CONTRIBUTIONS

FROM THE

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FOR

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Contents

1968

DR. JOSEPH JOHN GRAHAM
1909 - 1967

Dr. Joseph J. Graham, Associate Executive Head of the Stanford University Department of Geology and Professor of Micropaleontology, died of a heart attack November 15, 1967, in Palo Alto, California.

Professor Graham was born April 13, 1909 in Butler, Pennsylvania, where he attended Grammar and High School. He did his undergraduate studies at the University of Alabama and received the A.B. degree in 1937. For graduate study he went to Northwestern University where he was awarded the M.S. degree in 1939. He attended Ohio State University for one year, 1939-1940, as John Bowndocker Fellow in Geology and transferred from there to the University of California at Berkeley in 1940. Here he served as teaching assistant from 1940-1942 while working toward his doctorate. During the year 1943-1944 he was employed by the Standard Oil Co. of California at Taft, California, doing subsurface work. While he was there a symposium on the Dos Palos and Paleocene was held on April 11, 1944 at the El Tejon Hotel in Bakersfield and Joe was one of the principal speakers. It was his introduction to the large group of San Joaquin Valley geologists. The following years, 1945-1946, he returned to the University of California as a lecturer in Paleontology. In 1946 he accepted a position as Assistant Professor of Geology at Texas Agricultural and Mechanical College where he remained until 1948. It was while teaching there in 1947 that he was awarded the Ph. D. degree from the University of California. In 1948 he accepted an invitation to join the faculty at Stanford University as Assistant Professor of Geology. He was elevated to Associate Professor in 1951 and to Professor in 1961. He taught courses in general and historical geology, but his chief contribution was as a teacher of micropaleontology, particularly emphasizing the Foraminifera.

From 1954 to 1956 Dr. Graham served as Professor and Consultant in the Department of Geology, University of the Philippines, under an assistance program sponsored by the United States International Cooperation Administration. A result of this assignment was the publication of a paper on recent Foraminifera of the Philippines with Priscilla J. Militante of the Zoology Department, University of the Philippines, as coauthor. The title of this paper is: "Recent Foraminifera from the Puerto Galera area, Northern Mindoro, Philippines." The excellent illustrations were drawn by Mr. Perfecto M. Mary, Staff artist, School of Mineral Sciences at Stanford, who Dr. Graham brought back with him from the Philippines. In 1959 and 1960 Dr. Graham served as Campus Coordinator of a cooperative geological program with the University of Chile under the auspices of the State Department. He was Visiting Professor of Micropaleontology at the University of California in 1959. In his sabbatical year, 1962-1963, he did research in geology at the Austrian Geological Survey as a Fullbright Research Scholar. During his stay he traveled to other countries of Europe, visiting famous collecting localities and research centers. In September 1967 he attended the International Conference in Bologna, Italy, where the first serious symptons of his illness appeared.

On a chance visit to Palo Alto in October 1967, the writer went to Stanford to call on Dr. Graham. He was informed by one of his associates that Joe was at home in bed on the advice of his doctor. I went to see him that afternoon and found him surprisingly cheerful. He was happy because his baseball team, the Medford Giants, had just concluded a very successful season. This venture into professional baseball was not a sud-

den thing but the realization of a life-long dream. He had played semipro baseball in his home town of Butler and went to the University of Alabama on an athletic scholarship where he played on the baseball team. He later played semipro baseball but received an injury to his hand which probably forestalled his going into the major leagues. This did not lessen his interest, however, as he remained an ardent baseball fan for the rest of his life. In bringing professional baseball to Medford, Joe became very popular with the fans. In speaking of this venture he laughingly, but with considerable pride, remarked that for once in his life he was a "big shot." When he went to Medford for the games, the people of the town hailed him as a popular hero. This success in baseball, his great enthusiasm for the game, and the disparity between his hobby and his professional career was so exceptional that it captured the interest of sports writer James K. McGee of the San Francisco *Examiner* who devoted his column of November 17, 1967 in a tribute to Joe. In his pocket at the time of his death was a plane ticket to Medford, dated November 17, where he was presumably going in the interest of baseball.

While at Stanford Dr. Graham published numerous articles on the foraminifera. One of his major interests was the stratigraphy and fauna of the Cretaceous of California. In 1957 he organized the Cretaceous Micropaleontological Project with an Advisory Council and Board of Consultants. The group met once a year at Stanford as guests of Dr. Graham to discuss problems of Cretaceous stratigraphy and correlation. The meetings continued until 1960. They were of distinct value in pinpointing problems of correlation and contributing toward their solution. Special Report 66 of the California Division of Mines, published in 1961, was one of the results of Dr. Graham's work on the upper Cretaceous. The title of the paper is "An annotated bibliography of California Cretaceous microfossils."

In the summer of 1949 Joe was employed by Richfield Oil Co. in Nevada, and for the summers of 1951, 1952, 1953 and 1954 he worked for Phillips Petroleum Co., two summers in Wyoming and two in Washington.

Of professional and scientific societies, Dr. Graham was a Fellow in the Geological Society of America and member of the American Association of Petroleum Geologists and the affiliated Society of Economic Paleontologists and Mineralogists. Of the latter he was Vice-President of the Pacific Section in 1962. He also was a member of the Paleontological Society, the Society of Systematic Zoologists; Schweiz. Geol. Gesell. He was a member of Sigma Xi and Phi Beta Kappa.

One of Joe's special interests, aside from that of microfossils, was in the records of fossil man. On one occasion when he was scheduled to talk on some phase of microfossils, he asked if he might change to a talk on fossil man instead. His request was granted and his talk was an absorbing excursion into the fossils of prehistoric man.

One of the special qualities of Professor Graham as a teacher was his interest in and devotion to his students and their welfare. He helped them in many ways. On the occasions when geological field trips were being conducted within driving distance of Stanford, Joe would often arrive with a group of his students in the Geology Department's bus; very soon after arrival he would be busy arranging for meals and sleeping accommodations for his group and, if possible, without cost to them. He also helped his students by means of projects financed by oil companies; these often developed into permanent jobs for the graduates. Joe was a warm and friendly person and made friends with people from every

walk of life. Following the announcement of his death, a flood of letters poured in to the bereaved family from past students, staff members, colleagues and off-campus associates, all expressing their deep regrets in the loss of a true and valued friend. As a teacher he gave unstintingly of himself, even up to the very day of his fatal attack. His presence will be sorely missed.

He is survived by his wife, Ruth; a son, David, a first-year graduate student at the University of California School of Dentistry; and a daughter, Kathryn, a freshman at Stanford University.

The family of the deceased has established the Joseph J. Graham Memorial Fund, c/o Geology Department, Stanford University, Stanford, California 94305, to which friends may contribute if they desire.

C. C. CHURCH

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350. RECENT FORAMINIFERIDA FROM PORT HACKING, NEW SOUTH WALES

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ABSTRACT

In this study of foraminifera from Port Hacking, New South Wales, 120 species have been recorded and identified. None of these are considered to be new species, although 22 of them are recorded from Australian waters for the first time.

The distribution of the 120 species has been plotted on evidence gained from 14 samples collected from localities chosen as potentially representative of the various regions of the estuary. From this evidence, six areally restricted Faunal Groups have been recognized and correlated in a general way with the most conspicuous features of the physical environment.

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INTRODUCTION

Port Hacking is situated on the central coast of New South Wales approximately 18 miles south of the city of Sydney (text fig. 1) and opens into the South Pacific Ocean. It has been formed by the post-glacial drowning of Port Hacking River and is physiographically similar to Port Jackson and Broken Bay further to the north. There is no serious pollution of Port Hacking by sewerage or industrial waste.

