

FORAMINIFERAL FAUNULES FROM THE UEMATU FORMATION, OSAKA CITY *

(Studies on Japanese Pleistocene Foraminifera, II)

Manzo CHIJI

The Osaka Museum of Natural History

Introduction

The terraces which is considered as ancient coastal plains are developed along the coast of Japan Islands, at 20-70 m. above sea-level. The sediments which build up these terraces comprise frequently marine molluscs and plant remains as well as fossil mammals. The transgression which made up these terraces is generally considered to be closely related to the eustatic sea-level change of the Riss/Würm interglacial time.

The writer is studying the Foraminiferal faunules from these terrace deposits and other Japanese Pleistocene strata in order to make clear the paleo-ecological conditions of this late Pleistocene Epoch and to present one of the bases for the Quaternary geohistory of Japan Islands. The present paper is one of the records in the series of these studies.

The writer wishes to express his thanks to Prof. N. IKEBE of the Osaka City University, and Messer. H. KAJIYAMA and S. KANEKO for their useful suggestions and kind help in this study. Mr. I. HIURA, Curator of this museum help the writer in making the plates in this paper. Thanks are also due to Director Y. TSUTSUI of this museum for his continuous interest on the research work of the curators.

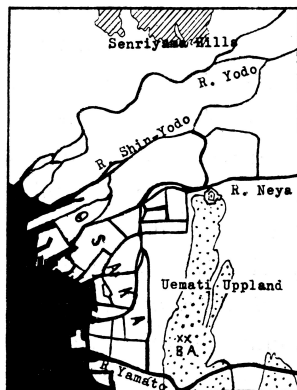


Fig. 1 Locality Map.

- A: Nishitanabe Station (Osaka City Subrailway), Abeno-ku, Osaka.
- B: 4 Cho me, Mandai-nishi, Sumiyoshi-ku, Osaka.

* Contributions from the Osaka Museum of Natural History, no. 80.

Uemati Formation

In the areas around Osaka Bay, the Pleistocene deposits are widely distributed, and they offer one of the standard stratigraphic column of the Pleistocene series in Japan as well as those of the areas around Tokyo Bay. The geology and chronology of the Pleistocene series in the areas around Osaka Bay were summarized by ICHIHARA. That consists of the Osaka Group, the Mantidani Formation, the terrace deposits and the Recent deposits.

The terrace around Osaka Bay is divided into three topographic domains, that is the High terrace, the Middle terrace and the Low terrace. The deposits, build up the Middle terrace, is called as the Uemati Formation. This is composed generally of gravels and sands accompanied by marine clay at some places in the Osaka area. The height of the depositional surfaces of the Middle terrace is 10-100 m. in the Osaka area (ICHIHARA, M.: 1961).

Materials

The materials which is dealt with in this paper were collected at two localities in the Uemati Member, one of members of the Uemati Formation. The Uemati Member is the deposits build up the Uemati uppland in Osaka City, and consists of gravels and sands accompanied by marine clay in the middle part. It frequently contains many fossil molluscs such as *Anadara granosa*, *Trisidos kiyonoi*, *Cardium braunsi*, etc. The Molluscan faunules of this member were reported by some students. Of the Foraminiferal faunules, any datum is not found until the present paper.

One material was collected by KAJIYAMA at the work spot where the Nishitanabe Station of the Osaka City Subrailway was built up, in 1958 (Locality A). At this locality, as shown in fig. 2, the Uemati Member consists of the gray medium sand (2 m. in thickness), the yellow fine sand

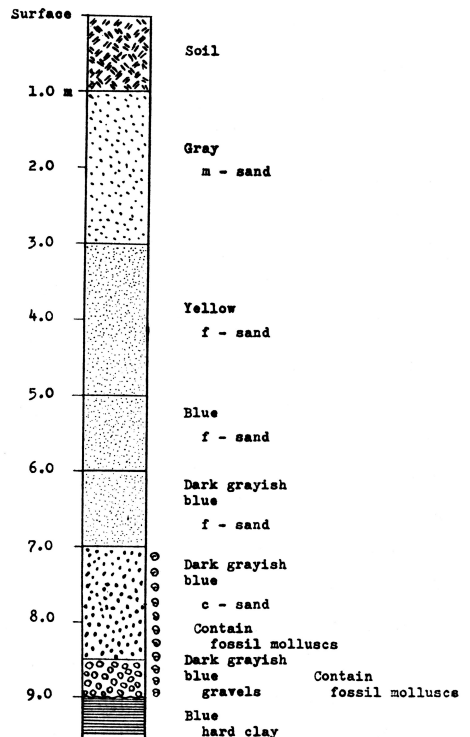


Fig. 2 Geologic column of Uemati Formation at the Nishitanabe Station of Osaka City Subrailway (Loc. A). (by H. KAJIYAMA)

(2 m.), the blue fine sand (1 m.), the dark grayish blue fine sand (1 m.), and the coarse sand (1.5 m.) and gravels (0.5 m.) of the same color in descending order. The Molluscan fossils were contained in the lower gravels and coarse sand. The Molluscan faunule from this locality was reported by KANEKO and KAJIYAMA. *Trisidos tortuosa*, *Anadara granosa*, *Pecten albicans*, *Anomia lischkei*, *Crassostrea gigas*, *Fulvia mutica*, *Dosinia japonica*, etc. are relative dominant species (KANEKO, S. and H. KAJIYAMA: 1962). The present material was from the lower most part of this coarse sand.

Another one was collected at the work spot, about 300 m. west of the Harima-cho Bus Stop, where the underground electric line was laid down by Kansai Denryoku Co. Ltd. (Locality B) and the material was brought to the writer in November of 1962. The sequence of the Uemati Member at this point is not ascertained. The material is the dark grayish blue muddy coarse sand and much resembles one from the Nishitanabe Station. The Molluscan fossils were collected by KAJIYAMA and KANEKO. The dominant species are *Turritella kurosio*, *Clathrofenella fusca*, *Eufenella pupoides*, *Ringicula dorialis*, etc., but the faunule has many common species with the faunule from the Nishitanabe Station*.

Foraminiferal faunule

Twenty one genera and twenty eight species and varieties were determined in the present materials. Beside these forms, there are several indeterminable ones belonging to Genus *Buccella*, *Cassidulina*, *Elphidium*, *Guttulina*, *Polymorphina*, *Pseudopolymorphina*, *Rosalina*, *Triloculina*. Each form occurs very rarely in the faunules.

Each form that is a member of the faunule and its frequency at two localities are given in the table 2. The faunules from both localities are much resemble. The dominant genera of these faunules are *Elphidium* (about 45%) and *Textularia* (about 23-32%). *Strebulus* is found showing the relatively high frequency (about 12%).

In Genus *Elphidium*, *E. subincertum* has most high frequency in the material

		Recent Deposits	
		Itami Formation (Low terrace deposits)	
		Uemati Formation (Middle terrace deposits)	
		Kiyotani F.	(High terrace deposits)
		Harima F.	
		Mantidani Formation	
Plio.	Osaka Group	Upper Part	Ibaragi Formation
		Lower Part	Senriyama Formation

Table 1 Stratigraphic table of the Pleistocene Sedimentaries in the Osaka Area. (after ICHIHARA, 1961)

* Communication from Mr. S. KANEKO.

from Loc. B and this species is reported from the bottom sediments, off Oki Is., Southwestern Japan Sea, under the warm Tsushima current. *E. advena depressulum* is most dominant species in Genus *Elphidium* comprised in the material from Loc. A. This is widely distributed species in the shallow waters of the Pacific region, and is also commonly found in the shallow waters around Japan Islands. *E. cf. translucens* is found in nearly equal frequency in both materials (about 7-10%). This species is frequently reported from the bottom sediments, off South California.

Textularia foliacea is the most dominant species in these faunules. This species has very wide distribution, especially it was recorded by CUSHMAN, LALICKER and McCULLOCH, and others in the Gulf of California, off Mexico, Central America and Columbia, in shallow waters and also at a large number of stations in the shallow waters of the Tropical Pacific.

