

## Deposits of Foraminiferal Tests in the Kii Strait, Japan

By

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(Received Sept. 28, 1957)

### Abstract

Distribution of foraminiferal tests in the Kii Strait are examined. Samples were obtained from 28 stations.

The composition of fauna in this area is considerably unique as compared with the other bays or shallow seas in Japan.

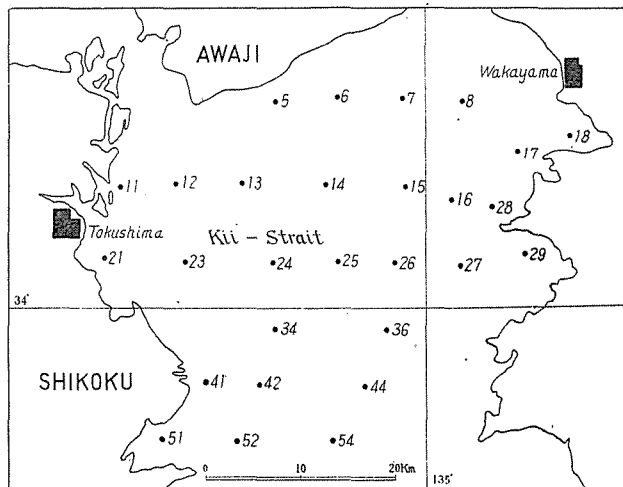


Fig. 1. Geographical location map.

### Introduction

This investigation is intentioned to obtain the ecologic criteria of the Recent foraminiferal fauna in the Kii Strait for the basis of paleoecologic research in the Paleo-Setouchi Group (The Neogenic strata that have deposited in the various basins in Kinki area). The Kii Strait is situated in the vicinity of Lat. 38°N, Long. 135°E.

The materials used for this work were collected by T. HABA and J. ITOGAWA.

The survey began on the 28th October and finished on the 4th November 1955, for the purpose of making a research in the thanatology and ecology of Mollusca. I express my gratitudes to all gentlemen who gave me many helps and particularly thanks are due to Prof. J. MAKIYAMA, Assist. Prof. M. MORISHIMA, T. HABE and J. ITOIGAWA for their kind suggestions.

Table 1.

Station No.	Depth (m)	Bottom Salinity (Cl ‰)	Bottom Chracter
5	23	18.70	fs
6	59	18.67	fs, sh
7	60	18.36	fs
8	52	18.50	Mnd
11	10	17.54	—
12	21	17.95	—
13	47	18.25	—
14	60	18.80	fs
15	68	18.89	Mud
16	59	18.60	Mud
17	32	18.36	Mud
18	10	18.31	—
21	17	17.56	Mud
23	46	18.38	Mud
24	54	18.62	Mud
25	58	18.65	Mud
26	70	18.88	fs
27	65	18.55	Mud
28	37	18.38	fs
29	34	18.42	fs
34	65	18.65	Mud
36	71	18.54	fs
41	42	17.91	Mud
42	60	17.65	Mud
44	74	18.95	Mud
51	15	18.04	Mud
52	50	17.49	Mud
54	80	19.07	Mud

(fs: fine sand, sh: shell fragments,)

### Method of Investigation

Bottom samples were taken from 28 stations. Ekman-Lenz's Bottom Sampler was employed.

About 30cc. of surface material of each locality was screened with the 200 mesh standard sieve.

The populations of Foraminifera in the residues were counted. In order to get the outline of the fauna of this region, the distribution chart was made at first.

The percentage densities of species were shown on Table 2.

### Distribution of foraminiferal tests

The composition of foraminiferal tests in this area is different from the other bays or shallow seas in that the various elements take places together at almost all stations. The mixed fauna is divisible into the following 4 groups: pelagic forms, arenaceous forms, calcareous imperforate forms and calcareous perforate forms.

#### Pelagic foraminiferal forms

The distribution of the pelagic forms shows nearly the same tendency as those of the other bays in Japan.

The pelagic forms are limited to the transitional zone between the bay and open sea waters. The following 4 species are recognized: *Globigerina bulloides* D'ORBIGNY, *G. eggeri* BHUMBLER, *G. inflata* D'ORBIGNY and *G. sp.*. These species compose only a small portion (5%) of the population.

Generally speaking, the number of pelagic forms increases toward the open sea area. The greatest number of the tests of this species is found at the station 44.

#### Arenaceous foraminiferal forms

The distribution of the arenaceous forms is not like the cases of Ago bay, Osaka bay, and Hiuchi-Nada.

These forms occur almost over the whole area; the following 5 species are dominant: *Ammobaculites foliaceus* (BRADY), accompanied with *Verneuilina advena* (CUSHMAN), *Haplophragmoides canariensis* (D'ORBIGNY), *Trochammina globigeriniformis* (PARKER and JONES), and *Textularia agglutinans* D'ORBIGNY.