Port Hacking River enters Port Hacking after a course of 11 miles draining country formed by Triassic rocks. Foraminifera are not known from the Triassic rocks of this area, so any likelihood of remanié foraminifera derived from the country rock can be dispelled. Undoubted Pleistocene deposits have not been recognized anywhere in Port Hacking and the post-glacial drowning of the valley makes their presence unlikely, so all the foraminifera collected are considered to be of Recent age.

Prior to this preliminary survey, no information existed on the number and identity of foraminiferal species in a typical estuary of the central coast of New South Wales or of their distribution in relation to the geography of the estuary and its general hydrological conditions.

PREVIOUS WORK

Systematic

Since 1884 many papers have been published on the occurrence of foraminifera in the Indo-Pacific region, such as those by Brady (1884), Millett (1898 etc.), Sidebottom (1912-1913), Heron-Allen and Earland (1914-1915), Cushman (1910 etc., 1918 etc., 1921, 1932), Parr (1950), but only a few papers have dealt specifically with the Recent foraminifera of Australian waters: Chapman (1907, 1914, 1941), Parr (1932, 1941, 1945, 1950), and Collins (1958).

Systematic studies similar to the present investigation have been made by Parr (1932, 1945) and Collins (1958), but neither of these authors related occurrences to variations in the physical environment.

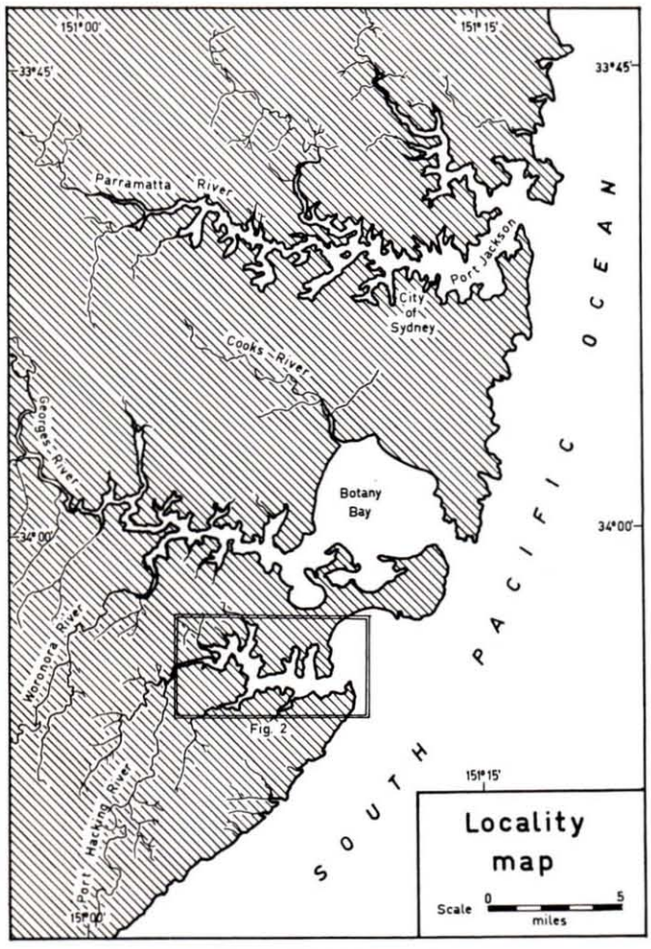
Ecological

No ecological studies have been made previously on Recent foraminifera from the east coast of Australia. A general consideration of the type of environment being investigated has been published by Rochford (1951, 1959), though from a predominantly hydrological point of view.

In general, the methods of investigation used here have been adapted from those used by other workers, e.g., Phleger and Walton (1950), Phleger (1954, 1955), Moore (1957), Lehmann (1957) and Parker and Athearn (1959). All these recent publications have shown more or less constant features in the methods of collecting and selecting the material for study. Although the number of stations may vary considerably, in relation to the area of the region studied, the quantity of sediment in each sample was small and could only show the distribution of the common species and a rather incomplete record of their relative abundance. Any record of new or rare species was unlikely, but this was not the purpose of their investigations; other studies in the same area, in fact, had previously dealt with this aspect of the foraminiferal distribution. In the present study, by contrast, the identification of as many species as could be collected was a major objective.

OBJECTIVES AND METHODS OF STUDY

The present study was a preliminary investigation of the composition of a foraminiferal fauna of a typical estuary of the central coast of New South



TEXT FIGURE 1

Wales and its distribution in relation to the main variable factors of the physical environment. Beach samples only were used in orded to obtain a comparable fraction of the fauna in each arm of the estuary.

They were collected between November 1962 and August 1963 from 14 stations (text fig. 2), in all cases from shore deposits exposed at low tide. Each sample consisted of fine to medium-grained quartz sand, containing very little clay and, in many stations, very little organic material.

The collecting, without special apparatus, was done once only at each station by simply picking up from the first 8-10 centimeters of shore sand the necessary quantity.

In describing the physical environment, data kindly made available by Mr. D. J. Rochford of C.S.I.R.O. Division of Fisheries and Oceanography, Cronulla N.S.W., have been used. These data, graphically plotted in text fig. 3, concern the year 1955, which may be regarded as typical. It is the writer's opinion that the summary of this information presents an "average" representation of the physical conditions more accurately than could have been achieved by making measurements of the environment at the time the samples were collected.

The material examined contained 120 species of foraminifera belonging to 70 genera. Some of them are illustrated here by means of unretouched microphotographs. Both the negatives and the positives of all the microphotographs were made by the author (Albani, 1964).

THE PHYSICAL ENVIRONMENT

Port Hacking is readily divisible into two regions: a predominantly marine section downstream from Burraneer Point (east of station 10) and an estuarine section upstream from that Point (text fig. 2). In terms of Rochford's classification of Australian estuaries (1951, 1959) the "marine zone" is represented up to Burraneer Point, the "tidal zone" from there to station 4 and from station 4 up to station 1 the "gradient zone." Upstream from station 1, where the bridge is shown on the map, a dam marks an abrupt boundary between brackish and fresh waters; i.e., between fresh water and the gradient zone.

The variable factors of the physical environment of Port Hacking which have been considered are temperature, salinity, oxygen concentration, phosphorus and "nitrate." Calculated mean values for the variations of these factors are given in text fig. 3. They are based on monthly measurements made during the year 1955 and accepted here as representative of the general annual pattern.