Strebulus beccarii tepida is comprised in both materials in nearly equal frequency (about 7-8%). This was recorded from some localities in shallow waters in Caribbean Sea.

The foraminiferal assemblages in the sediments of the Recent Osaka Bay were reported by

		A	B
<i>Bolivina</i>	<i>striatula</i>	.9%	1.3%
<i>Buccella</i>	sp.	.4	
<i>Buliminella</i>	<i>elegantissima</i>	.4	
<i>Cassidulina</i>	sp.	.4	
<i>Cibicides</i>	<i>lobatulus</i>	.4	
<i>Conorboides</i>	<i>advena</i>	2.4	
<i>Cymbaloporetta</i>	<i>bradyi</i>	.4	
<i>Elphidium</i>	<i>advena</i>	2.0	
<i>E.</i>	<i>advena depressulum</i>	19.8	2.1
<i>E.</i>	<i>craticulatum</i>	.4	.3
<i>E.</i>	<i>crispum</i>	.4	
<i>E.</i>	cf. <i>fimbriatum</i>	1.2	5.9
<i>E.</i>	<i>hispidulum</i>	1.2	1.3
<i>E.</i>	<i>jenseni</i>	5.7	1.3
<i>E.</i>	<i>subincertum</i>	4.4	27.1
<i>E.</i>	cf. <i>translucens</i>	9.7	6.7
<i>E.</i>	sp. A		.8
<i>Globulina</i>	<i>inaequalis</i> var.	.8	.8
<i>Guttulina</i>	<i>lactea</i>	.4	1.0
<i>G.</i>	<i>orientalis</i>	.8	
<i>G.</i>	sp.		.3
<i>Nonion</i>	<i>japonicum</i>		.5
<i>N.</i>	<i>manpukujiense</i>		.3
<i>Oolina</i>	<i>globosa</i>	.8	.5
<i>Polymorphina</i>	sp.	.4	
<i>Pseudopolymorphina</i>	sp.	.8	.5
<i>Pseudononion</i>	<i>atlanticus</i>	.8	5.0
<i>Quinqueloculina</i>	cf. <i>laevigata</i>		.5
<i>Reussella</i>	<i>miocenica</i>	6.1	.3
<i>Rosalina</i>	sp. A	.8	
<i>R.</i>	sp. B	.8	
<i>Strebulus</i>	<i>beccarii</i>	4.3	2.6
<i>S.</i>	<i>beccarii tepida</i>	6.9	7.9
<i>S.</i>	<i>ketienziensis angulata</i>	1.2	
<i>S.</i>	<i>murrayi</i>		.8
<i>Textularia</i>	<i>foliacea</i>	23.4	31.5
<i>Triloculina</i>	sp. A	.8	
INDIVIDUAL NUMBERS IN 50 g SAMPLE		248	390

Table 2.

A: Sample, from Nishitanabe Station (Osaka City Subrailway), Abeno-ku, Osaka
 B: Sample, from 4-chome, Mandai-nishi, Sumiyoshi-ku, Osaka.

NAKASEKO and by TAKAYANAGI. The following four types of assemblages are recognized in the Recent Osaka Bay (NAKASEKO, K.: 1953, TAKAYANAGI, Y.: 1953).

"*Rotalia beccarii* assemblage" occupies the northeastern part of the bay and comprises more than 30% of *Strebulus beccarii* together with *Buccella frigida*, *Elphidium advena*, *Nonion pacificum*, etc.

"*Rotalia papillosa* assemblage" is distributed in the western half of the bay and contains more than 30% of *Strebulus gaimardii* together with *Elphidium advena*, *Nonion japonicum*, etc.

"*Textularia* assemblage" is found in small areas of the bay mouth and the north-western part of the bay. This assemblage consists of dominant *Textularia articulata* and *T. conica* accompanied by *Poroepionides cribrorepandus* and *Quinqueloculina vulgaris*.

"*Elphidium crispum* assemblage" is from very small restricted area of near shore of the southeastern coast. *E. crispum* is the dominant species in this assemblage. *Gaudryina* sp., *Strebulus ozawai*, etc. are also found with *E. crispum*.

The majority of the present faunal members is also found in the above mentioned Recent assemblages. The present faunules correspond to the Recent "*Textularia* assemblage". However, there are some differences between fossil and recent assemblages. The most remarkable difference is that *T. foliacea* which is most dominant species in the fossil faunules is very rare in the Recent assemblage. *Elphidium subincertum* is not recorded in the Recent Osaka Bay. *Strebulus beccarii* is hardly found in the Recent "*Textularia* assemblage".

On the other hand, *Textularia articulata* and *T. conica*, the most important element species of the Recent "*Textularia* assemblage" are not found in the present faunules. *Hanzawaia nipponica* and *Strebulus gaimardii* which are frequently comprised in the Recent "*Textularia* assemblage" are not contained in the fossil faunules.

From view points of faunal assemblage, it is considered that the Uemati Member, which contains the present Foraminiferal faunules, had been deposited off shore as one of sand-bars in the ancient Osaka Bay, under the water that was similar to, or rather warm than that of the Recent time.

Systematic arrangement

Family TEXTULARIIDAE

Textularia foliacea HERON-ALLEN and EARLAND

Plate 5, figure 1

- 1915 *Textularia foliacea* HERON-ALLEN and EARLAND, Trans. Zool. Soc. London, vol. 20, p. 628, pl. 47, figs. 17-20.
- 1921 *Textularia foliacea* CUSHMAN, U.S. Nat. Mus., Bull. 100, vol. 4, p. 117, pl. 19, figs. 7a-b.
- 1940 *Textularia foliacea* LALICKER and McCULLOCH, Allan Hancock Pacific Exped., vol. 6, no. 2, p. 128, pl. 14, figs. 11a-c.
- 1949 *Textularia foliacea* SAID, Cushman Lab. Foram. Res., Spec. Publ., no. 26, p. 6, pl. 1, fig. 9.
- 1950 *Textularia foliacea* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 3, p. 5, figs. 19-20.
- 1957 *Textularia foliacea* TODD, U.S. Geol. Surv., Prof. Paper, 280-H, p. 286, pl. 85, figs. 5a-b.
- 1959 *Textularia foliacea* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 28, pl. 2, figs. 3a-b.

This species was reported from many localities of Tropical Pacific in shallow waters. The present specimens are somewhat shorter in length of test than the typical form.

FIGURED SPECIMEN: OMNH Reg. No. F8483F

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8426F, F8454F.

OCCURRENCE: Abundant, in sample A and B.

Family MILIOLIDAE

Quinqueloculina cf. laevigata D'ORBIGNY

- 1826 *Quinqueloculina laevigata* D'ORBIGNY, Ann. Sci. Nat., ser. 1, vol. 7, p. 301.
- 1929 *Quinqueloculina laevigata* CUSHMAN, U.S. Nat. Mus. Bull., 104, pt. 6, p. 30, pl. 4, figs. 3a-c.
- 1949 *Quinqueloculina laevigata* SAID, Cushman

Lab. Foram. Res., Spec. Publ., no. 26, p. 10, pl. 1, fig. 27.

- 1950 *Quinqueloculina laevigata* NATLAND, Geol. Soc. America, Mem. 43, pt. 4, p. 7, pl. 2, figs. 2-3.

- 1959 *Quinqueloculina laevigata* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 45, pl. 5, figs. 12-13.

Only two small specimens are found.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8447F, F8448F.

OCCURRENCE: Very Rare, in sample B.

Triloculina sp.

Plate 5, figures 2a-c, 3 a-c.

This very rare specimens seem to resemble *T. planiciana* D'ORBIGNY but have more acute peripheral angle.

FIGURED SPECIMENS: OMNH Reg. Nos. F8425F, F8484F.

OCCURRENCE: Very Rare, in sample A.

