

PLANKTONIC FORAMINIFERAL ASSEMBLAGES AND MERIDIONAL HYDROGRAPHIC SECTIONS IN THE WEST PACIFIC OCEAN

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Introduction

Oceanographical surveys and studies of planktonic foraminiferal assemblage were carried out in Nov. 1989. Plankton were collected in the west Pacific on a voyage from Kagoshima, Japan to Lae in Papua New Guinea, and the water temperature and salinity were noted.

The basic purpose of this study was to consider the ecology and environment of living planktonic foraminifera. Recent planktonic foraminifera provide much information on fossils, and fossils of planktonic foraminifera preserved in strata are very important when considering the geological age and palaeoecology of the strata.

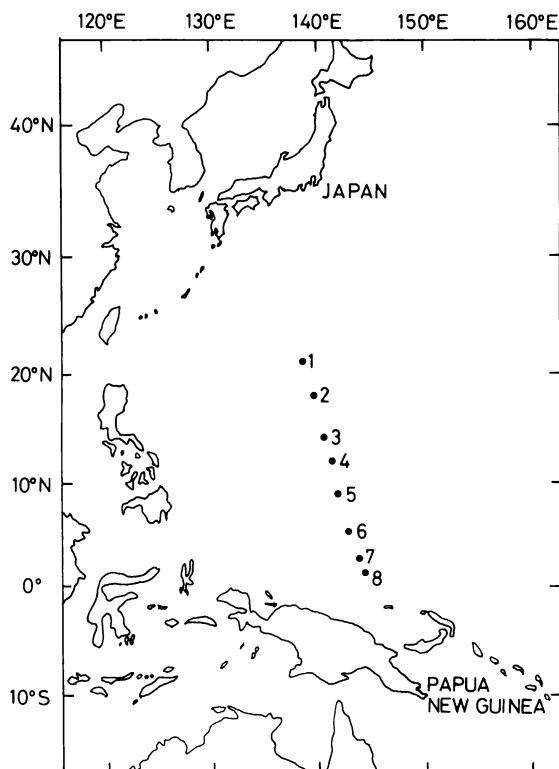


Fig. 1. Sampling stations in the West Pacific Ocean.

Previous Work

Planktonic foraminifera were discovered over a century ago and have been used for biostratigraphic analysis. D'ORBIGNY was the first researcher to describe the planktonic foraminifera from the beach sands of Cuba and Canary Islands in 1826 and 1839 (HEMLEBEN et al., 1989).

In 1884, BRADY reported on planktonic foraminifera collected by the H.M.S. Challenger from the north and south Pacific (BARKER, 1960), and since then living planktonic foraminifera have been studied by many researchers. BRADSHAW (1959) made a study of the ecology of living planktonic foraminifera in the north and equatorial Pacific. PARKER (1962) made a taxonomic study considering variations and intergradations, and discussed some of the planktonic species in the Recent sediment of the eastern half of the south Pacific. UJIÉ (1968) investigated the distribution of each species of living planktonic foraminifera from the southeast Indian Ocean. BÉ (1977) made a study from the ecological and zoogeographical points of view, and reviewed the taxonomy of Recent planktonic foraminifera. LIPPS (1979) studied the ecology and palaeoecology of planktonic foraminifera. SAITO et al. (1981) studied systematically the Recent and Pleistocene planktonic foraminifera. HATTA and HAYASAKA (1987) made a preliminary study of the distribution of planktonic foraminifera in the west Pacific. HEMLEBEN et al. (1989) have completed the most recent study of modern planktonic foraminifera.