DISTRIBUTION OF FORAMINIFERA

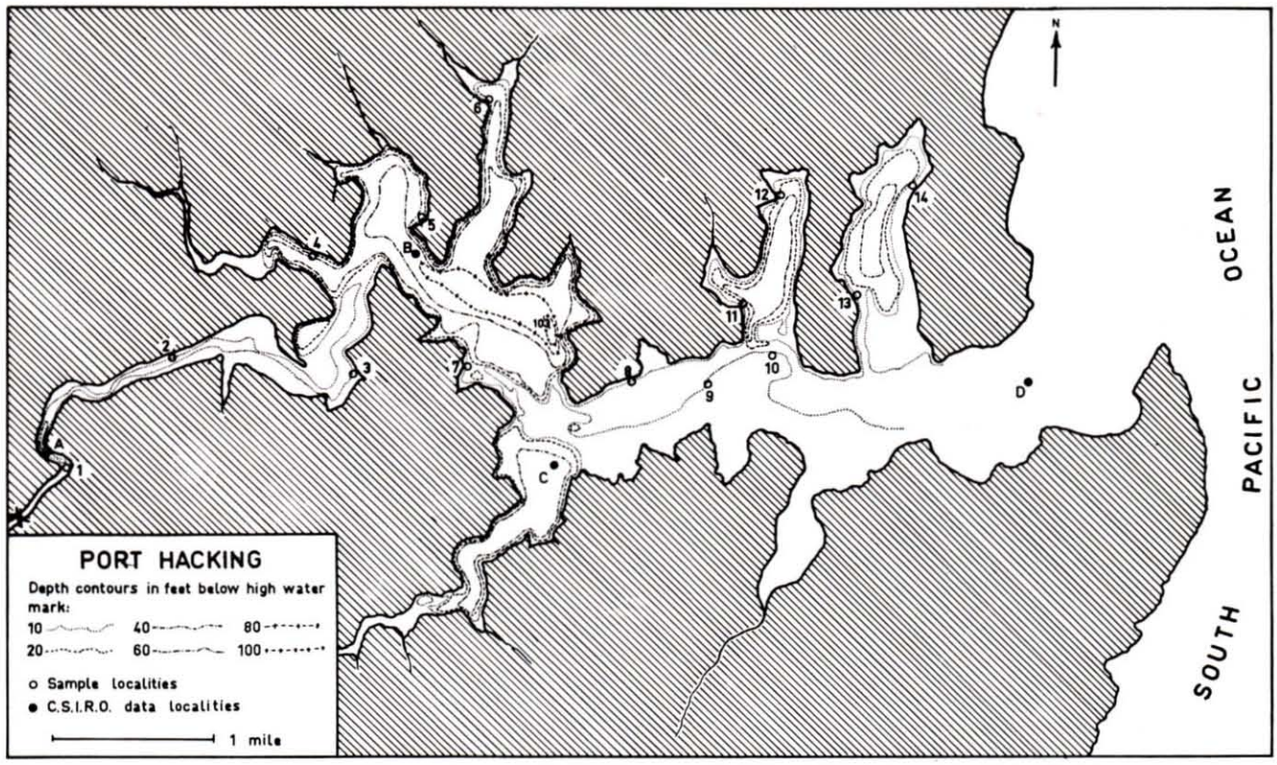
The nature of the sampling and of the samples themselves precludes any statistical significance being attached to counts of the number of species and individual foraminifers in the samples. Consequently only the relative abundance of species at the various stations is stated and is represented by the symbols R (= rare), F (= frequent) and C (= common). In Table 1 the occurrences of foraminifera, arranged in systematic order, is shown.

FAUNAL GROUPS

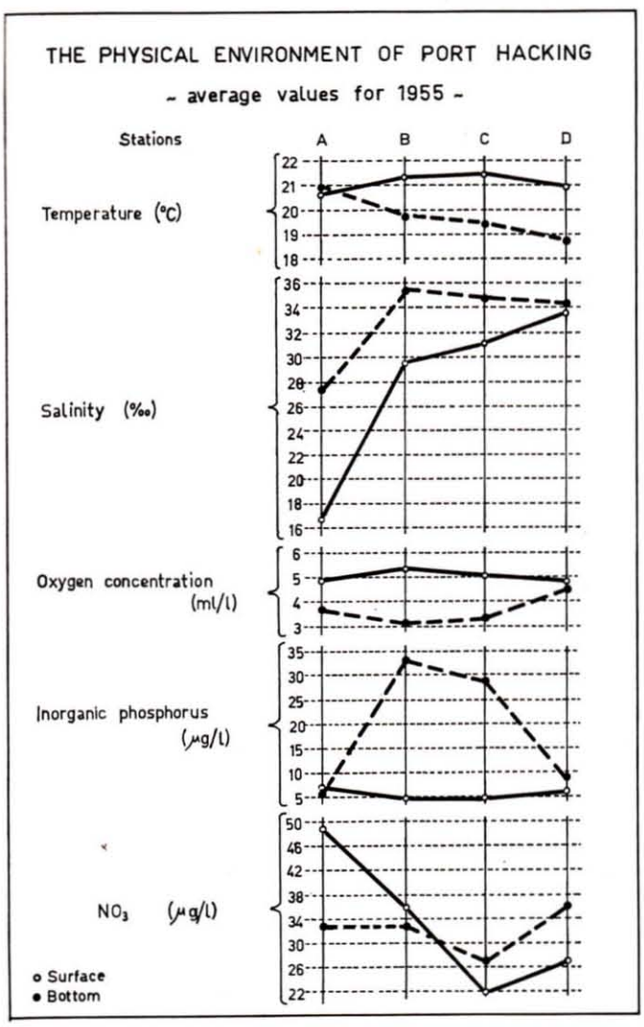
In order to assess the significance of the distribution of species, only occurrences recorded as "common" and "frequent" have been used. Table 1 shows that the majority of species occur in only a small number of samples, indicating a restricted distribution in the estuary. By grouping the species and their distribution, six Faunal Groups can be recognized.

It may be seen also from Table 1, and it is here emphasized, that the relative abundances of species show quite abrupt changes between adjacent stations; this gives to the Faunal Groups a distinctly limited character.

An examination of the map (text fig. 2) shows that Port Hacking is subdivided by sand bars into a number of subsidiary "basins." A comparison between these basins and the distribution of the Faunal Groups reveals a distinct correlation between sea-bed morphology and foraminiferal as-



TEXT FIGURE 2



TEXT FIGURE 3

semblages. Nevertheless the maps (text figs. 4-11) are slight approximations, because they show extrapolations of the actual station recordings. In a few instances these extrapolations have utilized the "rare" occurrences of a certain species.

In addition to the species recorded as "common" and "frequent," which form the basis of the Faunal Groups, 5 species are common and of widespread occurrence: *Ammonia beccarii* (stns. 2-14), *Elphidium poeyanum* (stns. 3-14), *Elphidium crispum*, *Rosalina australis*, and *Discorbis dimidiatus* (stns. 6-14).

Of the species whose occurrence is recorded as "rare," the majority occur in the samples in the outer part of the estuary (stns. 8-10); only 2 species are recorded as rare in the bays (stns. 3-4).

Text figs. 4 and 5 show the unusual distribution of the two species *Miliammina fusca* and *Tritaxis conica* respectively. The distribution of each Faunal Group is shown by the shaded area, and the C.S.I.R.O. data localities and the sample localities are shown as in text fig 2.

The Faunal Groups, their composition and the general environment are as follows:

Faunal Group A (text fig. 6)
Haplophragmoides canariensis (d'Orbigny) 1839
Trochammina inflata (Montagu) 1808

This Faunal Group occupies the region of the estuary that is farthest inland, where the fresh water of Port Hacking River mixes with the more brackish water of the bay. This upper part of the