Family LAGENIDAE

Oolina globosa (MONTAGU)

- 1803 *Vermiculum globosum* MONTAGU, Test. Brit., p. 528, fig. 8.
- 1853 *Entosolenia globosa* WILLIAMSON, Rec. Foram. Great Britain, p. 8, pl. 1, figs. 15-16.
- 1884 *Lagena globosa* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 452, pl. 56, figs. 1-3.
- 1913 *Lagena globosa* CUSHMAN, U. S. Nat. Mus., Bull. 71, pt. 3, p. 3, pl. 4, fig. 2.
- 1923 *Lagena globosa* CUSHMAN, Ibid., Bull. 104, pt. 4, p. 20, pl. 4, figs. 1-2.
- 1938 *Lagena globosa* ASANO, Sci. Rep. Tohoku Imp. Univ., ser. 2, vol. 19, no. 2, p. 215, pl. 27, fig. 52.
- 1956 *Oolina cf. globosa* ASANO, Sci. Rep. Tohoku Univ., ser. 2, vol. 27, p. 41, pl. 5, fig. 1.
- UNFIGURED SPECIMENS: OMNH Reg. No. F8444F.

OCCURRENCE: Very Rare, in sample B.

Family POLYMORPHINIDAE

Guttulina lactea (WALKER and JACOB)

Plate 5, figures 4a, b.

- 1784 *Serpula tenuis laevis* WALKER and JACOB, Test. Min., p. 2, pl. 1, fig. 5.
- 1798 *Serpula lactea* WALKER and JACOB (fide Kanchmacher), Adams' Essays, ed. 2, p. 634, pl. 14, fig. 4.
- 1858 *Polymorphina lactea* WILLIAMSON, Recent Foram. Great Britain, p. 70, pl. 6, figs. 145-152.
- 1923 *Polymorphina lactea* CUSHMAN, U.S. Nat. Mus., Bull. 104, pt. 4, p. 146, pl. 39, fig. 9 (not fig. 11).
- 1929 *Guttulina lactea* OZAWA, Contr. Cushman Lab. Foram. Res., vol. 5, p. 36, pl. 6, figs. 6-10.
- 1930 *Guttulina lactea* CUSHMAN and OZAWA, U.S. Nat. Mus., Proc., vol. 77, art. 6, p. 43, pl. 10, figs. 1-4.
- 1951 *Guttulina lactea* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 8, p. 2, figs. 8-9.
- FIGURED SPECIMEN: OMNH Reg. No. F8411F
UNFIGURED SPECIMENS: OMNH Reg. No. F8439F.
- OCCURRENCE: Very rare~Rare, in samples A and B.

Guttulina orientalis CUSHMAN and OZAWA

Plate 5, figures 7a, b.

- 1928 *Guttulina orientalis* CUSHMAN and OZAWA, Contr. Cushman Lab. Foram. Res., vol. 4, p. 15, pl. 2, fig. 1.
- 1929 *Guttulina orientalis* CUSHMAN and OZAWA, Japan. Jour. Geol. Geogr., vol. 6, p. 66, pl. 13, fig. 1; pl. 14, figs. 1-2.
- 1930 *Guttulina orientalis* CUSHMAN and OZAWA, U. S. Nat. Mus., Proc. vol. 77, art. 6, p. 24, pl. 3, figs. 2-3.

1951 *Guttulina orientalis* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 8, p. 3, figs. 11-12.

This species was originally described from the upper Pliocene Sawane Formation of Sado Is. of Japan. The present form is the typical one.

FIGURED SPECIMEN: OMNH Reg. No. F8472F.

UNFIGURED SPECIMEN: OMNH Reg. No. F8412F.

OCCURRENCE: Rare, in sample A.

Guttulina sp.

The present indeterminable specimen is very small and broken one.

UNFIGURED SPECIMEN: OMNH Reg. No. F8440F.

OCCURRENCE: Very rare, in sample B.

Globulina inaequalis REUSS, var.

Plate 5, figures 8a, b, 9a, b.

This form differs from *Globulina inaequalis* REUSS, var. *caribaea* D'ORBIGNY in the ornamentation of the test. Of this form, the entire surface of the test, is ornamented by numerous fine, very shortly broken, longitudinal costae.

FIGURED SPECIMENS: OMNH Reg. Nos. F8410F, F8471F.

UNFIGURED SPECIMENS: OMNH Reg. No. F8438F.

OCCURRENCE: Very rare, in sample A and B.

Polymorphina sp.

Only one specimen is obtained. This small compressed test consists of two chambers and has a radiate aperture. This specimen is probably a juvenile belonging to genus *Polymorphina*.

UNFIGURED SPECIMEN: OMNH Reg. No. F8416F.

OCCURRENCE: Very rare, in sample A.

Pseudopolymorphina sp.

Plate 5, figures 5, 6

The young specimens of which test consists of two or three chambers are very rarely found.

FIGURED SPECIMENS: OMNH Reg. Nos. F8475F, F8486F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8418F, F8445F.

OCCURRENCE: Very rare~Rare, in samples A and B.

Family NONIONIDAE

Nonion manpukujiense OTSUKA

1932 *Nonion manpukujiense* OTSUKA, Jour. Geol. Soc. Japan, vol. 39, no. 467, p. 654, fig. 1.

1950 *Nonion manpukujiense* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 2, figs. 7-8.

1960 *Nonion manpukujiense* ASANO, Sci. Rep. Tohoku Univ., ser. 2, Spec. vol., no. 4, p. 192, pl. 21, fig. 3.

UNFIGURED SPECIMEN: OMNH Reg. No. F8442F.

OCCURRENCE: Very rare, in sample B.

Nonion japonicum ASANO

1938 *Nonion japonicum* ASANO, Jour. Geol. Soc. Japan, vol. 45, no. 538, p. 593, pl. 15, figs. 1-2.

1950 *Nonion japonicum* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 2, figs. 5-6.

1960 *Nonion japonicum* ASANO, Sci. Rep. Tohoku Univ., ser. 2, Spec. vol., no. 4, p. 190, pl. 21, figs. 1a-b.

This species was commonly reported from the deposits on the continental shelf or upper part of the continental slope bordering Japan, under the warm Kuroshio Current. It is also the most common species in Japanese Neogene.

UNFIGURED SPECIMEN: OMNH Reg. No. F8441F.

OCCURRENCE: Very rare, in sample B.

Pseudononion atlanticus (CUSHMAN)

Plate 5, figures 10 a, b.

1947 *Nonionella atlantica* CUSHMAN, Contr. Cush-

man Lab. Foram. Res., vol. 23, pt. 4, p. 90, pl. 20, figs. 4-5.

1951 *Nonionella atlantica* PHLEGER and PARKER, Geol. Soc. America, Mem., vol. 46, pt. 2, p. 11, pl. 5, figs. 21-23.

1961 *Pseudononion atlanticus* ANDERSEN, Louisiana Geol. Surv., Geol. Bull., No. 35, pt. 2, p. 84, pl. 18, figs. 1-2.

FIGURED SPEIMEN: OMNH Reg. No. F8474F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8417F, F8446F.

OCCURRENCE: Rare, in sample A; Few, in sample B.

Family ELPHIDIIDAE

Elphidium advena (CUSHMAN)

Plate 6, figure 1.

1884 *Polystomella subnodosa* BRADY (not MÜNSTER), Rep. Voy. Challenger, Zool., vol. 9, p. 734, pl. 110, figs. 1 a-b.

1922 *Polystomella advena* CUSHMAN, Carnegie Inst. Washington, Publ. 311, p. 56, pl. 9, figs. 11-12.

1930 *Elphidium advenum* CUSHMAN, U.S. Nat. Mus., Bull. 104, pt. 7, p. 25, pl. 10, figs. 1-2.

1939 *Elphidium advenum* CUSHAN, Ibid. Bull. 161, pt. 2, p. 50, pl. 12, figs. 1-3.

1939 *Elphidium advenum* CUSHMAN, U.S. Geol. Surv., Prof. Paper 191, p. 60, pl. 16, figs. 31-35.

1950 *Elphidium advenum* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 6, figs. 32-33.

1956 *Elphidium advena* BHATIA, Contr. Cushman Found. Foram. Res., vol. 7, pt. 1, p. 20, pl. 5, figs. 9 a-b.