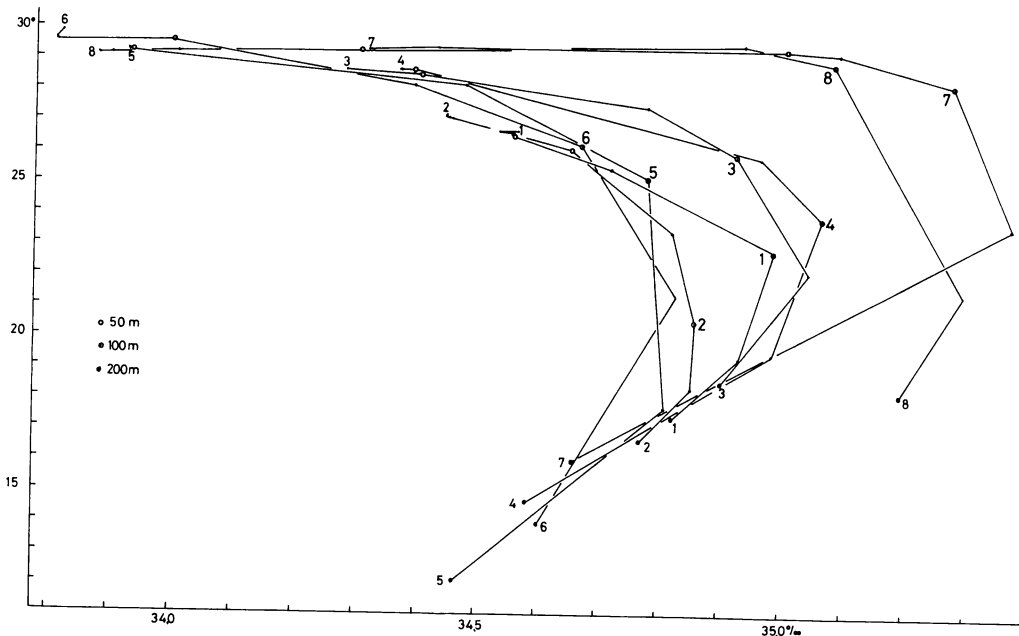


Fig. 2. Temperature and salinity of eight stations in the West Pacific Ocean.

Table 1. Observation data: sampling position, date, operation hour, salinity and water temperature.

Station number Position Start - Finish	No 1		No 2		No 3		No 4		No 5		No 6		No 7		No 8	
	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰	Temp. °	Sal. ‰
0	26.72	34.564	27.26	34.445	28.69	34.279	28.70	34.371	29.20	33.926	29.83	33.817	29.37	34.315	29.15	33.875
10	26.75	34.531	27.23	34.444	28.54	34.388	28.71	34.370	29.25	33.925	29.56	33.806	29.37	34.315	29.14	33.876
20	26.60	34.557	27.18	34.449	28.53	34.398	28.71	34.370	29.25	33.924	29.52	33.806	29.37	34.320	29.17	33.898
30	26.58	34.554	27.16	34.455	28.53	34.400	28.71	34.371	29.25	33.932	29.51	33.807	29.45	34.430	29.23	34.005
50	26.55	34.560	26.18	34.654	28.53	34.402	28.70	34.392	29.24	33.933	29.58	33.999	29.46	35.005	29.34	34.303
75	25.59	34.718	23.51	34.820	27.58	34.776	25.95	34.963	28.23	34.475	28.22	34.391	29.34	35.089	29.61	34.934
100	22.90	34.986	20.58	34.859	26.01	34.925	23.98	35.064	25.27	34.779	26.31	34.672	28.35	35.277	29.00	35.081
150	19.40	34.930	18.46	34.852	22.25	35.043	19.55	34.983	17.77	34.811	21.47	34.827	23.75	35.374	21.57	35.296
200	17.48	34.823	16.71	34.770	18.58	34.902	14.69	34.584	12.11	34.464	14.00	34.603	16.06	34.664	18.23	35.193

Sampling Methods and Materials

Sampling stations are shown in Fig. 1. The eight stations extended from Lat. 21° N, Long. 138° E to 1° N, 144° E. At each sampling station, we collected four samples by vertical towing between depth of 200 and 150 m, 150 and 100 m, 100 and 50 m, 50 and 0 m. The dates, operation hours, sampling positions, salinity, and temperatures of the sea water are shown in Table 1. At each sampling station, it took about one and a half hours to collect four samples.