TABLE 1

Distribution of Foraminifera in Port Hacking Arranged in Systematic Order

FORAMINIFERAL SPECIES	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. **Ammodiscus incertus** (d'Orbigny) 1839		...	...	F	F	...	...	R	...	...	...	R	...	...	...
2. **Protoschista findens** (Parker) 1870		...	...	F	...	...	...	...	...	...	...	...	...	...	..
3. **Miliammina fusca** (Brady) 1870		...	F	F	R	...	...	C	...	...	...	...	...	...	...
4. **Haplophragmoides canariensis** (d'Orbigny) 1839		F	...	...	...	...	...	...	...	...	...	...	...	...	...
5. **Ammobaculites agglutinans** (d'Orbigny) 1846		...	...	R	...	...	...	...	...	...	...	...	...	...	...
6. **Ammotium cassis** (Parker) 1870		...	...	R	R	...	...	...	...	...	...	...	...	R	...
7. **Textularia candeiana** d'Orbigny, 1839		...	...	...	...	...	...	F	C	C	C	...	...	R	..
8. **Textularia pseudogramen** Chapman and Parr, 1937		...	...	...	...	...	R	...	F	F	F	...	...	...	R
9. **Textularia sagittula atrata** Cushman, 1911		...	...	...	...	...	...	...	F	F	F	...	...	...	..
10. **Textularia siphonifera** Brady, 1881		...	...	...	...	...	...	...	F	...	...	...	...	...	...
11. **Trochammina inflata** (Montagu) 1808		C	F	C	C	C	...	F	...	...	...	F	R	R	..
12. **Tritaxis conica** (Parker and Jones) 1865		...	F	C	C	...	...	...	...	...	...	...	...	F	C
13. **Gaudryina quadrangularis** Bagg, 1908		...	...	...	...	...	...	...	F	F	F	...	...	...	R
14. **Eggerella subconica** Parr, 1950		...	R	F	...	...	...	...	...	...	...	...	...	...	...
15. **Spiroloculina antillarum** d'Orbigny, 1839		...	...	...	...	...	R	F	C	C	C	...	R	R	R
16. **Spiroloculina canaliculata** d'Orbigny, 1846		...	...	...	...	...	...	R	R	R	R	...	...	R	.
17. **Spiroloculina lucida** Cushman and Todd, 1944		...	...	...	...	...	...	...	C	C	C	...	R	R	R
18. **Vertebralina striata** d'Orbigny, 1826		...	...	...	...	...	...	...	C	F	...	...	R	R	...
19. **Quinqueloculina anguina arenata** Said, 1949		...	...	...	...	...	...	...	R	R	...	...	...	...	...
20. **Quinqueloculina baragwanathi** Parr, 1945		...	...	...	...	...	..	R	F	F	F	...	...	...	...
21. **Quinqueloculina costata** d'Orbigny, 1826		...	...	R	...	...	R	F	F	F	F	...	R	R	R
22. **Quinqueloculina lamarckiana** d'Orbigny, 1839		...	...	...	...	...	...	...	R	...	...	...	...	...	...
23. **Quinqueloculina pseudoreticulata** Parr, 1941		...	...	...	...	...	...	...	C	C	C	...	...	...	R
24. **Quinqueloculina seminula** (Linné) 1767		...	...	C	F	F	F	C	R	...	...	F	C	R	R
25. **Quinqueloculina seminula jugosa** Cushman, 1944		...	...	...	...	R	R	...	...	...	F	R	...	F	...
26. **Quinqueloculina subpolygona** Parr, 1945		...	...	...	...	...	F	C	C	C	C	...	...	R	C
27. **Quinqueloculina** sp. cf. **Q. cuvieriana queenslandica** Collins, 1958		...	...	...	...	...	...	F	F	C	F	...	...	R	...
28. **Quinqueloculina** sp. cf. **Q. moynensis** Collins, 1953		...	...	...	...	...	...	...	F	R	R	...	...	...	R
29. **Massilina secans tropicalis** Collins, 1958		...	...	...	...	...	F	C	F	...	...	...	C	C	...
30. **Pyrgo depressa** (d'Orbigny) 1826		...	...	...	...	...	...	F	F	C	C	...	...	F	...
31. **Sigmoilina australis** (Parr) 1932		...	...	...	...	...	...	R	F	F	F	...	...	R	...
32. **Triloculina affinis** d'Orbigny, 1826		...	...	...	...	...	R	R	R	R	R	...	R	R	R
33. **Triloculina oblonga** (Montagu) 1803		...	...	...	R	R	...	...	...	F	F	...	...	R	...
34. **Triloculina striatotrigonula** Parker and Jones, 1865		...	...	...	...	...	R	R	R	F	F	...	...	...	...
35. **Triloculina tricarinata** d'Orbigny, 1826		...	...	...	...	...	...	...	R	...	...	...	...	...	...
36. **Triloculina trigonula** (Lamarck) 1804		...	...	...	...	...	R	F	C	C	C	...	...	F	F
37. **Miliolinella labiosa** (d'Orbigny) 1839		...	...	...	...	...	...	...	R	R	R	...	...	R	...
38. **Polysegmentina circinata** (Brady) 1881		...	...	...	...	...	...	...	R	...	...	...	...	...	...
39. **Peneroplis planatus** (Fichtel and Moll) 1798		...	...	...	...	...	...	...	C	C	C	...	C	R	F
40. **Spirolina cylindracea** Lamarck, 1804		...	...	...	...	...	...	...	R	...	...	...	...	C	...
41. **Sorites marginalis** (Lamarck) 1816		...	...	...	...	...	...	...	R	...	...	...	...	F	...
42. **Amphicoryna scalaris** (Batsch) 1791		...	...	...	...	...	...	...	F	F	F	...	...	R	R
43. **Dentalina mutsui** Hada, 1931		...	...	...	...	...	...	...	...	...	...	...	...	R	...
44. **Lagena acuticosta** Reuss, 1861		...	...	...	...	...	...	...	R	...	...	...	...	...	...
45. **Lagena distoma margaritifera** Parker and Jones, 1865		...	...	...	...	...	...	...	F	F	F	...	...	R	R
46. **Lagena flatulenta** Loeblich and Tappan, 1953		...	...	...	...	...	...	...	...	R	...	...	...	...	...
47. **Lagena striata** (d'Orbigny) 1839		...	...	...	...	...	...	...	R	...	...	...	...	...	...
48. **Lagena striatopunctata** Parker and Jones, 1865		...	...	...	...	...	...	...	R	R	R	...	...	...	...
49. **Lagena sulcata** (Walker and Jacob) 1798		...	...	...	...	...	...	...	R	R	...	...	...	...	...
50. **Lagena sulcata peculiaris** Cushman and McCulloch, 1950		...	...	...	...	...	...	...	R	R	R	...	...	...	...
51. **Lenticulina reniformis** (d'Orbigny) 1846		...	...	...	...	...	...	...	R	R	R	...	...	R	...
52. **Pseudonodosaria rotundata** (Reuss) 1849		...	...	...	...	...	...	...	R	R	...	...	...	...	...
53. **Vaginulina patens** Brady, 1884		...	...	...	...	...	...	...	R	...	...	...	...	...	...
54. **Vaginulina vertebralis** Parr, 1932		...	...	...	...	...	...	...	R	...	...	...	...	...	...
55. Polymorphinidae, formae fistulosae		...	...	...	...	...	...	R	...	...	...	...	...	R	...
56. **Globulina gibba globosa** (v.Munster) 1838		...	...	...	...	...	...	...	...	R	R	...	...	...	...
57. **Guttulina lactea** (Walker and Jacob) 1798		...	...	...	...	...	...	...	C	R	R	...	...	...	...
58. **Guttulina pacifica** (Cushman and Ozawa) 1928		...	...	...	...	...	...	...	R	R	R	...	...	R	R
59. **Guttulina regina** (Brady, Parker and Jones) 1870		...	...	...	...	...	R	...	C	C	C	R	...	R	R
60. **Pseudopolymorphina ligua** (Roemer) 1838		...	...	...	...	...	...	...	...	R	...	...	...	...	...

TABLE 1 (continued)

