman
Ammobaculites americanus Cushman, 1910, p. 117, text-figs. 184, 185.
Ammodiscus minutissimus Cushman and McCulloch
Ammodiscus minutissimus Cushman and McCulloch, 1939, p. 70, pl. 5, figs. 3, 4.
Ammodiscus pacifica Cushman and Valentine .... Pl. 13, fig. 4
Ammodiscus pacifica Cushman and Valentine, 1930, p. 7, pl. 1, fig. 1.
Ammolagena clavata (Parker and Jones)
Trochammina irregularis (d'Orbigny) var. *clavata* Parker and Jones, 1860, p. 304. (*fide* Ellis and Messina, 1940 *et seq.*).
Ammolagena clavata (Parker and Jones). Cushman, 1910, p. 68, text-figs. 86-89.
Ammonia beccarii (Linné)
Nautilus beccarii Linné, 1758, Syst. Nat., ed. 10, p. 710 (*fide* Ellis and Messina, 1940 *et seq.*).
Ammonia beccarii (Linné). Frizzel and Keen, 1949, p. 106.
Ammonia inflata (Seguenza)
Rosalina inflata Seguenza, 1862, p. 106, pl. 1, fig. 6.
Ammonia japonica (Hada)
Rotalia. japonica Hada, 1931, p. 137, fig. 93.
Ammonia japonica (Hada). Ujiié, 1963, p. 236, pl. 2, figs. 3, 4.
Ammonia ketienziensis (Ishizaki)
.... Pl. 21, fig. 1
Streblus ketienziensis Ishizaki, 1948, p. 59, pl. 1, fig. 2.
Ammonia ketienziensis (Ishizaki). Huang, 1964, p. 53, pl. 1, fig. 13.
Ammonia okinawaensis (LeRoy)
Rotalidium okinawaensis LeRoy, 1964, p. 38, pl. 4, figs. 29-31.
Ammonia okinawaensis (LeRoy). Loeblich and Tappan, 1964, p. 607.
Ammonia takanabensis (Ishizaki)
.... Pl. 15, fig. 15
Streblus takanabensis Ishizaki, 1948, p. 57, pl. 1, fig. 5.
Ammonia takanabensis (Ishizaki). Huang, 1964, p. 56, pl. 1, fig. 2.
Ammoscalaris pseudospiralis (Williamson)
Proteonina pseudospiralis Williamson, 1858, p. 1.
Ammoscalaris pseudospiralis (Williamson). Parker, Phleger and Peirson, 1953, p. 6, pl. 1, figs. 29, 35.
Amphicoryna pauciloculata (Cushman)
Nodosaria pauciloculata Cushman, 1921, p. 205, pl. 36, figs. 10-12.
Amphicoryna pauciloculata (Cushman). Hasegawa, 1979, p. 142.
Amphicoryna proxima (Silvestri)
Nodosaria proxima Silvestri, 1872, p. 63, pl. 6, figs. 138-147. (*fide* Ellis and Messina, 1940 *et seq.*).
Amphicoryna proxima (Silvestri). (*fide* Barker, 1960).
Amphicoryna scalaris (Batsch)
.... Pl. 17, fig. 7
Nautilus scalaris Batsch, 1791, pl. 2, fig. 4. (*fide* Ellis and Messina, 1940 *et seq.*).
Amphicoryna scalaris (Batsch). Barker, 1960, p. 134, pl. 63, figs. 28-31.
Amphicoryna scalaris sagamiensis (Asano)
Lagenodosaria scalaris sagamiensis Asano, 1936b, p. 613, pl. 30, figs. 6, 7.
Amphicoryna scalaris sagamiensis (Asano). Matoba, 1967, p. 251, pl. 25, fig. 4.
Amphistegina madagascariensis d'Orbigny
Amphistegina madagascariensis d'Orbigny, 1826, p. 304.
Amphistegina radiata (Fichtel and Moll)
Nautilus radiatus Fichtel and Moll, 1798, p. 58, pl. 8, figs. a-d. (*fide* Ellis and Messina, 1940 *et seq.*).
Amphistegina radiata (Fichtel and

Moll). Graham and Militante, 1959, p. 104, pl. 16, figs. 12, 13.

Amphistegina wanneriana Fischer
Amphistegina wanneriana Fischer, 1927, p. 167, pl. 217 (6), fig. 131. (*fide* Ellis and Messina, 1940 *et seq.*).

Anomalinoides cavus Belford
Anomalinoides cavus Belford, 1966, p. 180, pl. 33, figs. 1-8.

Anomalinoides glabrata (Cushman)
Anomalina glabrata Cushman, 1924, p. 39, pl. 12, figs, 5-7.

Anomalinoides glabulosa (Chapman and Parr) ....Pl. 20, fig. 6
Anomalina glabulosa Chapman and Parr, 1937, p. 117.

Aschemonella scabra Brady
Aschemonella scabra Brady, 1879, p. 44, pl. 3, figs. 6, 7.

Astacolus crepidulus (Fichtel and Moll)
Nautilus crepidulus Fichtel and Moll, 1798, p. 107, pl. 19, figs. g, i. (*fide* Ellis and Messina, 1940 *et seq.*)
Astacolus crepidulus (Fichtel and Moll). Galloway and Wissler, 1927, p. 45.

Astrononion italicum Cushman and Edward
Astrononion italicum Cushman and Edwards, 1937, p. 35, pl. 3, figs. 19, 20.

Astrononion stellatum Cushman and Edwards ....Pl. 15, fig. 9
Astrononion stellatum Cushman and Edwards, 1937, p. 32, pl. 3, figs. 9-11.

Astrononion stelligerum (d'Orbigny) ....Pl. 15, fig. 8
Nonionina stelligera d'Orbigny, 1839b, p. 128, pl. 3, fig. 7.
Astrononion stelligerum (d'Orbigny). Cushman and Edwards, 1937, p. 31, pl. 3, fig. 7.

Asterorotalia cf. *trispinosa* (Thalmann)
cf. *Rotalia trispinosa* Thalmann, 1933, p. 248, figs. 2, 3. (*fide* Ellis and Messina, 1940 *et seq.*).
cf. *Astrorotalia trispinosa* (Thalmann). Barker, 1960, p. 238, pl. 115, fig. 8.

Baggina philippinensis (Cushman)
Pulvinulina philippinensis Cushman, 1921, p. 331, pl. 58, fig. 2.
Baggina philippinensis (Cushman). Cushman and Todd, 1944, p. 104, pl. 17, figs. 1-3.

Baggina philippinensis pilulifera Cushman and Todd
Baggina philippinensis var. *pilulifera* Cushman and Todd, 1944a, p. 105, pl. 17, fig. 4.

Bathysiphon filiformis M. Sars
Bathysiphon filiformis M. Sars, 1871, p. 251. (*fide* Ellis and Messina, 1940 *et seq.*).

Bathysiphon rufus de Folin
Bathysiphon rufum de Folin, 1887, p. 283, pl. 6, fig. 8. (*fide* Ellis and Messina, 1940 *et seq.*).

Biloculinella globula (Bornemann)
Biloculina globulus Bornemann, 1855, p. 349, pl. 19, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Biloculinella globula (Bornemann). Asano, 1951a, p. 20, figs. 134, 135.

Biloculinella cf. *japonica* Asano
cf. *Biloculinella japonica* Asano, 1956, p. 79, pl. 9, fig. 24.

Bolivina canvallaria Millett
Bolivina canvallaria Millett, 1900, p. 544, pl. 4, fig. 6.

Bolivina digitalis (d'Orbigny)
Polymorphina digitalis d'Orbigny, 1846, p. 235, pl. 14, figs. 1-4.
Bolivina digitalis (d'Orbigny). Papp and Schmid, 1985, p. 83, pl. 76, figs. 1-6.

Bolivina earlandi Parr
Bolivina earlandi Parr, 1950, p. 339, pl. 12, fig. 16. (*fide* Barker, 1960).

Bolivina mayori Cushman
Bolivina mayori Cushman, 1922a, p. 27, pl. 3, figs. 5, 6.

Bolivina pisciformis Galloway and Morrey
Bolivina pisciformis Galloway and Morrey, 1929, p. 36, pl. 5, fig. 10.

Bolivina robusta Brady

..........Pl. 16, fig. 1 ; Pl. 22, fig. 13
Bolivina robusta Brady, 1881, p. 27.
Bolivina semicostata Cushman
Bolivina semicostata Cushman, 1911, p. 43, text-fig. 70.
Bolivina sinuosum Cushman
Loxostoma sinuosum Cushman, 1936b, p. 60, pl. 8, fig. 16.
Bolivina spinescens Cushman
Bolivina spinescens Cushman, 1911, p. 46, text-fig. 76.
Bolivina subspinescens Cushman
Bolivina subspinescens Cushman, 1922b, p. 48, pl. 7, figs. 5.
Bolivina subtenuis Cushman
Bolivina subtenuis Cushman, 1936b, p. 57, pl. 8, fig. 10.
Bolivinita quadrilatera (Schwager)
......................Pl. 16, fig. 3
Textularia quadrilatera Schwager, 1866, p. 253, pl. 7, fig. 10.
Bolivinita quadrilatera (Schwager). Cushman, 1927a, p. 90.
Brizalina cf. *aenariensis* Costa
cf. *Brizalina aenariensis* Costa, 1856, p. 297, pl. 15, fig. 1. (*fide* Ellis and Messina, 1940 *et seq.*).
Brizalina amygdalaeformis (Brady)
Bolivina amygdalaeformis Brady, 1884, p. 426, pl. 53, figs. 28, 29.
Brizalina bradyi (Asano)..Pl. 15, fig. 11
Bolivina bradyi Asano, 1938b, p. 603, pl. 16, fig. 2.
Brizalina bradyi (Asano). Takayanagi and Hasegawa, 1987, p. 7.
Brizalina karreriana (Brady)
......................Pl. 16, fig. 2
Bolivina karreriana Brady, 1881, p. 28.
Brizalina karreriana (Brady). Belford, 1966, p. 39, pl. 2, figs. 23-25.
Brizalina kiiensis (Asano)
Bolivina kiiensis Asano, 1958, p. 19, pl. 4, figs. 7, 8.
Brizalina kiiensis (Asano). Takayanagi and Hasegawa, 1987, p. 7.
Brizalina pacifica (Cushman and McCulloch)..................Pl. 16, fig. 16
Bolivina acerosa Cushman var. *pacifica* Cushman and McCulloch, 1942, p. 185, pl. 21, figs. 2, 3.
Brizalina pacifica (Cushman and McCulloch). Hasegawa, 1979, p. 143.
Brizalina plicatella (Cushman)
Bolivina plicatella Cushman, 1930, p. 46, pl. 8, fig. 10. (*fide* Ellis and Messina, 1940 *et seq.*).
Brizalina plicatella (Cushman). Belford, 1966, p. 26, pl. 1, figs. 8, 9, text-fig. 1 : 1.
Brizalina pygmaea (Brady)
Bolivina pygmaea Brady, 1881, p. 59.
Brizalina pygmaea (Brady). Belford, 1966, p. 31, pl. 1, figs. 19-22.
Brizalina seminuda (Cushman)
Bolivina seminuda Cushman, 1911, p. 34, text-fig. 55.
Brizalina seminuda (Cushman). Hasegawa, 1979, p. 143.
Brizalina subangularis ogasaensis (Asano)
Bolivina subangularis ogasaensis Asano, 1936c, p. 142, pl. 18, figs. 17-19.
Brizalina subangularis ogasaensis (Asano). Takayanagi and Hasegawa, 1987, p. 8.
Brizalina subreticulata (Parr)
Bolivina subreticulata Parr, 1932, p. 12, pl. 1, fig. 21.
Brizalina subreticulata (Parr). Belford, 1966, p. 29, pl. 1, figs. 17, 18, text-fig. 3.
Brizalina viscistriata Belford
Brizalina viscistriata Belford, 1966, p. 34, pl. 2, figs. 11-12.
Buccella makiyamai Chiji
Buccella makiyamae Chiji, 1961, p. 234, text-fig. 2, pl. 1, figs. 13, 14.
Bueningia crecki Finlay
Bueningia crecki Finlay, 1939, p. 123, pl. 14, figs. 82-84.
Bulimina aculeata d'Orbigny
..........Pl. 16, fig. 5 ; Pl. 22, fig. 9
Bulimina aculeata d'Orbigny, 1826, p. 269, No. 7.
Bulimina inflata Seguenza
Bulimina inflata Seguenza, 1862, p.

109, pl. 1, fig. 10.
Bulimina marginata d'Orbigny
......................Pl. 16, fig. 6
Bulimina marginata d'Orbigny, 1826, p. 270, pl. 12, figs. 10, 11, modèles, no. 4.
Bulimina pseudotorta Cushman
Bulimina pseudotorta Cushman, 1926a, p. 55, pl. 7, fig. 3.
Bulimina rostrata Brady ..Pl. 16, fig. 7
Bulimina rostrata Brady, 1884, p. 408, pl. 51, figs. 14, 15.
Bulimina striata d'Orbigny
..........Pl. 16, fig. 8 ; Pl. 22, fig. 11
Bulimina striata d'Orbigny, 1826, p. 269, modèles, no. 2.
Buliminella elegans (d'Orbigny)
Bulimina elegans d'Orbigny, 1826, p. 270, no. 10, modèles, no. 9.
Buliminella elegans (d'Orbigny). Cushman and Parker, 1947, p. 68, pl. 17, fig. 14.
Burseolina marshallana (Todd)
Cassidulina marshallana Todd, Cushman, Todd and Post, 1954, p. 366, pl. 90, figs. 28, 29.
Burseolina marshallana (Todd) var. *minima* Nomura
Burseolina marshallana (Todd) var. *minima* Nomura, 1983a, p. 92, pl. 2, figs. 12, 13.
Burseolina pacifica (Cushman)
Cassidulina pacifica Cushman, 1925b, p. 53, pl. 9, figs. 14-16.
Burseolina pacifica (Cushman). Nomura, 1983a, p. 57, text-fig. 48, pl. 5, figs. 1-4 ; pl. 6, fig. 2 ; pl. 21, figs. 6-10.
Cancris auriculus (Fichtel and Moll)
Nautilus auricula var. *α* Fichtel and Moll, 1798, p. 108, pl. 20, figs. a-c. (*fide* Ellis and Messina, 1940 *et seq.*).
Nautilus auricula var. *β* Fichtel and Moll, 1798, p. 110, pl. 20, figs. d-f. (*fide* Ellis and Messina, 1940 *et seq.*).
Cancris auriculus (Fichtel and Moll). LeRoy, 1941b, p. 117, pl. 3, figs. 7-9 ; 16-18.
Cancris indicus (Cushman)
Pulvinulina indicus Cushman, 1921, p. 332.
Cancris indicus (Cushman). Cushman and Todd, 1942, p. 91, pl. 23, fig. 7 ; pl. 24, figs. 1, 2.
Cancris peroblongus (Cushman)
Pulvinulina peroblonga Cushman, 1924, p. 41, pl. 13, figs. 3-5.
Cancris peroblongus (Cushman). Cushman and Todd, 1942, p. 82, pl. 21, figs. 1-5.
Carpenteria monticularis Carter
......................Pl. 23, fig. 1
Carpenteria monticularis Carter, 1877, p. 211, pl. 13, figs. 9-12. (*fide* Ellis and Messina, 1940 *et seq.*).
Carterina spiculotesta (Carter)
Rotalia spiculotesta Carter, 1877, p. 470. (*fide* Ellis and Messina, 1940 *et seq.*).
Carterina spiculotesta (Carter). Loeblich and Tappan, 1955, p. 27. (*fide* Barker, 1960).
Cassidulina carinata Silvestri
......................Pl. 17, fig. 3
Cassidulina laevigata d'Orbigny var. *carinata* Silvestri, 1896, p. 104, pl. 2, fig. 10. (*fide* Ellis and Messina, 1940 *et seq.*).
Cassidulina norvangi Thalmann
Cassidulina islandica Norvang var. *norvangi* Thalmann, 1952, p. 83.
Cassidulina ? perumbonata Keyzer
Cassidulina ? perumbonata Keyzer, 1953, p. 281, pl. 3, figs. 27-29. (*fide* Ellis and Messina, 1940 *et seq.*).
Ceratobulimina pacifica Cushman and Harris.................Pl. 15, fig. 3
Ceratobulimina pacifica Cushman and Harris, 1927, p. 176, pl. 29, figs. 30-32.
Chilostomella oolina Schwager
......................Pl. 16, fig. 17
Chilostomella oolina Schwager, 1878, p. 527, pl. 1, fig. 16. (*fide* Ellis and Messina, 1940 *et seq.*).
Cibicides aknerianus (d'Orbigny)
.....................Pl. 20, fig. 1
Rotalia akneriana d'Orbigny, 1846, p.

156, pl. 8, figs. 13-15.
Cibicides aknerianus (d'Orbigny). Asano, 1951c, p. 17, figs. 30-32.
Cibicides lobatulus (Warker and Jacob)
Nautilus lobatulus Walker and Jacob, 1798, p. 642, pl. 14, fig. 36. (*fide* Ellis and Messina, 1940 *et seq.*).
Cibicides lobatula (Warker and Jacob). (sic) Cushman, 1931, p. 118, pl. 21, fig. 3.
Cibicides macneili LeRoy
Cibicides macneili LeRoy, 1964, p. 44, pl. 9, figs. 4-6.
Cibicides margaritiferus (Brady)
Truncatulina margaritifera Brady, 1881, p. 66.
Cibicides margaritiferus (Brady). Barker, 1960, p. 198, pl. 96, fig. 2.
Cibicides praecinctus (Karrer) .... Pl. 23, fig. 4
Rotalia praecinctus Karrer, 1868, p. 158, p. 189, pl. 5, fig. 7. (*fide* Ellis and Messina, 1940 *et seq.*).
Cibicides praecinctus (Karrer). Barker, 1960, p. 196, pl. 95, figs. 1-3.
Cibicides refulgens Montfort .... Pl. 23, fig. 5
Cibicides refulgens Montfort, 1808, p. 122. (*fide* Ellis and Messina, 1940 *et seq.*).
Cibicides cf. *refulgens* Montfort
Cibicides cf. *refulgens* Montfort. Asano, 1951c, p. 18, figs. 42-44.
Cibicides robertsonianus (Brady)
Truncatulina robertsoniana Brady, 1881, p. 65.
Cibicides robertsonianus (Brady). Cushman, 1931, p. 121, pl. 23, fig. 6.
Cibicides subdepressa (Asano)
Planulina subdepressa Asano, 1951c, p. 15, figs. 16-18.
Cibicides subdepressa (Asano). Takayanagi and Hasegawa, 1987, p. 37.
Cibicides tenuimargo (Brady) .... Pl. 23, fig. 6
Truncatulina tenuimargo Brady, 1884, p. 662, pl. 93, figs. 2, 3.
Cibicides tenuimargo (Brady). Finlay, 1940, p. 467.
Cibicides wuellerstorfi (Schwager) .... Pl. 23, fig. 7
Anomalina wuellerstorfi Schwager, 1866, p. 258, pl. 7, fig. 105.
Cibicides wuellerstorfi (Schwager). LeRoy, 1941, p. 46, pl. 1, figs 27-29.
Cibicidoides mediocris (Finlay) .... Pl. 20, fig. 3 ; Pl. 23, fig. 2
Cibicides mediocris Finlay, 1940, p. 464, pl. 67, figs. 198, 199.
Clavulina pacifica Cushman
Clavulina pacifica Cushman, 1924, p. 22, pl. 6, figs. 7-11.
Cribrolinoides curta (Cushman)
Quinqueloculina disparilis d'Orbigny var. *curta* Cushman, 1917, p. 49, pl. 14, fig. 2.
Cribrolinoides curta (Cushman). Cushman and LeRoy, 1939, p. 17, pl. 3, figs. 1-11 ; pl. 4, figs. 1-13.
Cribrorbulina serpens (Seguenza) .... Pl. 22, fig. 2
Robulina serpens Seguenza, 1880, p. 143, pl. 13, fig. 25. (*fide* Ellis and Messina, 1940 *et seq.*).
Cribrorbulina serpens (Seguenza). Selli, 1941, p. 83, pl. 1, figs. 1, 2, 5-10, 12-14 ; p. 86, text-figs. 1, 2.
Cruciloculina japonica Asano
Cruciloculina japonica Asano, 1949, p. 480, figs. 1, 2, 6-13.
Cyclammina bradyi Cushman .... Pl. 13, fig. 7
Cyclammina bradyi Cushman, 1910, p. 113, text-fig. 174.
Cyclammina cancellata Brady
Cyclammina cancellata Brady, 1879, p. 43.
Cyclogyra crassisepta (Brady)
Cornuspira crassisepta Brady, 1882, p. 714. (*fide* Ellis and Messina, 1940 *et seq.*).
Cyclogyra involvens (Reuss)
Operculina involvens Reuss, 1850, p. 370, pl. 45, fig. 20. (*fide* Ellis and Messina, 1940 *et seq.*).
Cyclogyra planorbis (Schlutze)
Cornuspira planorbis Schlutze, 1854, p. 40. (*fide* Ellis and Messina, 1940

et seq.).
Cyclogyra planorbis (Schlutze). Loeblich and Tappan, 1964, p. 438, fig. 392, 2.
Cymbaloporetta bradyi (Cushman)
Cymbalopora poeyi (d'Orbigny) var. *bradyi* Cushman, 1915, p. 25, pl. 10, fig. 2 ; pl. 14, fig. 2.
Cymbaloporetta bradyi (Cushman). Thalmann, 1932, p. 310.
Cystammina galeata (Brady)
Trochammina galeata Brady, 1881, p. 52.
Cystammina galeata (Brady). Galloway, 1933, p. 186.
Cystammina pauciloculata (Brady) ....Pl. 11, fig. 10
Trochammina pauciloculata Brady, 1879, p. 58, pl. 5, figs. 13, 14.
Cystammina pauciloculata (Brady). Galloway, 1933, p. 186.
Dentalina communis d'Orbigny
Dentalina communis d'Orbigny, 1826, p. 254.
Dentalina emaciata Reuss
Dentalina emaciata Reuss, 1851, p. 63, pl. 3, fig. 9.
Dentalina filiformis (d'Orbigny)
Nodosaria filiformis d'Orbigny, 1826, p. 253.
Dentalina intorta bradyensis (Dervieux)
Nodosaria intorta var. *bradyensis* Dervieux, 1894, p. 610. (*fide* Ellis and Messina, 1940 *et seq.*).
Dentalina intorta var. *bradyensis* (Dervieux). Barker, 1960, p. 130, pl. 62, figs. 19, 20.
Dentalina cf. *setanaensis* Asano
cf. *Dentalina setanaensis* Asano, 1938c, p. 215, pl. 30, figs. 9-12, 30-32.
Dentalina mucronata Neugeboren
Dentalina mucronata Neugeboren, 1856, p. 83, pl. 3, figs. 8-11. (*fide* Ellis and Messina, 1940 *et seq.*).
Discammina compressa (Goës)
Lituolina irregularis Roemer var. *compressa* Goës, 1882, p. 141, pl. 12, figs. 421-423.
Discammina compressa (Goës). Lacroix, 1935, p. 15. (*fide* Loeblich and Tappan, 1964).
Discanomalina coronata (Parker and Jones)
Anomalina coronata Parker and Jones, 1857, p. 294, pl. 10, figs. 15, 16. (*fide* Ellis and Messina, 1940 *et seq.*).
Discanomalina coronata (Parker and Jones). Asano, 1951c, p. 13, figs. 1, 2.
Discorbinella araucana (d'Orbigny)
Rosalina araucana d'Orbigny, 1839a, p. 44, pl. 6, figs. 13-16.
Discorbinella araucana (d'Orbigny). Loeblich and Tappan, 1964, p. 575.
Discorbinella baconica (Hantken)
Discorbina baconica Hantken, 1875, p. 76, pl. 10, fig. 3.
Discorbinella bertheloti (d'Orbigny)
Rosalina bertheloti d'Orbigny, 1839a, p. 135, pl. 1, figs. 28-30.
Discorbinella bertheloti (d'Orbigny). Loeblich and Tappan, 1964, p. 575.
Discorbinella convexa (Takayanagi) ....Pl. 18, fig. 4
Planulina convexa Takayanagi, 1953, p. 34, pl. 4, fig. 14.
Discorbinella convexa (Takayanagi). Takayanagi and Hasegawa, 1987, p. 37.
Discorbinella nitida (Williamson)
Rotalina nitida Williamson, 1858, p. 54, pl. 4, figs. 106-108.
Discorbinella subbertheloti (Cushman)
Discorbis subbertheloti Cushman, 1924, p. 33, pl. 10, fig. 1.
Discorbis mira Cushman
Discorbis mira Cushman, 1922a, p. 39, pl. 6, figs. 10, 11.
Discorbis pulvinulinoides Cushman
Discorbis pulvinulinoides Cushman, 1915, p. 23, pl. 6, fig. 3.
Dorothia exilis Cushman
Dorothia exilis Cushman, 1936b, p. 30, pl. 4, fig. 17.
Dyocibicides biserialis Cushman and Valentine
Dyocibicides biserialis Cushman and

Valentine, 1930, p. 31, pl. 10, figs. 1, 2.

Dyocibicides uniserialis Thalmann

Dyocibicides uniserialis Thalmann, 1933, p. 254. (*fide* Barker, 1960).

Eggerella bradyi (Cushman)

Verneuilina bradyi Cushman, 1911, p. 54, fig. 87.

Gaudryina bradyi (Cushman). Cushman, 1933a, p. 33, pl. 4, fig. 1.

Eggerella pusilla (Goës)

Verneuilina pusilla Goës, 1826, p. 39, pl. 5, figs. 6–8. (*fide* Ellis and Messina, 1940 *et seq*.).

Eggerella pusilla (Goës). Cushman and McCulloch, 1939, p. 96, pl. 10, figs. 2, 3.

Eggerella scabra (Williamson)

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

Eggerella scabra (Williamson). Cushman, 1937, p. 50, pl. 5, figs. 10, 11.

Ehrenbergina bosoensis Takayanagi

Ehrenbergina bosoensis Takayanagi, 1951, p. 87, text-fig. 8.

Ehrenbergina bosoensis decorata Takayanagi

Ehrenbergina bosoensis decorata Takayanagi, 1951, p. 89, text-fig. 8.

Ehrenbergina bradyi Cushman

Ehrenbergina bradyi Cushman, 1922, p. 134, pl. 26, fig. 5.

Ehrenbergina hystrix Brady
..........Pl. 15, fig. 7 ; Pl. 19, fig. 4

Ehrenbergina hystrix Brady, 1881, p. 60.

Ehrenbergina pacifica Cushman
......................Pl. 19, fig. 7

Ehrenbergina pacifica Cushman, 1927c, p. 5, pl. 2, fig. 2.

Ehrenbergina trigona Goës

Ehrenbergina serrata Reuss var. *trigona* Goës, 1896, p. 49. (*fide* Ellis and Messina, 1940 *et seq*.).

Elphidium advena (Cushman)
......................Pl. 17, fig. 1

Polystomella advena Cushman, 1922a, p. 56, pl. 9, figs. 11, 12.

Elphidium advenum (Cushman). Cushman, 1930, p. 25, pl. 10, figs. 1, 2.

Elphidium crispum (Linné)

Nautilus crispum Linné, 1758, p. 709. figured by Piancus, 1739, Conch., pl. 1, figs. 2d-f. (*fide* Ellis and Messina, 1940 *et seq*.).

Elphidium crispum (Linné). Cushman and Grant, 1927, p. 73, pl. 7, fig. 3.

Elphidium incertum (Williamson)

Polystomella umbilicatula var. *incerta* Williamson, 1858, p. 44, pl. 3, fig. 82.

Elphidium incertum (Williamson). Cushman, 1930, p. 18, pl. 7, figs. 4–9.

Elphidium jenseni (Cushman)

Polystomella jenseni Cushman, 1924, p. 49, pl. 16, figs. 4, 6.

Elphidium jenseni (Cushman). Cushman, 1933b, p. 48, pl. 11, figs. 6, 7.

Elphidium poeyanum (d'Orbigny)

Polystomella poeyana d'Orbigny, 1839a, p. 55, pl. 6, figs. 25, 26.

Elphidium poeyanum (d'Orbigny). Cushman, 1930, p. 25, pl. 10, figs. 4, 5.

Elphidium simplex Cushman

Elphidium simplex Cushman, 1933b, p. 52, pl. 12, figs. 8, 9.