1957 *Elphidium advenum* TODD and BRONNIMANN, Cushman Found. Foram. Res., Spec. Publ., no. 3, p. 39, pl. 6, figs. 5-7.

1959 *Elphidium advena* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no.

2, p. 73, pl. 11, figs. 7-8.

- 1960 *Elphidium advena* BARKER, Soc. Econ. Paleont. Min., Spec. Publ., No. 9, p. 226, pl. 110, figs. 1a-b.

The umbilical bosses of the present form are somewhat indistinct. This species is widely distributed in the warm waters of both Pacific and Atlantic, and also found in the deposits of the Recent Osaka Bay.

FIGURED SPECIMEN: OMNH Reg. No. F8460F.

UNFIGURED SPECIMENS: OMNH Reg. No. F8401F.

OCCURRENCE: Rare, in sample A.

Elphidium advena (CUSHMAN)

var. *depressulum* CUSHMAN

Plate 6, figure 2.

- 1939 *Elphidium advenum* (CUSHMAN) var. *depressulum* CUSHMAN, U.S. Nat. Mus., Bull. 161, pt. 2, p. 51, pl. 12, figs. 4a-b.
- 1939 *Elphidium advenum* CUSHMAN var. *depressulum* CUSHMAN, U.S. Geol. Surv., Prof. Paper 191, p. 61, pl. 17, fig. 1.

This form is commonly found in the warm shallow waters of the adjacent sea of Japan Islands. It is also reported from the deposits of the Recent Osaka Bay.

FIGURED SPECIMEN: OMNH Reg. No. F8485F

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8402F, F8428F.

OCCURRENCE: Common, in sample A; Rare, in sample B

Elphidium craticulatum (FICHEL and MOLL)

- 1798 *Nautilus craticulatus* FICHEL and MOLL, Test. Micr., p. 51, pl. 5, figs. h-k.
- 1826 *Polystomella craticulata* D'ORBIGNY, Ann. Sci. Nat., ser. 1, vol. 7, p. 284.
- 1884 *Polystomella craticulata* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 739, pl. 110, figs. 16-17.
- 1914 *Polystomella craticulata* CUSHMAN, U. S. Nat.

Mus., Bull. 71, pt. 4, p. 34, pl. 19, figs. 4a-b.

- 1933 *Elphidium craticulatum* CUSHMAN, Ibid., Bull. 161, pt. 2, p. 48, pl. 11, figs. 5a-b.
- 1939 *Elphidium craticulatum* CUSHMAN, U.S. Geol. Surv., Prof. Paper 191, p. 56, pl. 15, figs. 14-17.
- 1950 *Elphidium craticulatum* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 7, figs. 36-37.
- 1959 *Elphidium craticulatum* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 74, pl. 11, figs. 9-12.
- 1960 *Elphidium craticulatum* BARKER, Soc. Econ. Paleont. Min., Spec. Publ. No. 9, p. 228, pl. 110, figs. 16-17.

This widely distributed species is very rare in the present materials. This species is commonly found under the Kuroshio Current in adjacent sea of Japan Islands and is frequently found from the deposits of the Recent Osaka Bay as well as of the Seto-naikai (Inland Sea of Japan).

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8403F, F8429F.

OCCURRENCE: Very rare in sample A and B.

Elphidium crispum (LINNÉ)

- 1739 "*Cornu Hammonia orbiculatum*" PLANCUS, Conch. Mineral., p. 10, pl. 1, figs. 2d-f.
- 1742 "*Nautilus minimus*. GUALTERI, Index Test. Conch., pl. 19, figs. a, d.
- 1758 *Natutilus crispus* LINNÉ, Syst. Nat., ed. 10, vol. 1, p. 709.
- 1822 *Polystomella crispa* LAMARCK, Hist. Anim. sans. Vert., vol. 7, p. 625.
- 1884 *Polystomella crispa* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 736, pl. 110, figs. 6-7.
- 1927 *Elphidium crispum* CUSHMAN and GRANT, San Diego Soc. Nat. Hist., Trans., vol. 5, no. 6, p. 73, pl. 7, figs. 3a-b.
- 1939 *Elphidium crispum* CUSHMAN, U.S. Geol. Surv., Prof. Paper 191, p. 50, pl. 13, figs.

- 17-21.
- 1949 *Elphidium crispum* SAID, Cushman Lab. Foram. Res., Spec. Publ., no. 26, p. 23, pl. 2, fig. 36.
- 1950 *Elphidium fax barbarense* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 7, figs. 40-41.
- 1959 *Elphidium crispum* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 74, pl. 11, figs. 13a-b.
- 1960 *Elphidium crispum* BARKER, Soc. Econ. Paleont. Min., Spec. Publ. no. 9, p. 226, pl. 110, figs. 6-7.
- UNFIGURED SPECIMEN: OMNH Reg. No. F8404F.
- OCCURRENCE: Very rare, in sample A.

***Elphidium cf. fimbriatulum* (CUSHMAN)**

Plate 6, figure 7.

- 1918 *Polystomella fimbriatula* CUSHMAN, U. S. Geol. Surv., Bull. 676, p. 20, pl. 8, fig. 5.
- 1932 *Elphidium fimbriatulum* COLE, Florida Geol. Surv., Bull. 6, p. 33, pl. 4, fig. 7.
- 1939 *Elphidium fimbriatulum* CUSHMAN, U. S. Geol. Surv., Prof. Paper 191, p. 47, pl. 12, fig. 13.
- 1951 *Elphidium cf. fimbriatulum* PHLEGER and PARKER, Geol. Soc. America, Mem. 46, pt. 2, p. 10, pl. 5, fig. 12.
- 1961 *Elphidium fimbriatulum* ANDERSEN, Louisiana Geol. Surv., Geol. Bull. 35, p. 110, pl. 18, figs. 9a-b.

This species was reported from the Miocene and Pliocene of Florida and the Pliocene of North Carolina U.S.A. Cushman described that this species has about 10 chambers in the last whorl but showed the figure of the specimen which has 15 chambers in the same paper. PHLEGER and PARKER reported the specimen which has 17 chambers as *E. cf. fimbriatulum*. ANDERSEN's figure shows 15 chambers in the last whorl. The present form much resembles the figure of PHLEGER and

PARKER and has 16 or 17 chambers in the last whorl. The Recent species is reported from Northwest Gulf of Mexico and Mississippi River Mudlumps.

FIGURED SPECIMEN: OMNH Reg. No. F8461F.
UNFIGURED SPECIMENS: OMNH Reg. Nos. F8405F, F8430F.

OCCURRENCE: Rare, in sample A; Few, in sample B.

***Elphidium hispidulum* CUSHMAN**

Plate 6, figure 10.

- 1936 *Elphidium hispidulum* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 12, pt. 4, p. 83, pl. 14, fig. 13.
- 1939 *Elphidium hispidulum* CUSHMAN, U. S. Geol. Surv., Prof. Paper 191, p. 63, pl. 18, fig. 2.
- 1957 *Elphidium hispidulum* TODD and BRONNIMANN, Cushman Found. Foram. Res., Spec. Publ., no. 3, p. 39, pl. 7, fig. 1.
- FIGURED SPECIMEN: OMNH Reg. No. F8462F.
UNFIGURED SPECIMENS: OMNH Reg. Nos. F8406F, F8431F.
- OCCURRENCE: Rare, in sample A and B.

***Elphidium jenseni* (CUSHMAN)**

Plate 6, figures 5, 6.

- 1924 *Polystomella jenseni* CUSHMAN, Carnegie Inst. Washington, Publ. 342, p. 49, pl. 16, figs. 4, 6.
- 1933 *Elphidium jenseni* CUSHMAN, U. S. Nat. Mus., Bull. 161, pt. 2, p. 48, pl. 11, figs. 6-7.
- 1939 *Elphidium jenseni* CUSHMAN, U. S. Geol. Surv., Prof. Paper 191, p. 62, pl. 17, figs. 14-15.
- 1950 *Elphidium jenseni* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 9, figs. 48-49.
- 1960 *Elphidium jenseni* ASANO, Sci. Rep. Tohoku Univ., ser. 2, Spec. vol., no. 4, p. 199, pl. 22, figs. 5a-b.
- FIGURED SPECIMENS: OMNH Reg. Nos. F8463F, F8464F.
UNFIGURED SPECIMENS: OMNH Reg. Nos.