FORAMINIFERAL SPECIES	STATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14
61. **Sigmoidella elegantissima** (Parker and Jones) 1865		...	...	R	...	...	...	...	R	R	R	R	...	...	R
62. **Oolina globosa** (Montagu) 1803		...	...	...	...	...	...	...	F	R	R	...	...	...	...
63. **Fissurina fasciata carinata** (Sidebottom) 1906		...	...	...	...	...	...	...	F	R	R	...	...	R	R
64. **Fissurina lacunata** (Burrows and Holland) 1895		...	...	...	...	...	...	...	F	R	R	...	...	...	R
65. **Fissurina** sp. cf. **F. subquadrata** Parr, 1945		...	...	...	...	...	...	...	R	...	...	...	...	...	...
66. **Buliminella elegantissima** (d'Orbigny) 1839		...	...	...	...	...	...	R	R	...	...	...	...	...	...
67. **Buliminella gracilis** Collins, 1953		...	...	...	...	...	...	...	F	...	...	...	...	...	...
68. **Buliminoides williamsonianus** (Brady) 1881		...	...	...	...	...	...	...	R	...	R	...	...	...	...
69. **Bolivina alata** (Seguenza) 1862		...	...	...	...	...	...	...	R	R	...	...	...	R	R
70. **Bolivina robusta** Brady, 1881		...	...	...	...	...	...	...	R	...	...	...	...	F	...
71. **Rectobolivina raphana** (Parker and Jones) 1865		...	...	...	...	...	...	R	R	...	R	...	...	...	...
72. **Bulimina gibba** Fornasini, 1902		...	...	...	...	...	...	...	...	...	R	...	...	...	...
73. **Bulimina marginata** d'Orbigny, 1826		...	...	...	...	...	...	...	R	...	...	...	...	R	...
74. **Chrysalidinella dimorpha** (Brady) 1881		...	...	...	...	...	...	...	R	...	...	...	...	...	...
75. **Reussella spinulosa** (Reuss) 1850		...	...	...	...	...	...	...	R	...	R	...	...	R	R
76. **Uvigerina bassensis** Parr, 1950		...	...	...	...	...	R	...	F	C	C	...	...	R	F
77. **Siphouvigerina porrecta** (Brady) 1879		...	...	...	...	...	...	...	...	...	...	...	...	...	R
78. **Discorbis dimidiatus** (Jones and Parker) 1862		...	...	...	...	...	C	F	C	C	C	...	...	F	C
79. **Discorbinella planoconcava** (Chapman, Parr and Collins) 1932		...	...	...	...	...	...	...	R	...	...	...	...	...	...
80. **Patellinella inconspicua** (Brady) 1884		...	...	...	...	...	...	...	F	R	R	...	...	R	R
81. **Rosalina anglica** (Cushman) 1931		...	...	...	...	...	...	R	F	F	...	...	...	F	...
82. **Rosalina australis** (Parr) 1932		...	...	...	...	...	F	F	C	C	C	...	F	F	F
83. **Rosalina bertheloti** d'Orbigny, 1839		...	...	...	...	...	...	...	R	R	R	...	...	.	...
84. **Rosalina bradyi** (Cushman) 1915		...	...	...	...	R	...	R	R	...	...	...	...	F	...
85. **Baggina philippinensis** (Cushman) 1921		...	...	...	...	...	...	...	C	C	C	...	...	R	F
86. **Glabratella australensis** (Heron-Allen and Earland) 1932		...	...	...	...	...	F	F	C	C	C	...	...	R	...
87. **Glabratella patelliformis** (Brady) 1884		...	...	...	...	...	...	...	F	R	R	...	...	...	...
88. **Spirillina vivipara** Ehrenberg, 1843		...	...	C	...	...	...	F	R	...	...	...	...	...	...
89. **Rotalia perlucida** Heron-Allen and Earland, 1913		...	...	R	...	R	...	F	R	...	...	C	R	F	...
90. **Ammonia beccarii** (Linné) 1767		...	F	C	C	C	C	F	C	C	C	C	F	C	C
91. **Elphidium advenum** (Cushman) 1922		...	...	...	...	...	R	F	R	...	...	R	R	C	F
92. **Elphidium craticulatum** (Fichtel and Moll) 1798		...	...	...	...	...	...	F	C	C	C	F	C	C	...
93. **Elphidium crispum** (Linné) 1758		...	...	...	...	...	F	F	C	C	C	F	F	F	F
94. **Elphidium depressulum** Cushman, 1933		...	...	...	...	...	R	...	F	R	R	R	R	...	R
95. **Elphidium discoidale multiloculum** Cushman and Ellisor, 1945		...	R	F	R	...	...	...	...	...	...	R	...	...	...
96. **Elphidium imperatrix** (Brady) 1881		...	...	...	...	...	...	...	C	C	F	...	...	F	F
97. **Elphidium jenseni** (Cushman) 1924		...	...	...	...	...	...	F	C	C	C	F	F	F	R
98. **Elphidium milletti** (Heron-Allen and Earland) 1915		...	...	...	...	...	...	...	...	...	...	R	...	C	..
99. **Elphidium poeyanum** (d'Orbigny) 1839		...	...	C	R	F	C	F	F	C	C	C	F	F	F
100. **Elphidium simplex** Cushman, 1933		...	...	C	F	C	F	F	...	R	...	C	F	C	R
101. **Globigerinella siphonifera** (d'Orbigny) 1839		...	...	...	...	...	...	...	R	R	...	...	...	R	...
102. **Globorotalia hirsuta** (d'Orbigny) 1839		...	...	...	...	...	...	...	F	F	F	...	...	...	R
103. **Globorotalia inflata** (d'Orbigny) 1839		...	...	R	...	...	...	F	C	C	C	F	...	R	R
104. **Globorotalia truncatulinoides** (d'Orbigny) 1839		...	...	...	...	...	...	...	R	...	...	...	...	...	...
105. **Globigerina bulloides** d'Orbigny, 1826		...	...	...	...	...	...	R	R	R	R	R	...	R	...
106. **Globigerinoides conglobatus** (Brady) 1879		...	...	...	...	...	...	...	R	R	R	R	...	R	...
107. **Globigerinoides quadrilobatus sacculifer** (Brady) 1877		...	...	...	...	...	...	F	C	C	C	R	...	F	F
108. **Globigerinoides ruber** (d'Orbigny) 1839		...	...	...	...	...	...	...	C	R	R	...	...	R	R
109 **Globoquadrina dutertrei** (d'Orbigny) 1839		...	...	...	...	...	...	R	C	C	F	...	...	F	...
110. **Pulleniatina obliquiloculata** (Parker and Jones) 1865		...	...	...	...	...	...	...	F	R	...	...	...	R	...
111. **Sphaeroidinella dehiscens** (Parker and Jones) 1865		...	...	...	...	...	...	...	R	R	R	...	...	...	...
112. **Orbulina universa** d'Orbigny, 1839		...	...	R	...	...	R	F	C	C	C	R	R	F	...
113. **Cibicides cygnorum** Carter, 1964		...	...	...	...	...	R	F	F	F	F	...	...	R	R
114. **Cibicides refulgens** Montfort, 1808		...	...	...	...	...	R	R	F	F	F	F	...	R	R
115. **Cibicidella variabilis** (d'Orbigny) 1826		...	...	...	...	...	...	...	C	C	C	...	R	R	R
116. **Dyocibicides biserialis** Cushman and Valentine, 1930		...	...	...	...	...	F	...	C	C	C	...	R	...	R
117. **Planorbulina mediterranensis** d'Orbigny, 1826		...	...	...	...	...	...	...	C	F	F	...	...	...	R
118. **Cymbaloporetta bradyi** (Cushman) 1915		...	...	...	...	...	...	...	R	R	...	R	R	F	R
119. **Nonionella auris** (d'Orbigny) 1839		...	...	...	...	...	...	...	R	R	R	R	...	R	...
120. **Trichohyalus tropicus** (Collins) 1958		...	...	...	...	R	...	R	...	...	...	R	...	...	...
121. **Anomalina nonionoides** Parr, 1932		...	...	...	...	...	...	...	C	C	C	...	...	R	R

estuary has a width of about 200 yards for a distance of 2 miles; its depth is less than 10 feet, except for a narrow central channel. The sides of the river are fairly steep and covered with abundant vegetation. Mangroves are present along the water's edge.