Elphidium translucens Natland

Elphidium translucens Natland, 1938, p. 144, pl. 5, figs. 3, 4. (*fide* Ellis and Messina, 1940 *et seq*.).

Epistominella pulchra (Cushman)

Pulvinulinella pulchra Cushman, 1933c, p. 92, pl. 9, fig. 10.

Epistominella pulchra (Cushman). Todd, 1965, p. 31, pl. 10, figs. 3, 4.

Eponides tumidulus (Brady)

Truncatulina tumidula Brady, 1884, p. 666, pl. 95, fig. 8.

Eponides tumidulus (Brady). Cushman, 1931, p. 55.

Evolvocassidulina belfordi Nomura

Evolvocassidulina belfordi Nomura, 1983a, p. 79, pl. 2, fig. 6 ; pl. 20, figs. 8–12.

Evolvocassidulina brevis (Aoki)
......................Pl. 17, fig. 5

"Cassidulina" brevis Aoki, 1968, p.

261, pl. 27, fig. 4.
Evolvocassidulina brevis (Aoki). Nomura, 1983b, p. 49, pl. 4, figs. 4–7 ; pl. 20, fig. 11 ; pl. 21, figs. 1–5.
Evolvocassidulina kuwanoi (Matoba)
Cassidulinoides kuwanoi Matoba, 1967, p. 253, pl. 29, figs. 1, 2.
Evolvocassidulina kuwanoi (Matoba). Nomura, 1983b, p. 46, pl. 4, fig. 1 ; pl. 20, figs. 4–7.
Favocassidulina favus (Brady)
Pulvinulina favus Brady, 1877, p. 535. (*fide* Ellis and Messina, 1940 *et seq.*).
Favocassidulina favus (Brady). Loeblich and Tappan, 1957, p. 230, pl. 73, figs. 7–11.
Fissurina alveolata (Brady)
Lagena alveolata Brady, 1884, p. 487, pl. 60, figs. 30, 32.
Fissurina alveolata (Brady). Parr, 1950, p. 307. (*fide* Barker, 1960).
Fissurina circulocosta Asano
Fissurina circulocosta Asano, 1938c, p. 219, pl. 30, fig. 17.
Fissurina clathrata (Brady)
Lagena clathrata, Brady, 1884, p. 485, pl. 60, fig. 4.
Fissurina clathrata (Brady). Parr, 1950, p. 310. (*fide* Barker, 1960).
Fissurina crebra (Matthes)
Lagena crebra Matthes, 1939, p. 72, pl. 5, figs. 66–70.
Fissurina crebra (Matthes). Barker, 1960, p. 122, pl. 59, fig. 6.
Fissurina cucullata Silvestri
Fissurina cucullata Silvestri, 1902, p. 146, text-figs. 23–25. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina formosa (Schwager)
Lagena formosa Schwager, 1866, p. 206, pl. 4, fig. 19.
Fissurina formosa (Schwager). Srinivasan and Sharma, 1980, p. 41, pl. 3, figs. 15, 16.
Fissurina kerguelenensis Parr
Fissurina kerguelenensis Parr, 1950, p. 305, pl. 8, fig. 7. (*fide* Barker, 1960).
Fissurina lacunata (Burrows and Holland)
Lagena lacunata Burrows and Holland, 1895, p. 205, pl. 7, fig. 12. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina lacunata (Burrows and Holland). Parr, 1945, p. 203.
Fissurina laevigata Reuss
Fissurina laevigata Reuss, 1850, p. 366, pl. 46, fig. 1. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina lucida (Williamson)
Entosolenia marginata (Montagu) var. *lucida* Williamson, 1848, p. 17, pl. 2, fig. 7.
Fissurina lucida (Williamson). Loeblich and Tappan, 1953, p. 76, pl. 14, fig. 4.
Fissurina marginata (Montagu)
Vermiculum marginatum Montagu, 1803, p. 524. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina marginata (Montagu). Murray, 1971, p. 97, pl. 39, fig. 4–6.
Fissurina orbignyana Seguenza
Fissurina orbignyana Seguenza, 1862, p. 66, pl. 2, figs. 24, 26.
Fissurina quadrata (Williamson)
Entosolenia quadrata Williamson, 1870, p. 28, pl. 10, fig. 2. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina quadrata (Williamson). Barker, 1960, p. 122, pl. 59, fig. 3.
Fissurina quadrata (Williamson) var. *rizzae* Seguenza
Fissurina quadrata (Williamson) var. *rizzae* Seguenza, 1862, p. 72, pl. 2, fig. 46.
Fissurina radiata Seguenza
Fissurina radiata Seguenza, 1862, p. 70, pl. 2, figs. 2, 3.
Fissurina seguenziana (Fornasini)
Lagena seguenziana Fornasini, 1887, p. 350. (*fide* Ellis and Messina, 1940 *et seq.*).
Fissurina seguenziana (Fornasini). Earland, 1934, p. 160.
Fissurina semimarginata (Reuss)
Lagena marginata Williamson var. *semimarginata* Reuss, 1870, p. 468. (*fide* Ellis and Messina, 1940 *et seq.*).

Fissurina semimarginata (Reuss). Loeblich and Tappan, 1953, p. 78, pl. 14, fig. 3.

Frondicularia kiensis Barker
Frondicularia kiensis Barker, 1960, p. 138, pl. 65, fig. 18.

Gaudryina arenaria Galloway and Wissler
Gaudryina arenaria Galloway and Wissier, 1927, p. 68, pl. 11, fig. 5.

Gaudryina atlantica (Bailey)
Textuiaria atlantica Bailey, 1851, p. 12, figs. 38–43.
Gaudryina atlantica (Bailey). Cushman, 1922b, p. 70, pl. 13, figs. 1–3.

Gaudryina atlantica (Bailey) var. *pacifica* Cushman and McCulloch
Gaudryina atlantica (Bailey) var. *pacifica* Cushman and McCulloch, 1939, p. 94, pl. 9, figs. 1, 2.

Gaudryina flintii Cushman
Gaudryina flintii Cushman, 1911, p. 63, text-figs. 102.

Gaudryina matusimai Asano
Gaudryina matusimai Asano, 1937, p. 1234, text-figs. 1–3.

Gaudryina robusta Cushman
Gaudryina robusta Cushman, 1913b, p. 636, pl. 78, figs. 2.

Gaudryina siphonifera (Brady)
Textuiaria siphonifera Brady, 1881, p. 53.
Gaudryina siphonifera (Brady). Cushman, 1928, p. 109, pl. 16, figs. 1–5.

Gaudryina subglabrata Cushman and McCulloch
Gaudryina subglabrata Cushman and McCulloch, 1939, p. 92, pl. 8, figs. 5–7.

Glabratella australensis (Heron-Allen and Earland)
Discorbis australensis Heron-Allen and Earland, 1932, p. 416.
Glabratelia australensis (Heron-Allen and Earland). Loeblich and Tappan, 1964, p. 588.

Glabratella nakamurai (Asano)
Discorbis nakamurai Asano, 1951d, p. 2, figs. 8–12.
Glabratella nakamurai (Asano). Takayanagi and Hasegawa, 1987, p. 14.

Glabratella opercularis (d'Orbigny)
Rosalina opercularis d'Orbigny, 1839a, p. 93, pl. 3, figs. 24, 25.
Glabratella opercularis (d'Orbigny). Matoba, 1970, p. 54, pl. 5, fig. 4.

Glabratella ozawai (Asano)
Discorbis ozawai Asano, 1951d, p. 3, figs. 14–16.
Glabratella ozawai (Asano). Takayanagi and Hasegawa, 1987, p. 14.

Glabratella patelliformis (Brady)
Discorbina patelliformis Brady, 1884, p. 647, pl. 88, fig. 3 ; pl. 89, fig. 1.
Glabratella patelliformis (Brady). Loeblich and Tappan, 1964, p. 588.

Glabratella subopercularis (Asano)
Discorbis subopercularis Asano, 1951d, p. 3, figs. 14–16.
Glabratella subopercularis (Asano). Matoba, 1970, p. 54, pl. 5, fig. 5.

Glabratella tabernacularis (Brady)
Discorbis tabernacularis Brady, 1881, p. 65.

Glandulina laevigata (d'Orbigny)
Nodosaria laevigata d'Orbigny, 1826, p. 252, pl. 10, figs. 1–3.

Glandulina nipponica Asano
Glandulina nipponica Asano, 1951e, p. 14, figs. 71, 72.

Globobulimina auriculata (Bailey)
Bulimina auriculata Bailey, 1851, p. 12, figs. 25–27.
Globobulimina auriculata (Bailey). Asano, 1958, p. 9, pl. 2, figs. 1–3.

Globobulimina hanzawai Asano
Globobulimina hanzawai Asano, 1958, p. 10, pl. 2, figs. 4–6.

Globobulimina pacifica Cushman
.... Pl. 16, fig. 9
Globobulimina pacifica Cushman, 1927b, p. 67, pl. 14, fig. 12.

Globocassidulina bisecta Nomura
Globocassidulina bisecta Nomura, 1983a, p. 73, pl. 2, figs. 2, 3 ; pl. 2, fig. 3 ; pl. 14, figs. 8–12 ; pl. 15, figs. 1–5.

Globocassidulina brocha (Poag)

......................Pl. 18, fig. 7
Cassidulina brocha Poag, 1966, p. 426, pl. 8, figs. 33–35.
Globocassidulina brocha (Poag). Nomura, 1983a, pl. 18, figs. 8–12; 1983b, p. 31, pl. 3, figs. 3–5.

Globocassidulina crassa (d'Orbigny)
Cassidulina crassa d'Orbigny, 1839a, p. 56, pl. 7, figs. 18–20.
Globocassidulina crassa (d'Orbigny). Nomura, 1983b, p. 37, pl. 3, figs. 9, 10.

Globocassidulina decorata (Sidebottom)
Cassidulina decorata Sidebottom, 1910, p. 107, pl. 4, fig. 2. (*fide* Ellis and Messina, 1940 *et seq.*).
Globocassidulina decorata (Sidebottom). Nomura, 1983b, p. 27, pl. 2, figs. 14–16.

Globocassidulina depressa (Asano and Nakamura)
Cassidulina subglobosa Brady *depressa* Asano and Nakamura, 1937, p. 148, pl. 13, fig. 8.
Globocassidulina depressa (Asano and Nakamura). Nomura, 1983a, pl. 15, figs. 11, 12, pl. 6, figs. 1–4; 1983b, p. 35, pl. 3, fig. 6.

Globocassidulina elegans (Sidebottom) ....Pl. 18, fig. 5
Cassidulina elegans Sidebottom, 1910, p. 106, pl. 4, fig. 1. (*fide* Ellis and Messina, 1940 *et seq.*).

Globocassidulina gemma (Todd) ....Pl. 18, fig. 3
Cassidulina gemma Todd, *in* Cushman, Todd and Post, 1954, p. 366, pl. 90, figs. 26, 27.
Globocassidulina gemma (Todd). Belford, 1966, p. 147, pl. 24, figs. 22–25, text-fig. 16, nos. 11, 12.

Globocassidulina moluccensis (Germeraad) ....Pl. 18, fig. 6
Cassidulina moluccensis Germeraad, 1946, p. 72, pl. 2, figs. 29–32. (*fide* Ellis and Messina, 1940 *et seq.*).
Globocassidulina moluccensis (Germeraad). Nomura, 1983b, p. 19, pl. 2, fig. 6, 7; pl. 11, fig. 12; pl. 12, figs. 1, 2.

Globocassidulina mucronata Nomura
Globocassidulina mucronata Nomura, 1983a, p. 63, pl. 1, fig. 15; pl. 12, fig. 13.

Globocassidulina neobrocha Nomura
Globocassidulina neobrocha Nomura, 1983a, p. 67, pl. 1, fig. 16; pl. 19, figs. 3–6.

Globocassidulina okinawaensis (LeRoy)
Cassidulina okinawaensis LeRoy, 1964, p. F40, pl. 11, figs. 21, 22.
Globocassidulina okinawaensis (LeRoy). Nomura, 1983b, p. 29, pl. 2, fig. 20; pl. 18, fig. 2.

Globocassidulina oriangulata (Belford) ....Pl. 18, fig. 2
Cassidulina oriangulata Belford, 1966, p. 148, pl. 25, figs. 1–5, text-figs. 16, nos. 13, 14.
Globocassidulina oriangulata (Belford). Nomura, 1983b, p. 43, pl. 3, figs. 16, 17; pl. 6, fig. 16; pl. 16, figs. 11, 12; pl. 17, figs. 1, 2.

Globocassidulina paratortuosa (Kuwano) ....Pl. 18, fig. 8
Cassidulina paratortuosa Kuwano, 1954, p. 34, figs. 4–6.
Globocassidulina paratortuosa (Kuwano). Nomura, 1983b, p. 28, pl. 2, fig. 19.

Globocassidulina parva (Asano and Nakamura)................Pl. 18, fig. 4
Cassidulina subglobosa Brady *parva* Asano and Nakamura, 1937, p. 148, pl. 13, fig. 5.
Globocassidulina parva (Asano and Nakamura). Nomura, 1983a, pl. 15, figs. 6–10; 1983b, p. 41, pl. 3, fig. 13.

Globocassidulina parviapertura Nomura ....Pl. 18, fig. 1
Globocassidulina parviapertura Nomura, 1983a, p. 56, pl. 1, fig. 6; pl. 12, figs. 5–8.

Globocassidulina pseudoquadrata Nomura
Globocassidulina pseudoquadrata Nomura, 1983a, p. 62, pl. 1, fig. 14; pl. 12, figs. 5, 6.

Globocassidulina subglobosa (Brady)

Cassidulina subglobosa Brady, 1881, p. 30.
Globocassidulina subglobosa (Brady). Belford, 1966, p. 149, pl. 25, figs. 11-16.
Globocassidulina subparva Nomura
Globocassidulina subparva Nomura, 1983a, p. 64, pl. 1, fig. 11.
Globocassidulina tsuchidai Nomura
Globocassidulina tsuchidai Nomura, 1983a, p. 70, pl. 2, fig. 4 ; pl. 17, figs. 3-7.
Globocassidulina venustas Nomura
Globocassidulina venustas Nomura, 1983a, p. 60, pl. 1, figs. 7, 8 ; pl. 14, figs. 4-7.
Glomospira charoides (Jones and Parker) ....Pl. 11, fig. 7 ; Pl. 13, fig. 6
Trochammina squamata charoides Jones and Parker, 1860, p. 304. (*fide* Ellis and Messina, 1940 *et seq.*).
Glomospira charoides (Jones and Parker). Cushman, 1925c, p. 25, pl. 2, fig. 12.
Glomospira gordialis (Jones and Parker) ....Pl. 11, fig. 8 ; Pl. 13, fig. 5
Ammodiscus gordialis Jones and Parker, 1880, pl. 5, fig. 22. (*fide* Ellis and Messina, 1940 *et seq.*).
Glomospira gordialis (Jones and Parker). Cushman and Jarvis, 1928, p. 87, pl. 12, figs. 7, 8.
Gyroidina altiformis R.E. and K.C. Stewart
Gyroidina soldanii var. *altiformis* R.E. and K.C. Stewart, 1930, p. 67, pl. 9, fig. 2.
Gyroidina cf. *broeckhiana* (Karrer)
cf. *Rotalia broeckhiana* Karrer, 1878, p. 98, pl. 5, fig. 26. (*fide* Ellis and Messina, 1940 *et seq.*).
cf. *Gyroidina broeckhiana* (Karrer). Hofker, 1951, p. 403, figs. 281, 282.
Gyroidina cushmani Boomgaart ....Pl. 21, fig. 3
Gyroidina cushmani Boomgaart, 1949, p. 125, pl. 14, fig. 1.
Gyroidina neosoldanii acuta Boomgaart
Gyroidina neosoldanii acuta Boomgaart, 1949, p. 124, pl. 9, fig. 9.
Gyroidina orbicularis d'Orbigny
Gyroidina orbicularis d'Orbigny, 1826, p. 278, modèles, no. 13.
Gyroidina soldanii d'Orbigny ....Pl. 24, fig. 5
Gyroidina soldanii d'Orbigny, 1826, p. 278, modèles, no. 36.
Gyroidinoides nipponicus (Ishizaki) ....Pl. 21, fig. 4
Gyroidina nipponica Ishizaki, 1944, p. 102, pl. 3, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Gyroidinoides nipponicus (Ishizaki). Matoba, 1967, p. 255, pl. 29, fig. 13.
Hanzawaia nipponica Asano ....Pl. 20, fig. 4
Hanzawaia nipponica Asano, 1944, p. 99, pl. 4, fig. 1, 2.
Haplophragmoides columbiensis Cushman ......Pl. 11, fig. 2 ; Pl. 13, fig. 8
Haplophragmoides columbiensis Cushman, 1925a, p. 39, pl. 6, fig. 2.
Haplophragmoides columbiensis evolutum Cushman and McCulloch
Haplophragmoides columbiensis evolutum Cushman and McCulloch, 1939, p. 73, pl. 5, figs. 11, 12 ; pl. 6, figs. 1, 2.
Heronallenia lingulata (Burrows and Holland)
Discorbina lingulata Burrows and Holland, 1896, p. 297, pl. 7, fig. 33. (*fide* Ellis and Messina, 1940 *et seq.*).
Heronallenia lingulata (Burrows and Holland). Chapman and Parr, 1931, p. 236, pl. 9, fig. 6.
Heterolepa haidingerii (d'Orbigny)
Rotalia haidingerii d'Orbigny, 1846, p. 154, pl. 8, figs. 7-9.
Heterolepa subhaidingerii (Parr) ....Pl. 23, fig. 3
Cibicides subhaidingerii Parr, 1950, p. 364. (*fide* Ellis and Messina, 1940 *et seq.*).
Heterolepa subpraecincta (Asano)
Eponides subpraecinctus Asano, 1951d, p. 12, figs. 88-90.
Heterolepa subpraecincta (Asano).

Takayanagi and Hasegawa, 1987, p. 19.

Hoeglundina elegans (d'Orbigny) ....Pl. 21, fig. 7 ; Pl. 24, fig. 6

Rotalia elegans d'Orbigny, 1826, p. 276.

Hoeglundina elegans (d'Orbigny). Brotzen, 1948, p. 92.

Hormosina globulifera Brady

Hormosina globulifera Brady, 1879, p. 60, pl. 4, figs. 4, 5.

Hyalinea balthica (Schröter) ....Pl. 20, fig. 5

Nautilus balthicus Schröter, 1783, p. 20, pl. 1, fig. 2. (*fide* Ellis and Messina, 1940 *et seq.*).

Hyalinea balthica (Schröter). Hofker, 1951, p. 508, figs. 346-348.

Hyperammina friabilis Brady

Hyperammina friabilis Brady, 1884, p. 258, pl. 23, figs. 1-3, 5, 6.

Hyperammina laevigata Wright

Hyperammina elongata Brady var. *laevigata* Wright, 1891, p. 466, pl. 20, fig. 1. (*fide* Ellis and Messina, 1940 *et seq.*).

Hyperammina laevigata Wright. Cushman, 1918, p. 77, pl. 29, figs. 5, 6.

Islandiella kazusaensis (Asano and Nakamura)

Cassidulina kazusaensis Asano and Nakamura, 1937, p. 146, pl. 14, fig. 2.

Islandiella kazusaensis (Asano and Nakamura). Nomura, 1983b, p. 6, pl. 1, fig. 5 ; pl. 11, figs. 10, 11.

Jaculella acuta Brady

Jaculella acuta Brady, 1879, p. 35, pl. 3, figs. 12-13.

Karreriella apicularis (Cushman) ....Pl. 12, fig. 2

Gaudryina apicularis Cushman, 1911, p. 69, text-fig. 110.

Karreriella (*Karrerulina*) *apicularis* (Cushman). Barker, 1960, p. 94, pl. 46, figs. 17-19.

Karreriella baccata (Schwager)

Gaudryina baccata Schwager, 1866, p. 200, pl. 4, fig. 12.

Karreriella baccata (Schwager). Cushman, 1937a, p. 133, pl. 15, figs. 20-24.

Karrerielia bradyi (Cushman)

Gaudryina bradyi Cushman, 1911, p. 67, fig. 107.

Karreriella bradyi (Cushman). Barker, 1960, p. 94, pl. 46, fig. 1-4.

Karreriella subrotundata (Schwager)

Gaudryina subrotundata Schwager, 1866, p. 198, pl. 4, fig. 9.

Karreriella subrotundata (Schwager). Srinivasan and Sharma, 1980, p. 17, pl. 2, figs. 11, 18.

Lagena acuticosta Reuss

Lagena acuticosta Reuss, 1861, p. 305, pl. 1, fig. 4. (*fide* Ellis and Messina, 1940 *et seq.*).

Lagena distoma Parker and Jones

Lagena distoma Parker and Jones, 1865, p. 467, pl. 48, fig. 6.

Lagena elongata (Ehrenberg)

Miliola elongata Ehrenberg, 1844, p. 274. (*fide* Ellis and Messina, 1940 *et seq.*).

Lagena elongata (Ehrenberg). Brady, 1884, p. 456, pl. 56, fig. 29.

Lagena filicosta Reuss

Lagena filicosta Reuss, 1863, p. 328, pl. 4, figs. 50, 51. (*fide* Ellis and Messina, 1940 *et seq.*).

Lagena flexa Cushman and Gray

Lagena flexa Cushman and Gray, 1946, p. 68, pl. 12, figs. 18-21.

Lagena gracilis Williamson

Lagena gracilis Williamson, 1848, p. 13, pl. 1, fig. 5.

Lagena gracillima (Seguenza)

Amphorina gracillima Seguenza, 1862, p. 51, pl. 1, fig. 37.

Lagena gracillima (Seguenza). Brady, 1884, p. 456, pl. 56, figs. 19-26, (not 27, 28).

Lagena hispida Reuss

Lagena hispida Reuss, 1858, p. 434. (*fide* Ellis and Messina, 1940 *et seq.*).

Lagena laevis (Montagu) ..Pl. 19, fig. 17

Vermiculum laevis Montagu, 1803, p. 524. (*fide* Ellis and Messina, 1940 *et seq.*).

Lagena laevis (Montagu). Cushman, 1913a, p. 5, pl. 1, fig. 3 ; pl. 38, fig. 5.

Lagena parri Loeblich and Tappan
Lagena parri Loeblich and Tappan, 1953, p. 64, pl. 11, figs. 11-13.

Lagena perlucida (Montagu)
Vermiculum perlucidum Montagu, 1803, p. 525, pl. 14, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Lagena perlucida (Montagu). Brown, 1827, pl. 1, fig. 29. (*fide* Cushman and McCulloch, 1950).

Lagena semistriata Williamson
Lagena vulgaris var. *semistriata* Williamson, 1858, p. 6, pl. 1, fig. 9.

Lagena setigera Millett
Lagena clavata (d'Orbigny) var. *setigera* Millett, 1901, p. 491, pl. 8, fig. 9.
Lagena setigera Millett. Loeblich and Tappan, 1953, p. 66, pl. 11, figs. 23, 24.

Lagena striata (d'Orbigny)
Oolina striata d'Orbigny, 1839b, p. 21, pl. 5, fig. 12.
Lagena striata (d'Orbigny). Asano, 1938c, p. 217, pl. 27, fig. 26 ; pl. 29, fig. 28.

Lagena striata toddi LeRoy
Lagena striata (d'Orbigny) var. *toddi* LeRoy, 1964, p. 25, pl. 13, figs. 39.

Lagena substriata Williamson
Lagena substriata Williamson, 1848, p. 15, pl. 2, fig. 12.

Lagena sulcata laevicostata Cushman and Gray
Lagena sulcata (Walker and Jacob) var. *laevicostata* Cushman and Gray, 1946, p. 68, pl. 12, figs. 13, 14.

Lagena sulcata peculiaris Cushman and McCulloch
Lagena sulcata (Walker and Jacob) var. *peculiaris* Cushman and McCulloch, 1950, p. 361, pl. 48, figs. 11-13.

Lagena sulcata spicata Cushman and McCulloch
Lagena sulcata var. *spicata* Cushman and McCulloch, 1950, p. 360, pl. 48, figs. 3-7.

Lamarckina scabra (Brady)
Pulvinulina oblonga (Williamson) var. *scabra* Brady, 1884, p. 689, pl. 106, fig. 8.
Lamarckina scabra (Brady). Cushman, 1931, p. 35, pl. 7, fig. 6.

Lamarckina ventricosa (Brady)
Discorbis ventricosa Brady, 1884, p. 654, pl. 91, fig. 7.
Lamarckina ventricosa (Brady). Cushman, 1926b, p. 12.

Lenticulina gibba (d'Orbigny)
Cristellaria gibba d'Orbigny, 1826, p. 292, no. 17.
Lenticulina gibba (d'Orbigny). Thalmann, 1932, p. 305.

Lenticulina kamakuraensis Asano
Lenticulina kamakuraensis Asano, 1936b, p. 612, pl. 31, fig. 1.

Lernella inflata (LeRoy)
Cassidulina inflata LeRoy, 1944a, p. 37, pl. 4, figs. 30, 31.
Lernella inflata (LeRoy). Nomura, 1983b, p. 86, pl. 2, fig. 9.

Lernella ogasawarai Nomura
Lernella ogasawarai Nomura, 1983a, p. 88, pl. 2, fig. 8.

Lernella seranensis (Germeraad)
Cassidulina seranensis Germeraad, 1946, p. 72, pl. 5, figs. 5, 6. (*fide* Ellis and Messina, 1940 *et seq.*).
Lernella seranensis (Germeraad). Nomura, 1983a, p. 24, figs. 6, 7 ; 1983b, p. 56, pl. 4, figs. 15-17.

Lituotuba lituiformis (Brady)
Trochammina lituiformis Brady, 1879, p. 59, pl. 5, fig. 16.
Lituotuba lituiformis (Brady). Rhumbler, 1895, p. 83. (*fide* Barker, 1960).

Marginulina glabra d'Orbigny
Marginulina glabra d'Orbigny, 1826, p. 259, modèles, no. 55.

Marginulina tenuis Bornemann
Marginulina tenuis Bornemann, 1855, p. 326, pl. 13, figs. 14. (*fide* Ellis and Messina, 1940 *et seq.*).

Marsipella cylindrica Brady
Marsipella cylindrica Brady, 1882, p.

714.

Marsipella elongata Norman. . Pl. 12, fig. 9

Marsipella elongata Norman, 1878, p. 281, pl. 16, fig. 7. (*fide* Ellis and Messina, 1940 *et seq.*).

Martinottiella communis (d'Orbigny)

Clavulina communis d'Orbigny, 1826, p. 268.

Martinottiella communis (d'Orbigny). Cushman, 1933a, p. 37, pl. 4, figs. 6–8.

Melonis barleeanus (Williamson)

Nonionina barleeana Williamson, 1858, p. 32, pl. 3, figs. 68, 69.

Melonis barleeanum (Williamson). Woodruff, 1985, p. 167.

Melonis pacificus (Cushman)

Nonionina umbilicatula (Montagu) var. *pacifica* Cushman, 1924, p. 48, pl. 16, fig. 3.

Melonis pacificus (Cushman). Hasegawa, 1979, p. 151.

Melonis parkerae (Uchio)

. . . . Pl. 17, fig. 2 ; Pl. 18, fig. 9

Nonion parkerae Uchio, 1960, p. 60, pl. 4, figs. 9, 10.

Melonis parkerae (Uchio). Matoba, 1967, p. 256, pl. 29, fig. 15.

Melonis sphaeroides Voloshinova

Melonis sphaeroides Voloshinova, 1958, p. 153, pl. 3, figs. 8, 9.

Miliolinella australis (Parr)

. . . . Pl. 15, fig. 14 ; Pl. 22, fig. 5

Quinqueloculina australis Parr, 1932, p. 7, pl. 1, fig. 8.

Miliolinella (?) australis (Parr). Barker, 1960, p. 10, pl. 5, figs. 10, 11.

Miliolinella circularis (Bornemann)

Pl. 15, fig. 12 ; Pl. 17, fig. 9 ; Pl. 22, fig. 6

Triloculina circularis Bornemann, 1855, p. 349, pl. 19, fig. 4. (*fide* Ellis and Messina, 1940 *et seq.*).

Miliolinella circularis (Bornemann). Asano, 1951a, p. 9, figs. 65–67.