Usually these forms are good indicators of the strong embayment character. However, the arenaceous forms altogether are only 7% of the total in population.

Generally the number of arenaceous forms increases toward the interior part of the Strait.

This group is regarded to represent the embayment water.

#### Imperforate foraminiferal forms

This group occurs almost everywhere in the area though low percentage (4.5%) in population and it is composed of only one family, *Miliolidae*. The following 5 species are dominant species: *Quinqueloculina vulgaris* D'ORBIGNY, *Q. lamarckiana* D'ORBIGNY, *Massilina alveoliformis* (MILLET), *Sigmoilina arenaria* (BRADY) and *Schlumbergesina alveoliformis* (BRADY).

The number of this fauna increases toward the interior part of the Strait in general. The greatest number is found in the vicinity of the Awaji Island.

#### Perforate foraminiferal forms

This group is found at almost all the stations, except those in the shore of Shikoku.



in the Kii Strait, Japan.

15	16	17	18	21	23	24	25	26	27	28	29	34	36	41	42	44	51	52	54
													5.0		0.4				
															1.5				
	0.3										0.5								
	1.2										1.0					0.4	8.0		
				2.5													12.0		
	0.6		100.0	45.0				1.0		25.0		1.2	0.5				16.0		
0.5				8.0														4.3	
																0.4		4.3	
								1.4								0.4			
																0.4			
											1.5								
2.0																			
				10.0	50.0		12.0			50.0							0.8		
				5.0				1.8	1.7		0.5								
1.0	0.6																0.8		
	1.0							1.8									0.8		
	0.3																		
								1.8											
													0.5						
															0.4				
																	12.0		
																2.4	4.0	4.3	
																1.2	4.0		
1.0											1.0					2.4	8.0	13.0	
												1.2						8.8	
	1.5							1.8			1.5								
															0.4				
												2.4			0.4				
																0.4			
								1.8										4.3	
												2.4			1.0	1.6			
											0.5								
												1.2							
	0.3										0.5								
																	16.0		
																		8.6	
				22.0															
	0.3				5.0														
0.5	0.6							1.8	1.7		1.0	1.2	2.5		1.0	1.2			
0.5																			
													0.5						
7.5	0.3							4.6											
													3.5		2.0				12.0

Table 2.

			Station							
Foraminifera			5	6	7	8	11	12	13	14
51	<i>Lagenodosaria</i>	<i>aculeata</i>	(D'ORBIGNY)	—	—	—	—	—	—	—
52		<i>saclaris</i>	(BATSCH)	—	—	—	0.4	—	—	—
53	<i>Nodosaria</i>	<i>raphanus</i>	(LINNAEUS)	—	—	—	—	—	—	—
54	<i>Dentalina</i>	<i>consobrina</i>	(D'ORBIGNY)	—	—	—	—	—	—	—
55		<i>emaciata</i>	REUSS	—	—	—	—	—	—	—
56	<i>Lagena</i>	<i>elongata</i>	(EHRENBERG)	—	—	—	—	—	—	—
57		<i>laevis</i>	(MONTAGU)	—	—	—	—	—	—	—
58		<i>melo</i>	(D'ORBIGNY)	—	—	—	—	—	—	—
59	cf.	<i>orbignyana</i>	(SEGUENZA)	—	—	—	—	—	—	—
60		<i>striata</i>	D'ORBIGNY	—	—	—	0.4	—	—	3.6
61		<i>sulcata spicata</i>	CUSHMAN and McCULLOCH	—	—	—	—	—	—	—
62	<i>Entosolenia</i>	<i>marginata</i>	(MONTAGU)	—	—	—	—	2.9	—	—
63	cf.	<i>orbignyana</i>	(SEGUENZA)	—	—	—	—	—	—	—
64	<i>Gutulina</i>	<i>kishinouyei</i>	CUSHMAN and OZAWA	0.8	—	—	—	—	—	—
65		<i>pacifica</i> ( <i>Sigmoidina</i> )	(CUSHMAN and OZAWA)	0.4	—	0.5	—	—	—	—
66	<i>Glandulina</i>	<i>rotundata</i>	REUSS	—	—	—	—	—	—	—
67	<i>Pseudopolymorphina</i>	sp.		0.4	—	0.5	—	—	—	—
68	<i>Nonion</i>	<i>bouenum</i>	(D'ORBIGNY)	—	—	—	—	—	—	—
69		<i>grateloupi</i>	(D'ORBIGNY)	—	—	—	—	—	—	—
70		<i>japonicum</i>	ASANO	5.8	39.0	13.0	3.6	11.6	—	24.8
71		<i>orbicularis</i>	(BRADY)	—	—	—	—	—	—	—
72		<i>pacificum</i>	(CUSHMAN)	—	—	—	—	—	—	—
73		<i>scaphum</i>	(FICHEL and MOLL)	—	—	—	—	—	—	—
74	cf.	<i>umbilicatum</i>	MONTAGU	—	—	—	0.4	—	—	—
75	<i>Pseudononion</i>	<i>japonicum</i>	ASANO	—	2.6	—	2.8	—	—	6.0
76	<i>Elphidium</i>	<i>advenum</i>	(CUSHMAN)	20.0	3.9	8.0	8.0	8.7	—	10.0
77		<i>fax barbarensis</i>	(NICOL)	14.0	—	—	0.4	2.9	—	—
78		<i>granulosum</i>	(GALLOWAY and WISSLER)	—	—	—	—	5.8	—	—
79		<i>jenseni</i>	(CUSHMAN)	—	—	—	—	—	—	—
80		<i>verricatum</i>	(BRADY)	—	—	0.5	—	—	—	—
81		sp.		—	—	—	—	—	—	—
82	<i>Bulimina</i>	<i>aculeata</i>	D'ORBIGNY	0.4	—	—	—	—	—	—
83		<i>marginata</i>	D'ORBIGNY	0.4	1.3	0.5	1.2	—	—	—
84		sp.		—	—	—	—	—	—	—
85	<i>Globobulimina</i> cf.	<i>perversa</i>	(CUSHMAN)	—	—	—	—	—	—	—
86	<i>Virgulina</i>	<i>bradyi</i>	CUSHMAN	1.6	—	—	—	—	—	—
87		<i>shreibersiana</i>	CZJZEK	—	3.9	—	1.2	—	—	—
88		sp.		—	—	1.0	—	—	—	—
89	<i>Bolivina</i> cf.	<i>beyrichi</i>	REUSS	—	—	—	—	—	—	—
90		<i>hanikeniana</i>	BRADY	—	—	—	—	—	—	—
91		<i>limbata</i>	BRADY	—	—	—	0.8	—	—	—
92	<i>Bolivina</i>	<i>pseudodiformis</i>	ASANO	—	—	—	—	—	—	—
93		<i>robusta</i>	BRADY	4.4	9.1	2.0	30.0	—	—	22.0
94		<i>subangularis</i>	ASANO	—	—	—	—	—	—	—
		<i>ogasaensis</i>		—	—	—	—	—	—	—
95		<i>seminuda</i>	CUSHMAN	—	—	—	—	—	—	—