Faunal Group B (text fig. 7)
Ammodiscus incertus (d'Orbigny) 1839
Protoschista findens (Parker) 1870
Eggerella subconica Parr, 1950
Elphidium discoidale multiloculum Cushman & Ellisor, 1945

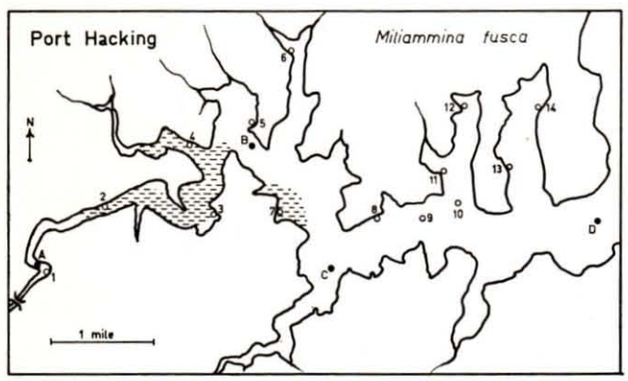
The area to which this group is restricted is characterized by fairly deep water, generally close to 60 feet. This part of the estuary is flanked by steep, heavily timbered hillsides that continue to be steeply inclined below water level, the depth increasing rapidly so that the 40 foot contour line is reached within 50 yards from the shore.

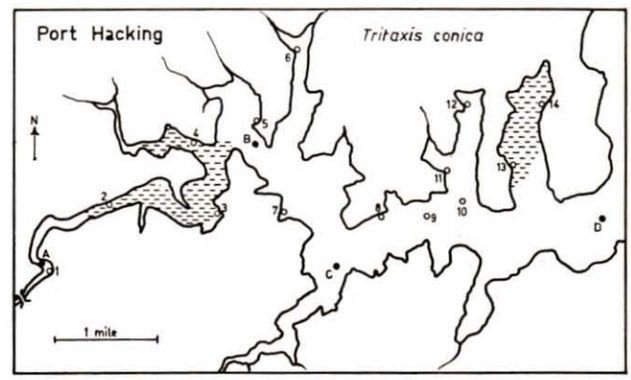
Faunal Group C (text fig. 8)
Quinqueloculina seminula (Linné) 1767
Massilina secans tropicalis Collins, 1958
Triloculina oblonga (Montagu) 1803
Rotalia perlucida Heron-Allen & Earland, 1913
Elphidium advenum (Cushman) 1922
Elphidium simplex Cushman, 1933

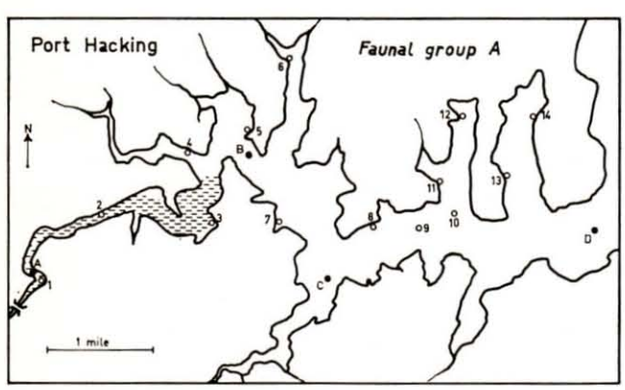
This group is composed of all those species which, being present in Faunal Group B, extend their tolerance to ecological conditions that are more strongly influenced by the ocean. This group extends up to stn. 7, and its environment is characterized by a large basin of quite deep water, the maximum depth being 103 feet. The banks in many places are quite steep, with cliffs. This Faunal Group is also present in two lateral bays in which the ecological conditions seem to be similar: Burraneer Bay (stns. 11, 12) and Gunnamatta Bay (stns. 13, 14).

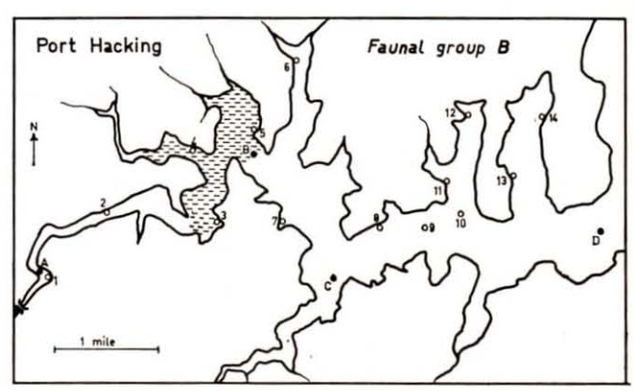
Faunal Group D (text fig. 9)
Textularia candeiana d'Orbigny, 1839
Textularia pseudogramen Chapman and Parr, 1937
Spiroloculina antillarum d'Orbigny, 1839
Quinqueloculina baragwanathi Parr, 1945
Quinqueloculina subpolygona Parr, 1945
Pyrgo depressa (d'Orbigny) 1826
Sigmoilina australis (Parr) 1932
Triloculina striatotrigonula Parker and Jones, 1865
Triloculina trigonula (Lamarck) 1804
Guttulina regina (Brady, Parker and Jones) 1870
Rosalina anglica (Cushman) 1931
Glabratella australensis (Heron-Allen & Earland) 1932
Globorotalia inflata (d'Orbigny) 1839
Globigerinoides quadrilobatus sacculifer (Brady) 1877
Globoquadrina dutertrei (d'Orbigny) 1839
Orbulina universa d'Orbigny, 1839
Cibicides cygnorum Carter, 1964
Cibicides refulgens Montfort, 1808
Dyocibicides biserialis Cushman & Valentine, 1930

Faunal Group D inhabits the eastern side of the deep basin mentioned with Faunal Group C and the

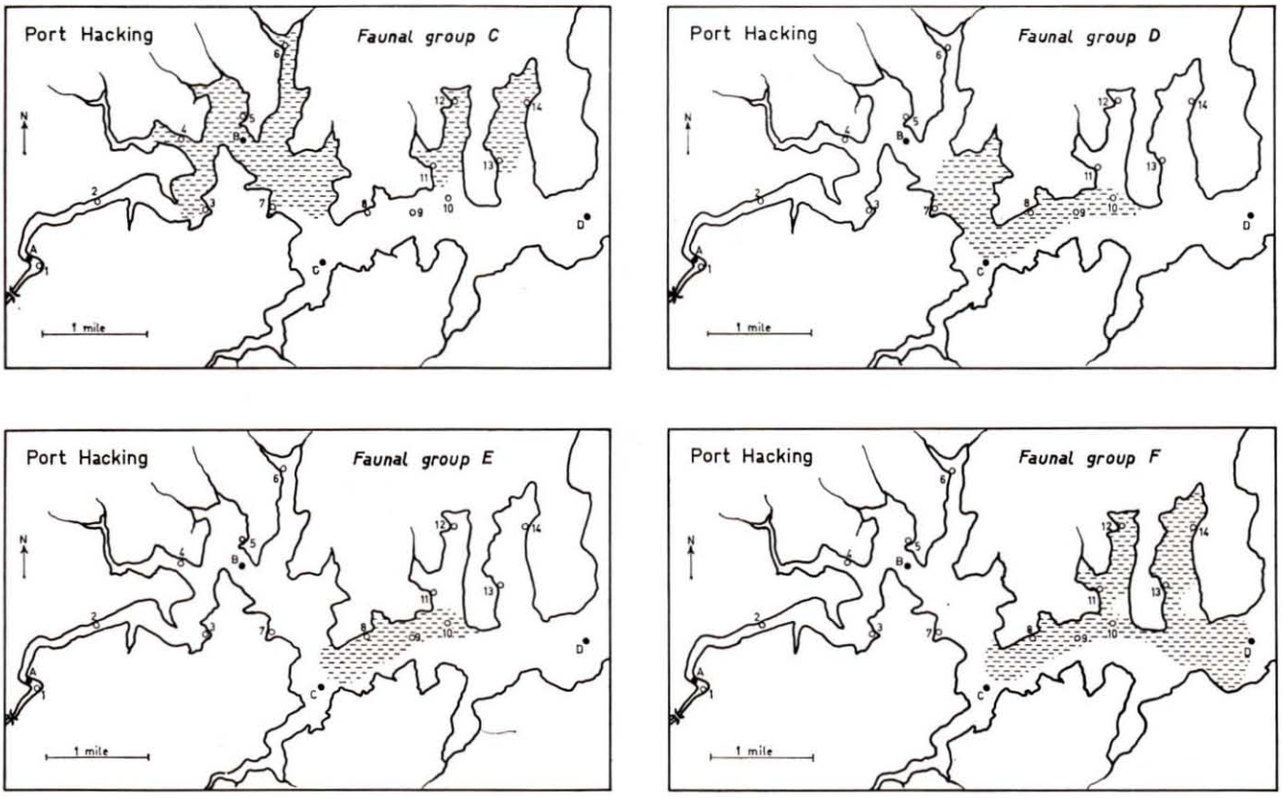








TEXT FIGURES 4 - 7



TEXT FIGURES 8 - 11

central part of Port Hacking; this latter portion of the estuary contains quite shallow water, less than 18 feet, the northern side of it being formed by a steep cliff of sandstone while the southern side is limited by a sand bar which runs parallel to the shore line, leaving a channel at the northern side only.