F8407F, F8432F.

OCCURRENCE: Few, in sample A; Rare, in sample B.

***Elphidium subincertum* ASANO**

Plate 6, figures 8, 9.

1950 *Elphidium subincertum* ASANO, Ill. Cat. Japan. Tert. Small. Foram., pt. 1, p. 10, figs. 56-57.

1960 *Elphidium subincertum* ASANO, Sci. Rep. Tohoku Univ., ser. 2, Spec. vol., no. 4, p. 201, pl. 22, fig. 12.

This species was originally reported from the Pliocene Setana Formation of Hokkaido, Japan. In the deposits of the continental shelf bordering Japan Islands, it was reported from near Oki Island by ASANO. There is no record of this species in the Recent Osaka Bay.

FIGURED SPECIMENS: OMNH Reg. Nos. F8465F, F8466F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8408F, F8434F.

OCCURRENCE: Few, in sample A; Abundant, in Sample B.

***Elphidium cf. translucens* NATLAND**

Plate 5, figures 11, 12.

1938 *Elphidium translucens* NATLAND, Scripps Inst., Bull., Tech. ser., vol. 4, p. 144, pl. 5, figs. 3-4.

1939 *Elphidium translucens* CUSHMAN, U. S. Geol. Surv., Prof. Paper 191, p. 65, pl. 20, figs. 7a-b.

1940 *Elphidium translucens* CUSHMAN and McCULLOCH, Allan Hancock Pacific Exped., Rep., vol. 6, no. 3, p. 172, pl. 19, figs. 9a-b.

1953 *Elphidium translucens* PARKER, PHLEGER and PEIRSON, Cushman Found. Foram. Res., Spec. Publ., no. 2, p. 9, pl. 3, fig. 27.

1957 *Elphidium translucens* TODD and BRONNIMANN, Ibid. no. 3, p. 39, pl. 7, fig. 6.

1960 *Elphidium spinatum translucens* UCHIO, Ibid.,

no. 5, p. 62, pl. 4, figs. 23-24.

The small size specimens of this form were commonly found in the present materials. According to original description, *E. translucens* has 12 to 13 chambers in the last whorl, but the present specimens examined generally have 9 to 11 chambers. The specimens which have 10 chambers are most abundant in the present materials. UCHIO included *E. translucens* into *E. spinatum* CUSHMAN and VALENTINE as one of its varieties, on the bases of his observation that the former grades into the latter. In the present materials, the form identical to *E. spinatum* was not observed. There are some specimens resemble *E. poeyanum* (D'ORBIGNY) and some others seem to be the juvenile of *E. advena* (CUSHMAN). It is necessary the critical examination in further studies.

FIGURED SPECIMENS: OMNH Reg. Nos. F8467F, F8468F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8409F, F8435F.

OCCURRENCE: Common, in sample A; Few, in sample B.

***Elphidium* sp. A**

Plate 6, figures 3, 4.

This form has a very thin translucent wall. The chambers are not inflated and the last chamber has very short few spine like raises at the peripheral end. The periphery of test is rounded. The surface of test is characterized by weak slender lines parallel to the periphery.

FIGURED SPECIMENS: OMNH Reg. Nos. F8469F, F8470F.

UNFIGURED SPECIMENS: OMNH Reg. No. F8436F.

OCCURRENCE: Very rare, in sample B.

Family BULIMINIDAE

***Buliminella elegantissima* (D'ORBIGNY)**

1839 *Bulimina elegantissima* D'ORBIGNY, Voy. Amér.

- Mérid., vol. 5, pt 5, p. 51, pl. 7, figs. 13-14.
- 1884 *Bulimina elegantissima* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 402, pl. 50, figs. 20-22.
- 1919 *Buliminella elegantissima* CUSHMAN, U. S. Nat. Mus., Proc., vol. 56, p. 606.
- 1932 *Bulimina elegantissima* HERON-ALLEN and EARLAND, Discovery Rep., vol. 4, p. 351, pl. 8, figs. 35-37.
- 1933 *Buliminella elegantissima* CUSHMAN, Cushman Lab. Foram. Res., Spec. Publ., no. 4, pl. 22, fig. 3.
- 1933 *Buliminella elegantissima* CUSHMAN, Ibid., Spec. Publ., no. 5, pl. 27, fig. 4.
- 1948 *Buliminella elegantissima* CUSHMAN and MCCULLOCH, Allan Hancock Pacific Exped., vol. 6, no. 5, p. 236, pl. 29, fig. 4.
- 1953 *Buliminella elegantissima* PARKER and PHLEGER, Cushman Found. Foram. Res., Spec. Publ., no. 2, p. 6, pl. 4, figs. 8-9.
- 1957 *Buliminella elegantissima* TODD and BRONNIMANN, Ibid., Spec. Publ., no. 3, p. 32, pl. 8, figs. 1-2.
- 1962 *Buliminella elegantissima* forma A, KUWANO, Misc. Rep., Res. Inst. Nat. Resour., nos. 58-59, pl. 15, fig. 15.
- UNFIGURED SPECIMEN: OMNH Reg. No. F8396F.
- OCCURRENCE: Very rare, in sample A.

***Bolivina striatula* CUSHMAN**

Plate 6, figures 11, 12, 13.

- 1922 *Bolivina striatula* CUSHMAN, Carnegie Inst. Washington. Publ. 311, p. 27, pl. 3, fig. 10.
- 1922 *Bolivina striatula* CUSHMAN, U. S. Nat. Mus., Bull. 104, pt. 3, p. 43.
- 1937 *Bolivina striatula* CUSHMAN, Cushman Lab. Foram. Res., Spec. Publ., no. 9, p. 154, pl. 18, figs. 30-31.
- 1942 *Bolivina striatula* CUSHMAN and MCCULLOCH, Allan Hancock Pacific Exped., vol. 6, no. 4, p. 212, pl. 26, figs. 12-13.

- 1953 *Bolivina striatula* PARKER and PHLEGER, Cushman Found. Foram. Res., Spec. Publ. no. 2, p. 6, pl. 4, figs. 4-5.
- 1957 *Bolivina striatula* TODD and BRONNIMANN, Ibid. Spec. Publ. no. 3, p. 34, pl. 8, figs. 12-16.

Bolivina substriatula ASANO, reported from the Recent sediments under the warm Kuroshio Waters, off Southwestern Japan Islands, in 90-350 m. depth, is very closely related to the present form.

FIGURED SPECIMENS: OMNH Reg. Nos. F8394F, F8457F, F8458F.

UNFIGURED SPECIMENS: OMNH Reg. No. F8427F.

OCCURRENCE: Rare, in sample A and B.

***Reussella miocenica* CUSHMAN**

Plate 6, figure 14.

- 1945 *Reussella miocenica* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 21. pt. 2, p. 38, pl. 6, figs. 19-20.
- 1947 *Reussella spinulosa* (REUSS) var. *atlantica* CUSHMAN, Contr. Cushman Lab. Foram. Res., vol. 23, pt. 4, p. 91, pl. 20, figs. 6-7.
- 1951 *Reussella atlantica* PHLEGER and PARKER, Geol. Soc., America, Mem., vol. 46, pt. 2, p. 18, pl. 8, figs. 8-9.
- 1961 *Reussella miocenica* ANDERSEN, Louisiana Geol. Surv., Geol. Bull. no. 35, p. 88, pl. 19, figs. 17-18.

FIGURED SPECIMEN: OMNH Reg. No. F8476F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8419F, F8449F.

OCCURRENCE: Few, in sample A; Very rare, in sample B.

Family ROTALIIDAE

***Strebulus beccarii* (LINNÉ)**

Plate 7, figures 4a, b.