The temperature-salinity ratio of each station is indicated in Fig. 2. It can be seen that the ratios for stations 7 and 8 are slightly different from the others.

Features of Planktonic Foraminiferal Assemblage

32 samples of fresh planktonic foraminifera have been examined. Table 2 is a list of planktonic foraminifera from 8 sampling stations.

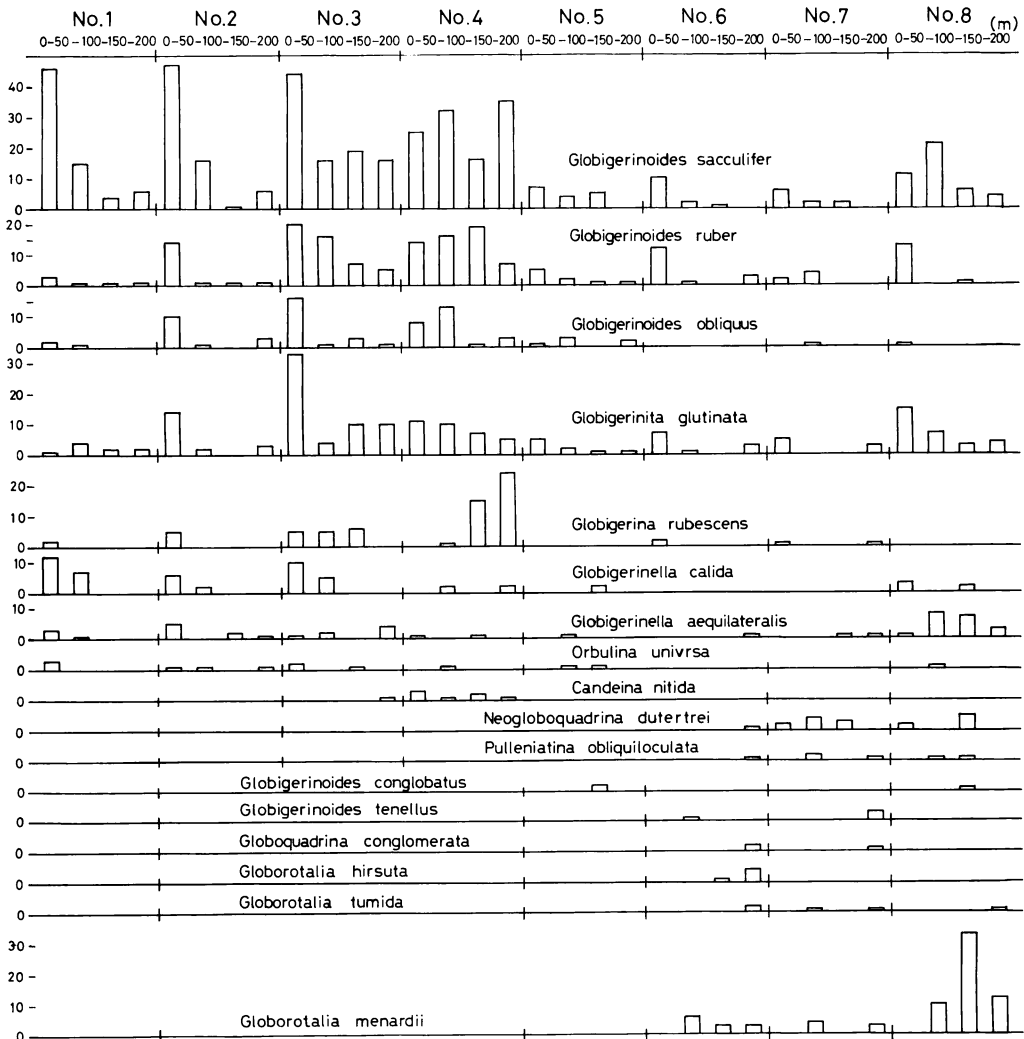


Fig. 3. Frequency distribution of planktonic foraminifera from each sampling zone.