Table 2.

Station			Station									
			5	6	7	8	11	12	13	14		
Foraminifera												
96	<i>semicostata</i>	CUSHMAN	—	—	—	—	—	—	—	—	—	—
97	<i>textilarioides</i>	REUSS	—	—	—	—	—	—	—	—	—	—
98	sp.		—	—	—	—	—	—	—	—	—	4.8
99	<i>Loxostoma amygdalaeforme</i>	(BRADY)	—	—	1.0	—	—	—	2.9	—	—	—
100	<i>Reussella aculeata</i>	CUSHMAN	2.8	—	—	0.4	—	—	2.9	—	—	—
101	<i>Uvigerina excellens</i>	TODD	—	—	—	—	—	—	—	—	—	—
102	<i>farinosa</i>	HANTKEN	—	—	—	—	—	—	—	—	—	—
103	<i>proboscidea</i>	SCHWAGER	—	—	—	1.6	—	—	—	—	—	2.4
104	<i>tenuistriata</i>	REUSS	—	—	—	—	—	—	—	—	—	—
105	sp.		—	—	—	—	—	—	—	—	—	—
106	<i>Siphogenerina raphana</i>	PARKER and JONES	0.4	—	—	—	—	—	—	—	—	—
107	<i>Discorbis bacconica</i>	(HANTKEN)	—	—	—	—	—	—	—	—	—	—
108	<i>vilardeboana</i>	(D'ORBIGNY)	—	—	—	—	—	—	—	—	—	—
109	<i>Discopulvinulina bertheloti</i>	(D'ORBIGNY)	—	—	—	—	—	—	—	—	—	—
110	cf. <i>isabellena</i>	(D'ORBIGNY)	12.0	—	3.5	8.0	—	—	—	—	—	—
111	cf. <i>orbicularis</i>	(TERQUEM)	0.4	—	—	—	—	—	—	—	—	—
112	<i>Eponides fragidus</i>	(CUSHMAN)	—	—	—	—	—	—	—	—	—	—
113	<i>haidingerii</i>	(D'ORBIGNY)	—	—	3.0	—	—	—	—	—	—	—
114	<i>procerus</i>	(BRADY)	—	—	1.5	—	—	—	—	—	—	—
115	sp.		—	—	—	—	—	—	—	—	—	—
116	<i>Rotalia beccarii</i>	(LINNAEUS)	8.0	20.0	0.5	2.4	—	—	2.9	—	—	18.8
117	<i>papillosa</i>	(BRADY)	6.4	11.0	7.5	4.6	—	—	29.0	—	—	2.4
118	sp.		—	—	—	—	—	—	—	—	—	—
119	<i>auriculus</i>	(FICHEL and MOLL)	0.4	—	1.0	—	—	—	—	—	—	—
120	<i>Baggina philippinensis</i>	(CUSHMAN)	—	—	—	—	—	—	—	—	—	—
121	cf. "		—	—	0.5	—	—	—	—	—	—	—
122	<i>Amphistegina radiata</i>	(MICHEL and MOLL)	0.8	—	—	0.4	—	—	—	—	—	—
123	<i>Cymbalopora</i> cf. <i>squammosa</i>	(D'ORBIGNY)	—	—	—	—	—	—	—	—	—	—
124	<i>Cassidulina laevigata</i>	D'ORBIGNY	—	—	—	—	—	—	—	—	—	1.2
125	<i>Epistominella tamana</i>	(KUWANO)	—	—	—	—	—	—	—	—	—	—
126	sp.		—	—	—	—	—	—	—	—	—	—
127	<i>Anomalina balthica</i>	(SCHROETER)	—	—	—	—	—	—	—	—	—	—
128	<i>glabrata</i>	CUSHMAN	—	—	—	—	—	—	—	—	—	—
129	<i>Hanzawaia nipponica</i>	ASANO	—	—	—	—	—	—	—	—	—	—
130	<i>Cibicides lobatulus</i>	(WALKER and JACOB)	—	—	3.5	0.4	—	—	—	—	—	—
			1.6	1.3	7.5	2.0	—	—	—	—	—	—
131	<i>refulgens</i>	(MONTFORT)	4.0	—	20.0	5.6	—	—	—	—	—	—