Miliolinella inflata LeRoy

. . . . Pl. 15, fig. 13 ; Pl. 22, fig. 4

Miliolinella inflata LeRoy, 1964, p. 21, pl. 12, figs. 36, 37.

Miliolinella oblonga (Montagu)

Vermiculum oblonga Montagu, 1803, p. 522, pl. 14, figs. 9. (*fide* Ellis and Messina, 1940 *et seq.*).

Miliolinella oblonga (Montagu). Cushman, 1933b, p. 15, fig. 6.

Miliolinella subrotunda (Montagu)

Vermiculum subrotunda Montagu, 1803, p. 521. (*fide* Ellis and Messina, 1940 *et seq.*).

Miliolinella subrotunda (Montagu). Wiesner, 1931, p. 107. (*fide* Barker, 1960).

Mississippina concentrica (Parker and Jones) . . . . Pl. 24, fig. 9

Pulvinulina concentrica Parker and Jones, 1865, p. 393. (*fide* Ellis and Messina, 1940 *et seq.*).

Mississippina concentrica (Parker and Jones). Uchio, 1952a, p. 197, pl. 18, figs. 3–5.

Neoconorbina pacifica LeRoy

Neoconorbina pacifica LeRoy, 1964, p. 36, pl. 4, figs. 26–28.

Neoconorbina terquemi (Rzehak)

Discorbina terquemi Rzehak, 1888, p. 228. (*fide* Ellis and Messina, 1940 *et seq.*).

Neoconorbina terquemi (Rzehak). Hofker, 1951, p. 433.

Neoconorbina tuberocapitata (Chapman)

Discorbina tuberocapitata Chapman, 1900, p. 11, pl. 1, fig. 9.

Neoconorbina tuberocapitata (Chapman). Todd, 1965, p. 17, pl. 1, figs. 8, 9.

Neoeponides procerus (Brady)

Pulvinulina procerus Brady, 1884, p. 698, pl. 105, fig. 7.

Neoeponides procerus (Brady). Reiss, 1960, p. 17.

Nodellum membranaceum (Brady)

. . . . Pl. 12, fig. 8 ; Pl. 13, fig. 1

Reophax membranaceum Brady, 1879, p. 53, pl. 4, fig. 9.

Nodellum membranaceum (Brady). Rhumbler, 1913, p. 474. (*fide* Barker, 1960).

Nodosaria aculeata d'Orbigny
Nodosaria aculeata d'Orbigny, 1846, p. 35, pl. 1, figs. 26, 27.
Nodosaria millettii Cushman
Nodosaria millettii Cushman, 1917, p. 654.
Nodosaria subraphana Asano
Nodosaria subraphana Asano, 1938c, p. 212, pl. 29, fig. 19; pl. 30, figs. 33, 35.
Nonion granosum (d'Orbigny)
Nonionina granosum d'Orbigny, 1826, p. 294, no. 8.
Nonion granosum (d'Orbigny). Cushman, 1939, p. 11, pl. 2, figs. 17, 18.
Nonion manpukuziensis Otuka
Nonion manpukuziensis Otuka, 1932, p. 654, fig. 5.
Nonion japonicum Asano . . Pl. 14, fig. 6
Nonion japonicum Asano, 1938a, p. 593, pl. 15, figs. 1, 2.
Nonion pauperatum (Balkwell and Wright)
Nonionina pauperata Balkwell and Wright, 1885, p. 353, pl. 13, figs. 25, 26. (*fide* Ellis and Messina, 1940 *et seq.*).
Nonion pauperatum (Balkwell and Wright). Cushman, 1930, p. 13, pl. 5, figs. 4, 5, 7.
Nonionella amplilabrata Belford
Nonionella amplilabrata Belford, 1966, p. 159, pl. 31, figs. 16–20.
Nonionella basiloba Cushman and McCulloch
Nonionella basiloba Cushman and McCulloch, 1940, p. 162, pl. 18, fig. 3.
Nonionella bradii (Chapman)
Nonionina scapha var. *bradii* Chapman, 1917, p. 71, pl. 5, fig. 42.
Nonionella bradii (Chapman). Barker, 1960, p. 224, pl. 109, fig. 16.
Nonionella miocenica Cushman
Nonionella miocenica Cushman, 1926a, p. 64.
Nonionellina labradorica (Dawson) . . . . Pl. 14, fig. 13
Nonionina labradorica Dawson, 1860, p. 191, text-fig. 4. (*fide* Ellis and Messina, 1940 *et seq.*).
Nonionellina labradorica (Dawson). Cushman, 1939, p. 23, pl. 6, figs. 13–16.
Nuttallides umbonifera (Cushman) . . . . Pl. 14, fig. 8
Pulvinulinella umbonifera Cushman, 1933c, p. 90, pl. 9, fig. 9.
Nuttallides umbonifera (Cushman). Todd, 1965, p. 29, pl. 11, fig. 1.
Oolina costata (Williamson)
Entosolenia costata Williamson, 1858, p. 9, pl. 1, fig. 18.
Oolina costata (Williamson). Loeblich and Tappan, 1953, p. 68, pl. 13, figs. 4–6.
Oolina globosa (Montagu)
Vermiculum globosum Montagu, 1803, p. 523 (*fide* Ellis and Messina, 1940 *et seq.*).
Oolina globosa (Montagu). Parr, 1950, p. 302. (*fide* Barker, 1960).
Oolina hexagona (Williamson)
Entosolenia sequamosa (Montagu) var. *hexagona* Williamson, 1858, p. 13, pl. 1, fig. 32.
Oolina hexagona (Williamson). Parr, 1950, p. 304. (*fide* Barker, 1960).
Oolina melo d'Orbigny
Oolina melo d'Orbigny, 1839a, p. 20, pl. 5, fig. 9.
Oolina ovum (Ehrenberg)
Miliola ovum Ehrenberg, 1843, p. 166. (*fide* Ellis and Messina, 1940 *et seq.*).
Oolina ovum (Ehrenberg). Barker, 1960, p. 114, pl. 56, fig. 5.
Operculina ammonoides (Gronovius) . . . . Pl. 15, fig. 11
Nautilus ammonoides Gronovius, 1781, p. 282, pl. 19, figs. 5, 6. (*fide* Ellis and Messina, 1940 *et seq.*).
Operculina ammonoides (Gronovius). Carpenter, Parker and Jones, 1862, p. 310. (*fide* Barker, 1960).
Operculina venosa (Fichtel and Moll)
Nautilus venosa Fichtel and Moll, 1798, p. 59, pl. 8, figs. e-h. (*fide* Ellis and Messina, 1940 *et seq.*).
Operculina venosa (Fichtel and Moll).

Cushman, 1921, p. 39, pl. 14, fig. 6.

Ophthalmidium acutimargo (Brady)

Spiroloculina acutimargo Brady, 1884, p. 154, pl. 10, figs. 12-15.

Ophthalmidium acutimargo (Brady). Loeblich and Tappan, 1964, p. 448, fig. 340, 2.

Oridorsalis pauciapertura Belford

Oridorsalis pauciapertura Belford, 1966, p. 173, pl. 30, figs. 7-13, text-fig. 22, no. 3.

Oridorsalis tener (Brady) . . Pl. 21, fig. 5

Truncatulina tenera Brady, 1884, p. 665, pl. 95, fig. 11.

Oridorsalis tener (Brady). Pflum and Frerichs, 1976, p. 106, pl. 6, figs. 2-4.

Oridorsalis umbonatus (Reuss) .... Pl. 24, fig. 4

Rotalia umbonata Reuss, 1851, p. 75, pl. 5, fig. 35.

Oridorsalis umbonatus (Reuss). Parker, 1964, p. 626, pl. 99, figs. 4-6.

Osangularia culter (Parker and Jones)

Planorbulina culter Parker and Jones, 1865, p. 421, pl. 19, fig. 1.

Osangularia culter (Parker and Jones). Todd, 1965, p. 25, pl. 15, fig. 1.

Osangularia rugosa (Phleger and Parker)

Pseudoparrella (?) *rugosa* Phleger and Parker, 1951, p. 28, pl. 15, figs. 8, 9.

Osangularia rugosa (Phleger and Parker). Pflum and Frerichs, 1976, p. 122, pl. 7, figs. 2-4.

Paracassidulina miuraensis (Higuchi) .... Pl. 15, fig. 4

Cassidulina miuraensis Higuchi, 1956, p. 58, text-figs. 58, 59.

Paracassidulina miuraensis (Higuchi). Nomura, 1983a, pl. 5, fig. 3 ; pl. 25, figs. 4-6 ; 1983b, p. 70, pl. 6, figs. 7-10.

Paracassidulina neocarinata (Thalmann) .... Pl. 17, fig. 4

Cassidulina neocarianta Thalmann, 1950, p. 44.

Paracassidulina neocarinata (Thalmann). Nomura, 1983b, p. 63, pl. 5, fig. 11.

Paracassidulina nipponensis (Eade) .... Pl. 19, fig. 2

Globocassidulina nipponensis Eade, 1967, p. 65, pl. 13, figs. 1, 2, 4.

Paracassidulina nipponensis (Eade). Nomura, 1983a, p. 95, pl. 25, fig. 3 ; 1983b, pl. 6, figs. 13, 14.

Paracassidulina oshimai (Aoki)

Cassidulina oshimai Aoki, 1967, p. 381, pl. 1, figs. 10-15.

Paracassidulina oshimai (Aoki). Nomura, 1983b, p. 71, pl. 6, figs. 11, 12.

Paracassidulina quasicarinata Nomura .... Pl. 19, fig. 5

Paracassidulina quasicarinata Nomura, 1983a, p. 100, pl. 2, fig. 19 ; pl. 25, figs. 9-11.

Paracassidulina sulcata (Belford) .... Pl. 19, fig. 1

Cassidulina sulcata Belford, 1966, p. 142, 144, pl. 24, figs. 11-14, text-fig. 16, nos. 7, 8.

Paracassidulina sulcata (Belford). Nomura, 1983b, p. 69, pl. 6, figs. 4-6.

Paracassidulina tomiyensis (Uchio) .... Pl. 19, fig. 3

Cassidulina tomiyensis Uchio, 1951, p. 40, pl. 3, fig. 3.

Paracassidulina tomiyensis (Uchio). Nomura, 1983b, pl. 5, figs. 12, 13.

Parafissurina lateralis Cushman

Parafissurina lateralis Cushman, 1913a, p. 9, pl. 1, fig. 1.

Pararotalia calcar (d'Orbigny) .... Pl. 15, fig. 16

Calcarina calcar d'Orbigny, 1826, p. 276, no. 1.

Pararotalia nipponica (Asano)

Rotalia nipponica Asano, 1936b, p. 614, pl. 30, fig. 2.

Pararotalia nipponica (Asano). Ujiié, 1966, p. 192, text-figs. 1-3 ; pl. 24, figs. 1-7 ; pl. 25, figs. 1-5.

Parrelloides bradyi (Trauth) .... Pl. 20, fig. 2 ; Pl. 23, fig. 8

Truncatulina bradyi Trauth, 1918, p. 235.

Parrelloides bradyi (Trauth). Belford, 1966, p. 100, pl. 11, figs. 10-

19.

Patellina corrugata Williamson
Patellina corrugata Williamson, 1858, p. 46, pl. 3, figs. 86–89.

Patellinella hanzawai Asano
Patellinella hanzawai Asano, 1936b, p. 613, pl. 30, fig. 3.

Patellinella jugosa (Brady)
Textularia jugosa Brady, 1884, p. 358, pl. 42, fig. 7.
Patellinella jugosa (Brady). Cushman, Todd and Post, 1954, p. 358, pl. 89, fig. 3.

Pelosina cylindrica Brady
Pelosina cylindrica Brady, 1884, p. 236, pl. 26, figs. 1–6.

Peneropsis pertusus (Forskal)
Nautilus pertusus Forskal, 1775, p. 125, no. 65. (*fide* Ellis and Messina, 1940 *et seq.*).
Peneropsis pertusus (Forskal). Cushman, 1921, p. 481.

Planispirinella exigua (Brady)
Hauerina exigua Brady, 1879, p. 267.
Planispirinella exigua (Brady). Wiesner, 1931, p. 69. (*fide* Barker, 1960).

Planularia australis Chapman
Planularia australis Chapman, 1915, p. 24. (*fide* Ellis and Messina, 1940 *et seq.*).

Planularia planulata (Galloway and Wissler)
Astacolus planulata Galloway and Wissler, 1927, p. 46, pl. 8, fig. 5.
Planularia planulata (Galloway and Wissler). Cushman and McCulloch, 1950, p. 303, pl. 40, figs. 1–5.

Planulina ariminensis d'Orbigny
Planulina ariminensis d'Orbigny, 1826, p. 280, pl. 5, figs. 1–3.

Planulina tricarinella (Reuss)
Cristellaria tricarinella Reuss, 1862, p. 68, pl. 7, fig. 9 ; pl. 12, figs. 2–4. (*fide* Ellis and Messina, 1940 *et seq.*).
Planulina tricarinella (Reuss). Asano, 1938c, p. 207, pl. 30, figs. 2, 3.

Poroeponides cribrorepandus Asano and Uchio . . . . Pl. 24, fig. 1
Poroeponides cribrorepandus Asano and Uchio, *in* Asano, 1951d, p. 18, figs. 134, 135.

Praeglobobulimina ovata (d'Orbigny)
Bulimina ovata d'Orbigny, 1846, p. 185, pl. 11, figs. 13, 14.
Praeglobobulimina ovata (d'Orbigny). Haymes, 1954, p. 190, text-figs. 9–12, 17–19, pl. 35, figs. 2, 3.

Praeglobobulimina pupoides (d'Orbigny)
Bulimina pupoides d'Orbigny, 1846, p. 185, pl. 11, figs. 11, 12.
Praeglobobulimina pupoides (d'Orbigny). Loeblich and Tappan, 1964, p. 561, figs. 442, 14, 15.

Praeglobobulimina pyrula (d'Orbigny)
Bulimina pyrula d'Orbigny, 1846, p. 184, pl. 9, figs. 9, 10.

Praeglobobulimina spinescens (Brady)
Bulimina pyrula d'Orbigny var. *spinescens* Brady, 1884, p. 400, pl. 50, figs. 11, 12.
Praeglobobulimina spinescens (Brady). Loeblich and Tappan, 1964, p. 561, figs. 442, 12, 13.

Psammosphaera fusca Schulze
Psammosphaera fusca Schulze, 1875, p. 113, pl. 2, fig. 8. (*fide* Ellis and Messina, 1940 *et seq.*).

Psammosphaera parva Flint. . Pl. 12, fig. 5
Psammosphaera parva Flint, 1897, p. 268, pl. 9, fig. 1.

Pseudoeponides nakazatoensis (Kuwano)
Epistomaria (*Epistominella*) *nakazatoensis* Kuwano, 1950, p. 316, figs. 4, 11.
Pseudoeponides nakazatoensis (Kuwano). Asano, 1951d, p. 19, figs. 141–143.

Pseudononion auricula (Heron-Allen and Earland)
Nonionella auricula Heron-Allen and Earland, 1930, p. 192, pl. 5, figs. 68–70. (*fide* Ellis and Messina, 1940 *et seq.*).

Pseudononion decora (Cushman and McCulloch)
Nonionella decora Cushman and

McCulloch, 1940, p. 160, pl. 17, figs. 11, 12.

Pseudononion grateloupi (d'Orbigny)
Nonionina grateloupi d'Orbigny, 1826, p. 294.
Pseudononion grateloupi (d'Orbigny). Hasegawa, 1979, p. 152.

Pseudononion japonicum Asano
Pseudononion japonicum Asano, 1936a, p. 347, text-figs. a-c.

Pseudoparrella exigua (Brady) ....Pl. 20, fig. 7 ; Pl. 24, fig. 3
Pulvinulina exigua Brady, 1884, p. 696, pl. 103, figs. 13, 14.
Pseudoparrella exigua (Brady). Phleger and Parker, 1951, p. 28, pl. 15, figs. 6, 7.

Pseudorotalia gaimardii (d'Orbigny) ....Pl. 21, fig. 2
Rotalia gaimardii d'Orbigny, 1826, p. 275, no. 46.
Pseudorotalia gaimardii (d'Orbigny). Matoba, 1967, p. 257, pl. 27, fig. 4.

Pullenia bulloides (d'Orbigny) ....Pl. 17, figs. 11, 12 ; Pl. 22, fig. 15
Nonionina bulloides d'Orbigny, 1846, p. 107, pl. 5, figs. 9, 10.
Pullenia bulloides (d'Orbigny). Parker and Jones, 1862, 106 p. 184. (*fide* Loeblich and Tappan, 1964).

Pullenia elegans Cushman and Todd
Pullenia elegans Cushman and Todd, 1943, p. 23, pl. 4, fig. 11.

Pullenia quinqueloba (Reuss) ....Pl. 17, fig. 13
Nonionina quinqueloba Reuss, 1851, p. 71, pl. 5, fig. 31. (*fide* Ellis and Messina, 1940 *et seq.*).
Pullenia quinqueloba (Reuss). Cushman and Todd, 1943, p. 11, pl. 2, fig. 8.

Pullenia salisburyi R.E. and R.C. Stewart ....Pl. 17, fig. 14
Pullenia salisburyi R.E. and R.C. Stewart, 1930, p. 72, pl. 8, fig. 2.

Pyrgo depressa (d'Orbigny)
Biloculina depressa d'Orbigny, 1826, p. 298, no. 7, modèles, no. 91.
Pyrgo depressa (d'Orbigny). Cushman, 1929, p. 71, pl. 19, figs. 4, 5.

Pyrgo elongata (d'Orbigny)
Biloculina elongata d'Orbigny, 1826, p. 298, no. 4.
Pyrgo elongata (d'Orbigny). Cushman, 1929, p. 70, pl. 19, figs. 2, 3.

Pyrgo fornasinii Chapman and Parr
Pyrgo fornasinii Chapman and Parr, 1935, p. 5.

Pyrgo murrhina (Schwager)
Biloculina murrhina Schwager, 1866, p. 203, pl. 4, fig. 15.
Pyrgo murrhina (Schwager). Cushman, 1929, p. 71, pl. 19, fig. 6, 7.

Pyrgo pacifica Asano
Pyrgo pacifica Asano, 1956, p. 78, pl. 9, fig. 3.

Pyrgo serrata (Bailey)
Biloculina serrata Bailey, 1862, p. 350, pl. 8, fig. E. (*fide* Ellis and Messina, 1940 *et seq.*).
Pyrgo serrata (Bailey). Cushman, 1929, p. 73.

Pyrgo vespertilio (Schlumberger)
Biloculina vespertilio Schlumberger, 1891, p. 174, pl. 10, figs. 74-76.
Pyrgo vespertilio (Schlumberger). Thalmann, 1932, p. 295.

Pyrulina angusta (Egger)
Polymorphina (*Globulina*) *angusta* Egger, 1857, p. 290, pl. 13, figs. 13-15.
Pyrulina angusta (Egger). Barker, 1960, p. 150, pl. 72, figs. 1-3.

Pyrulina gutta d'Orbigny
Pyrulina gutta d'Orbigny, 1826, p. 267, no. 28, modèles, no. 30.

Quadrimorphina laevigata (Phleger and Parker) ....Pl. 24, fig. 7
Valvulineria laevigata Phleger and Parker, 1951, p. 25, pl. 13, figs. 11, 12.
Quadrimorphina laevigata (Phleger and Parker). Belford, 1966, p. 155, pl. 37, figs. 21-25.

Quinqueloculina akneriana d'Orbigny
Quinqueloculina akneriana d'Orbigny, 1846, p. 290, pl. 18, figs. 16-20.

Quinqueloculina bicostata d'Orbigny

Quinqueloculina bicostata d'Orbigny, 1839a, p. 195, pl. 12, figs. 8-10.

Quinqueloculina boueana d'Orbigny
Quinqueloculina boueana d'Orbigny, 1846, p. 293, pl. 19, figs. 7-9.

Quinqueloculina bradyana Cushman
Quinqueloculina bradyana Cushman, 1917, p. 52, pl. 18, fig. 2.

Quinqueloculina contorta d'Orbigny
Quinqueloculina contorta d'Orbigny, 1846, p. 298, pl. 20, figs. 4-6.

Quinqueloculina costata d'Orbigny
Quinqueloculina costata d'Orbigny, 1826, p. 301, no. 3.

Quinqueloculina ferussaci d'Orbigny
Quinqueloculina ferussaci d'Orbigny, 1826, p. 301, no. 18.

Quinqueloculina hashimotoi Asano
Quinqueloculina hashimotoi Asano, 1938e, p. 92, pl. 10, fig. 5.

Quinqueloculina lamarckiana d'Orbigny
Quinqueloculina lamarckiana d'Orbigny, 1839a, p. 189, pl. 11, figs. 14, 15.

Quinqueloculina monroei Cushman and Todd
Quinqueloculina monroei Cushman and Todd, 1946, p. 79, pl. 14, figs. 1, 2.

Quinqueloculina polygona d'Orbigny
Quinqueloculina polygona d'Orbigny, 1839a, p. 198, pl. 12, figs. 21-23.

Quinqueloculina reticulata (d'Orbigny)
Triloculina reticulata d'Orbigny, 1826, p. 209.
Quinqueloculina reticulata (d'Orbigny). Cushman, 1917, p. 55, pl. 16, figs. 1-3.

Quinqueloculina seminulum (Linné)
Serpula seminulum Linné, 1767, p. 1267, No. 791. (*fide* Ellis and Messina, 1940 *et seq.*).
Quinqueloculina seminula (Linné). Cushman and Gray, 1946, p. 3.

Quinqueloculina vulgaris d'Orbigny
Quinqueloculina vulgaris d'Orbigny, 1826, p. 302.

Quinqueloculina yabei Asano
Quinqueloculina yabei Asano, 1936, p. 942, pl. 51, fig. 1.

Rectobolivina bifrons (Brady)
Sagrina bifrons Brady, 1881, p. 34.
Rectobolivina bifrons (Brady). Cushman, 1927b, p. 204, pl. 23, figs. 13, 14.

Rectobolivina columellaris (Brady)
Sagrina columellaris Brady, 1881, p. 64.
Rectobolivina columellaris (Brady). Barker, 1960, p. 156, pl. 75, figs. 15-17.

Rectobolivina limbata (Brady)
Bolivina limbata Brady, 1881, p. 27.
Rectobolivina limbata (Brady). Belford, 1966, p. 49, pl. 4, figs. 12-15.

Rectobolivina limbata (Brady) var. *costulata* (Cushman)
Bolivina limbata Brady var. *costulata* Cushman, 1922, p. 26, pl. 3, fig. 8.

Rectobolivina raphanus (Parker and Jones) ....Pl. 15, fig. 6; Pl. 16, fig. 4
Uvigerina (*Sagrina*) *raphanus* Parker and Jones, 1865, p. 364, pl. 18, figs. 16, 17.
Rectobolivina raphana (Parker and Jones). Loeblich and Tappan, 1964, p. C533, figs. 438 (9-11).

Reophax bacillaris Brady
Reophax bacillaris Brady, 1881, p. 49.

Reophax dentaliniformis Brady
Reophax dentaliniformis Brady, 1881, p. 49.

Reophax difflugiformis Brady ....Pl. 12, fig. 6
Reophax difflugiformis Brady, 1879, p. 51, pl. 4, fig. 3.

Reophax distans Brady ....Pl. 12, fig. 7; Pl. 13, fig. 2
Reophax distans Brady, 1881, p. 50.

Reophax fusiformis (Williamson)
Proteonina fusiformis Williamson, 1858, p. 1, pl. 1, fig. 1.
Reophax fusiformis (Williamson). Siddall, 1879, p. 4. (*fide* Brady, 1884).

Reophax guttifer Brady
Reophax guttifer Brady, 1881, p. 49.

Reophax nodulosus Brady

Reophax nodulosus Brady, 1849, p. 52, pl. 4, figs. 7, 8.
Reophax pilulifer Brady
Reophax pilulifer Brady, 1884, p. 292, pl. 30, figs. 18–20.
Reophax scorpiurus Montfort
Reophax scorpiurus Montfort, 1808, p. 331, fig. 83d. (*fide* Ellis and Messina, 1940 *et seq.*).
Reophax spiculifera Brady Pl. 13, fig. 3
Reophax spiculifera Brady, 1879, p. 54, pl. 4, figs. 10, 11.
Reussella aculeata Cushman
Reussella aculeata Cushman, 1945, p. 41, pl. 7, figs. 10, 11.
Reussella aequa Cushman and McCulloch
Reussella aequa Cushman and McCulloch, 1948, p. 251, pl. 31, fig. 7.
Reussella insueta Cushman
Reussella insueta Cushman, 1945, p. 40, pl. 7, fig. 9.
Reussella pacifica Cushman and McCulloch
Reussella pacifica Cushman and McCulloch, 1948, p. 251, pl. 31, fig. 6.
Reussella simplex (Cushman)
Trimosina simplex Cushman, 1929, p. 158, text-fig. 2.
Reussella simplex (Cushman). Cushman, 1945, p. 40, pl. 7, fig. 5.
Reussella spinulosa (Reuss) Pl. 15, fig. 1
Verneuilina spinulosa Reuss, 1850, p. 374, pl. 47, fig. 12. (*fide* Ellis and Messina, 1940 *et seq.*).
Reussella spinulosa (Reuss). Cushman, 1945, p. 33, pl. 6, figs. 8, 9.
Rhabdammina abyssorum M. Sars
..........Pl. 12, fig. 10; Pl. 14, fig. 4
Rhabdammina abyssorum M. Sars, 1868, p. 248. (*fide* Ellis and Messina, 1940 *et seq.*).
Rhizammina algaeformis Brady
Rhizammina algaeformis Brady, 1879, p. 39, pl. 4, figs. 16, 17.
Robulus abensis Asano
Robulus abensis Asano, 1936c, p. 327, pl. 37, figs. 5, 10.
Robulus calcar (Linné)
..........Pl. 15, fig. 10; Pl. 17, fig. 6
Nautilus calcar Linné, 1767, p. 1162. (*fide* Ellis and Messina, 1940 *et seq.*).
Robulus calcar (Linné). d'Orbigny, 1846, p. 99, pl. 4, figs. 18–20.
Robulus chitanii Yabe and Asano
Robulus chitanii Yabe and Asano, 1937, p. 100, pl. 18, fig. 14.
Robulus cultratus Montfort
Robulus cultrata Montfort, 1808, p. 215. (*fide* Ellis and Messina, 1940 *et seq.*).
Robulus kotiensis Asano
Robulus kotiensis Asano, 1938c, p. 203, pl. 29, fig. 35.
Robulus lucida (Cushman)
Cristellaria lucida Cushman, 1923, p. 111, pl. 30, fig. 2.
Robulus lucida (Cushman). Asano, 1951e, p. 5, figs. 21, 22.
Robulus nikobarensis (Schwager)
Cristellaria nikobarensis Schwager, 1866, p. 243, pl. 6, fig. 87.
Robulus nikobarensis (Schwager). Asano, 1938c, p. 204, pl. 28, figs. 5, 6; pl. 29, fig. 8.
Robulus orbicularis d'Orbigny
......................Pl. 22, fig. 1
Robulus orbicularis d'Orbigny, 1826, p. 288, pl. 15, figs. 8, 9.
Robulus obetusata (Reuss)
Cristellaria obetusata Reuss, 1870, p. 479, No. 2. (*fide* Ellis and Messina, 1940 *et seq.*).
Robulus obetusata (Reuss). Thalmann, 1932, p. 304.
Robulus pseudorotulatus Asano
Robulus pseudorotulatus Asano, 1938c, p. 201, pl. 25, figs. 1, 3, 4; pl. 26, fig. 28; pl. 31, figs. 3, 4.
Robulus sagamiensis Asano
Robulus sagamiensis Asano, 1938c, p. 201, pl. 25, fig. 6; pl. 26, figs. 11–13, pl. 28, fig. 12; pl. 29, fig. 16.
Robulus surugaensis Asano
Robulus surugaensis Asano, 1936c, p. 328, pl. 37, fig. 4.
Robulus tumidus Asano
Robulus tumidus Asano, 1938c, p. 200,

pl. 24, fig. 9.

Robulus tangens LeRoy

Robulus tangens LeRoy, 1939, p. 233, pl. 8, figs. 12, 13.

Robulus vortex (Fichtel and Moll)

Nautilus vortex Fichtel and Moll, 1798, p. 33, pl. 2, figs. d-e. (*fide* Ellis and Messina, 1940 *et seq.*).