Table 2. Planktonic Foraminifera at stations No. 1 to No. 8.

Station number	No. 1 N21°0' E138°44' 17 : 00—18 : 00	No. 2 N18°0' E139°42' 11 : 30—12 : 50	No. 3 N14°18' E140°44' 8 : 00—9 : 00	No. 4 N12°06' E141°24' 22 : 00—23 : 30	No. 5 N9°0' E141°56' 18 : 00—19 : 15	No. 6 N5°07' E142°54' 15 : 00—16 : 15	No. 7 N2°35' E143°53' 5 : 00—6 : 10	No. 8 N1°08' E144°32' 13 : 30—15 : 00
Depth	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200	0-50-100-150-200
<i>Condeeta nitida</i> D'ORBIGNY			1	3 1 2 1				
<i>Globigerina rubescens</i> HOPKER	2	5	5 5 6	1 15 24		2	1	1
<i>Globigerinella aequilateralis</i> (BRADY)	3 1	5 2 1	1 2 4	1 1 1	1	1	1 1	1 8 7 3
<i>G. calida</i> (PARKER)	12 7	6 2	10 5	2 2	2			3 2
<i>Globigerinita glutinata</i> (EGGER)	1 4 2 2	14 2 3	33 4 10 10	11 10 7 5	5 2 1 1	7 1 3	5 3	15 7 3 4
<i>Globigerinoides conglobatus</i> (BRADY)					2			1
<i>G. obliquus</i> BOLLI	2 1	10 1 3	16 1 3 1	8 13 1 3	1 3 2		1	1
<i>G. ruber</i> (D'ORBIGNY)	3 1 1 1	14 1 1 1	20 16 7 5	14 16 19 7	5 2 1 1	12 1 3	2 4	13 1
<i>G. succitifer</i> (BRADY)	46 15 4 6	47 16 1 6	44 16 19 16	25 32 16 35	7 4 5	10 2 1	6 2 2	11 21 6 4
<i>G. tenellus</i> PARKER						1		3
<i>Globoquadrina conglomerata</i> (SCHWAGER)								1
<i>Globovalvula hirsuta</i> (D'ORBIGNY)								2
<i>G. menardii</i> (PARKER, JONES & BRADY)		1						1
<i>G. tumida</i> (BRADY)						1 4		
<i>Negloboquadrina dutertrei</i> (D'ORBIGNY)						6 3 3	4 3	10 33 12
<i>Orbulina universa</i> (D'ORBIGNY)	3	1 1 1	2 1	1	1 1	2	1 1	2 5
<i>Pulleniatina obliquiloculata</i> (PARKER & JONES)						1		1
Miscellaneous	12 6	47	38 2 2	67 41 29 3	5 3 2	8	3 1 1	1 4 3 3
Total	84 35 7 9	149 23 4 16	169 49 48 39	129 117 90 80	23 16 12 6	39 11 5 20	19 19 6 15	47 52 62 27

The following species were found in every sample : *Globigerinoides sacculifer* (BRADY), *G. ruber* (D'ORBIGNY), and *Globigerinita glutinata* EGGER. *Candeina nitida* D'ORBIGNY was found only in samples from stations No. 3 and 4.

Globorotalia menardii (PARKER, JONES & BRADY), *G. tumida* (BRADY), *Neogloboquadrina dutertrei* (D'ORBIGNY), and *Pulleniatina obliquiloculata* (D'ORBIGNY) were contained only in the sample from station No. 6.

The frequency distribution of each species from every sampling zone is shown in Fig. 3.