- 1758 *Nautilus beccarii* LINNÉ, Syst. Nat., ed. 10,

vol. 1, p. 710.

- 1884 *Rotalia beccarii* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 704, pl. 107, figs. 2-3.
- 1915 *Rotalia beccarii* CUSHMAN, U. S. Nat. Mus., Bull. 71, pt. 5, p. 67, pl. 30, figs. 3a-c.
- 1931 *Rotalia beccarii* CUSHMAN, Ibid., Bull. 104, pt. 8, p. 58, pl. 12, figs. 1-7; pl. 13, figs. 1-2.
- 1952 *Strebulus beccarii* BERMUDEZ, Bol. de Geol., vol. 2, no. 4, p. 71, pl. 12, figs. 2a-c.
- 1957 *Strebulus beccarii* TODD, U. S. Geol. Surv., Prof. Paper 280-H, p. 290, pl. 91, figs. 3a-c.
- 1959 "*Rotalia*" *beccarii* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 99, pl. 15, figs. 1a-c.

The present form has no umbilical boss on ventral side, and sutures are limbated and slightly raised on dorsal side. The periphery is rounded and not lobulated. The dorsal side is rather flattend.

FIGURED SPECIMEN: OMNH Reg. No. F8478F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8422F, F8451F.

OCCURRENCE: Few, in sample A and B.

Strebulus beccarii (LINNÉ)

var. *tepida* CUSHMAN

Plate 7, figures 5a, b; 6a, b; 8a, b.

- 1926 *Rotalia beccarii* (LINNÉ) var. *tepida* CUSHMAN, Carnegie Inst. Washington, Publ. 344, p. 79, pl. 1.
- 1931 *Rotalia beccarii* (LINNÉ) var. *tepida* CUSHMAN, U. S. Nat. Mus., Bull. 104, Pt. 8, p. 61, pl. 13, figs. 3a-c.
- 1951 "*Rotalia*" *beccarii* (LINNÉ) var. *tepida* PHLEGER and PARKER, Geol. Soc. America, Mem., vol. 46, pt. 2, p. 23, pl. 12, figs. 7a-b.
- 1957 *Strebulus beccarii* (LINNÉ) var. *tepida*, TODD and BRONNIMANN, Cushman Found. Foram. Res., Spec. Publ., no. 3, p. 38, pl. 10, figs. 5-11.
- 1961 *Strebulus beccarii* (LINNÉ) var. *tepida* ANDERSEN, Louisiana Geol. Surv., Geol. Bull. 35,

pt. 2, p. 99, pl. 22, figs. 2a-b.

This form is reported from Gulf of Mexico, West Indian region and Caribbean Sea, in shallow waters and Mangrove swamps.

FIGURED SPECIMENS: OMNH Reg. Nos. F8479F, F8480F, F8482F.

UNFIGURED SPECIMENS: OMNH Reg. Nos. F8423F, F8452F.

OCCURRENCE: Few, in sample A and B.

Strebulus ketienziensis ISHIZAKI

var. *angulata* (KUWANO)

Plate 7, figures 7a, b.

- 1950 *Rotalia ketienziensis* (ISHIZAKI) var. *angulata* KUWANO, Jour. Geol. Soc. Japan, vol. 56, no. 657, p. 312, figs. 1a-c.
- 1951 *Rotalia ketienziensis* (ISHIZAKI) var. *angulata* ASANO, III. Cat. Japan. Tert. Small. Foram., pt. 14, p. 14, figs. 109-111.
- FIGURED SPECIMEN: OMNH Reg. No. F8481F.
- UNFIGURED SPECIMENS: OMNH Reg. No. F8424F.
- OCCURRENCE: Rare, in sample A.

Strebulus murrayi

(HERON-ALLEN and EARLAND)

- 1915 *Rotalia murrayi* HERON-ALLEN and EARLAND, Trans. Zool. Soc., London, vol. 20, p. 720, pl. 53, figs. 27-34.
- 1959 "*Rotalia*" *murrayi* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 100, pl. 15, figs. 5a-c.
- The very small specimens are found in the present materials.
- UNFIGURED SPECIMENS: OMNH Reg. No. F8453F.
- OCCURRENCE: Very rare, in sample B.

Conorboides advena (CUSHMAN)

Plate 7, figures 3a, b.

- 1922 *Discorbis advena* CUSHMAN, Carnegie Inst. Washington, Publ. 311, p. 40.

- 1931 *Discorbis advena* CUSHMAN, U. S. Nat. Mus., Bull. 104, pt. 8, p. 13, pl. 2, figs. 8a-c.
- 1952 *Discopulvinulina advena* BERMUDEZ, Bol. de Geol., vol. 2, pt. 4, p. 33, pl. 3, figs. 1a-c.
- 1957 *Strebulus advenus* TODD and BRONNIMANN, Cushman Found. Foram. Res., Spec. Publ., no. 3, p. 38, pl. 11, figs. 2a-b.
- 1959 *Discopulvinulina advena* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 92, pl. 13, figs. 21a-c.
- 1960 *Conorboides advena* BARKER, Soc. Econ. Paleont. Min., Spec. Publ., no. 9, p. 180, pl. 87, figs. 1a-c.

This species was described from and reported as common in the Tortugas region off Florida. It was also reported as common in the area of northern Mindoro Is., Philippines, in shallow waters.

FIGURED SPECIMEN: OMNH Reg. No. F8459F.
UNFIGURED SPECIMENS: OMNH Reg. No. F8400F.

OCCURRENCE: Few, in sample A.

***Rosalina* sp. A.**

Plate 7, figures 1a, b; 2a, b.

This form somewhat resembles ASANO's figures of *Discopulvinulina nagoi*, but differs from it in having seven chambers in the last whorl, the rounded periphery and less compressed test.

FIGURED SPECIMENS: OMNH Reg. Nos. F8421F, F8477F.

OCCURRENCE: Very rare, in sample A.

***Rosalina* sp. B.**

Plate 6, figures 15a, b.

This form somewhat resembles *Rosalina globularis* D'ORBIGNY but differs from it in having nearly circular, less lobulated outline of periphery and less inflated chambers.

FIGURED SPECIMEN: OMNH Reg. No. F8473F.
UNFIGURED SPECIMEN: OMNH Reg. No.

F8420F.

OCCURRENCE: Very rare, in sample A.

***Buccella* sp.**

Only one very small broken specimen was obtained from the present materials.

UNFIGURED SPECIMEN: OMNH Reg. No. F8395F.

OCCURRENCE: Very rare, in sample A.

Family CYMBALOPORIDAE

***Cymbaloporetta bradyi* (CUSHMAN)**

- 1884 *Cymbalopora poeyi* (D'ORBIGNY) var. BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 637, pl. 102, figs. 14a-b.
- 1915 *Cymbalopora poeyi* (D'ORBIGNY) var. *bradyi* CUSHMAN, U. S. Nat. Mus., Bull. 71, pt. 5, p. 25, pl. 10, figs. 2a-c.
- 1924 *Cymbalopora bradyi* CUSHMAN, Carnegie Inst. Washington, Publ. 342, p. 34, pl. 10, figs. 2-4.
- 1931 *Cymbaloporetta bradyi* CUSHMAN, U. S. Nat. Mus., Bull. 104, pt. 8, p. 85.
- 1957 *Cymbaloporetta bradyi* TODD and BRONNIMANN, Cushman Found. Foram. Res., Spec. Publ., no. 3, p. 37, pl. 11, figs. 9a-b.
- 1959 *Cymbaloporetta bradyi* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 108, pl. 18, figs. 2a-c.
- 1960 *Cymbaloporetta bradyi* BARKER, Soc. Econ. Paleont. Min., Spec. Publ., no. 9, p. 210, pl. 102, figs. 14a-d.
- UNFIGURED SPECIMEN: OMNH Reg. No. F8399F.
- OCCURRENCE: Very rare, in sample A.

Family CASIDULINIDAE

***Cassidulina* sp.**

Plate 7, figures 9a, b.