Robulus vortex (Fichtel and Moll). Barker, 1960, p. 144, pl. 69, figs. 14-16.

Rosalina australis (Parr)

Discorbis australis Parr, 1932, p. 227.

Rosalina australis (Parr). Matoba, 1970, p. 60, pl. 4, fig. 7.

Rosalina bradyi (Cushman)

Discorbis globularis var. *bradyi* Cushman, 1915, p. 12, pl. 8, fig. 1.

Rosalina bradyi (Cushman). Matoba, 1970, p. 60, pl. 4, fig. 8.

Rosalina floridana (Cushman)

Discorbis floridana Cushman, 1922a, p. 39, pl. 5, figs. 11, 12.

Rosalina floridana (Cushman). Parker, 1954, p. 524, pl. 8, figs. 19, 20.

Rosalina globularis d'Orbigny

Rosalina globularis d'Orbigny, 1826, p. 217, pl. 13, figs. 1-4, modèles, no. 69.

Rosalina micens (Cushman)

Discorbis micens Cushman, 1933c, p. 89, pl. 9, fig. 5.

Rosalina micens (Cushman). Todd, 1965, p. 12, pl. 4, fig. 2.

Rosalina ponticulus Belford

Rosalina ponticulus Belford, 1966, p. 94, pl. 13, figs. 12-16.

Rosalina vilardeboana d'Orbigny

.... Pl. 22, fig. 16

Rosalina vilardeboana d'Orbigny, 1839a, p. 44, pl. 6, figs. 13-15.

'Rotalia' murrayi Heron-Allen and Earland

Rotalia murrayi Heron-Allen and Earland, 1915, p. 720, pl. 53, figs. 27-34.

'Rotalia' murrayi Heron-Allen and Earland. Graham and Millitante, 1959, p. 100, pl. 15, fig. 5.

Rutherfordoides mexicanus (Cushman)

.... Pl. 19, fig. 9

Virgulina mexicana Cushman, 1922a, p. 120, pl. 23, fig. 8.

Rutherfordoides mexicana (Cushman). Kohl, 1985, p. 89, pl. 18, fig. 3.

Rutherfordoides subtenuis (Nomura)

Hastilina subtenuis Nomura, 1983a, p. 83, pl. 2, fig. 14 ; pl. 3, fig. 8 ; pl. 25, fig. 12.

Rutherfordoides subtenuis (Nomura). Takayanagi and Hasegawa, 1987, p. 26.

Rutherfordoides virga (Nomura)

Hastilina virga Nomura, 1983a, p. 84, pl. 2, fig. 15.

Rutherfordoides virga (Nomura). Takayanagi and Hasegawa, 1987, p. 26.

Saccammina sphaerica M. Sars

.... Pl. 12, fig. 1

Saccammina sphaerica M. Sars, 1872, p. 250 (*fide* Ellis and Messina, 1940 *et seq.*).

Saccorhiza ramosa Brady

.... Pl. 12, fig. 11 ; Pl. 14, fig. 1

Saccorhiza ramosa Brady, 1879, p. 33, pl. 3, figs. 14, 15.

Saracenaria angularis Natland

Saracenaria angularis Natland, 1938, p. 143, pl. 5, figs. 1, 2.

Saracenaria latifrons (Brady)

Cristellaria latifrons Brady, 1884, p. 544, pl. 68, fig. 19 ; pl. 113, fig. 11.

Saracenaria latifrons (Brady). Asano, 1951e, p. 13, figs. 67, 68.

Schlumbergerina alveoliniformis (Brady)

Miliolina alveoliniformis Brady, 1879, p. 268.

Schlumbergerina alveoliniformis (Brady). Cushman, 1929, p. 36.

Seabrookia pellucida Brady

Seabrookia pellucida Brady, 1890, p. 570. (*fide* Loeblich and Tappan, 1964).

Sigmavirgulina atlantica (Cushman)

Bolivina tortuosa Brady var. *atlantica* Cushman, 1936b, p. 57, pl. 8, fig. 8.

Sigmavirgulina tortuosa (Brady)

Bolivina tortuosa Brady, 1881, p. 57.

Sigmavirgulina tortuosa (Brady). Loeblich and Tappan, 1957, p. 227, text-fig. 30, pl. 73, figs. 1, 2.

Sigmoidella kagaensis Cushman and Ozawa

Sigmoidella kagaensis Cushman and Ozawa, 1928, pl. 2, fig. 14.

Sigmoidella pacifica Cushman and Ozawa

Sigmoidella pacifica Cushman and Ozawa, 1928, p. 19, pl. 2, fig. 13.

Sigmoilopsis schlumbergeri (Silvestri) ....Pl. 17, fig. 8 ; Pl. 22, fig. 8

Sigmoilina schlumbergeri Silvestri, 1904, p. 267. (*fide* Ellis and Messina, 1940 *et seq.*).

Sigmoilopsis schlumbergeri (Silvestri). Finlay, 1947, p. 270.

Sigmomorphina gallowayi Cushman and Ozawa

Sigmomorphina gallowayi Cushman and Ozawa, 1930, p. 135, pl. 36, fig. 4.

Sigmomorphina cf. *ozawai* (Hada)

cf. *Sigmomorpha ozawai* Hada, 1931, p. 115, text-figs. 73, 74.

cf. *Sigmomorphina ozawai* (Hada). Asano, 1951b, p. 12, figs. 57, 58.

Sigmomorphina semitecta (Reuss)

Polymorphina semitecta Reuss, 1867, p. 91, pl. 3, fig. 10. (*fide* Ellis and Messina, 1940 *et seq.*).

Sigmomorphina semitecta (Reuss). Cushman and Ozawa, 1930, p. 129, pl. 33, figs. 6, 7.

Sigmomorphina semitecta (Reuss) var. *terquemiana* (Fornasini)

Polymorphina amygdaloides Reuss var. *terquemiana* Fornasini, 1902, p. 72, fig. 25. (*fide* Ellis and Messina, 1940 *et seq.*).

Sigmomorphina semitecta (Reuss) var. *terquemiana* (Fornasini). Cushman and Ozawa, 1930, p. 129, pl. 33, figs. 4, 5 ; pl. 34, figs. 2, 3 ; pl. 35, fig. 1.

Siphonina tubulosa Cushman

Siphonina tubulosa Cushman, 1924, p. 40, pl. 13, figs. 1, 2.

Siphotextularia concava (Karrer)

Plecanium concavum Karrer, 1868, p. 129, pl. 1, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).

Siphotextularia concava (Karrer). Barker, 1960, p. 86, pl. 42, figs. 13, 14.

Siphotextularia crispata (Brady)

Textularia crispata Brady, 1884, p. 359, pl. 113, figs. 2.

Siphotextularia crispata (Brady). Cushman, Todd and Post, 1954, p. 330.

Siphotextularia saulcyana (d'Orbigny)

Textularia saulcyana d'Orbigny, 1839a, p. 146, pl. 1, fig. 21, 22.

Textularia (*Siphotextularia*) *saulcyana* d'Orbigny. Asano, 1950c, p. 7, figs. 33, 34.

Sphaeroidina austriaca d'Orbigny

Sphaeroidina austriaca d'Orbigny, 1846, p. 284, pl. 20, figs. 19-21.

Sphaeroidina bulloides d'Orbigny

Sphaeroidina bulloides d'Orbigny, 1826, p. 267.

Sphaeroidina compacta Cushman and Todd

Sphaeroidina compacta Cushman and Todd, 1949, p. 19, pl. 4, fig. 14.

Spirillina limbata Brady ..Pl. 23, fig. 9

Spirillina limbata Brady, 1879, p. 278, pl. 8, fig. 26.

Spirolina arietina (Batsch)

Nautilus (*Lituus*) *arietinus* Batsch, 1791, p. 4, pl. 6, fig. 15. (*fide* Ellis and Messina, 1940 *et seq.*).

Spirolina arietina (Batsch). Cushman, 1933b, p. 43, pl. 15, figs. 4, 5.

Spiroloculina angulata Cushman

Spiroloculina grata var. *angulata* Cushman, 1917, p. 36, pl. 7, fig. 5.

Spiroloculina angulata Cushman. Cushman and Todd, 1944a, p. 50. (*fide* Barker, 1960)

Spiroloculina antillarum d'Orbigny

Spiroloculina antillarum d'Orbigny, 1839, p. 166, pl. 9, figs. 3, 4.

Spiroloculina canaliculata d'Orbigny

Spiroloculina canaliculata d'Orbigny, 1846, p. 269, pl. 16, figs. 10-12.

Spiroloculina communis Cushman and Todd

Spiroloculina communis Cushman and Todd, 1944b, p. 63, pl. 9, figs. 4, 5, 7, 8.

Spiroloculina communis incisa Cushman
Spiroloculina grateloupi d'Orbigny *incisa* Cushman, 1921, p. 397, pl. 78, fig. 5.
Spiroloculina communis incisa Cushman. Asano, 1951a, p. 13, figs. 89, 90.

Spiroloculina hadai Thalmann
Spiroloculina hadai Thalmann, 1933, p. 354.

Spiroloculina dentata Cushman and Todd
Spiroloculina dentata Cushman and Todd, 1944b, p. 71, pl. 9, figs. 33, 34.

Spiroplectammina higuchii Takayanagi ....Pl. 14, fig. 4
Spiroplectammina higuchii Takayanagi, 1953, p. 27, pl. 4, fig. 1.

Stainforthia exilis (Brady) var. *tenuata* (Cushman)
Buliminella subfusiformis Cushman var. *tenuata* Cushman, 1927, p. 149, pl. 2, fig. 9.
Bulimina exilis Brady var. *tenuata* (Cushman). Cushman and Parker, 1947, p. 124, pl. 28, fig. 29.

Streptochilus globigerum (Schwager)
Textularia globigera Schwager, 1866, p. 252, pl. 7, fig. 100.
Streptochilus globigerum (Schwager). Brönnimann and Resig, 1971, p. 1288, pl. 51, fig. 2. (*fide* Srinivasan and Sharma, 1980).

Stilostomella ketienziensis (Ishizaki)
Ellipsonodosaria ketienziensis Ishizaki, 1943, p. 684, text-figs. 1, 6, 11.
Stilostomella ketienziensis (Ishizaki). Takayanagi and Hasegawa, 1987, p. 15.

Stilostomella lepidula (Schwager)
Nodosaria lepidula Schwager, 1866, p. 210, pl. 5, figs. 27, 28.
Stilostomella lepidula (Schwager). LeRoy, 1964, p. F35.

Textularia abbreviata d'Orbigny
Textularia abbreviata d'Orbigny, 1846, p. 249, pl. 15, figs. 9–12.

Textularia agglutinans d'Orbigny
Textularia agglutinans d'Orbigny, 1839a, p. 136, pl. 1, figs. 17, 18, 32, 34.

Textularia articulata d'Orbigny
Textularia articulata d'Orbigny, 1846, p. 250, pl. 15, figs. 16–18.

Textularia astutia Lalicker and McCulloch
Textularia astutia Lalicker and McCulloch, 1940, p. 119, pl. 13, fig. 4.

Textularia aura Lalicker and McCulloch
Textularia aura Lalicker and McCulloch, 1940, p. 119, pl. 13, fig. 5.

Textularia calva Lalicker
Textularia calva Lalicker, 1935, p. 1, pl. 1, figs. 1, 2. (*fide* Ellis and Messina, 1940 *et seq.*).

Textularia candeiana d'Orbigny
Textularia candeiana d'Orbigny, 1839a, p. 143, pl. 1, figs. 25–27.

Textularia catenata Cushman
Textularia catenata Cushman, 1911, p. 23, text-figs. 39, 40.

Textularia conica d'Orbigny
Textularia conica d'Orbigny, 1839a, p. 143, pl. 1, figs. 19, 20.

Textularia fistula Cushman
Textularia agglutinans d'Orbigny var. *fistula* Cushman, 1911, p. 10, fig. 11.
Textularia fistula Cushman. Cushman and McCulloch, 1940, p. 127, pl. 14, fig. 10.

Textularia rugosa (Reuss)
Plecanium rugosa Reuss, 1869, p. 453, pl. 1, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Textularia rugosa (Reuss). Brady, 1884, p. 362, pl. 42, figs. 23, 24.

Textularia sagittula Defrance
Textularia sagittula Defrance, 1824, p. 177. (*fide* Ellis and Messina, 1940 *et seq.*).

Textularia sagittula Defrance var. *atrata* Cushman
Textularia sagittula Defrance var. *atrata* Cushman, 1911, p. 7, figs. 2–5.

Textularia sagittula Defrance var.

fistulosa Brady
Textularia sagittula Defrance var. *fistulosa* Brady, 1884, p. 362, pl. 42, figs. 19–22.
Textularia schencki Cushman and Valentine
Textularia schencki Cushman and Valentine, 1930, p. 8, pl. 1, fig. 3.
Textularia scrupta Lalicker and McCulloch
Textularia scrupta Lalicker and McCulloch, 1940, p. 141, pl. 16, fig. 25.
Textularia semialta Cushman
Textularia semialta Cushman, 1913b, p. 634, pl. 80, figs. 6, 7.
Textularia cf. *trochus* d'Orbigny
cf. *Textularia trochus* d'Orbigny, 1840, p. 45, pl. 4, figs. 25, 26.
Textularia vola Lalicker and McCulloch
Textularia vola Lalicker and McCulloch, 1940, p. 142, pl. 16, fig. 27.
Textulariella pacifica Cushman
Textulariella pacifica Cushman, 1937, p. 67, pl. 7, figs. 11–13.
Thalmannammina parkerae (Uchio)
Recurvoidella parkerae Uchio, 1960, p. 53, pl. 1, figs. 18, 19.
Thalmannammina parkerae (Uchio). Loeblich and Tappan, 1964, p. 226, fig. 136, 8.
Tosaia hanzawai Takayanagi
......................Pl. 22, fig. 10
Tosaia hanzawai Takayanagi, 1953, p. 30, pl. 4, fig. 7.
Trifarina bradyi Cushman..Pl. 15, fig. 5
Trifarina bradyi Cushman, 1923, p. 99, pl. 22, figs. 3–9.
Trifarina carinata (Cushman)
Angulogerina carinata Cushman, 1927c, p. 159, pl. 4, fig. 3.
Trifarina hughesi (Galloway and Wissler)
Uvigerina hughesi Galloway and Wissler, 1927, p. 76, pl. 12, fig. 5.
Trifarina occidentalis (Cushman)
Uvigerina occidentalis Cushman, 1923, p. 169.
Triloculina tricarinata d'Orbigny
......................Pl. 22, fig. 7
Triloculina tricarinata d'Orbigny, 1826, p. 299.
Triloculina trigonula (Lamarck)
....................Pl. 17, fig. 10
Miliolites trigonula Lamarck, 1804, p. 351, No. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Triloculina trigonula (Lamarck). d'Orbigny, 1826, p. 299, pl. 16, figs. 5–9, modèles, no. 93.
Trochammina charlottensis Cushman
Trochammina charlottensis Cushman, 1925, p. 39, pl. 6, fig. 4.
Trochammina discorbis Earland
Trochammina discorbis Earland, 1934, p. 104, pl. 3, figs. 28–31.
Trochammina globigeriniformis (Parker and Jones) Pl. 11, fig. 6 ; Pl. 13, fig. 9
Lituola nautiloidea var. *globigeriniformis* Parker and Jones, 1865, p. 407, pl. 15, figs. 46, 47.
Trochammina globigeriniformis (Parker and Jones). Poag, 1981, p. 85, pl. 13, fig. 1 ; pl. 14, fig. 1.
Trochammina inflata (Montagu)
......................Pl. 11, fig. 4
Nautilus inflata Montagu, 1808, p. 81, pl. 18, fig. 3. (*fide* Ellis and Messina, 1940 *et seq.*).
Trochammina inflata (Montagu). Carpenter, Parker and Jones, 1862, p. 141, pl. 11, fig. 5. (*fide* Brady, 1884).
Trochammina nana (Brady)
Haplophragmium nanum Brady, 1881, p. 50.
Trochammina nana (Brady). Barker, 1960, p. 72, pl. 35, figs. 6–8.
Trochammina nitida Brady
Trochammina nitida Brady, 1881, p. 52.
Trochammina pacifica Cushman
...................Pl. 11, fig. 5
Trochammina pacifica Cushman, 1925, p. 39, pl. 6, fig. 3.
Trochammina squamata Jones and Parker
Trochammina squamata Jones and

Parker, 1860, p. 304. (*fide* Ellis and Messina, 1940 *et seq.*).

Trochammina squamiformis Cushman and McCulloch

Trochammina squamiformis Cushman and McCulloch, 1939, p. 108, pl. 12, fig. 4.

Trochammina vesicularis Goës

Trochammina vesicularis Goës, 1894, p. 31, pl. 6, figs. 235–237. (*fide* Ellis and Messina, 1940 *et seq.*).

Tubulogenerina zanzibarica (Cushman)

Brizalina zanzibarica Cushman, 1936b, p. 58, pl. 8, fig. 12.

Tubulogenerina zanzibarica (Cushman). Loeblich and Tappan, 1964, p. 654.

Uvigerina asperula Cžjžek

Uvigerina asperula Cžjžek, 1848, p. 146, pl. 13, figs. 14, 15. (*fide* Ellis and Messina, 1940 *et seq.*).

Uvigerina flintii Cushman

Uvigerina flintii Cushman, 1923, p. 165, pl. 42, fig. 13.

Uvigerina hispida Schwager .... Pl. 16, fig. 11

Uvigerina hispida Schwager, 1866, p. 249, pl. 7, fig. 95.

Uvigerina hispidocostata Cushman and Todd .... Pl. 16, fig. 10

Uvigerina hispido-costata Cushman and Todd, 1945, p. 51, pl. 7, figs. 27, 31.

Uvigerina interrupta Brady

Uvigerina interrupta Brady, 1879, p. 274, pl. 8, figs. 17, 18.

Uvigerina nitidula Schwager

Uvigerina nitidula Schwager, 1866, p. 248, pl. 7, fig. 93.

Uvigerina peregrina Cushman

Uvigerina peregrina Cushman, 1923, p. 166, pl. 42, figs. 7–10.

Uvigerina peregrina pavula Cushman

Uvigerina peregrina pavula Cushman, 1923, p. 168, pl. 42, fig. 11.

Uvigerina peregrina Cushman *shiwoensis* Asano

Uvigerina peregrina Cushman *shiwoensis* Asano, 1958, p. 35, pl. 6, figs. 5–8.

Uvigerina porrecta Brady .. Pl. 15, fig. 2

Uvigerina porrecta Brady, 1879, p. 274, pl. 8, figs. 15, 16.

Uvigerina proboscidea Schwager .... Pl. 22, fig. 12

Uvigerina proboscidea Schwager, 1866, p. 250, pl. 7, fig. 96.

Uvigerina proboscidea vadescens Cushman .... Pl. 16, fig. 12

Uvigerina proboscidea Schwager var. *vadescens* Cushman, 1933, p. 85, pl. 8, figs. 14, 15.

Uvigerina pseudoampullacea Asano

Uvigerina pseudoampullacea Asano, 1938d, p. 613, pl. 17, figs. 28, 29.

Uvigerian schencki Asano .. Pl. 16, fig. 13

Uvigerian schencki Asano, 1950b, p. 17, figs. 74, 75.

Uvigerina schwageri Brady

Uvigerina schwageri Brady, 1884, p. 575, pl. 74, figs. 8–10.

Vaginulinopsis asanoi Ishizaki .... Pl. 22, fig. 3

Vaginulinopsis asanoi Ishizaki, 1942, p. 106, text-figs. 1–3.

Vaginulinopsis pacifica (Cushman and Hanzawa)

Polymorphinella pacifica Cushman and Hanzawa, 1936, p. 47.

Vaginulinopsis pacifica (Cushman and Hanzawa). Parr, 1950, p. 325. (*fide* Barker, 1960).

Vaginulinopsis tasmanica Parr

Vaginulinopsis tasmanica Parr, 1950, p. 324, pl. 11, figs. 13, 14.

Valvobifarina mackinnoni (Millett) var. *robusta* (Sidebottom)

Bifarina mackinnoni (Millett) var. *robusta* Sidebottom, 1818, p. 125, pl. 3, figs. 17, 18. (*fide* Ellis and Messina, 1940 *et seq.*).

Valvulineria hamanakoensis (Ishiwada)

Anomalina hamanakoensis Ishiwada, 1958, p. 18, text-fig. 3, pl. 1, figs. 24–27.

Valvulineria hamanakoensis (Ishiwada). Matoba, 1970, p. 63, pl. 4, figs. 12, 13.

Valvulineria rugosa (d'Orbigny)

Rosalina rugosa d'Orbigny, 1839c, p. 42, pl. 2, figs. 12-14.
Valvulineria rugosa (d'Orbigny). Barker, 1960, p. 180, pl. 87, fig. 3.

Valvulineria rugosa (d'Orbigny) var. *minuta* (Schubert)
Discorbina rugosa d'Orbigny var. *minuta* Schubert, 1904, p. 420. (*fide* Ellis and Messina, 1940 *et seq.*).
Valvulineria rugosa (d'Orbigny) var. *minuta* (Schubert). Barker, 1960, p. 188, pl. 91, fig. 4.

Vertebralina striata d'Orbigny
Vertebralina striata d'Orbigny, 1826, p. 283, no. 1.

Wiesnerella auriculata (Egger)
Planispirina auriculata Egger, 1893, p. 245, pl. 3, figs. 13-15. (*fide* Ellis and Messina, 1940 *et seq.*).
Wiesnerella auriculata (Egger). Cushman, 1933d, p. 33, pl. 3, figs. 7-9.

DESCRIPTION OF NEW SPECIES

Superfamily Discorbacea Ehrenberg, 1938
Family Discorbidea Ehrenberg, 1938
Genus *Valvulineria* Cushman, 1926
Valvulineria gunjii Akimoto, n. sp.
Pl. 21, fig. 6.

Description : Test medium, ovoid in outline, longer than broad, biconvex, trochospirally coiled, umbilical side more convex than spiral side, periphery rounded, not lobulate ; composed of two whorls ; chambers somewhat inflated, seven in last whorl, increasing gradually in size as added ; suture distinct, not limbate, radial, gently curved, somewhat depressed on spiral side, umbilical side not limbate, radial, nearly straight, slightly depressed : aperture interiomarginal, extraumbilical-umbilical ; several continuous series of rounded opening along suture ; umbilicus covered with rhomboidal valvular plates.

Dimension (in mm) :

	length	breadth	thickness
Holotype	0.37	0.23	0.18
Paratypes	0.36	0.22	0.18
	0.36	0.23	0.18

Type and occurrence : Holotype, IGPS coll. cat. no. 100603, from sample KT86-11-P8, Nankai Trough.

Occurrence : Rare, only at type locality.

REFERENCES

Aoki, N., 1964, Upper Miocene foraminifera from the Kiyosumi Formation, Boso Peninsula. *Trans. Proc. Palaeont. Soc. Japan. N.S.*, no. 53, p. 163-169, pl. 25.

————, 1967, Recent foraminifera from Nabeta, Shimoda, Izu Peninsula. *Prof. H. Shibata Mem. Vol.*, p. 378-382, pl. 1.

————, 1968, Benthonic foraminiferal zonation of the Kazusa Group, Boso Peninsula. *Trans. Proc. Palaeont. Soc. Japan N.S.*, no. 70, p. 238-266, 5 figs., 3 tabs., pl. 27.

Aoshima, M., 1978, Depositional environment of the Plio-Pleistocene Kakegawa Group, Japan. — A comparative study of the fossil and the Recent foraminifera —. *Jour. Fac. Sci., Univ. Tokyo, sec. II*, v. 19, no. 5, p. 401-441, 25 figs., 7 tabs.

Asano, K., 1936a, *Pseudononion*, a new genus of foraminifera found in Muraoka-mura, Kamakura-gori, Kanagawa Prefecture. *Jour. Geol. Soc. Japan*, v. 43, no. 512, p. 347-348, 1 text-figs.

————, 1936b, Foraminifera from Muraoka-mura, Kamakura-gori, Kanagawa Prefecture (Studies on the fossil foraminifera from the Neogene of Japan. part 1). *Jour. Geol. Soc. Japan*, v. 43, p. 603-622, pls. 30, 31.

————, 1936c, New foraminifera from the Kakegawa district, Totomi, Japan. (Studies on the fossil foraminifera from the Neogene of Japan. part 4). *Japan. Jour. Geol. Geogr.*, v. 13, nos.

3-4, p. 325-331, pls. 36, 37.

———, 1936d, New species of foraminifera from Tosa Province, Japan (Studies on the fossil foraminifera from the Neogene of Japan. part 7). *Jour. Geol. Soc. Japan*, v. 43, p. 942-946, pls. 36, 37.

———, 1937, Pleistocene foraminifera from the Hiradoko shall beds, Noto Peninsula Japan. *Jour. Geol. Soc. Japan*, v. 44, p. 1231-1238.

———, 1938a, On the Japanese species of *Nonion* and its allied genera. *Jour. Geol. Soc. Japan*, v. 45, no. 538, p. 592-599, pls. 14, 15.

———, 1938b, On the Japanese species of *Bolivina* and its allied genera. *Jour. Geol. Soc. Japan*, v. 45, p. 600-609, pl. 16.

———, 1938c, Japanese fossil Nodosariidae, with notes on the Frondiculariidae. *Sci. Rep., Tohoku Univ., 2nd ser.* (*Geol.*), v. 19, no. 2, p. 179-220, 4 text-figs., pls. 1-8.

———, 1938d, On the Japanese species of *Uvigerina* and its allied genera. *Jour. Geol. Soc. Japan*, v. 45, p. 609-616, pl. 17.

———, 1938e, On some Pliocene foraminifera from the Setana beds, Hokkaido. *Japan. Jour. Geol. Geogr.*, v. 15, nos. 1-2, p. 86-103, pls. 9-11.

———, 1944, *Hanzawaia*, a new genus of foraminifera, from the Pliocene of Japan. *Jour. Geol. Soc. Japan*, v. 51, p. 97-99, pl. 4 (*in* Japanese with English description).

———, 1949, The foraminiferal genus *Cruciloculina* d'Orbigny, 1839. *Jour. Paleont.*, v. 23, p. 479-480, pl. 80.

———, 1950a, Illustrated catalogue of Japanese Tertiary smaller foraminifera: Pt. 1, Family Nonionidae. p. 1-12, 73 figs. *Hosokawa Printing Co.*, Tokyo.

———, 1950b, *Ibid.*, Pt. 2, Family Buliminidae. p. 1-19, 96 figs.

———, 1950c, *Ibid.*, Pt. 3, Family Textulariidae. p. 1-7, 36 figs.

———, 1951a, *Ibid.*, Pt. 6, Family Miliolidae. p. 1-20, 135 figs.

———, 1951b, *Ibid.*, Pt. 8, Family Polymorphinidae. p. 1-14, 72 figs.

———, 1951c, *Ibid.*, Pt. 13, Family Anomalinidae. p. 12-19, 52 figs.

———, 1951d, *Ibid.*, Pt. 14, Family Rotalinidae. p. 1-21, 155 figs.

———, 1951e, *Ibid.*, Pt. 15, Family Lagenidae. p. 1-39, 165 figs.

———, 1956, The foraminifera from the adjacent seas of Japan, collected by the S.S. Soyo-maru, 1922-1930: Pt. 2, Miliolidae. *Sci. Rep. Tohoku Univ., 2nd ser.* (*Geol.*), v. 27, p. 57-83, pls. 7-9.

———, 1958, *Ibid.*, Pt. 4, Buliminidae. *Sci. Rep. Tohoku Univ., 2nd ser.* (*Geol.*), v. 29, p. 1-41, pls. 1-7.

——— and Nakamura, M., 1937, On the Japanese species of *Cassidulina*. *Japan. Jour. Geol. Geogr.*, v. 14, nos. 2-3, p. 143-153, 12 text-figs., pls. 13, 14.

Bailey, J.W., 1851, Microscopical examination of soundings, made by the U.S. coast survey off the Atlantic coast of the U.S.. *Smithsonian Contr. Knowledge*, v. 2, art. 3, p. 3-15, pl. 1.

Barker, R.W., 1960, Taxonomic notes on the species figured by H.B. Brady in his report on the foraminifera dredged by H.M.S. Challenger during the years 1873-1876. *Soc. Econ. Paleont. Miner., Spec. Publ.*, no. 9, xxiv+238 p., pls. 1-115.