Results

Distinct differences were found in planktonic foraminiferal assemblage between the northern region of station No. 5 and southern region of No. 6. The temperature and salinity of sea water at stations No. 7 and 8 distinguish them from other stations. There was also a little difference between the distribution of planktonic foraminiferal assemblage and of sea water.

Globigerinoides sacculifer, *G. ruber*, *G. obliquus* and *Globigerinita glutinata* were conspicuously abundant in the 0–50 m zone during the day (stations No. 1 and 2) and became abundant in the 50–200 m zone at night (station No. 4). *Globorotalia menardii* was abundant in the 50–200 m zone but absent from the 0–50 m zone at three stations (No. 6, 7 and 8). *Candeina nitida* was found at only two stations (No. 3 and 4).

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Explanation of Plate 1

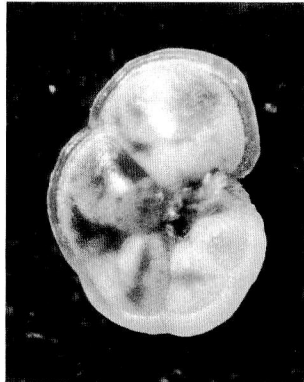
(All figs. $\times 36$)

- Figs. 1–2. *Globorotalia menardii* (PARKER, JONES & BRADY), St. No. 7, 150–200.
Figs. 3–4. *Globorotalia hirsuta* (D'ORBIGNY), St. No. 6, 150–200.
Fig. 5. *Globorotalia tumida* (BRADY), St. No. 6, 150–200.
Fig. 6. *Globigerinella calida* (PARKER), St. No. 1, 0–50.
Fig. 7. *Globigerinella aequilateralis* (BRADY), St. No. 8, 100–150.
Figs. 8–10. *Candeina nitida* D'ORBIGNY, St. No. 4, 100–150.
Fig. 11. *Globigerinoides conglobatus* (BRADY), St. No. 5, 100–150.
Fig. 12. *Globigerinoides obliquus* BOLLI, St. No. 3, 0–50.
Fig. 13. *Globigerinoides ruber* (D'ORBIGNY), St. No. 3, 0–50.
Fig. 14. *Globigerinoides sacculifer* (BRADY), St. No. 3, 0–50.
Fig. 15. *Globigerinoides tenellus* PARKER, St. No. 7, 150–200.
Fig. 16. *Globigerina rubescens*, St. No. 4, 150–200.
Fig. 17. *Globigerinita glutinata* (EGGER), St. No. 3, 0–50.
Fig. 18. *Orbulina universa* (D'ORBIGNY), St. No. 1, 0–50.
Figs. 19–20. *Pulleniatina obliquiloculata* (PARKER & JONES), St. No. 6, 150–200.
Figs. 21–22. *Neogloboquadrina dutertrei* (D'ORBIGNY), St. No. 8, 100–150.
Figs. 23–25. *Globoquadrina conglomerata* (SCHWAGER), St. No. 7, 150–200.
Fig. 26. *Globoquadrina conglomerata* (SCHWAGER), St. No. 6, 150–200.