The present moderately compressed specimen

seems to be a young one belonging to genus *Cassidulina*.

FIGURED SPECIMEN: OMNH Reg. No. F8397F.

OCCURRENCE: Very rare, in sample A.

Family ANOMALINIDAE

Cibicides lobatulus (WALKER and JACOB)

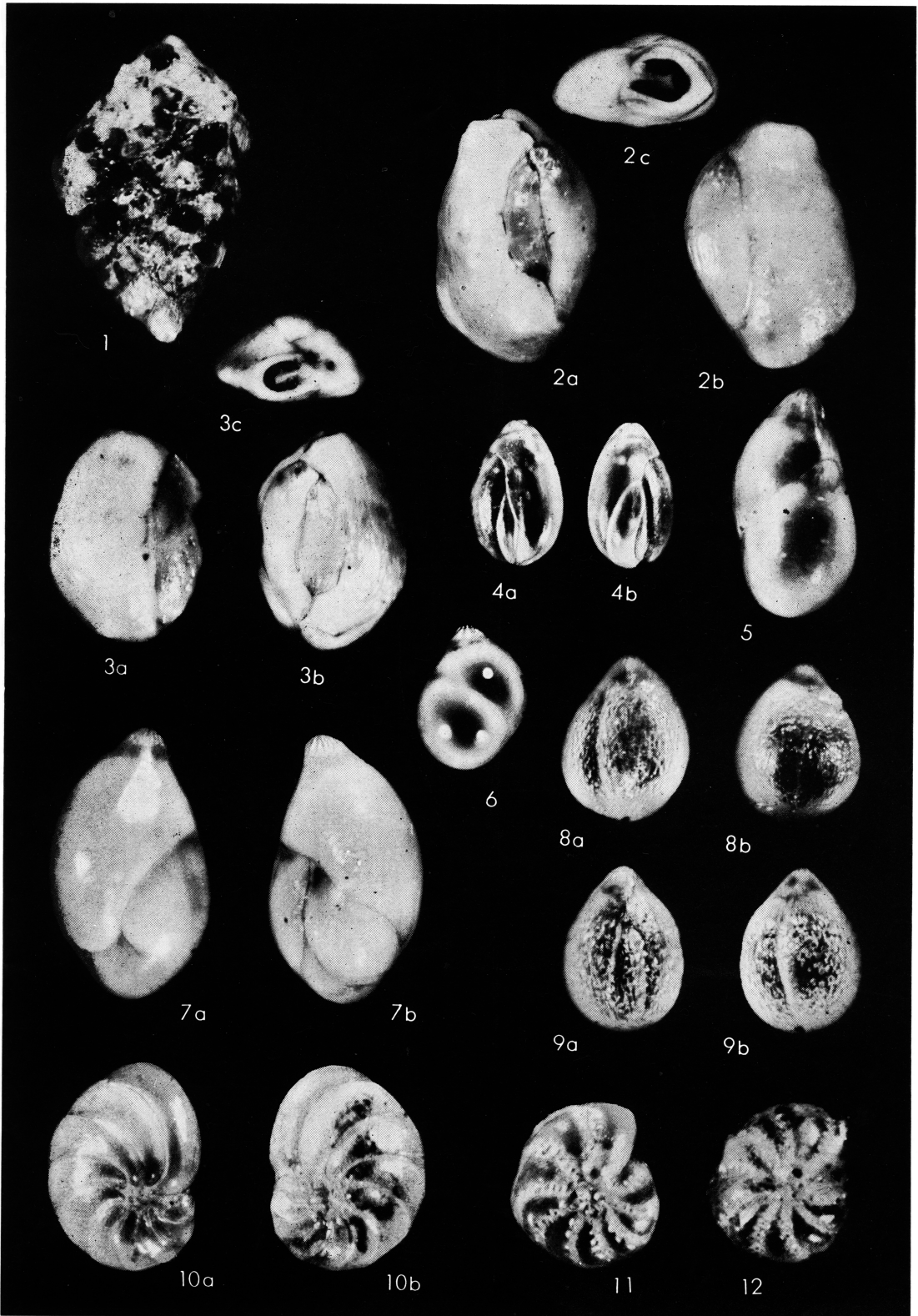
- 1798 *Nautilus lobatulus* WALKER and JACOB, Adams' Essays, p. 642, pl. 14, fig. 36.
- 1884 *Truncatulina lobatula* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 660, pl. 92, fig. 10; pl. 93, figs. 1, 4, 5.
- 1915 *Truncatulina lobatula* CUSHMAN, U. S. Nat. Mus., Bull. 71, pt. 5, p. 31, pl. 15, fig. 1.
- 1931 *Cibicides lobatula* CUSHMAN, Ibid. Bull. 104, pt. 8, p. 118, pl. 21, figs. 3a-c.
- 1946 *Cibicides lobatulus* CUSHMAN, Cushman Lab. Forum. Res., Spec. Publ., no. 17, p. 9, pl. 2, figs. 6-7.
- 1951 *Cibicides lobatulus* ASANO, Ill. Cat. Japan. Tert. Small. Forum., pt. 13, p. 17, figs. 36-38.
- 1959 *Cibicides lobatulus* GRAHAM and MILITANTE, Stanford Univ. Publ., Geol. ser., vol. 6, no. 2, p. 116, pl. 19, figs. 12a-c.
- 1960 *Cibicides lobatulus* BARKER, Soc. Econ. Paleont. Min., Spec. Publ., no. 9, p. 190, pl. 92, fig. 10; p. 192, pl. 93, figs. 1a-c, 4, 5.
- Only one very small specimen was obtained from the present materials.
- UNFIGURED SPECIMEN: OMNH Reg. No. F8398F.
- OCCURRENCE: Very rare, in sample A.

References

- ICHIHARA, M. (1954): Bottom Sediments of Osaka Bay, Pt. 1, Mechanical Analysis and Frustules of Diatom, *Jour. Inst. Polytech. Osaka City Univ.*, ser. G, vol. 2, pp. 89-99.
- , K. HUZITA, A. MORISHITA and K. NAKASEKO (1955): Stratigraphy of the Osaka Group in the Senriyama Hills (in Japanese with English abstract), *Jour. Geol. Soc. Japan*, vol. 61, pp. 433-441.
- (1961): Some Problems of the Quaternary Sedimentaries in the Osaka and Akashi Areas, Japan, *Jour. Inst. Polytech. Osaka City Univ.*, ser. G, vol. 5, pp. 13-30.
- KANEKO S. and H. KAJIYAMA (1962): Pleistocene mollouscan and other fossils in Osaka (in Japanese), *Nature Study*, vol. 8, pp. 106-116.
- NAKASEKO, K. (1953): Foraminiferal Thanatocoenoses of Osaka Bay, (in Japanese with English abstract) *Sci. Rep. South & North Coll. Osaka Univ.*, no. 2, pp. 101-105.
- and M. CHIJI (1956): On the fossil Foraminifera in the Subsurface Sediments in Osaka City and Its Suburbs (in Japanese with English abstract), *Sci. Rep. South & North Coll. Osaka Univ.*, no. 5, pp. 43-71.
- TAKAYANAGI, Y. (1953): Distribution of the Recent Foraminifera from the adjacent seas of Japan (I), (Izumi-nada in the Eastern Part of the Inland Sea of Japan), *Rec. Oceanographic Works in Japan*, vol. 1, no. 2, N.S., pp. 78-85.