Belford, D.J., 1966, Miocene and Pliocene Smaller Foraminifera from Papua and New Guinea. *Bureau Min. Res. Geol. Geophys., Bull.* 79, p. 306, 25 figs., pls. 1-38.

Boomgaart, L., 1949, Smaller foraminifera from Bodjonegoro (Java). *Geol. Inst. Univ. Utrecht*, p. 1-175, 3 figs., 6 tabs., pls. 1-14, pocket 1 tab.

Brady, H.B., 1879, Notes on some of the Reticularian Reizopoda of the "Challenger" Expedition. *Quaterly Jour. Microsc. Sci., N.S.*, v. 19, p. 1-43, pls. 3-5.

———, 1881, Notes on some of the Reticularian Reizopoda of the "Challenger" Expedition. pt. 3. *Quaterly Jour. Microsc. Sci., N.S.*, v. 21, p. 1-41, pl. 8.

———, 1884, Report on the foraminifera dredged by H.M.S. Challenger, during the years 1873-1876. *Rep. Sci. Res. Explor. Voy. H.M.S. Challenger*, v. 9, (*Zool.*), xxi+814 p., 20 figs., 4 tabs., 2 maps, pls. 1-115.

Brotzen, F., 1948, The Swedish Paleocene and its foraminiferal fauna. *Sveriges Geologiska Undersokning, Ser. C*, v. 42, no. 2, p. 1-140, 39 figs., pls. 1-19.

Buzas, M. and Gibson, T.G., 1969, Species diversity: Benthonic foraminifera in western north Atlantic. *Science*, v. 163, p. 72-75, 2 figs.

Chapman, F., 1900, Foraminifera from the lagoon of Funafuti. *Linn. Soc. London, Jour. Zool.*, v. 28, p. 161-210, 2 figs., 2 tabs., pls. 19, 20.

———, 1937, Foraminifera. *Australasian Antarctic Expedition 1911-14. Sci. Rep. Ser. C.*, v. 1, pt. 2, p. 1-190, 4 tabs., pls. 7-10. David Harold Paisley, Sydney.

——— and Parr, W.J., 1931, Notes on new and aberrant types of foraminifera. *Proc. Roy. Soc. Victoria, N.S.*, v. 43, pt. 2, p. 236-240, pl. 9.

——— and ———, 1935, Foraminifera and ostracoda from Sounding made by the Trawler "Bonthorpe" in the Great Australian Bight. *Jour. Roy. Soc. W. Australia*, v. 21, p. 1-7, pl. 1.

Chiji, M., 1961, Foraminifera from the Asahiyama shell bed, Himi City, Toyama Prefecture.

Prof. J. Makiyama, Mem. Vol., Kyoto, p. 229-238, 2 figs., pls. 1, 2.

Cushman, J.A., 1910, A monograph of the foraminifera of the Pacific Ocean: Pt. 1, Astrophizidae and Lituolidae. *Bull. U.S. Nat. Mus.*, no. 71, xiv+134 p., 203 figs.

———, 1911, A monograph of the foraminifera of the Pacific Ocean: Pt. 2, Textulariidae. *Bull. U.S. Nat. Mus.*, no. 71, xiii+108 p., 156 figs.

———, 1913a, A monograph of the foraminifera of the Pacific Ocean: Pt. 3, Lagenidae. *Bull. U.S. Nat. Mus.*, no. 71, ix+125 p., pls. 1-47.

———, 1913b, New Textulariidae and other arenaceous foraminifera from the Philippine Islands and contiguous waters. *U.S. Nat. Mus. Proc.*, 44, p. 633-638, pls. 78-80.

———, 1915, A monograph of the foraminifera of the Pacific Ocean: Pt. 5, Rotaliidae. *Bull. U.S. Nat. Mus.*, no. 71, vii+87 p., 62 figs., pls. 1-32.

———, 1917, New species and varieties of foraminifera from the Philippines and adjacent waters. *U.S. Nat. Mus. Proc.*, 51, p. 651-662.

———, 1918, The foraminifera of the Atlantic Ocean: Pt. 1, Astrorhizidae. *Bull. U.S. Nat. Mus.*, no. 104, vii+111 p., pls. 1-39.

———, 1921, Foraminifera of the Philippines and adjacent seas. *Bull. U.S. Nat. Mus.*, no. 100, v. 4, 608 p., 52 figs., pls. 1-100.

———, 1922a, Shallow-water foraminifera of the Tortugas region. *Carnegie Inst. Washington. Publ.*, no. 311, p. 1-85, 5 tabs., 1 map, pls. 1-14.

———, 1922b, The foraminifera of the Atlantic Ocean: Pt. 3, Textulariidae. *Bull. U.S. Nat. Mus.*, no. 104, viii+149 p., pls. 1-26.

———, 1923, The foraminifera of the Atlantic Ocean: Pt. 4, Lagenidae. *Bull. U.S. Nat. Mus.*, no. 104, x+228 p., pls. 1-42.

———, 1924, Samoan foraminifera. *Carnegie Inst. Washington Publ.*, no. 342, 75 p., 1 tab., pls. 1-25.

———, 1925a, Recent foraminifera from British Columbia. *Contr. Cushman Lab. Foram. Res.*, v. 1, Pt. 2, p. 38-45, pls. 6, 7.

———, 1925b, Notes on the genus *Cassidulina*. *Contr. Cushman Lab. Foram. Res.*, v. 1, Pt. 2, p. 51-60, pls. 8-9.

———, 1925c, An introduction to the morphology and classification of the foraminifera: *Smithsonian Inst. Misc. Coll.*, v. 77, no. 4, p. 1-77, pls. 1-16.

———, 1926a, Foraminifera of the typical Monterey of California. *Contr. Cushman Lab. Foram. Res.*, v. 2, pt. 3, p. 53-69, pls. 7-9.

———, 1926b, The genus *Lamarckina* and its American species. *Contr. Cushman Lab. Foram. Res.*, v. 2, pt. 1, p. 7-13, pl. 1.

———, 1927a, American Upper Cretaceous species of *Bolivina* and related species. *Contr. Cushman Lab. Foram. Res.*, v. 2, p. 85-91.

———, 1927b, An outline of a re-classification of the foraminifera. *Contr. Cushman Lab. Foram. Res.*, v. 3, pt. 1, p. 1-105, pls. 1-21.

———, 1927c, Some characteristic Mexican fossil foraminifera. *Jour. Paleont.*, v. 1, no. 2, p. 147-172, pls. 23-28.

———, 1927d, Recent foraminifera from the west coast of America. *Bull. Scripps Inst. Oceanogr., Tech. Ser.*, v. 1, no. 10, p. 119-188, pls. 1-6.

———, 1927e, Foraminifera of the genus *Ehrenbergina* and its species. *U.S. Nat. Mus. Proc.*, 70, p. 1-5, pls. 1, 2.

———, 1928, Fistulose species of *Gaudryina* and *Heterostomella*. *Contr. Cushman Lab. Foram. Res.*, v. 4, pt. 4, p. 107-112, pl. 16.

———, 1929, The foraminifera of the Atlantic Ocean: Pt. 6, Miliolidae, Ophthalmidiidae and Fischerinidae. *Bull. U.S. Nat. Mus.*, no. 104, viii+129 p., 1 tab., pls. 1-22.

———, 1930, The foraminifera of the Atlantic Ocean: Pt. 7, Nonionidae, Camerinidae, Peneroplidae and Alveolinellidae. *Bull. U.S. Nat. Mus.*, no. 104, vi+79 p., pls. 1-18.

———, 1931, The foraminifera of the Atlantic Ocean: Pt. 8, Rotaliidae, Amphisteginidae, Calcarinidae, Cymbaloporettidae, Globorotaliidae, Anomalinidae, Planorbulinidae, Rupertiidae and Homotremidae. *Bull. U.S. Nat. Mus.*, no. 104, ix+179 p., pls. 1-26.

———, 1933a, Some new foraminiferal genera. *Contr. Cushman Lab. Foram. Res.*, v. 9, pt. 1, p. 32-38, pl. 4.

———, 1933b, The foraminifera of the tropical Pacific collections of the "Albatross", 1899-1900: Pt. 2, *Bull. U.S. Nat. Mus.*, no. 161, 79 p., 33 tabs., pls. 1-19.

———, 1933c, Some new Recent foraminifera from the tropical Pacific. *Contr. Cushman Lab. Foram. Res.*, v. 9, pt. 4, p. 77-95, pls. 8-10.

———, 1936, New genera and species of the families Verneuilinidae and Valvulinidae and of the subfamily Virgulininae. *Cushman Lab. Foram. Res., Spec. Publ.*, no. 6, p. 1-71, pls. 1-8.

———, 1937, A monograph of the foraminiferal family Valvulinidae. *Cushman Lab. Foram. Res., Spec. Publ.*, no. 8, xiii+210 p., pls. 1-24.

———, 1939, A monograph of the foraminiferal family Nonionidae. *U.S. Geol. Surv., Prof. Paper*, no. 191, p. 1-100, pls. 1-20.

———, 1945, The species of the subfamily Reussellinae of the foraminiferal family Buliminidae. *Contr. Cushman Lab. Foram. Res.*, v. 21, pt. 2, p. 23-54, pls. 5-8.

——— and Edwards, P.G., 1937, *Astrononion*, a new genus of the foraminifera, and its species. *Contr. Cushman Lab. Foram. Res.*, v. 13, p. 29-

36, pl. 3.

———— and Grant, U.S. IV, 1927, Late Tertiary and Quaternary Elphidiums of the west coast of north America. *Trans. San Diego Soc. Nat. Hist.*, v. 5, no. 6, p. 69-82, pls. 7-8.

———— and Gray, H.B., 1946, A foraminiferal fauna from the Pliocene of Timms Point, California. *Cushman Lab. Foram. Res., Spec. Publ.*, no. 19, p. 1-46, pls. 1-8.

———— and Hanzawa, S., 1936, New genera and species of foraminifera of the Late Tretiary of the Pacific. *Contr. Cushman Lab. Foram. Res.*, v. 12, pt. 2, p. 45-48, pl. 8.

———— and Harris, R.W., 1927, Some notes on the genus *Ceratobulimina*. *Contr. Cushman Lab. Foram. Res.*, v. 3, pt. 4, p. 171-179, pls. 29-30.

———— and Jarvis, P.W., 1928, Cretaceous foraminifera from Trinidad. *Contr. Cushman Lab. Foram. Res.*, v. 4, pt. 4, p. 86-103, pls. 12-14.

———— and LeRoy, L.W., 1939, *Cribrolinoides*, a new genus of the foraminifera, its development and relationships. *Contr. Cushman Lab. Foram. Res.*, v. 15, pt. 1, p. 15-19.

———— and McCulloch, I., 1939, A report on some arenaceous foraminifera. *Allan Hancock Pac. Exped.*, v. 6, no. 1, p. 1-113, 11 tabs., pls. 1-12.

———— and ————, 1940, Some Nonionidae in the collections of the Allan Hancock Foundation. *Allan Hancock Pac. Exped.*, v. 6, no. 3, p. 145-178, 1 tab., pls. 17-20.

———— and ————, 1942, Some Virgulininae in the collections of the Allan Hancock Foundation. *Allan Hancock Pac. Exped.*, v. 6, no. 4, p. 179-230, 3 tabs., pls. 21-28.

———— and ————, 1948, The species of *Bulimina* and related genera in the collections on the Allan Hancock Foundation. *Allan Hancock Pac. Exped.*, v. 6, no. 5, p. 231-294, 1 tab., pls. 29-36.

———— and ————, 1950, Some Lagenidae in the collections of the Allan Hancock Foundation. *Allan Hancock Pac. Exped.*, v. 6, no. 6, p. 295-364, pls. 37-48.

———— and Ozawa, Y., 1928, An outline of a revision of the Polymorphinidae. *Contr. Cushman Lab. Foram. Res.*, v. 4, pt. 1, p. 13-21, pl. 2.

———— and ————, 1930, A monograph of the foraminiferal family Polymorphinidae Recent and fossil. *Proc. U.S. Nat. Mus.*, v. 77, art. 6, p. 1-185, 1 fig., pls. 1-40.

———— and Parker, F.L., 1947, The Recent species of *Bulimina* named by d'Orbigny in 1826. *Contr. Cushman Lab. Foram. Res.*, v. 14, pt. 4, p. 90-94, pl. 16.

———— and ————, 1947, *Bulimina* and related foraminiferal genera. *U.S. Geol. Surv., Prof. Paper*, no. 210-D, p. 1-176, pls. 1-30.

———— and Todd, R., 1942, The genus *Cancris* and its species. *Contr. Cushman Foram. Res.*, v. 18, pt. 3, p. 72-95, pls. 17-24.

———— and ————, 1943, The genus *Pullenia* and its species. *Contr. Cushman Foram. Res.*, v. 19, pt. 1, p. 1-23, pls. 1-4.

———— and ————, 1944a, The genera *Baggina* and *Neocribrella* and their species. *Contr. Cushman Foram. Res.*, v. 20, no. 4, p. 97-107, pls. 15-17.

———— and ————, 1944b, The genus *Spiroloculina* and its species. *Cushman Lab. Foram. Res., Spec. Publ.*, no. 11, p. 1-82, pls. 1-9.

———— and ————, 1945, Miocene foraminifera from Buff Bay, Jamaica. *Cushman Lab. Foram. Res., Spec. Publ.*, no. 15, p. 1-73, pls. 1-12.

———— and ————, 1946, A foraminiferal fauna from the Byram marl at its type locality. *Contr. Cushman Lab. Foram. Res.*, v. 22, p. 76-102, pls. 13-16.

———— and ————, 1949, Species of the genera *Allomorphina* and *Quadrimorphina*. *Contr. Cushman Foram. Res.*, v. 25, no. 3, p. 59-72, pls. 11, 12.

———— and Valentine, W.W., 1930, Shallow-water foraminifera from the Channel Islands of southern California. *Contr. Dep. Geol. Stanford Univ.*, v. 1, no. 1, p. 5-51, pls. 1-10.

————, Todd, R. and Post, R.J., 1954, Recent foraminifera of the Marshall Islands. Bikini and nearby atolls, part 2, Oceanography (Biologic). *U.S. Geol. Surv., Prof. Paper*, 260-H, p. 319-384, figs. 116-118, 5 tabs., pls. 82-93.

Eade, J.V., 1967, New Zealand Recent foraminifera of the families Islandiellidae and Cassidulinidae. *Jour. Marine Freshwater Res. New Zealand*, v. 1, no. 4, p. 421-454, 9 figs., 1 tab.

Earland, A., 1934, Foraminifera Pt. III. The Falklands sector of the Antarctic (Excluding South Geogia). *Discovery Reports*. v. 10, p. 1-208, 1 fig., pls. 1-10.

Ellis, B.F. and Messina, A.R., 1940 *et seq.*, Catalogue of Foraminifera. *Am. Mus. Nat. Hist.*, New York, 30 vols. and supplement-vols.

Finlay, K.J., 1939, New Zealand foraminifera: Key species in stratigraphy, no. 3. *Trans. Roy. Soc. N.Z.*, v. 69, pt. 3, p. 309-329, pls. 24-29.

————, 1940, New Zealand foraminifera: Key species in stratigraphy, no. 4. *Trans. Roy. Soc. N.Z.*, v. 70, pt. 4, p. 448-472, pls. 62-67.

————, 1947, New Zealand foraminifera: Key species in stratigraphy, no. 5. *N.Z. Sci. Tech., ser. B*, v. 28, no. 5, p. 257-292, pls. 1-9.

Flint, J.M., 1897, Recent foraminifera. A descriptive catalogue of specimens dredged by the U.S. Fish Commission Steamer Albatross. *U.S.*

Nat. Mus., p. 251-349, 1 tab., pls. 1-80.

Frizzell, D.L. and Keen, A.M., 1949, On the nomenclature and generic position of *Nautilus beccarii* Linné (Foraminifera, "Rotaliidae"). *Jour. Paleont.*, v. 23, no. 1, p. 106-108.

Galloway, J.J., 1933, Manual of the Foraminifera. *James Furman Memorial Ser. Pub. No. 1*, 483 p., pls. 1-42, *Principia Press Inc.*, Bloomington, Indiana.

———— and Morrey, M., 1929, A lower Tertiary foraminiferal fauna from Monta, Ecuador. *Bull. Amer. Paleont.*, v. 15, no. 55, p. 7-46, pls. 1-6.

———— and Wissler, S.G., 1927, Pleistocene foraminifera from the Lomita Quarry, Palos Verdes Hill, California. *Jour. Paleont.*, v. 1, no. 1, p. 35-87, 2 tabs., pls. 8-12.

Gibson, T.G. and Buzas, M.A., 1973, Species diversity: patterns in modern and Miocene foraminifera of the eastern margin of North America. *Geol. Soc. Amer., Bull.*, v. 84, p. 217-238, 17 figs., 8 tabs.

Goës, A., 1882, On the Reticularian Rhizopoda of the Caribbean Sea. *Kongl. Svenska Vetenskaps-Akademiens Handlinger*, v. 19, no. 4, p. 3-151, pls. 1-12.

Graham, J.J. and Militante, P.J., 1959, Recent foraminifera from the Puerto Galera area northern Mindoro, Philippines. *Stanford Univ. Publ.*, v. 6, no. 2, p. 1-170, 2 figs., 8 tabs., pls. 1-19.

Hada, Y., 1931, Report of the biological survey of Mutsu Bay. 19. Notes on the Recent foraminifera from Mutsu Bay. *Sci. Rep., Tohoku Imp. Univ., 4th ser. (Biol.)*, v. 6, no. 1, p. 45-148, 95 text-figs.

Hantken, M. von, 1875, Die Fauna der *Clavulina Szabói*-Schichten. 1. Theil: Foraminiferen. *Mitth. Jahrb. K. Ungar. Geol. Anstalt*, v. 4, no. 1, p. 1-93, 1 tab., pls. 1-16.

Hasegawa, S., 1979, Foraminifera of the Himi Group, Hokuriku Province, Central Japan. *Sci. Rep. Tohoku Univ. 2nd ser. (Geol.)*, v. 49, no. 2, p. 89-163, 33 figs., 8 tabs., pls. 3-10.

————, 1984, notes on the taxonomy and paleontology of *Melonis pompilioides* and its allied taxa from Japan. *In*: Oertli, H.J. ed., *Benthos '83; 2nd Int. Symp. Benthic Foram.*, p. 299-304, 3 figs., 2 tabs., pl. 1. *Elf Aquitaine, Esso REP and Total CFP*. Pau and Bordeaux.

Haynes, J., 1954, Taxonomic position of some British Paleocene Buliminidae. *Contr. Cushman Found. Foram. Res.*, v. 5, pt. 4, p. 185-191, 20 text-figs.

Heron-Allen, E. and Earland, A., 1915, The foraminifera of the Kerimba Archipelago. *Trans. Zool. Soc. London*, v. 20, pt. 2, p. 543-794, pls. 40-53.

———— and ————, 1932, The Ice-Free area of the Falkland Islands and adjacent sea. *Discovery Report*, v. 4, Foraminifera, Pt. 1, p. 291-460, 1 fig., pls. 6-17.

Higuchi, T., 1956, Fossil foraminifera from the North-Miura Peninsula, Kanagawa Prefecture, Japan. *Jour. Geol. Soc. Japan*, v. 62, no. 725, p. 49-60, 7 text-figs. (*in* Japanese with English abstract and description.).

Hirota, I., Matsumura, T., Mashiko N. and Imamura, Y. 1986, [Distribution of trace elements in offshore and ocean, Hachijojima cruise 3-1]. *The data of Marine Oceanographical Observations. Fac. Oceanol., Tokai Univ.*, no. 7, p. 35-42, 1 fig., 5 tabs. (*in* Japanese; original title translated).

Hofker, J., 1951, The foraminifera of the Siboga Expedition. Pt. 3, p. 1-513, 348 figs. *E.J. Brell*, Leiden.

Höglund, K., 1947, Foraminifera in the Gullmar Fjord and the Skagerak. *Zoolgiska Bidrag Från Uppsala*, v. 26, p. 1-328, 312 figs., 7 tabs., 2 maps, pls. 1-32.

Honza, E., Isoyama, I., Onodera, K. and Ishibashi, K., 1983, Morphological setting of the Ogasawara Arc. *In* Honza, E., Inoue, E., and Ishihara, T., eds., Geolgical investigation of the Ogasawara (Bonin) and Northern Mariana Arcs. April-August 1979 (GH79-2, 3 and 4 Cruise), *Geol. Surv., Japan, Cruise Rep.*, no. 14, p. 30-35, 5 figs.

Horn, H.S., 1966, Measurement of "overlap" in comparative ecological studies. *Amer. Naturalist*, v. 100, p. 419-424.

Huang, T., 1964, "*Rotalia*" group from the upper Cenozoic of Taiwan. *Micropaleontology*, v. 10, no. 1, p. 49-62, 3 text-figs., pls. 1-3.

Ikehara, K., 1985, The characteristics of grain size distributions of muddy sediments off southwest Japan. *Jour. Sediment. Soc. Japan*, nos. 22-23, p. 71-77, 5 figs. (*in* Japanese with English abstract).

Inouchi, Y., 1981, Sediments on the Shinkurose Bank in its vicinity. *In* Inoue, E. ed., Geological investigation of the area northeast of Hachijojima Island, Northern part of Ogasawara Arc. July-August 1980 (GH80-4 Cruise). *Geol. Surv. Japan, Cruise Rep.*, no. 16, p. 49-52, 2 figs.

Inoue, Y., 1986, [Foraminiferal assemblages in the sediments of the Suruga Bay]. *Marine Sci. Month.*, v. 18, no. 9, p. 555-569, 3 figs., 1 tab. (*in* Japanese; original title translated)

Ishiwada, Y., 1958, Studies on the brackish water III. Recent foraminifera from the brackish lake Hamana-ko. *Rep. Geol. Surv. Japan*, no. 180, 19+2 p., pls. 1, 2. (*in* Japanese with English abstract).

————, 1964, Benthonic foraminifera off the Pacific coast of Japan referred to biostratigraphy of the Kazusa Group. *Rep. Geol. Surv.*

Japan, no. 205, p. 1-45, 14 figs., 5 tabs., pls. 1-8.
Ishizaki, K., 1942, *Vaginulinopsis asanoi*, a new species of foraminifera from Lower Pliocene of Kyushu and Shikoku, Japan. *Trans. Nat. Soc. Formosa*, v. 32, no. 221, p. 106-108.
———, 1943, On the species of *Ellipsonodosaria* from Japan. *Trans. Nat. Hist. Soc. Taiwan*, v. 33, no. 242-243, p. 678-689, 1 figs.
———, 1948, Six new fossil species of *Streblus* from Eastern Asia. *Acta Geol. Taiwanica*, v. 2, no. 1, p. 55-66, pl. 1.
Kohl, B., 1985, Early Pliocene benthic foraminifers from the Salina Basin, southeastern Mexico. *Bull. Amer. Paleont.*, v. 88, no. 322, p. 1-173, 18 text-figs., pls. 1-37.
Kuwano, Y., 1950, New species of foraminifera from the Pliocene formations of Tama Hills in the vicinity of Tokyo. *Jour. Geol. Soc. Japan*, v. 56, p. 311-321, 13 figs.
———, 1954, Notes on the genus *Cassidulina* and allied genera from Japan, II: Description of new species of *Cassidulina* from the Pliocene of southern Kuwanto region, (2), *Res. Inst. Nat. Res., Misc. Rep.*, no. 35, p. 33-36, 11 figs.
———, 1956, On the staining method for living foraminifera. *Res. Inst. Nat. Res., Misc. Rep.*, nos. 41-42, p. 67-75 (*in* Japanese).
Lalicker, C.G. and McCulloch, I., 1940, Some Textulariidae of the Pacific Ocean. *Allan Hancock Pac. Exped.*, v. 6, no. 2, p. 115-143, pls. 13-16.
LeRoy, L.W., 1939, Some small foraminifera, ostracoda and otoliths from the Neogene ("Miocene") of the Rokan-Tapanoeli area, central Sumatra. *Natuurk. Tijdschr. Nederl.-Indie*, v. 99, p. 215-296, 2 figs., pls. 1-14.
———, 1941a, Small foraminifera from the Late Tertiary of the Nederlands East Indies: Pt. 1, Small foraminifera from the Late Tertiary of the Sangkoelirang Bay area, East Borneo, Nederlands East Indies. *Colorado School Min. Quart.*, v. 36, no. 1, p. 1-62, 5 figs., 1 tab., 1 map, pls. 1-3.
———, 1941b, Some small foraminifera from the Late Tertiary of the Nederlands East Indies: Pt. 3, Some small foraminifera from the type locality of the Bantamien substage, Bodjong Beds, Bantam Residency, West Java, Nederlands East Indies. *Colorado School Min. Quart.*, v. 36, no. 1, p. 108-132, 2 figs., 1 tab., pls. 1-3.
———, 1944, Miocene foraminifera of central Sumatra, and Java, Netherlands East Idies: pt. 1, Miocene foraminifera of central Sumatra, Netherlands East Indies. *Colorado School Min. Quart.*, v. 39, no. 3, p. 7-69, pls. 1-9.
———, 1964, Smaller foraminifera from the Late Tertiary of southern Okinawa. *U.S. Geol. Surv. Prof. Paper*, 454-F, 58 p., 6 figs., pls. 1-16.
Loeblich, A.R. Jr. and Tappan, H., 1953, Studies of Arctic foraminifera. *Smith. Misc. Coll.*, v. 121, no. 7, p. 1-150, 1 fig., 1 tab., pls. 1-24.
——— and ———, 1957, Eleven new genera of foraminifera. *U.S. Nat. Mus., Bull.* 215, p. 223-232, text-fig. 30, pls. 72, 73.
——— and ———, 1964, Treatise on Invertebrate Paleontology, Moore, R.C., ed., Pt. C, *Protista 2*, v. 2, C533 p., 438 figs. (9-11). *Geol. Soc. Amer.*, Boulder and *Univ. Kansas Press*, Lourence.
Makiyama, J., 1931, Stratigraphy of the Kakegawa Pliocene in Totomi. *Mem. Coll. Sci. Kyoto Imp. Univ., Ser. B*, v. 7, no. 1, p. 1-51, pls. 1-4.
Matoba, Y., 1967, Younger Cenozoic foraminiferal assemblages from the Choshi district, Chiba Prefecture. *Sci. Rep. Tohoku Univ., 2nd ser. (Geol.)*, v. 38, no. 2, p. 221-263, 8 figs., 1 tab., pls. 25-30.
———, 1970, Distribution of Recent shallow water foraminifera in Matsushima Bay, Miyagi Prefecture, Northeast Japan. *Sci. Rep. Tohoku Univ., 2nd ser. (Geol.)*, v. 42, no. 1, p. 1-85, 64 figs., 3 tabs., pls. 1-8.
Matthes, H.W., 1939, Die Lagenen des deutschen Tertiars. *Palaeontographica*, v. 90, p. 49-105, 1 tab., pls. 3-8.
Miller G.H. and Lohmann, G.P., 1982, Environmental distribution of Recent benthic foraminifera on the northeast United States continental slope. *Bull. Geol. Soc. Amer.*, v. 93, p. 200-206, 6 figs., 1 tab., 1 pl.
Millett, 1900, Report on the Recent foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R. M.S. — Part IX. *Jour. Micr. Soc. London*, p. 539-549, pl. 4.
———, 1901, Report on the Recent foraminifera of the Malay Archipelago collected by Mr. A. Durrand, F.R. M.S. — Part XI. *Jour. Roy. Micr. Soc. London*, p. 484-497, pl. 8.
Murray, J.W., 1971, An Atlas of British Recent Foraminiferids. xii+244 p., 2 figs., pls. 1-95, *Heinemann Educ. Books*, London.
Nagao, M., Ajiro, T. and Tozaki, T., 1977, Submarine geography of Ensyu-Nada Sea, south of Honshu. *Rep. Hydrogr. Res.*, no. 12, p. 1-13, 5 figs., 19 pls. (*in* Japanese with English abstract).
Nomura, R., 1983a, Cassidulinidae (Foraminiferida) from the uppermost Cenozoic of Japan (Part 1). *Sci. Rep. Tohoku Univ., 2nd ser. (Geol.)*, v. 53, no. 1, p. 1-101, 60 figs., 1 tab., pls. 1-25.
———, 1983b, Cassidulinidae (Foraminiferida from the uppermost Cenozoic of Japan (Part 2). *Sci. Rep. Tohoku Univ., 2nd ser. (Geol.)*, v. 54, no. 1, p. 1-93, 58 figs., 1 tab., pls. 1-6.
Orbigny, A.D., d', 1826, Tableau méthodique de la classe des Céphalopodes. *Ann. Sci. Nat. Paris, ser. 1*, v. 7, p. 245-314, pls. 10-17.
———, 1839a, Foraminifères. *In* de la Sagra, R.,

Histoire Physique, Poiitique et Naturelle de l'Ile de Cuba, A. Bertrad, Paris, p. 1-224, pls. 1-12.