Faunal Group E (text fig. 10)
Textularia sagittula atrata Cushman, 1911
Textularia siphonifera Brady, 1881
Gaudryina quadrangularis Bagg, 1908
Spiroloculina lucida Cushman and Todd, 1944
Vertebralina striata d'Orbigny, 1826
Quinqueloculina pseudoreticulata Parr, 1941
Amphicoryna scalaris (Batsch) 1791
Lagena distoma margaritifera Parker & Jones, 1865
Baggina philippinensis (Cushman) 1921
Globorotalia hirsuta (d'Orbigny) 1839
Globigerinoides ruber (d'Orbigny) 1826
Cibicidella variabilis (d'Orbigny) 1826
Planorbulina mediterranensis d'Orbigny, 1826

This Faunal Group is perhaps the most restricted in area; it occupies only the channel and adjacent shallower water on the sand bank, which is also inhabited by Faunal Group D; stations 8, 9 and 10 are those in which the great majority of "rare" species are found. It is the region in which the tidal currents, because of their concentration, are strongest.

Faunal Group F (text fig. 11)
Peneroplis planatus (Fichtel and Moll) 1798
Uvigerina bassensis Parr, 1950
Elphidium craticulatum (Fichtel and Moll) 1798
Elphidium imperatrix (Brady) 1881
Elphidium jenseni (Cushman) 1924
Cymbaloporetta bradyi (Cushman) 1915

This Faunal Group occupies the remaining outer part of the estuary; it inhabits also the channel and shallows in which Faunal Groups D and E occur. It is present also in Burraneer Bay and Gunnamatta Bay, the two lateral bays in which the Faunal Group C was found. In depressions in the central parts of these bays, the water reaches a maximum depth of 40-50 feet.

In order to facilitate the correlation of foraminiferal distribution with the variation of the physical environment, the "commonly" and "frequently" occurring species have been arranged in Table 2 in order of their appearance along a traverse proceeding along the estuary towards the ocean. A similar arrangement of the "rare" species is shown in Table 3.

A comparison of Table 1 with Tables 2 and 3 may suggest that certain oceanic species enter the estuary but are not well adapted to the conditions prevailing there; conversely, though rather obviously, it would seem that the species occurring in the estuary-proper are adapted to the prevailing conditions and, therefore, occur abundantly.

A comparison of the Faunal Groups with variations in the physical environment shows a general correlation of these groups with a decline in salinity and an increase in NO_3 concentration as the estuary is ascended.

TABLE 2

Distribution of Common Foraminifera Arranged in Order of Appearance on a Longitudinal Traverse of Port Hacking

		FORAMINIFERAL SPECIES	STATION	1	2	3	4	5	7	8	9	10	12	11	14	13
1.	(4)	**Haplophragmoides canariensis** (d'Orbigny) 1839 ..		F	...	...	...	...	...	...	...	...	...	...	...	...
2.	(11)	**Trochammina inflata** (Montagu) 1808		C	F	C	C	C	F	...	...	...	...	F	...	...
3.	(3)	**Miliammina fusca** (Brady) 1870		...	F	F	...	...	C	...	...	...	...	...	...	...
4.	(12)	**Tritaxis conica** (Parker and Jones) 1865		...	F	C	C	...	...	...	...	...	...	...	C	F
5.	(90)	**Ammonia beccarii** (Linné) 1767		...	F	C	C	C	F	C	C	C	F	C	C	C
6.	(1)	**Ammodiscus incertus** (d'Orbigny) 1839		...	...	F	F	...	...	...	...	...	...	...	...	...
7.	(2)	**Protoschista findens** (Parker) 1870		...	...	F	...	...	...	...	...	...	...	...	...	...
8.	(14)	**Eggerella subconica** Parr, 1950		...	...	F	...	...	...	...	...	...	...	...	...	...
9.	(95)	**Elphidium discoidale multiloculum** Cushman and Ellisor, 1945		...	...	F	...	...	...	...	...	...	...	...	...	...
10.	(88)	**Spirillina vivipara** Ehrenberg, 1843		...	...	C	...	...	F	...	...	...	...	...	...	...
11.	(24)	**Quinqueloculina seminula** (Linné) 1767		...	...	C	F	F	C	...	...	...	C	F	...	...
12.	(100)	**Elphidium simplex** Cushman, 1933		...	...	C	F	C	F	...	...	...	F	C	...	C
13.	(99)	**Elphidium poeyanum** (d'Orbigny) 1839		...	...	C	...	F	F	F	C	C	F	C	F	F
14.	(91)	**Elphidium advenum** (Cushman) 1922		...	...	...	...	...	F	...	...	...	...	...	F	C
15.	(89)	**Rotalia perlucida** Heron-Allen and Earland, 1913		...	...	...	...	...	F	...	...	...	...	C	...	F
16.	(29)	**Massilina secans tropicalis** Collins, 1958		...	...	...	...	...	C	F	...	...	C	...	...	C
17.	(21)	**Quinqueloculina costata** d'Orbigny, 1826		...	...	...	...	...	F	F	F	F	...	...	...	...
18.	(113)	**Cibicides cygnorum** Carter, 1964		...	...	...	...	...	F	F	F	F	...	...	...	...
19.	(27)	**Quinqueloculina** sp. cf. **Q. cuvieriana queenslandica** Collins, 1958		...	...	...	...	...	F	F	C	F	...	...	...	...
20.	(30)	**Pyrgo depressa** (d'Orbigny) 1826		...	...	...	...	...	F	F	C	C	...	...	...	F
21.	(7)	**Textularia candeiana** d'Orbigny, 1839		...	...	...	...	...	F	C	C	C	...	...	...	...
22.	(15)	**Spiroloculina antillarum** d'Orbigny, 1839		...	...	...	...	...	F	C	C	C	...	...	...	...
23.	(36)	**Triloculina trigonula** (Lamarck) 1804		...	...	...	...	...	F	C	C	C	...	...	F	F
24.	(78)	**Discorbis dimidiatus** (Jones and Parker) 1862 ...		...	...	...	...	...	F	C	C	C	...	...	C	F
25.	(86)	**Glabratella australensis** (Heron-Allen and Earland) 1932		...	...	...	...	...	F	C	C	C	...	...	...	...
26.	(82)	**Rosalina australis** (Parr) 1932		...	...	...	...	...	F	C	C	C	F	...	F	F
27.	(103)	**Globorotalia inflata** (d'Orbigny) 1839		...	...	...	...	...	F	C	C	C	...	F	...	...
28.	(107)	**Globigerinoides quadrilobatus sacculifer** (Brady) 1877		...	...	...	...	...	F	C	C	C	...	...	F	F
29.	(112)	**Orbulina universa** d'Orbigny, 1839		...	...	...	...	...	F	C	C	C	...	...	...	F
30.	(92)	**Elphidium craticulatum** (Fichtel and Moll) 1798 .		...	...	...	...	...	F	C	C	C	C	F	...	C
31.	(93)	**Elphidium crispum** (Linné) 1758		...	...	...	...	...	F	C	C	C	F	F	F	F
32.	(97)	**Elphidium jenseni** (Cushman) 1924		...	...	...	...	...	F	C	C	C	F	F	...	F
33.	(26)	**Quinqueloculina subpolygona** Parr, 1945		...	...	...	...	...	C	C	C	C	...	...	C	...
34.	(10)	**Textularia siphonifera** Brady, 1881		...	...	...	...	...	...	F	...	...	...	...	...	...
35.	(28)	**Quinqueloculina** sp. cf. **Q. moynensis** Collins, 1953		...	...	...	...	...	...	F	...	...	...	...	...	...
36.	(62)	**Oolina globosa** (Montagu) 1803		...	...	...	...	...	...	F	...	...	...	...	...	...
37.	(63)	**Fissurina fasciata carinata** (Sidebottom) 1906 ..		...	...	...	...	...	...	F	...	...	...	...	...	...
38.	(64)	**Fissurina lacunata** (Burrows and Holland) 1895 .		...	...	...	...	...	...	F	...	...	...	...	...	...
39.	(67)	**Buliminella gracilis** Collins, 1953		...	...	...	...	...	...	F	...	...	...	...	...	...
40.	(80)	**Patellinella inconspicua** (Brady) 1884		...	...	...	...	...	...	F	...	...	...	...	...	...
41.	(87)	**Glabratella patelliformis** (Brady) 1884		...	...	...	...	...	...	F	...	...	...	...	...	...
42.	(110)	**Pulleniatina obliquiloculata** (Parker and Jones) 1865		...	...	...	...	...	...	F	...	...	...	...	...	...
43.	(94)	**Elphidium depressulum** Cushman, 1933		...	...	...	...	...	...	F	...	...	...	...	...	...
44.	(57)	**Guttulina lactea** (Walker and Jacob) 1798		...	...	...	...	...	...	C	...	...	...	...	...	...
45.	(108)	**Globigerinoides ruber** (d'Orbigny) 1839		...	...	...	...	...	...	C	...	...	...	...	...	...
46.	(81)	**Rosalina anglica** (Cushman) 1931		...	...	...	...	...	...	F	F	...	...	...	...	F
47.	(18)	**Vertebralina striata** d'Orbigny, 1826		...	...	...	...	...	...	C	F	...	...	...	...	...
48.	(8)	**Textularia pseudogramen** Chapman and Parr, 1937		...	...	...	...	...	...	F	F	F	...	...	...	...
49.	(9)	**Textularia sagittula atrata** Cushman, 1911		...	...	...	...	...	...	F	F	F	...	...	...	...
50.	(13)	**Gaudryina quadrangularis** Bagg, 1908		...	...	...	...	...	...	F	F	F	...	...	...	...
51.	(20)	**Quinqueloculina baragwanathi** Parr, 1945		...	...	...	...	...	...	F	F	F	...	...	...	...
52.	(31)	**Sigmoilina australis** (Parr) 1932		...	...	...	...	...	...	F	F	F	...	...	...	...
53.	(45)	**Lagena distoma margaritifera** Parker and Jones, 1865		...	...	...	...	...	...	F	F	F	...	...	...	...
54.	(42)	**Amphicoryna scalaris** (Batsch) 1791		...	...	...	...	...	...	F	F	F	...	...	...	...
55.	(114)	**Cibicides refulgens** Montfort, 1808		...	...	...	...	...	...	F	F	F	...	F	...	...
56.	(102)	**Globorotalia hirsuta** (d'Orbigny) 1839		...	...	...	...	...	...	F	F	F	...	...	...	...
57.	(76)	**Uvigerina bassensis** Parr, 1950		...	...	...	...	...	...	F	C	C	...	...	...	...
58.	(117)	**Planorbulina mediterranensis** d'Orbigny, 1826 ...		...	...	...	...	...	...	C	F	F	...	...	...	...
59.	(109)	**Globoquadrina dutertrei** (d'Orbigny) 1839		...	...	...	...	...	...	C	C	F	...	...	...	F