Plate 1



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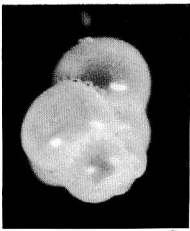
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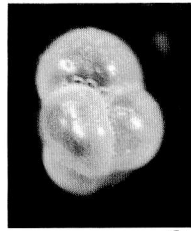
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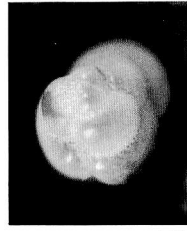
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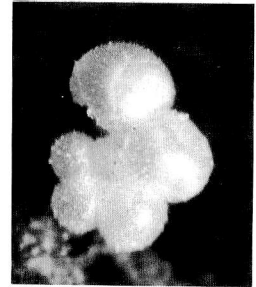
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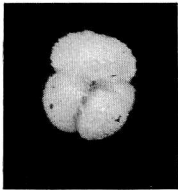
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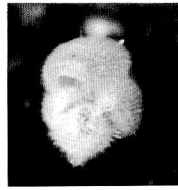
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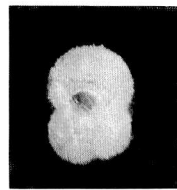
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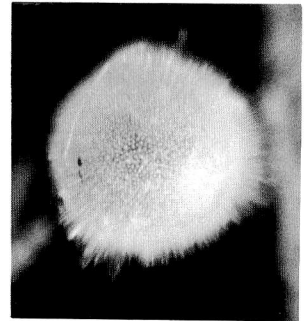
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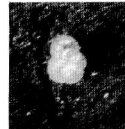
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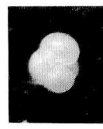
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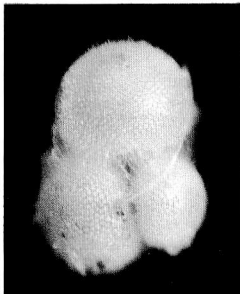
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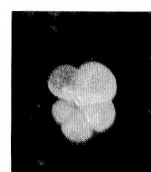
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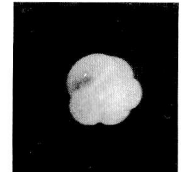
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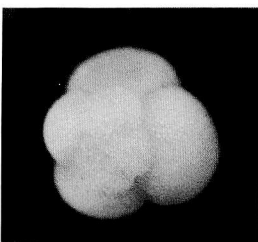
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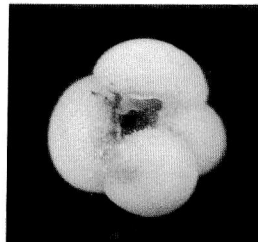
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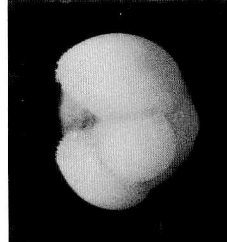
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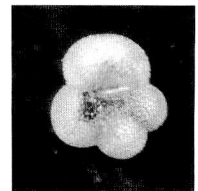
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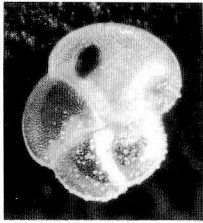
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Explanation of Plate 2

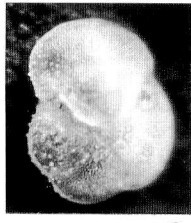
(Figs. 1–14 $\times 60$, Figs. 15–19 $\times 150$)

- Figs. 1–3. *Globorotalia hirsuta* (D'ORBIGNY), St. No. 6, 150–200.
Figs. 4–5. *Globorotalia tumida* (BRADY), St. No. 6, 150–200.
Figs. 6–7. *Globigerinoides obliquus* BOLLI St. No. 3, 0–50.
Fig. 8. *Orbulina universa* (D'ORBIGNY), St. No. 5, 100–150.
Figs. 9–10. *Globigerinoides conglobatus* (BRADY), St. No. 5, 100–150.
Figs. 11–12. *Neogloboquadrina dutertrei* (D'ORBIGNY), St. No. 8, 100–150.
Figs. 13–14. *Globigerinoides ruber* (D'ORBIGNY), St. No. 3, 0–50.
Fig. 15. *Globigerinoides tenellus* PARKER, St. No. 7, 150–200.
Fig. 16. *Globigerina rubescens*, HOFKER, St. No. 4, 150–200.
Fig. 17. *Pulleniatina obliquiloculata* (PARKER & JONES), St. No. 6, 150–200.
Fig. 18. *Globigerinella calida* (PARKER), St. No. 1, 0–50.
Figs. 19–20. *Globigerinita glutinata* (EGGER), St. No. 3, 10–50.