———, 1839b, Foraminifères. *In* Barker-Webb, P. and Berthelot, S., *Histoire Naturelle des Îles Canaries*, Bethune, Paris, v. 2, pt. 2, Zool., p. 119-146, pls. 1-3.

———, 1839c, Foraminiféres. Voyage dans l'Amérique méridionale, v. 5, pt. 5, p. 1-86, pls. 1-9.

———, 1840, Mémoire sur les Foraminifères de la craie blanche du bassin de Paris. *Mèm. Soc. Geol. France*, v. 4, no. 1, p. 1-51, pl. 12.

———, 1846, Foraminifères fossiles du Bassin Tertiare de Vienne. xxxvii+312 p., Tabs. 1-21. *Gide et Comp, Libralires-Editeurs*, Paris.

Otuka, Y., 1932, Geology of Tama Hill (part 1). *Jour. Geol. Soc. Tokyo*, v. 39, no. 469, p. 641-655, 5 figs., 2 tabs. (*in* Japanese).

Papp, A. and Schmid, M.E., 1985, The fossil foraminifera of the Tertiary Basin of Vienna. Revision of the monograph by Alcide d'Orbigny (1846). Abhandlungen der Geologischen Bundesanstalt, v. 37, 311 p., 16 text-pls., 1 tab., 102 pls.

Parker, F.L., 1954, Distribution of the foraminifera in the northeastern Gulf of Mexico. *Bull. Mus. Comp. Zool. Harverd Univ.*, v. 111, no. 10, p. 454-588, 9 figs., 30 tabs., pls. 1-13.

———, 1964, Foraminifera from the experimental Mohole Drilling near Guadalupe Island, Mexico. *Jour. Paleont*, v. 38, no. 4, p. 617-636, 2 tabs., pls. 97-102.

———, Phleger, F.B. and Peirson, J. F., 1953, Ecology of foraminifera from San Antonio Bay and environs, Southwest Texas. *Cushman Found. Foram. Res., Spec. Publ.*, no. 2, p. 1-75, 48 figs., 7 tabs., pls. 1-4.

Parker, W.K. and Jones, T.R., 1865, On some foraminifera from the North Atlantic and Arctic Oceans, including Davis Straits and Baffin's Bay. *Phil. Trans.*, p. 325-441, 12 tabs., 2 maps, pls. 13-19.

Parr, W.J., 1932, Victorian and south Australian shallow-water foraminifera. — part I. *Proc. Roy. Soc. Victoria, N.S.*, v. 44, pt. 1, p. 1-14, 1 text-fig., pl. 1.

———, 1945, Recent foraminifera from Barwon Heads, Victoria. *Proc. Roy. Soc. Victoria, N.S.*, v. 56, pt. 2, p. 189-218, 2 figs., pls. 8-12.

Pflum, C.E. and Frerichs, W.E., 1976, Gulf of Mexico deep water foraminifers. *Cushman Found. Foram. Res., Spec. Publ.*, no. 14, 41 p., 23 figs., 7 tabs., pls. 1-8.

Phleger, F.B. and Parker, F.L., 1951, Ecology of foraminifera, northeast Gulf of Mexico: Pt. 2, Foraminifera species. *Geol. Soc. Amer., Mem.* 46, p. 1-64, pls. 1-20.

Poag, C.W., 1966, Paynes Hammock (lower Miocene ?) foraminifera of Alabama and Mississippi. *Micropaleontology*, v. 12, no. 4, p. 393-440, 11 text-figs., pls. 1-9.

———, 1981, Ecologic Atlas of Benthic Foraminifera of the Gulf of Mexico. vi+174 p., 23 figs., pls. 1-64. *Hutchinson Ross Publ. Com.*

Reiss, Z., 1960, Structure of so-called *Eponides* and some other rotaliiform foraminifera. *Bull. Israel Geol. Surv.*, no. 29, p. 1-29, 2 text-figs., 1 tab., pls. 1, 2.

Reuss, A.E., 1851, Ueber die fossilen Foraminiferen und Entomostraceen der Septarienthone der Umgegend von Berlin. *Z. dtsch. geol. Ges.*, v. 3, p. 49-92, 1 tab., pls. 3-17.

Sakurai, M. and Sato, T., 1983, Geological structure of the outer ridge off Tokai district. *Rep. Hydrogr. Res.*, no. 18, p. 25-35, 9 figs. (*in* Japanese with English abstract).

Schlumberger, C., 1891, Révision des Biloculines des grands Fronds. *Mém. Soc. Zool. France*, v. 4, p. 155-191, 46 figs., pls. 9-12.

Schwager, C., 1866, Fossile Foraminiferen von Kar Nikobar. Reise der Oesterreichischen Fregatte Novara um die Welt, in 1857-59, & c, Geological part. v. 2, p. 187-268, Tafs. 4-7.

Seguenza, G., 1862, Descrizione dei foramiferi monotalamici delle marne Mioceniiche del distretto di Messina. p. 1-84, tab. 2.

Selli, R., 1941, Sulla struttura della *"Cristellaria" serpens* Seguenza. *Gior. Geol., ser. 2*, v 14, p. 83-92, pl. 1.

Shimamura, K., 1988, Sedimentation and tectonics of Zenis Ridge, eastern Nankai Trough and Suruga Trough regions. *Sci. Rep. Tohoku Univ., 2nd ser.* (*Geol.*), v. 58, no. 2, p. 107-167, 48 figs., 2 tabs., pocket pls. 1-131, 2 appendixes.

Srinivasan, M.S. and Sharma, V., 1980, Schwager's Car Nicobar foraminifera in the reports of the Novara Expedition — A revision. 83 p., 7 figs., 1 tab., pls. 1-8, *Today and Tomorrow's Print. and Publ.*, New Delhi.

Stewart, R.E. and Stewart, R.C., 1930, Post-Miocene foraminifera from the Ventura Quadrangle, Ventura County, California. *Jour. Paleont*, v. 4, p. 60-72, pls. 8-9.

Takayanagi, Y., 1951, On some *Ehrenbergina* from Japan. *Trans. Proc. Palaeont. Soc. Japan., N.S.*, no. 3, p. 85-93.

———, 1953, New genus and species of foraminifera found in the Tonohama Group, Kochi Prefecture, Shikoku. *Tohoku Univ. Inst. Geol. Paleont., Short Papers*, no. 5, p. 25-36, 1 tab., pl. 4.

——— and Hasegawa, S., 1987, Checklist and bibliography of post-Paleozoic foraminifera established by Japanese workers, 1890-1986. 95 p., *Toko Print. Co. Ltd.*, Sendai.

Tamaki, K., Tanahashi, M., Okada, Y. and Honza, E., 1981, Geological investigation of the Ogasawara (Bonin) and northern Mariana Arcs.

Cruise Rep. Geol. Surv. Japan, no. 14, p. 83-91, 5 figs., 2 tabs.

Thalmann, H.E., 1932, Nomenclator (Um- und Neubenennungen) zu den Tafeln 1 bis 115 in H.B. Brady's Werk uber die Foraminiferen der Challenger-Expedition, London 1884, *Ecl., geol. Helvetiae*, v. 25, no. 2, p. 293- 313.

————, 1950, New names and homonyms in foraminifera. *Contr. Cushman Lab. Foram. Res.*, v. 1, pt. 3-4, p. 41-45.

————, 1952, In Phleger, F.B., 1952, Foraminifera distribution in some sediment samples from the Canadian and Greenland Arctic. *Ibid.*, v. 3, pt. 2, p. 83.

Todd, R., 1965, The foraminifera of the Tropical Pacific collections of the "Albatross", 1899-1900: Pt. 4, Rotaliform families and planktonic families. *U.S. Nat. Mus. Bull.*, no. 161, p. 1-139, 5 tabs., pls. 1-20.

Trauth, F., 1918, Das Eozänvorkommen bei Radstadt im Pongau und seine Beziehungen zu den gleichalterigen Ablagerungen bei kirchberg am Wechsel und Wimpassing am Leithagebirge. *Denkschr. Akad. Wiss. Wien, Math-Naturw.* Kl., v. 95, p. 171-277, 4 figs., 5 tabs., pls. 1-5.

Uchio, T., 1951, New species and genus of the foraminifera of the Cenozoic formations in the middle part of the Boso Peninsula, Chiba-ken, Japan. *Trans., Proc. Palaeont. Soc. Japan, N.S.*, no. 2, p. 33-42, 1 text-fig., pl. 3.

————, 1952a, An interesting relation between *Stomatorbina* Dorreen, 1948, and *Mississippina* Howe, 1930, of foraminifera. *Trans., Proc. Palaeont. Soc. Japan, N.S.*, no. 7, p. 195-200, pl. 18.

————, 1952b, Foraminiferal assemblages from Hachijo Island, Tokyo Prefecture, with description of some new genera and species. *Japan. Jour. Geol. Geogr.*, v. 22, p. 145-159, 3 text-figs., 1 tab., pls. 6-7.

————, 1960, Ecology of living benthonic foraminifera from the San Diego, California, Area. *Cushman Found. Foram. Res., Spec. Publ.*, no. 5, 72 p., 18 figs., 8 tabs., pls. 1-10.

Ujiié, H., 1963, Foraminifera from the Yûrakuchô Formation (Holocene), Tokyo City. *Sci. Rep. Kyoiku Daigaku, Sec. C. (Geol., Miner., Geogr.)*, no. 79, p. 229-243, 2 text-figs., 1 tab., pls. 1-3.

————, 1966, Shell structure of Japanese smaller foraminifera, Part 2. *Pararotalia nipponica* (Asano, 1936). *Trans. Proc. Palaeont. Soc. Japan, N.S.*, no. 61, p. 191-200, pls. 24, 25.

Voloshinova, N.A., 1958, On new systematics of the Nonionidae. *Trudy VNIGRI*, vol. 115 (Microfauna USSR, sbor. 9), p. 117-191, pls. 1-16. (*in* Russian).

Walton, W.R., 1952, Techniques for recognition of living foraminifera. *Cushman Found. Foram. Res., Contr.*, v. 3, pt. 2, p. 56-60.

Williamson, W.C., 1848, On the British Recent species of the genus *Lagena*. *Ann. Mag. Nat. Hist., ser. 2*, v. 1, p. 1-20, pls. 1, 2.

————, 1858, On the Recent foraminifera of Great Britain. *Prof. Nat. Hist. Owen's College, Manchester*. xx+107 p., 8 figs., pls. 1-7.

Woodruff, F., 1985, Changes in Miocene deep-sea benthic foraminiferal distribution in the Pacific Ocean: Relationship to paleoceanography. *Mem. Geol. Soc. Amer.*, no. 163, p. 131-175, 26 figs., pls. 1-3.

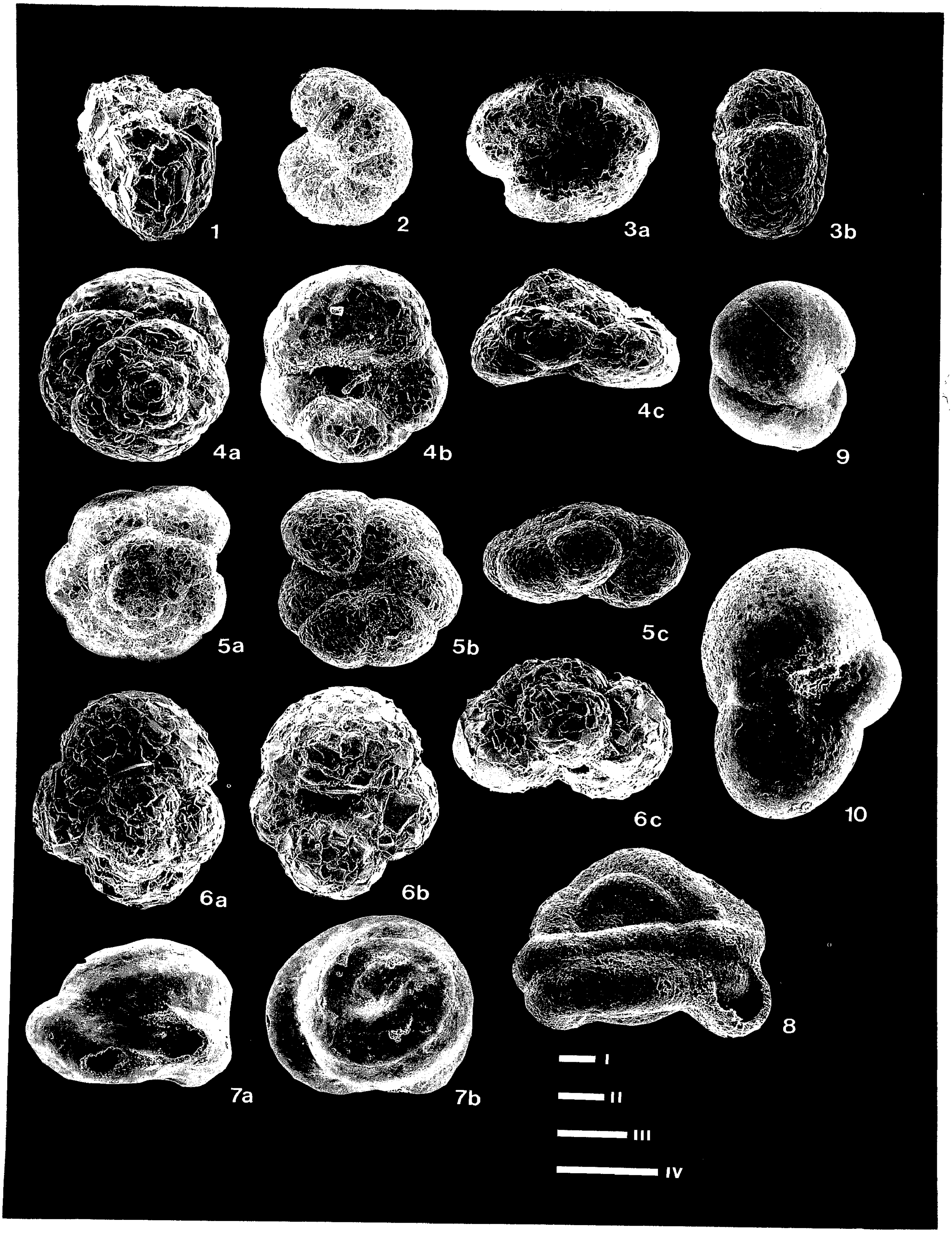
Yabe, H. and Asano, K., 1937, Contribution to the paleontology of the Tertiary formations of West Java, Part 1, Minute foraminifera from the Neogene of West Java. *Sci. Rep., Tohoku Imp. Univ., 2nd ser. (Geol.)*, v. 19, no. 1, p. 87-126, pls. 17-19.

Yuasa, M., Honza, E., Tamaki, K., Tanahashi, M. and Nishimura, A., 1982, Geological Map of the northern Ogasawara Arc. *1 : 1,000,000 Marine Ser. 17*, Geol. Surv. Japan.

Plate 11

Fig. 1. *Adercotryma glomeratum* (Brady)
(IGPS 101001), Sample GH80-4-D372, Hachijojima area, ×200.
Fig. 2. *Haplophragmoides columbiensis* Cushman
(IGPS 101002), Sample GH80-4-D372, Hachijojima area, ×200.
Fig. 3. *Alveolophragmium subglobosa* (G.O. Sars)
(IGPS 101003), Sample GH80-4-D372, Hachijojima area, ×150.
Fig. 4. *Trochammina inflata* (Montagu)
(IGPS 101004), Sample GH80-4-D376, Hachijojima area, ×300.
Fig. 5. *Trochammina pacifica* Cushman
(IGPS 101005), Sample GH80-4-D372, Hachijojima area, ×200.
Fig. 6. *Trochammina globigeriniformis* (Parker and Jones)
(IGPS 101006), Sample GH80-4-D372, Hachijojima area, ×300.
Fig. 7. *Glomospira chaloides* (Jones and Parker)
(IGPS 101007), Sample GH80-4-D372, Hachijojima area, ×300.
Fig. 8. *Glomospira gordialis* (Jones and Parker)
(IGPS 101008), Sample GH80-4-D372, Hachijojima area, ×300.
Fig. 9. *Alveolophragmium ringens* (Brady)
(IGPS 101009), Sample GH80-4-D372, Hachijojima area, ×300.
Fig. 10. *Cystammina pauciloculata* (Brady)
(IGPS 101010), Sample GH80-4-D376, Hachijojima area, ×300.

Scale bar : 0.1 mm ; I : 9 ; II : 3 ; III : 1, 2, 5 ; IV : 4, 6, 7, 8, 10.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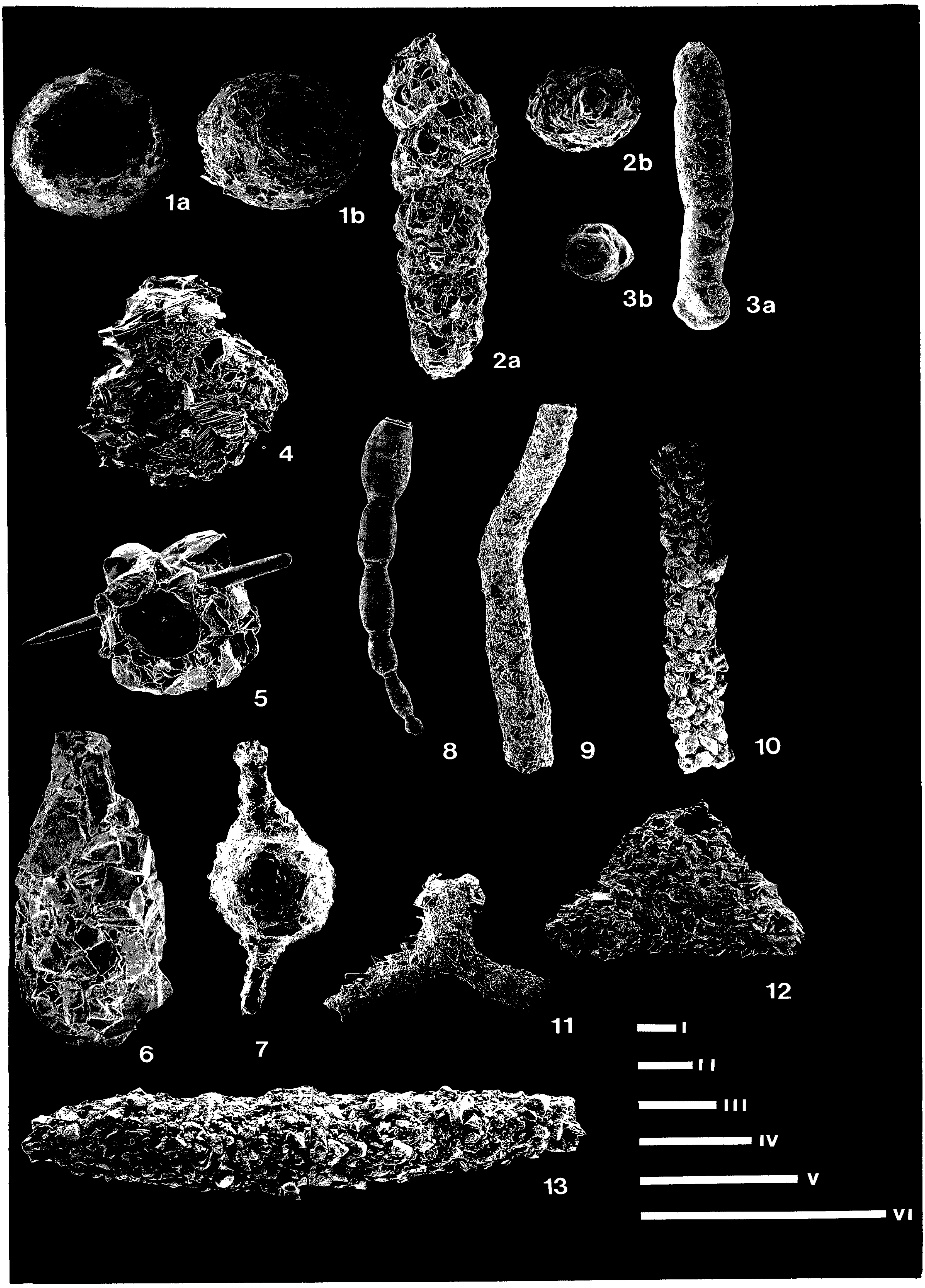
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Plate 12

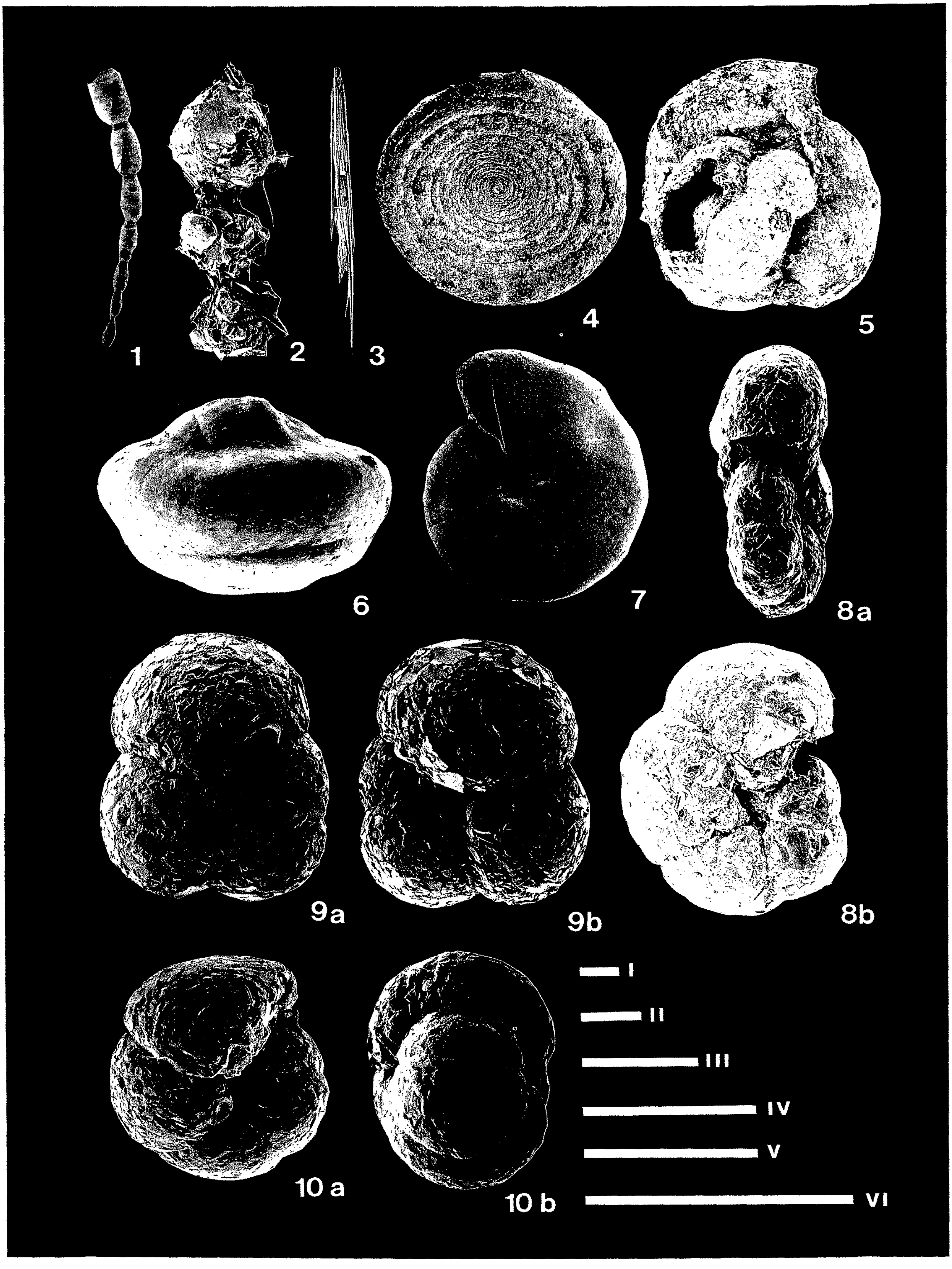
Fig. 1. *Saccammina sphaerica* M. Sars
(IGPS 101011), Sample GH80-4-D372, Hachijojima area, ×100.
Fig. 2. *Karreriella apicularis* (Cushman)
(IGPS 101012), Sample GH80-4-D372, Hachijojima area, ×150.
Fig. 3. *Ammobaculites agglutinans filiformis* Earland
(IGPS 101013), Sample GH80-4-D372, Hachijojima area, ×200.
Fig. 4. *Ammobaculites agglutinans* (d'Orbigny)
(IGPS 101014), Sample GH80-4-D372, Hachijojima area, ×70.
Fig. 5. *Psammosphaera parva* Flint
(IGPS 101015), Sample GH80-4-D372, Hachijojima area, ×200.
Fig. 6. *Reophax difflugiformis* Brady
(IGPS 101016), Sample GH80-4-D372, Hachijojima area, ×300.
Fig. 7. *Reophax distans* Brady
(IGPS 101017), Sample GH80-4-D372, Hachijojima area, ×70.
Fig. 8. *Nodellum membranaceum* (Brady)
(IGPS 101018), Sample GH80-4-D372, Hachijojima area, ×150.
Fig. 9. *Marsipella elongata* Norman
(IGPS 101019), Sample GH80-4-D373, Hachijojima area, ×100.
Fig. 10. *Rhabdammina abyssorum* M. Sars
(IGPS 101020), Sample GH80-4-D375, Hachijojima area, ×70.
Fig. 11. *Saccorhiza ramosa* Brady
(IGPS 101021), Sample GH80-4-D373, Hachijojima area, ×45.
Fig. 12. *Rhabdammina abyssorum* M. Sars forma A
(IGPS 101022), Sample GH80-4-D375, Hachijojima area, ×45.
Fig. 13. *Rhabdammina abyssorum* M. Sars forma A
(IGPS 101023), Sample GH80-4-D375, Hachijojima area, ×45.

Scale bar : 0.1 mm ; I : 1, 9 ; II : 2, 8 ; III : 3, 5. IV : 6 ; 1.0 mm ; V : 11, 12, 13 ; VI : 4, 7, 10.

Plate 13

Fig. 1. *Nodellum membranaceum* (Brady)
(IGPS 101024), Sample GH84-3-3, Tanegashima area, ×100.
Fig. 2. *Reophax distans* Brady
(IGPS 101025), Sample GH84-3-3, Tanegashima area, ×100.
Fig. 3. *Reophax spiculifer* Brady
(IGPS 101026), Sample GH84-3-3, Tanegashima area, ×45.
Fig. 4. *Ammodiscus pacifica* Cushman and Valentine
(IGPS 101027), Sample GH84-3-3, Tanegashima area, ×45.
Fig. 5. *Glomospira gordialis* (Jones and Parker)
(IGPS 101028), Sample GH84-3-3, Tanegashima area, ×100.
Fig. 6. *Glomospira charoides* (Jones and Parker)
(IGPS 101029), Sample GH84-3-3, Tanegashima area, ×300.
Fig. 7. *Cyclammina bradyi* Cushman
(IGPS 101030), Sample GH84-3-3, Tanegashima area, ×150.
Fig. 8. *Haplophragmoides columbiensis* Cushman
(IGPS 101031), Sample GH84-3-52, Tanegashima area, ×200.
Fig. 9. *Trochammina globigeriniformis* (Parker and Jones)
(IGPS 101032), Sample GH84-3-3, Tanegashima area, ×150.
Fig. 10. *Alveolophragmium subglobosa* (G.O. Sars)
(IGPS 101033), Sample GH84-3-3, Tanegashima area, ×70.