Plate 5

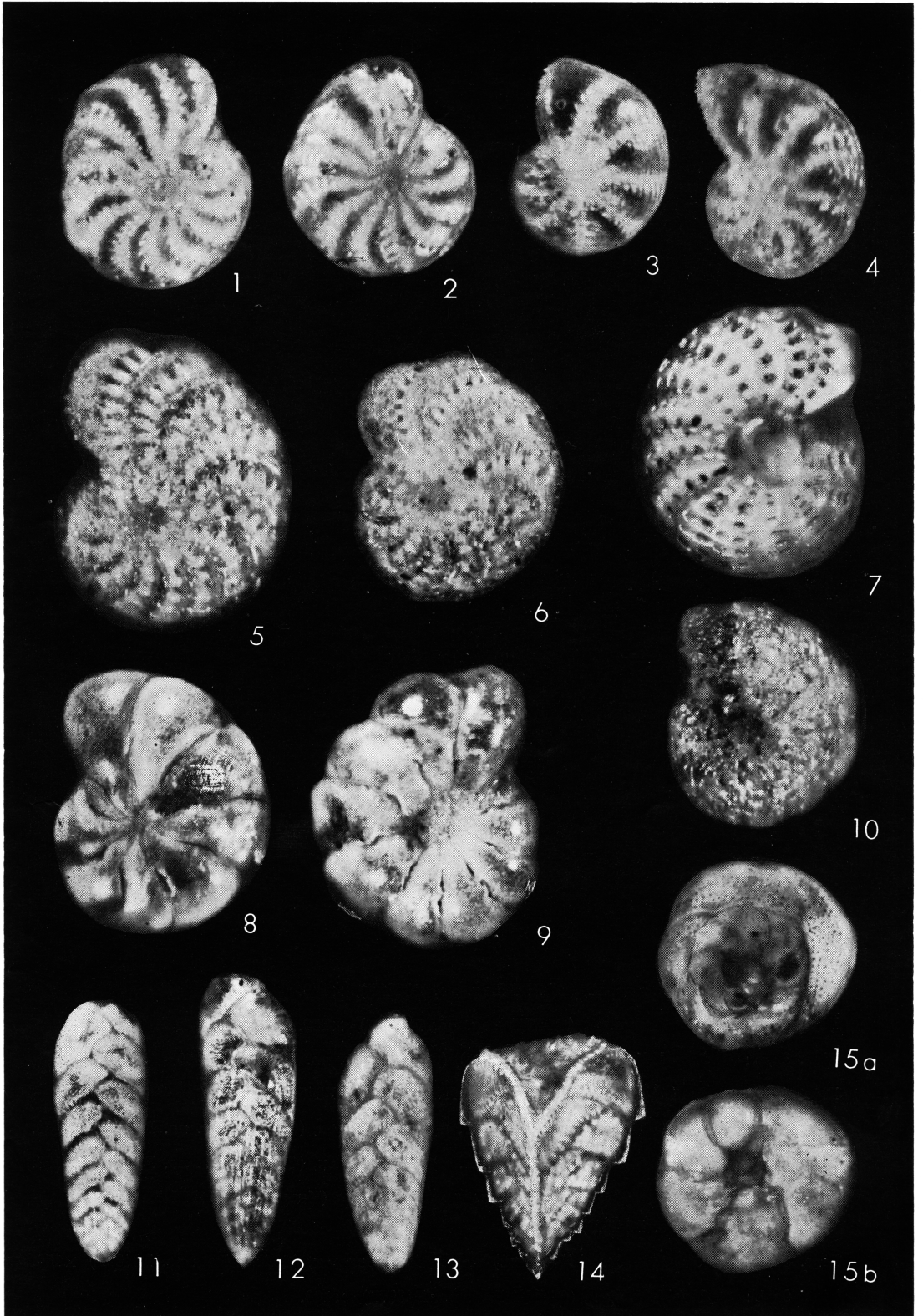
- Fig. 1: *Textularia foliacea* HERON-ALLEN & EARLAND, (OMNH Reg. no. F8483F), ×120.
- Figs. 2a, b, c: *Triloculina* sp., (OMNH Reg. no. F8484F), ×120.
- Figs. 3a, b, c: *T.* sp., (OMNH Reg. no. F8425F), ×120.
- Figs. 4a, b: *Guttulina lactea* (WALKER & JACOB), (OMNH Reg. no. F8411F), ×150.
- Fig. 5: *Pseudopolymorphina* sp., (OMNH Reg. no. F8475F), ×120.
- Fig. 6: *P.* sp., (OMNH Reg. no. F8418F), ×150.
- Figs. 7a, b: *Guttulina orientalis* CUSHMAN & OZAWA, (OMNH Reg. no. F8472F), ×120.
- Figs. 8a, b: *Globulina inaequalis* REUSS var., (OMNH Reg. no. F8410F), ×150.
- Figs. 9a, b: *G. inaequalis* REUSS var., (OMNH Reg. no. F8471F), ×150.
- Figs. 10a, b: *Pseudononion atlanticus* (CUSHMAN), (OMNH Reg. no. F8474F), ×120.
- Fig. 11: *Elphidium* cf. *translucens* NATLAND, (OMNH Reg. no. F8467F), ×150.
- Fig. 12: *Elphidium* cf. *translucens* NATLAND, (OMNH Reg. no. F8468F), ×150.



M. CHIJI: Foraminiferal Faunules from the Uemati Formation, Osaka City

Plate 6

- Fig. 1 : *Elphidium advena* (CUSHMAN), (OMNH Reg. no. F8460F), ×100.
- Fig. 2 : *E. advena* (CUSHMAN) var. *depressulum* CUSHMAN, (OMNH Reg. no. F8428F), ×100.
- Fig. 3 : *E. sp. A*, (OMNH Reg. no. F8469F), ×150.
- Fig. 4 : *E. sp. A*, (OMNH Reg. no. F8470F), ×150.
- Fig. 5 : *E. jenseni* (CUSHMAN), (OMNH Reg. no. F8463F), ×100.
- Fig. 6 : *E. jenseni* (CUSHMAN), (OMNH Reg. no. F8464F), ×100.
- Fig. 7 : *E. cf. fimbriatulum* (CUSHMAN), (OMNH Reg. no. F8461F), ×150.
- Fig. 8 : *E. subincertum* ASANO, (OMNH Reg. no. F8466F). ×120.
- Fig. 9 : *E. subincertum* ASANO, (OMNH Reg. no. F8465F), ×120.
- Fig. 10 : *E. hispidulum* CUSHMAN, (OMNH Reg. no. F8462F), ×120.
- Fig. 11 : *Bolivina striatula* CUSHMAN, (OMNH Reg. no. F8394F), ×120.
- Fig. 12 : *B. striatula* CUSHMAN, (OMNH Reg. no. F8458F), ×120.
- Fig. 13 : *B. striatula* CUSHMAN, (OMNH Reg. no. F8457F), ×120.
- Fig. 14 : *Reussella miocenica* CUSHMAN, (OMNH Reg. no. F8419F), ×150.
- Figs. 15a, b : *Rosalina sp. B*, (OMNH Reg. no. F8473F), ×120.



M. CHIJI: Foraminiferal Faunules from the Uemati Formation, Osaka City

Plate 7

- Figs. 1a, b: *Rosalina* sp. A, (OMNH Reg. no. F8421F), $\times 150$.
- Figs. 2a, b: *R.* sp. A, (OMNH Reg. no. F8477F), $\times 150$.
- Figs. 3a, b: *Conorboides advena* (CUSHMAN), (OMNH Reg. no. F8459F), $\times 150$.
- Figs. 4a, b: *Strebulus beccarii* (LINNÉ), (OMNH Reg. no. F8451F), $\times 100$.
- Figs. 5a, b: *S.* *beccarii* (LINNÉ) var. *tepida* CUSHMAN, (OMNH Reg. no. F8480F), $\times 150$.
- Figs. 6a, b: *S.* *beccarii* (LINNÉ) var. *tepida* CUSHMAN, (OMNH Reg. no. F8479F), $\times 150$.
- Figs. 7a, b: *S.* *ketienziensis* ISHIZAKI var. *angulata* (KUWANO), (OMNH Reg. no. F8481F), $\times 120$.
- Figs. 8a, b: *S.* *beccarii* (LINNÉ) var. *tepida* CUSHMAN, (OMNH Reg. no. F8482F), $\times 150$.
- Figs. 9a, b: *Cassidulina* sp., (OMNH Reg. no. F8397F), $\times 100$.



M. CHIJI: Foraminiferal Faunules from the Uemati Formation, Osaka City