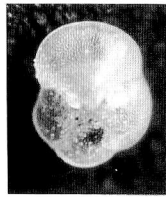
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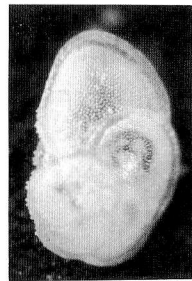
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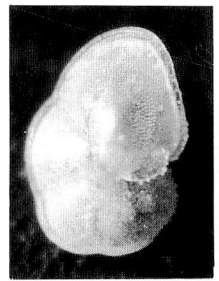
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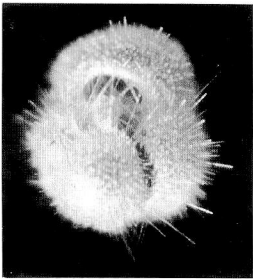
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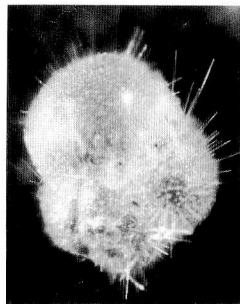
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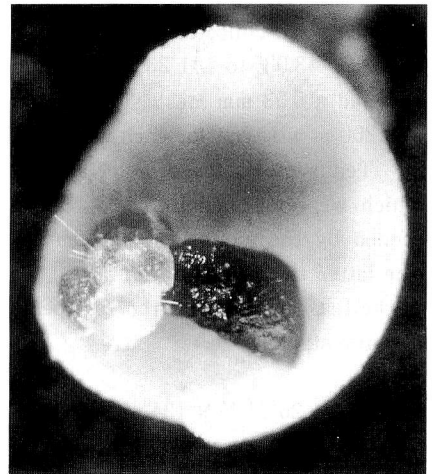
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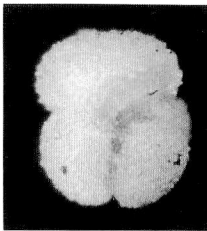
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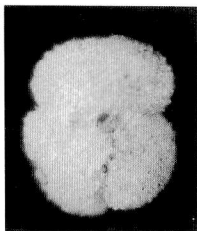
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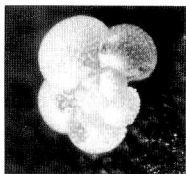
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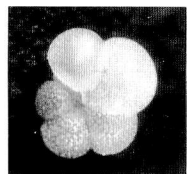
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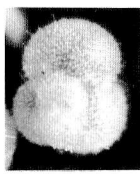
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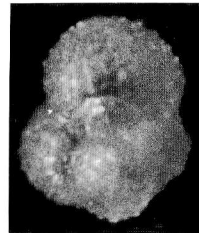
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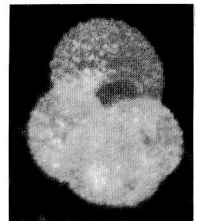
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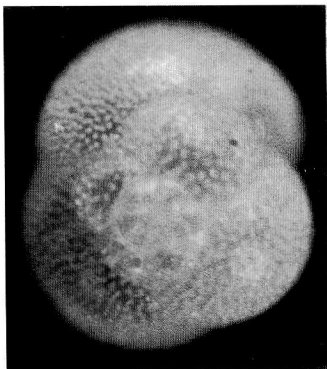
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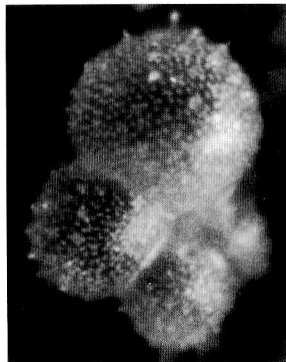
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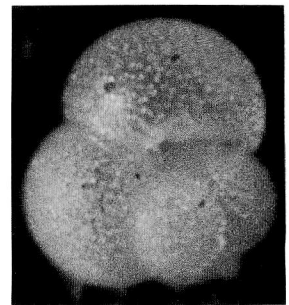
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