Scale bar : 0.1 mm ; I : 1, 2, 5 ; II : 7, 8, 9 ; III : 6. 1.0 mm ; IV : 3, 4 ; V : 10.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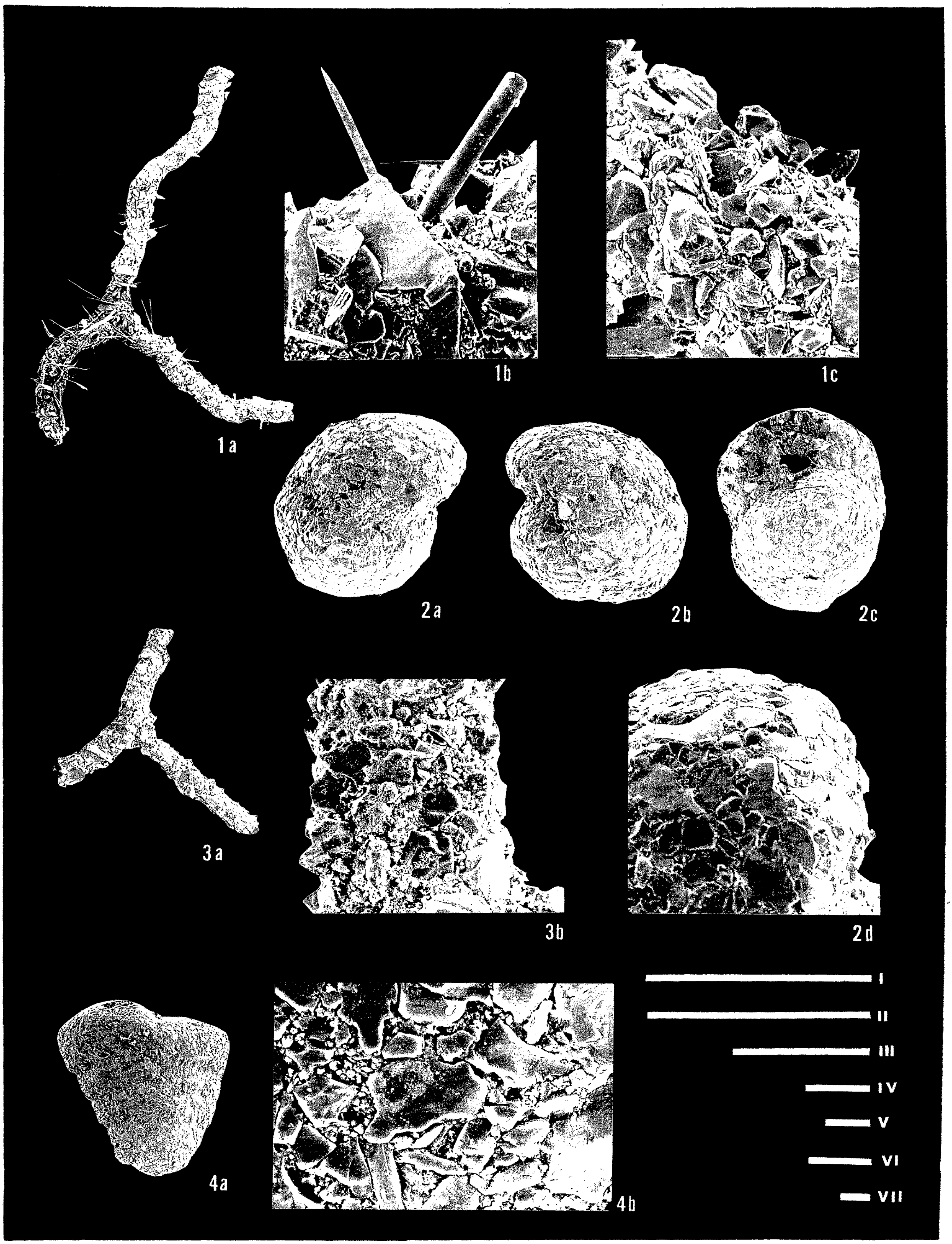
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Plate 14

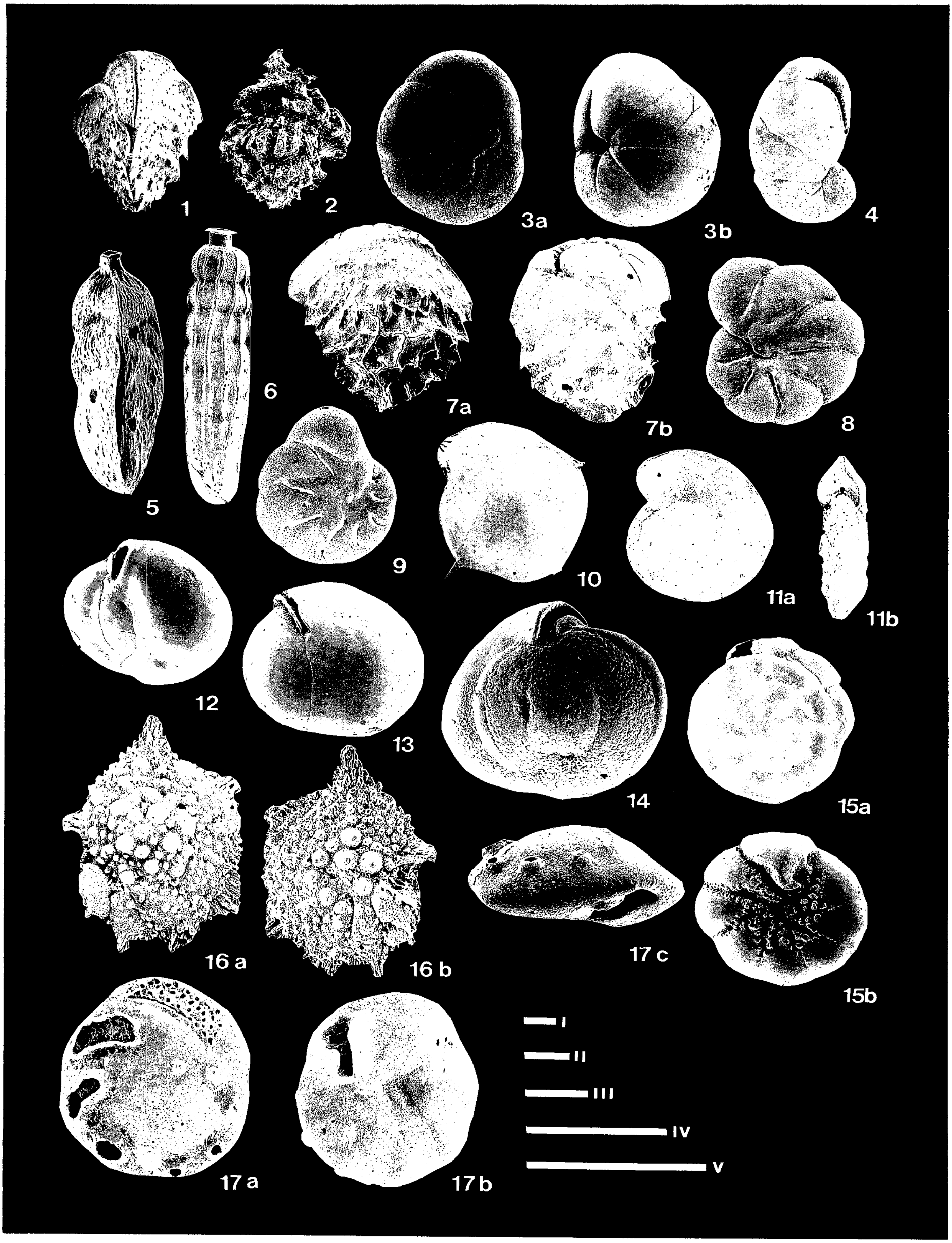
Fig. 1. *Saccorhiza ramosa* Brady
(IGPS 101034), Sample KT85-6-G7, Enshunada area, a, ×70 ; b, c, ×700.
Fig. 2. *Alveolopharagmium subglobosa* (G.O. Sars)
(IGPS 101035), Sample KT86-11-MP8, Nankai Trough, a, b, c, ×150 ; d, ×450.
Fig. 3. *Rhabdammina abyssorum* M. Sars
(IGPS 101036), Sample KT-85-6-G7, Enshunada area, a, ×150 ; b, ×1,000.
Fig. 4. *Spiroplectammina higuchii* Takayanagi
(IGPS 101037), Sample KT85-6-G5, Enshunada area, a, ×200 ; b, ×2,000.

Scale bar : 1.0 mm ; I : 1a. 0.1 mm ; II : 1b, c ; III : 2d ; IV : 4a ; V : 2a-c, 3a. 0.01 mm ; VI : 3b ; VII : 4b.

Plate 15

Fig. 1. *Reussella spinulosa* (Reuss)
(IGPS 101038), Sample GH84-3-54, Tanegashima area, ×150.
Fig. 2. *Uvigerina porrecta* Brady
(IGPS 101039), Sample GH84-3-55, Tanegashima area, ×200.
Fig. 3. *Ceratobulimina pacifica* Cushman and Harris
(IGPS 101040), Sample GH84-3-3, Tanegashima area, ×100.
Fig. 4. *Paracassidulina miuraensis* (Higuchi)
(IGPS 101041), Sample GH84-3-52, Tanegashima area, ×200.
Fig. 5. *Trifarina bradyi* Cushman
(IGPS 101042), Sample GH84-3-52, Tanegashima area, ×200.
Fig. 6. *Rectobolivina raphanus* (Parker and Jones)
(IGPS 101043), Sample GH84-3-55, Tanegashima area, ×100.
Fig. 7. *Ehrenbergina hysterix* Brady
(IGPS 101044), Sample GH84-3-54, Tanegashima area, ×200.
Fig. 8. *Astrononion stelligerum* (d'Orbigny)
(IGPS 101045), Sample GH84-3-52, Tanegashima area, ×150.
Fig. 9. *Astrononion stellatum* Cushman and Edwards
(IGPS 101046), Sample GH84-3-52, Tanegashima area, ×200.
Fig. 10. *Robulus calcar* (Linné)
(IGPS 101047), Sample GH84-3-54, Tanegashima area, ×70.
Fig. 11. *Operculina ammonoides* (Gronovius)
(IGPS 101048), Sample GH84-3-101, Tanegashima area, ×70.
Fig. 12. *Miliolinella circularis* (Bornemann)
(IGPS 101049), Sample GH84-3-54, Tanegashima area, ×100.
Fig. 13. *Miliolinella inflata* LeRoy
(IGPS 101050), Sample GH84-3-55, Tanegashima area, ×150.
Fig. 14. *Miliolinella australis* (Parr)
(IGPS 101051), Sample GH84-3-54, Tanegashima area, ×200.
Fig. 15. *Ammonia takanabensis* (Ishizaki)
(IGPS 101052), Sample GH84-3-52, Tanegashima area, ×100.
Fig. 16. *Pararotalia calcar* (d'Orbigny)
(IGPS 101053), Sample GH84-3-101, Tanegashima area, ×100.
Fig. 17. *Alabamina tubulifera* (Heron-Allen and Earland)
(IGPS 101054), Sample GH84-3-52, Tanegashima area, ×200.

Scale bar : 0.1 mm ; I : 3, 6, 12, 15, 16 ; II : 1, 8, 13 ; III : 2, 4, 5, 7, 9, 14, 17. 1.0 mm ; IV : 11 ; V : 10.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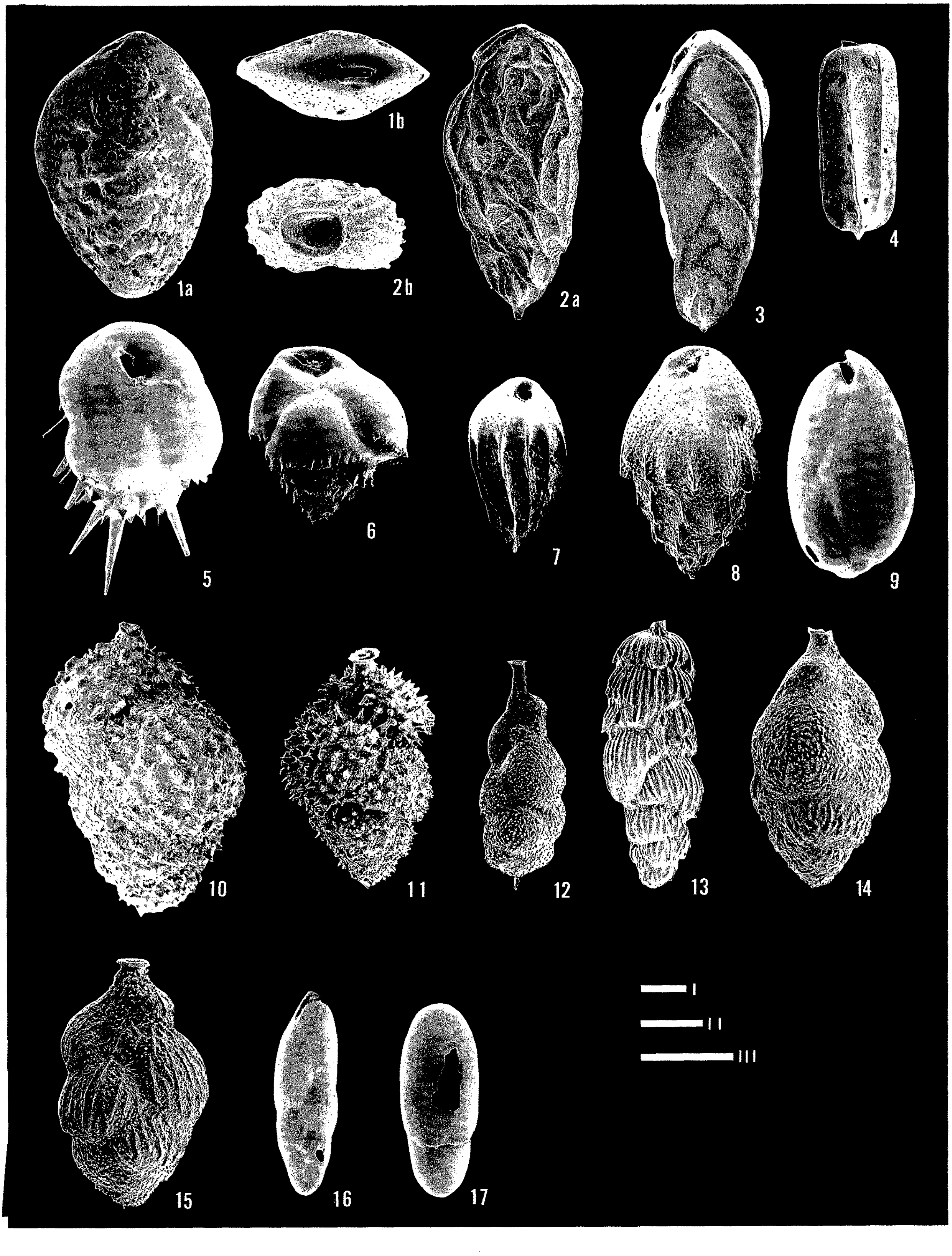
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Plate 16

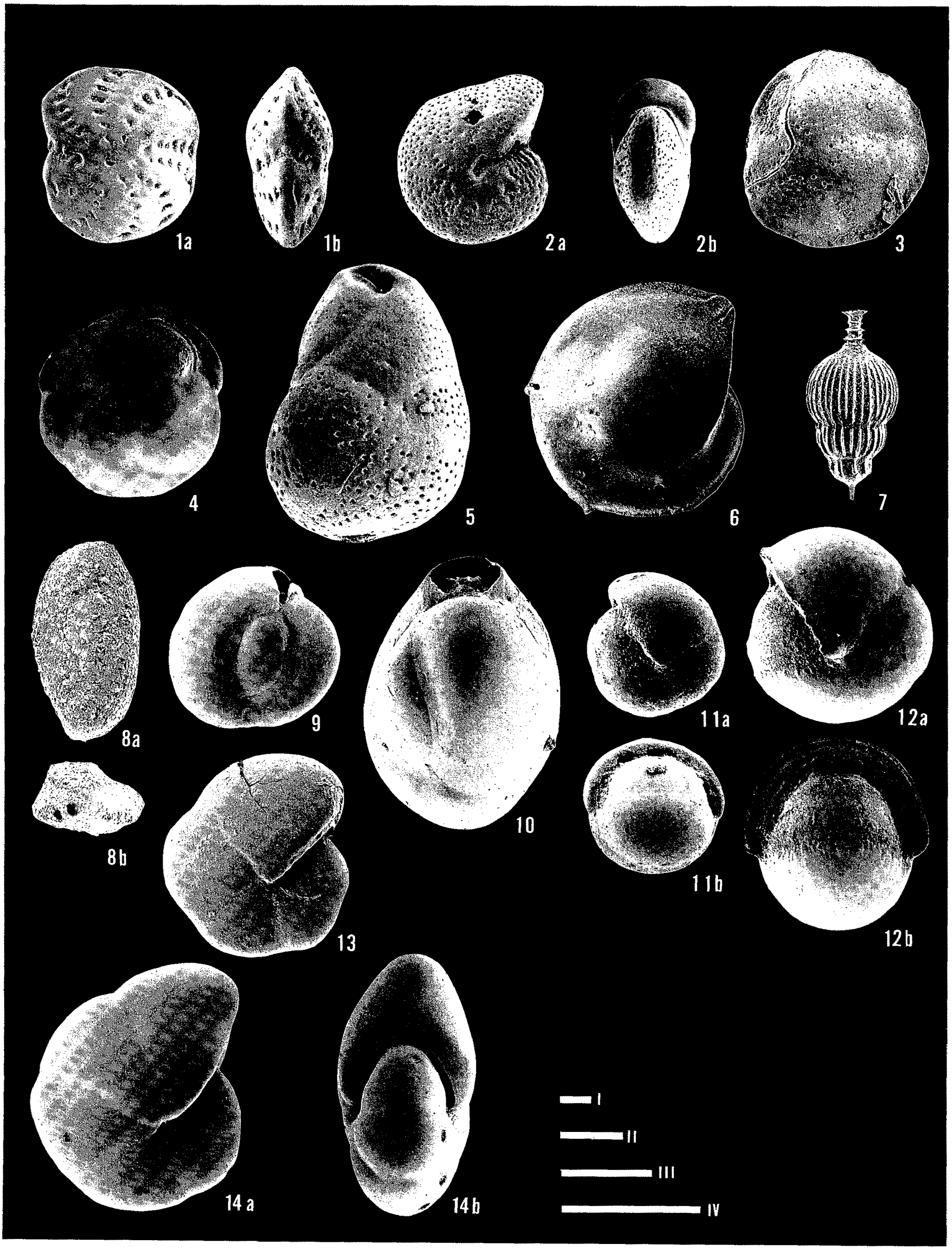
Fig. 1. *Bolivina robusta* Brady
(IGPS 101055), Sample KT85-6-G2, Enshunada area, ×300.
Fig. 2. *Brizalina karreriana* (Brady)
(IGPS 101056), Sample KT85-6-G3, Enshunada area, ×300.
Fig. 3. *Bolivinita quadrilatera* (Schwager)
(IGPS 101057), Sample KT85-6-G2, Enshunada area, ×200.
Fig. 4. *Rectobolivina raphanus* (Parker and Jones)
(IGPS 101058), Sample KT85-6-G4, Enshunada area, ×200.
Fig. 5. *Bulimina aculeata* d'Orbigny
(IGPS 101059), Sample KT85-6-G1, Enshunada area, ×300.
Fig. 6. *Bulimina marginata* d'Orbigny
(IGPS 101060), Sample KT85-6-G4, Enshunada area, ×200.
Fig. 7. *Bulimina rostrata* Brady
(IGPS 101061), Sample KT85-6-G2, Enshunada area, ×200.
Fig. 8. *Bulimina striata* d'Orbigny
(IGPS 101062), Sample KT85-6-G2, Enshunada area, ×200.
Fig. 9. *Globobulimina pacifica* Cushman
(IGPS 101063), Sample KT86-11-MP8, Nankai Trough, ×150.
Fig. 10. *Uvigerina hispidocostata* Cushman and Todd
(IGPS 101064), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 11. *Uvigerina hispida* Schwager
(IGPS 101065), Sample KT85-6-G1, Enshunada area, ×150.
Fig. 12. *Uvigerina proboscidea vadescens* Cushman
(IGPS 101066), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 13. *Uvigerina schencki* Asano
(IGPS 101067), Sample KT85-6-G5, Enshunada area, ×150.
Figs. 14, 15. *Uvigerina* sp.
14, (IGPS 101068), Sample KT85-6-G4, Enshunada area, ×300.
15, (IGPS 101069), Sample KT85-6-G4, Enshunada area, ×300.
Fig. 16. *Brizalina pacifica* (Cushman and McCulloch)
(IGPS 101070), Sample KT86-11-MP8, Nankai Trough, ×200.
Fig. 17. *Chilostomella oolina* Schwager
(IGPS 101071), Sample KT86-11-MP6, Nankai Trough, ×150.

Scale bar: 0.1 mm; I: 1, 2, 5, 14, 15; II: 3, 4, 6, 7, 8, 10, 12, 16; III: 9, 11, 13, 17.

Plate 17

Fig. 1. *Elphidium advena* (Cushman)
(IGPS 101072), Sample KT85-6-G5, Enshunada area, ×200.
Fig. 2. *Melonis parkerae* (Uchio)
(IGPS 101073), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 3. *Cassidulina carinata* Silvestri
(IGPS 101074), Sample KT85-6-G2, Enshunada area, ×300.
Fig. 4. *Paracassidulina neocarinata* (Thalmann)
(IGPS 101075), Sample KT85-6-G4, Enshunada area, ×300.
Fig. 5. *Evolvocassidulina brevis* (Aoki)
(IGPS 101076), Sample KT85-6-G4, Enshunada area, ×450.
Fig. 6. *Robulus calcar* (Linne)
(IGPS 101077), Sample KT85-6-G4, Enshunada area, ×200.
Fig. 7. *Amphicoryna scalaris* (Batsch)
(IGPS 101078), Sample KT85-6-G4, Enshunada area, ×100.
Fig. 8. *Sigmoilopsis schlumbergeri* (Silvestri)
(IGPS 101079), Sample KT85-6-G2, Enshunada area, ×100.
Fig. 9. *Miliolinella circularis* (Bronemann)
(IGPS 101080), Sample KT85-6-G6, Enshunada area, ×200.
Fig. 10. *Triloculina trigonula* (Lamarck)
(IGPS 101081), Sample KT85-6-G6, Enshunada area, ×300.
Figs. 11, 12. *Pullenia bulloides* (d'Orbigny)
11, (IGPS 101082), Sample KT85-6-G1, Enshunada area, ×200.
12, (IGPS 101083), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 13. *Pullenia quinqueloba* (Reuss)
(IGPS 101084), Sample KT85-6-G1, Enshunada area, ×300.
Fig. 14. *Pullenia salisburyi* R.E. and R.C. Stewart
(IGPS 101085), Sample KT85-6-G1, Enshunada area, ×200.

Scale bar : 0.1 mm ; I : 7, 8 ; II : 1, 2, 6, 9, 11, 12, 14 ; III : 3, 10, 13 ; IV : 4, 5.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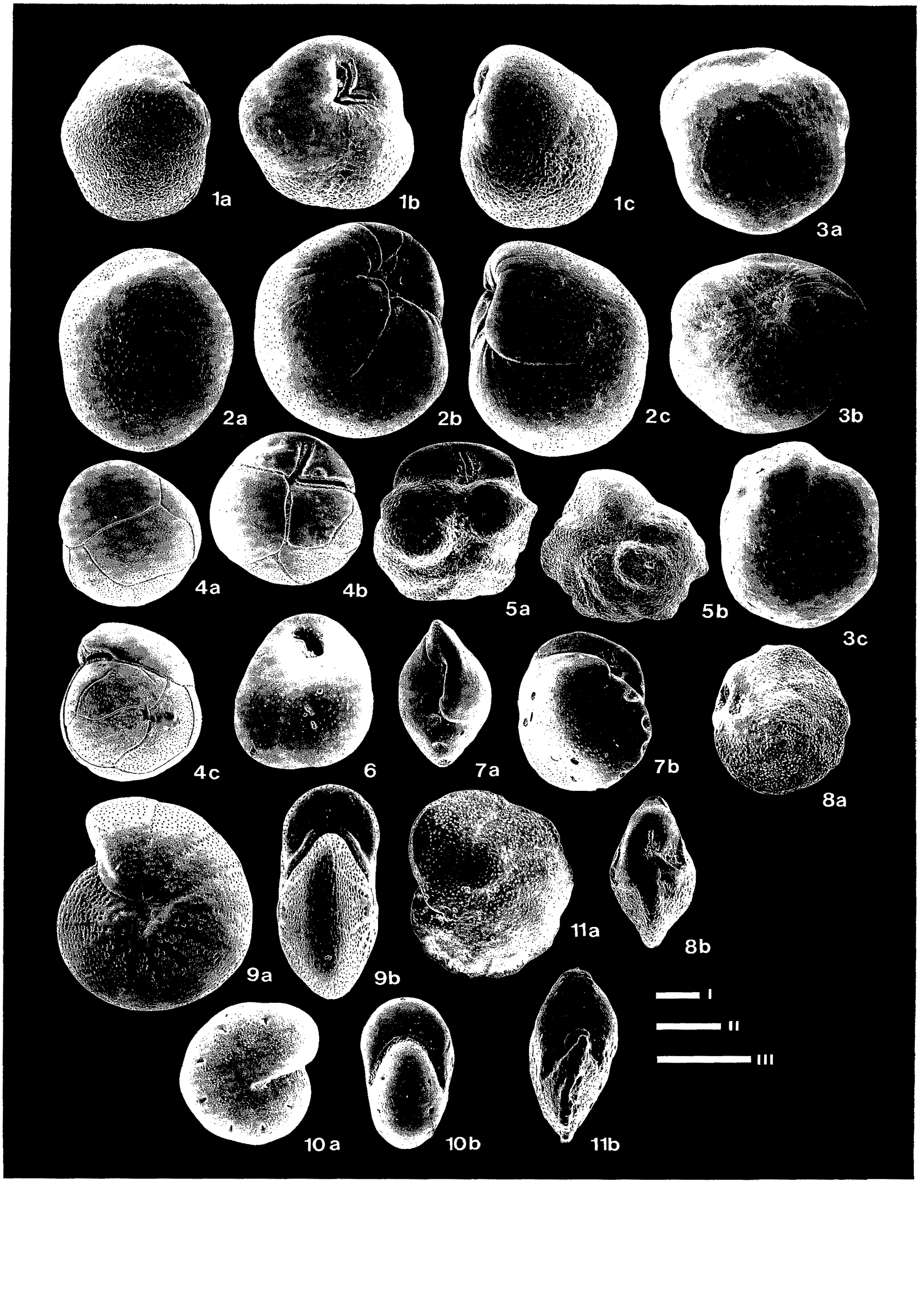
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Plate 18

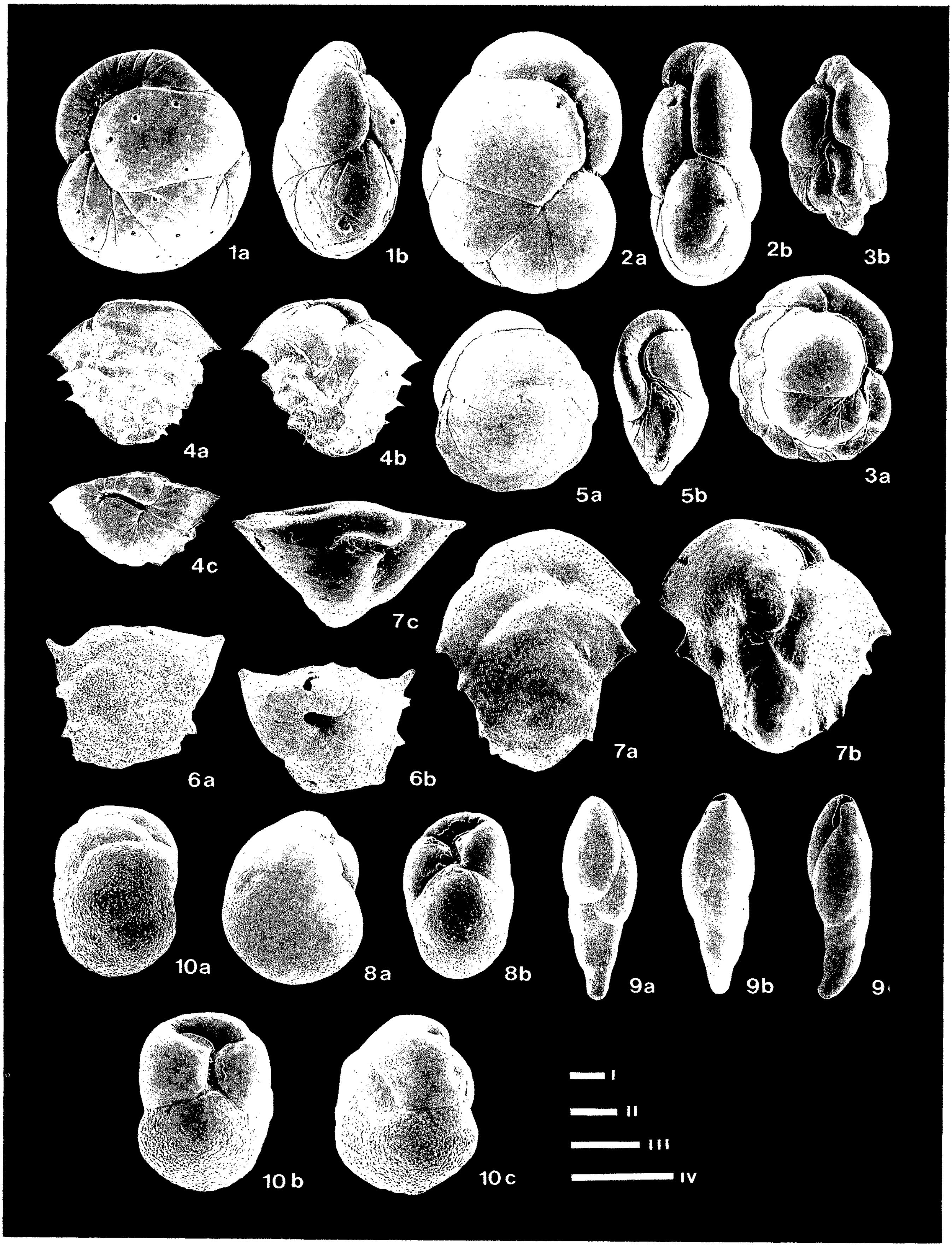
Fig. 1. *Globocassidulina pseudoquadrata* Nomura
(IGPS 101086), Sample GH80-4-94, Hachijojima area, ×300.
Fig. 2. *Globocassidulina oriangulata* (Belford)
(IGPS 101087), Sample GH80-4-94, Hachijojima area, ×300.
Fig. 3. *Globocassidulina gemma* (Todd)
(IGPS 101088), Sample GH80-4-D370, Hachijojima area, ×150.
Fig. 4. *Globocassidulina parva* (Asano and Nakamura)
(IGPS 101089), Sample GH80-4-94, Hachijojima area, ×150.
Fig. 5. *Globocassidulina elegans* (Sidebottom)
(IGPS 101090), Sample GH80-4-D370, Hachijojima area, ×200.
Fig. 6. *Globocassidulina moluccensis* (Germeraad)
(IGPS 101091), Sample GH80-4-RC102, Hachijojima area, ×200.
Fig. 7. *Globocassidulina brocha* (Poag)
(IGPS 101092), Sample GH80-4-94, Hachijojima area, ×200.
Fig. 8. *Globocassidulina paratortuosa* (Kuwano)
(IGPS 101093), Sample GH80-4-D370, Hachijojima area, ×200.
Fig. 9. *Melonis parkerae* (Uchio)
(IGPS 101094), Sample GH80-4-RC102, Hachijojima area, ×150.
Fig. 10. *Astrononion* sp.
(IGPS 101095), Sample GH80-4-RC102, Hachijojima area, ×200.
Fig. 11. *Nonionellina* sp.
(IGPS 101096), Sample GH80-4-97, Hachijojima area, ×300.