132	<i>Globigerina bulloides</i>	D'ORBIGNY	—	—	—	—	—	—	—	—	—	2.4
133	<i>eggeri</i>	BHUMBLER	—	—	—	—	—	—	—	—	—	—
134	<i>inflata</i>	D'ORBIGNY	—	—	—	—	—	—	—	—	—	—
135	sp.		—	—	—	—	—	—	—	—	—	—
Number of species (Total 135)			27	12	29	32	3	13	1	13		
Population (Total 2639)			246	81	216	235	10	34	2	81		
Benthonic Foraminiferal Number (%)			160	100	100	100	100	100	100	97.6		
Pelagic Foraminiferal Number (%)			—	—	—	—	—	—	—	—	—	—
Arenaceous Foraminiferal Number (%)			3.6	3.9	2.5	13.2	100	17.4	100	2.4		
Calcareous Perforate Foraminiferal Number (%)			72.8	96.1	84.5	76.4	0	82.6	0	97.6		
Calcareous Imperforate Foraminiferal Number (%)			13.6	0	13.0	10.4	0	0	0	0		





The dominant species (11) are as follows: *Bolivina robusta* (BRADY), *Nonion japonica* ASANO, *Elphidium advenum* (CUSHMAN), *Rotalia beccarii* (LINNAEUS), *Rotalia papillosa* BRADY, *Cibicides refulgens* (MONTFORT), *Virgulina schreibersiana* CZYZEK, *Robulus calcar* (LINNAEUS), *Cibicides lobatulus* (WAKLER and JACOB), *Elphidium fax barbarense* (NICOL), and *Bulimina marginata* D'ORBIGNY. These species altogether are 84% of the total in population. This group is the representative of the foraminiferal composition of this area. *Bolivina robusta* (Brady) is predominant, with a high percentage (16%) in population; the greatest number of the tests of this species is found at the station 16.

### References

- ITIHARA, M.: Bottom Sediments of Osaka Bay. Part I. Mechanical Analysis and Frustules of Diatom. Jour. Inst. Polytech., Osaka City University, Ser. G, 2, (1954).
- MORISHIMA, M.: The accumulation of foraminiferal tests in inlets of Wakasa Bay of the Inland Sea of Japan. Nat. Res. Coun. Rept. Comm. Marine Ecol. Paleocol., Washington, no. 7, pp. 89-91, (1947).
- MORISHIMA, M.: Foraminiferal thanatocoenoses of Ago Bay, Kii Peninsula, Japan. Ibid., no. 8, pp. 111-117, (1948).
- MORISHIMA, M. and CHIJI, M.: Foraminiferal thanatocoenoses of Akkeshi Bay and its vicinity. Mem. Coll. Sci., Univ. of Kyoto, Ser. B, XX, no. 2, pp. 113-117, (1952).
- NAKASEKO, K.: Foraminiferal Tanatocoenoses of Osaka Bay, Science Report of North College of Osaka University, 1, No. 2, (1953).