Scale bar : 0.1 mm ; I : 3, 4, 9 ; II : 5, 6, 7, 8, 10 ; III : 1, 2, 11.

Plate 19

Fig. 1. *Paracassidulina sulcata* (Belford)
(IGPS 101097), Sample GH80-4-94, Hachijojima area, ×300.
Fig. 2. *Paracassidulina nipponensis* (Eade)
(IGPS 101098), Sample GH80-4-96, Hachijojima area, ×300.
Fig. 3. *Paracassidulina tomiyensis* (Uchio)
(IGPS 101099), Sample GH80-4-94, Hachijojima area, ×150.
Fig. 4. *Ehrenbergina hysterix* Brady
(IGPS 101100), Sample GH80-4-97, Hachijojima area, ×200.
Fig. 5. *Paracassidulina quasicarinata* Nomura
(IGPS 101101), Sample GH80-4-96, Hachijojima area, ×200.
Fig. 6. *Ehrenbergina* sp. A
(IGPS 101102), Sample GH80-4-D367, Hachijojima area, ×150.
Fig. 7. *Ehrenbergina pacifica* Cushman
(IGPS 101103), Sample GH80-4-D370, Hachijojima area, ×200.
Figs. 8, 10. *Globocassidulina pseudoquadrata* Nomura forma A
Fig. 8, (IGPS 101104), Sample GH80-4-86, Hachijojima area, ×300.
Fig. 10, (IGPS 101106), Sample GH80-4-94, Hachijojima area, ×300.
Fig. 9. *Rutherfordoides mexicanus* (Cushman)
(IGPS 101105), Sample GH80-4-86, Hachijojima area, ×300.

Scale bar: 0.1 mm; I: 9; II: 3, 6; III: 4, 5, 7; IV: 1, 2, 8, 10.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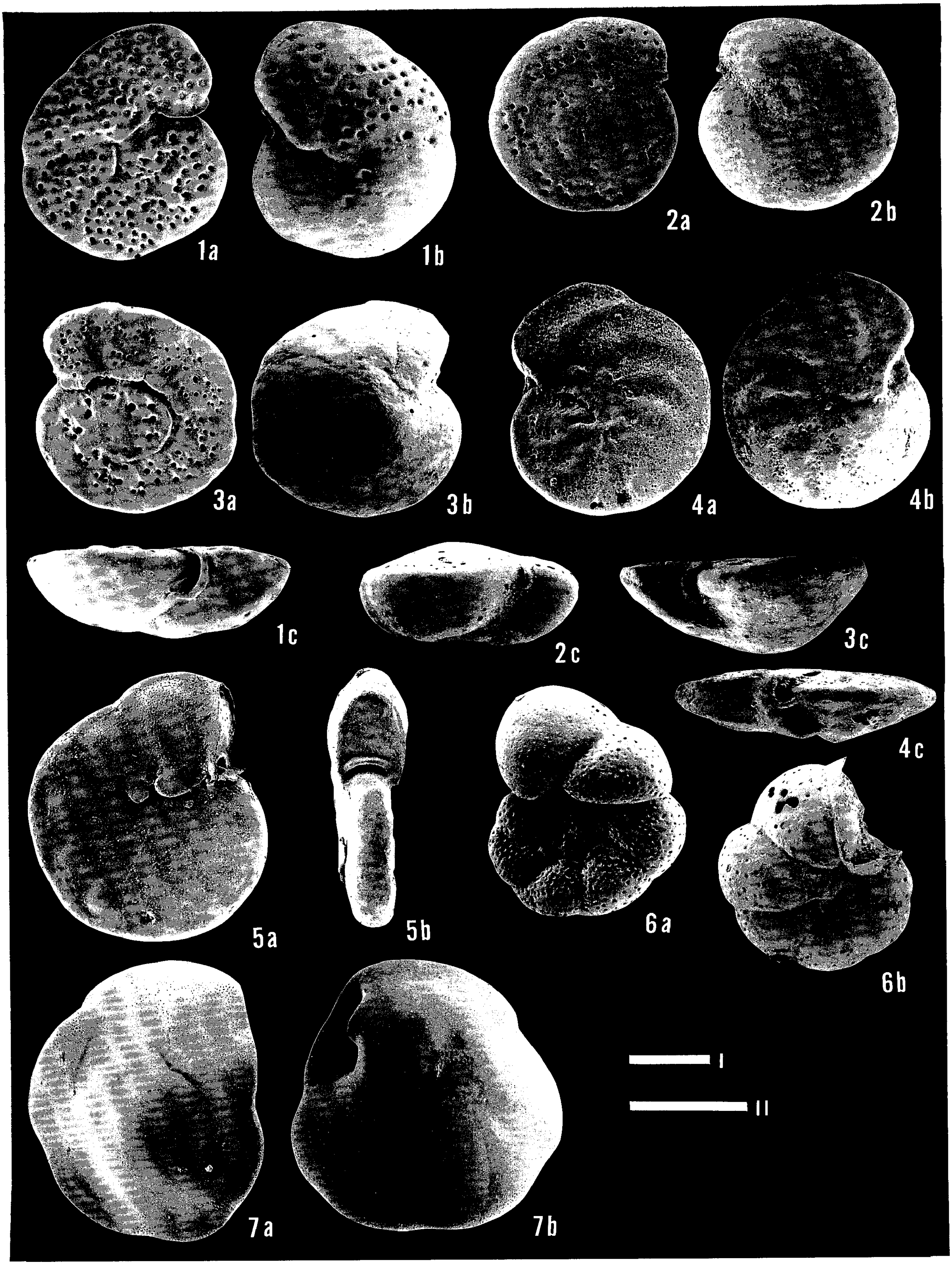
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Plate 20

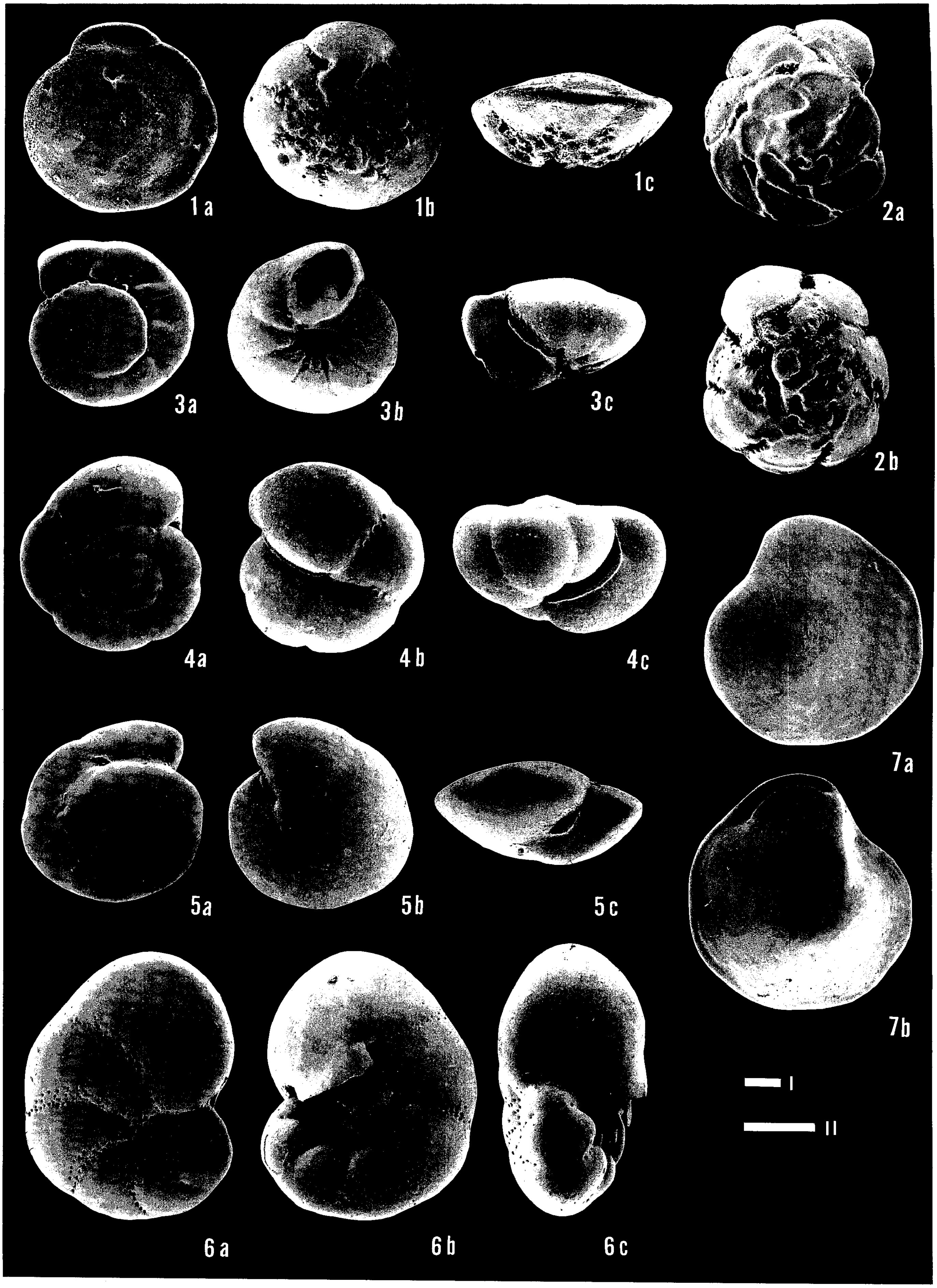
Fig. 1. *Cibicides aknerianus* (d'Orbigny)
(IGPS 101107), Sample KT85-6-G4, Enshunada area, ×200.
Fig. 2. *Parrelloides bradyi* (Trauth)
(IGPS 101108), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 3. *Cibicidoides mediocris* (Finlay)
(IGPS 101109), Sample KT-85-6-G6, Enshunada area, ×200.
Fig. 4. *Hanzawaia nipponica* Asano
(IGPS 101110), Sample KT85-6-G5, Enshunada area, ×200.
Fig. 5. *Hyalinea balthica* (Schröter)
(IGPS 101111), Sample KT85-6-G5, Enshunada area, ×300.
Fig. 6. *Anomalinoides globulosa* (Chapman and Parr)
(IGPS 101112), Sample KT85-6-G6, Enshunada area, ×200.
Fig. 7. *Pseudoparrella exigua* (Brady)
(IGPS 101113), Sample KT86-11-MP6, Nankai Trough, ×300.

Scale bar : 0.1 mm ; I : 1, 2, 3, 4, 6 ; II : 5, 7.

Plate 21

Fig. 1. *Ammonia ketienziensis* (Ishizaki)
(IGPS 101114), Sample KT85-6-G5, Enshunada area, ×200.
Fig. 2. *Pseudorotalia gaimardii* (d'Orbigny)
(IGPS 101115), Sample KT85-6-G6, Enshunada area, ×100.
Fig. 3. *Gyroidina cushmani* Boomgraat
(IGPS 101116), Sample KT-85-6-G5, Enshunada area, ×200.
Fig. 4. *Gyroidinoides nipponicus* (Ishizaki)
(IGPS 101117), Sample KT85-6-G4, Enshunada area, ×200.
Fig. 5. *Oridorsaris tener* (d'Orbigny)
(IGPS 101118), Sample KT85-6-G1, Enshunada area, ×200.
Fig. 6. *Valvulineria gunjii* Akimoto, n. sp.
Holotype (IGPS 101119), Sample KT86-11-MP8, Nankai Trough, ×200.
Fig. 7. *Hoeglundina elegans* (d'Orbigny)
(IGPS 101120), Sample KT86-11-MP6, Nanakai Trough, ×100.

Scale bar : 0.1 mm ; I : 2, 7 ; II : 1, 3, 4, 5, 6.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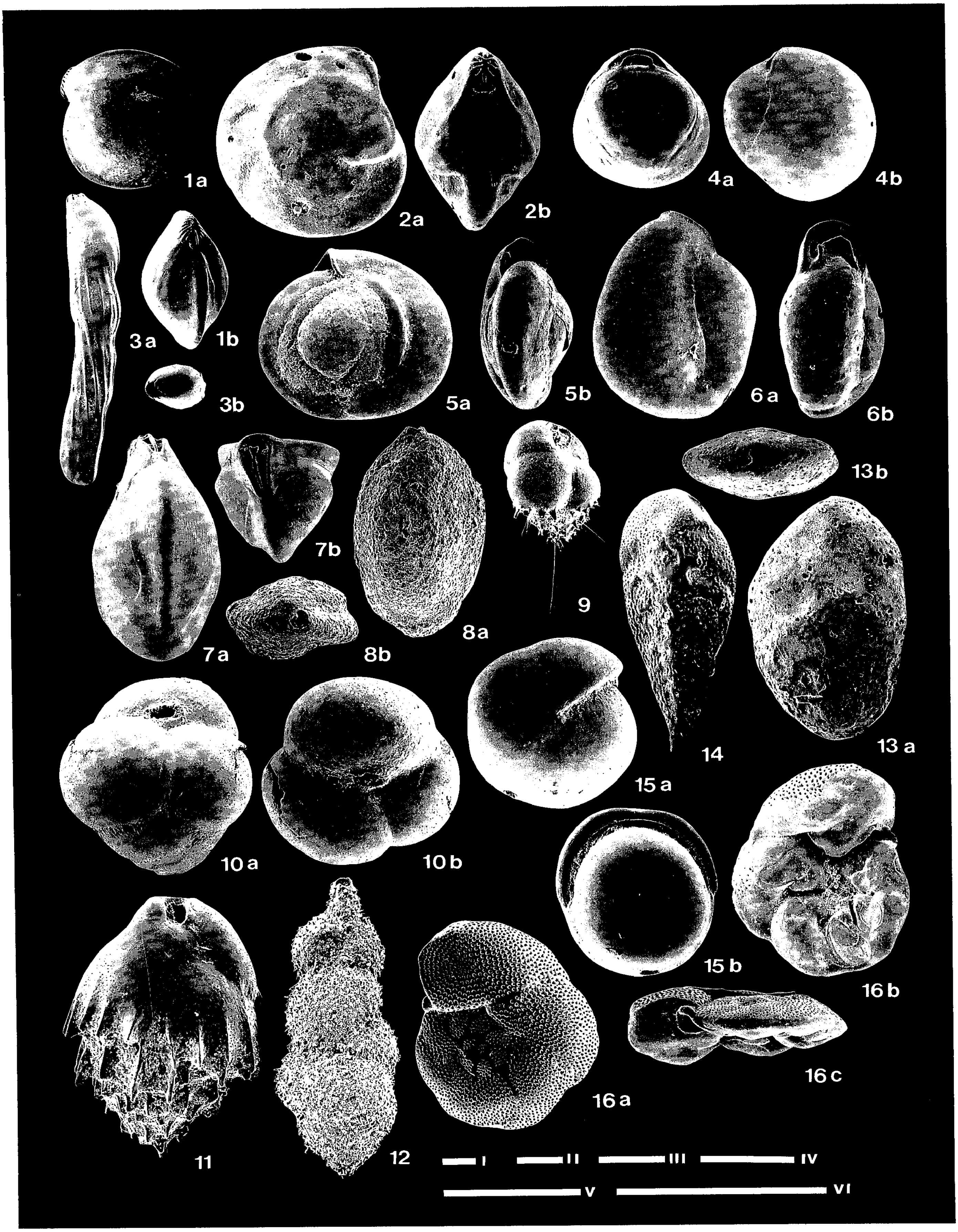
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Plate 22

Fig. 1. *Robulus orbicularis* d'Orbigny
(IGPS 101121), Sample GH80-4-85, Hachijojima area, ×70.
Fig. 2. *Cribrorbulina serpens* (Seguenza)
(IGPS 101122), Sample GH80-4-85, Hachijojima area, ×200.
Fig. 3. *Vaginulinopsis asanoi* Ishizaki
(IGPS 101123), Sample GH80-4-97, Hachijojima area, ×45.
Fig. 4. *Miliolinella inflata* LeRoy
(IGPS 101124), Sample GH80-4-85, Hachijojima area, ×150.
Fig. 5. *Miliolinella australis* (Parr)
(IGPS 101125), Sample GH80-4-85, Hachijojima area, ×200.
Fig. 6. *Miliolinella circularis* (Bornemann)
(IGPS 101126), Sample GH80-4-94, Hachijojima area, ×200.
Fig. 7. *Triloculina tricarinata* d'Orbigny
(IGPS 101127), Sample GH80-4-85, Hachijojima area, ×100.
Fig. 8. *Sigmoilopsis schlumbergeri* (Silvestri)
(IGPS 101128), Sample GH80-4-D370, Hachijojima area, ×100.
Fig. 9 *Bulimina aculeata* d'Orbigny
(IGPS 101129), Sample GH80-4-RC102, Hachijojima area, ×200.
Fig. 10. *Tosaia hanzawai* Takayanagi
(IGPS 101130), Sample GH80-4-D373, Hachijojima area, ×200.
Fig. 11. *Bulimina straiata* d'Orbigny
(IGPS 101131), Sample GH80-4-D370, Hachijojima area, ×200.
Fig. 12. *Uvigerina proboscidea* Schwager
(IGPS 101132), Sample GH80-4-D371, Hachijojima area, ×150.
Fig. 13. *Bolivina robusta* Brady
(IGPS 101133), Sample GH80-4-97, Hachijojima area, ×300.
Fig. 14. *Bolivina robusta* Brady forma A
(IGPS 101134), Sample GH80-4-D371, Hachijojima area, ×150.
Fig. 15. *Pullenia bulloides* (d'Orbigny)
(IGPS 101135), Sample GH80-4-D370, Hachijojima area, ×150.
Fig. 16. *Rosalina vilardeboana* d'Orbigny
(IGPS 101136), Sample GH80-4-85, Hachijojima area, ×100.

Scale bar : 0.1 mm ; I : 7, 8, 16 ; II : 4, 12, 14, 15 ; III : 2, 5, 6, 9, 10, 11 ; IV : 13. 1.0 mm ; V : 3 ; VI : 1.

Plate 23

Fig. 1. *Carpenteria monticularis* Carter
(IGPS 101137), Sample GH80-4-85, Hachijojima area, ×45.
Fig. 2. *Cibicidoides mediocris* (Finlay)
(IGPS 101138), Sample GH80-4-85, Hachijojima area, ×150.
Fig. 3. *Heterolepa subhaidingerii* (Parr)
(IGPS 101139), Sample GH80-4-85, Hachijojima area, ×100.
Fig. 4. *Cibicides praecinctus* (Karrer)
(IGPS 101140), Sample GH80-4-94, Hachijojima area, ×150.
Fig. 5. *Cibicides refulgens* Montfort
(IGPS 101141), Sample GH80-4-94, Hachijojima area, ×70.
Fig. 6. *Cibicides tenuimargo* (Brady)
(IGPS 101142), Sample GH80-4-94, Hachijojima area, ×45.
Fig. 7. *Cibicides wuellerstorfi* (Schwager)
(IGPS 101143), Sample GH80-4-D371, Hachijojima area, ×100.
Fig. 8. *Parrelloides bradyi* (Trauth)
(IGPS 101155), Sample GH80-4-D371, Hachijojima area, ×150.
Fig. 9. *Spirillina limbata* Brady
(IGPS 101144), Sample GH80-4-94, Hachijojima area, ×200.
Fig. 10. *Spirillina* sp.
(IGPS 101145), Sample GH80-4-97, Hachijojima area, ×150.

Scale bar : 0.1 mm ; I : 3, 7 ; II : 2, 4, 8, 10 ; III : 9. 1.0 mm ; IV : 1, 6 : V : 5.


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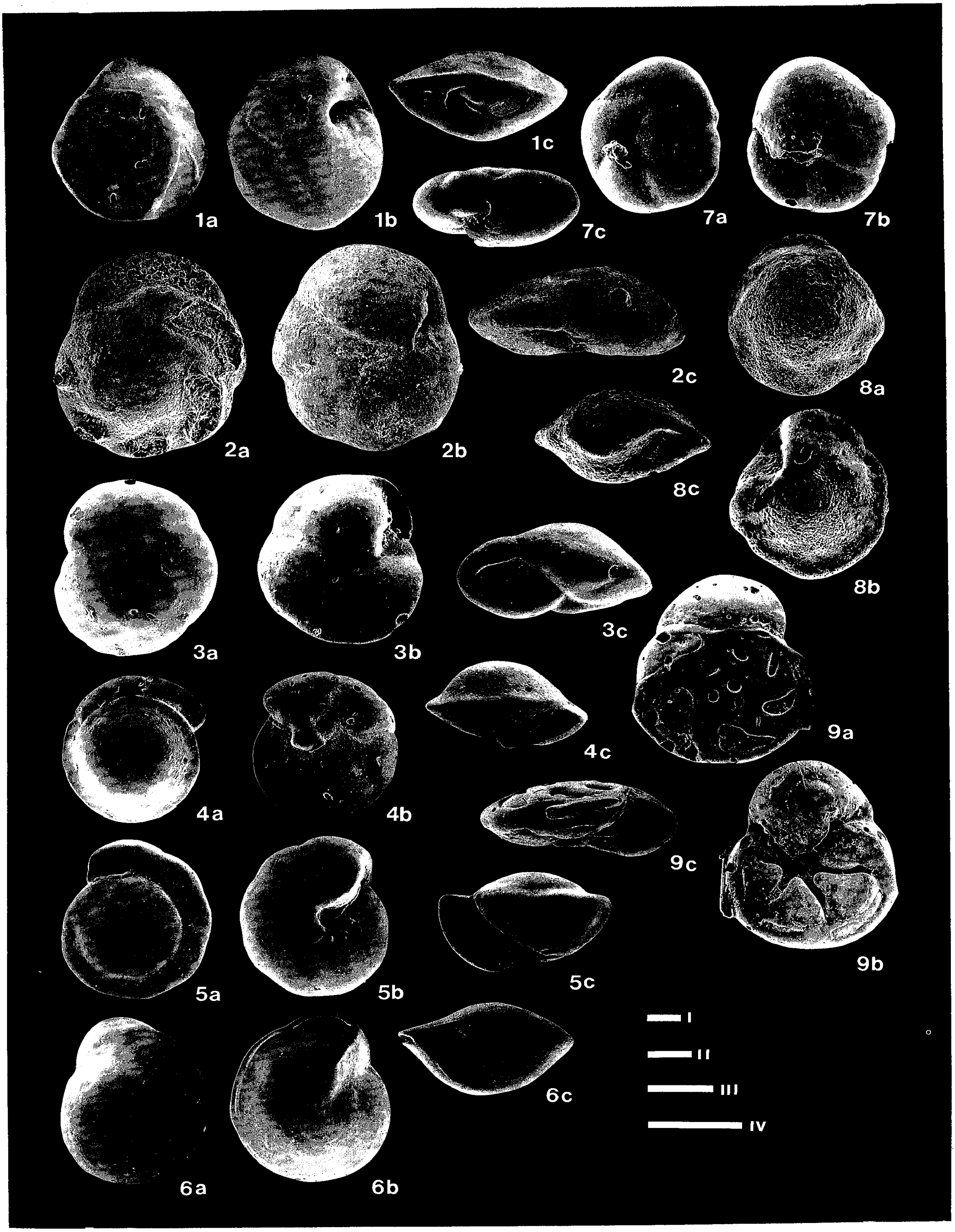
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Plate 24

Fig. 1. *Poroeponides cribrorephandus* Asano and Uchio
(IGPS 101146), Sample GH80-4-85, Hachijojima area, ×100.
Fig. 2. *Alabamina tubulifera* (Heron-Allen and Earland)
(IGPS 101147), Sample GH80-4-85, Hachijojima area, ×150.
Fig. 3. *Pseudoparrella exigua* (Brady)
(IGPS 101148), Sample GH80-4-RC102, Hachijojima area, ×300.
Fig. 4. *Oridorsalis umbonatus* (Reuss)
(IGPS 101149), Sample GH80-4-D370, Hachijojima area, ×100.
Fig. 5. *Gyroidina soldanii* d'Orbigny
(IGPS 101150), Sample GH80-4-D370, Hachijojima area, ×100.
Fig. 6. *Hoeglundina elegans* (d'Orbigny)
(IGPS 101151), Sample GH80-4-96, Hachijojima area, ×150.
Fig. 7. *Quadrimorphina laevigata* (Phleger and Parker)
(IGPS 101152), Sample GH80-4-RC102, Hachijojima area, ×200.
Fig. 8. *Nuttallides umbonifera* (Cushman)
(IGPS 101153), Sample GH80-4-D376, Hachijojima area, ×200.
Fig. 9. *Mississippina concentrica* (Parker and Jones)
(IGPS 101154), Sample GH80-4-85, Hachijojima area, ×100.

Scale bar: 0.1 mm; I: 1, 4, 5, 9; II: 2, 6; III: 7, 8; IV: 3.