TABLE 2 (continued)

FORAMINIFERAL SPECIES	STATION	1	2	3	4	5	7	8	9	10	12	11	14	13
60. (96) **Elphidium imperatrix** (Brady) 1881		...	...	...	...	...	...	C	C	F	...	...	F	F
61. (23) **Quinqueloculina pseudoreticulata** Parr, 1941		..	...	...	...	...	...	C	C	C	...	...	...	...
62. (17) **Spiroloculina lucida** Cushman and Todd, 1944		...	...	...	...	...	...	C	C	C	...	...	...	...
63. (39) **Peneroplis planatus** (Fichtel and Moll) 1798		...	...	...	...	...	...	C	C	C	C	...	F	...
64. (59) **Guttulina regina** (Brady, Parker and Jones) 1870		...	...	...	...	...	...	C	C	C	...	...	...	...
65. (116) **Dyocibicides biserialis** Cushman and Valentine, 1930		...	...	...	...	...	...	C	C	C	...	...	...	...
66. (115) **Cibicidella variabilis** (d'Orbigny) 1826		...	...	...	...	...	...	C	C	C	...	...	...	...
67. (121) **Anomalina nonionoides** Parr, 1932		...	...	...	...	...	...	C	C	C	...	...	...	...
68. (85) **Baggina philippinensis** (Cushman) 1921		...	...	...	...	...	...	C	C	C	...	...	F	...
69. (33) **Triloculina oblonga** (Montagu) 1803		...	...	...	...	...	...	...	F	F	...	...	...	...
70. (34) **Triloculina striatotrigonula** Parker and Jones, 1865		...	...	...	...	...	...	...	F	F	...	...	...	...
71. (25) **Quinqueloculina seminula jugosa** Cushman, 1944		...	...	...	...	...	...	...	...	F	...	...	...	F
72. (70) **Bolivina robusta** Brady, 1881		...	...	...	...	...	...	...	...	...	...	...	...	F
73. (98) **Elphidium milletti** (Heron-Allen and Earland) 1915		...	...	...	...	...	...	...	...	...	...	...	...	C
74. (40) **Spirolina cylindracea** Lamarck, 1804		...	...	...	...	...	...	...	...	...	...	...	...	C
75. (41) **Sorites marginalis** (Lamarck) 1816		...	...	...	...	...	...	...	...	...	...	...	...	F

Temperature and oxygen concentration do not appear to be important factors, because stations A and D, showing similar values for these factors, are inhabited by different assemblages.

The same factors seem to be responsible for the distribution of Faunal Groups D and E, but it must also be considered that the area inhabited by Faunal Group E is a channel with fairly strong tidal currents. Tides affect Port Hacking up to station 1, but it is only in the narrow area near stations 8 and 9 that they produce currents of noticeable strength.

Faunal Group F shows a greater tolerance to tidal currents, and its distribution seems to be controlled more by salinity, which approximates that of the open sea.

In August 1963, at the C.S.I.R.O. marine biological laboratory at the entrance of Port Hacking, an undisturbed aquarium through which sea water had been flowing continuously for some weeks was found to contain living foraminifera. All the species of Faunal Group F were found to be present. In the light of this aquarium occurrence, depth of water would seem to play little part in determining the distribution of this Faunal Group.

NEW RECORDS OF RECENT FORAMINIFERA IN AUSTRALIA

The following papers are taken to contain the reliably identified records of Australian Recent foraminiferal fauna: Chapman (1907, 1941), Chapman and Parr (1935, 1937), Collins (1953, 1958), Collins and Parr (1937), Howchin and Parr (1938), Parr (1932, 1943, 1945, 1950) and Sidebottom (1912-1913, 1917-1918). Many isolated records of species from Australia in papers by J. A. Cushman are covered by Parr's check list (1943).

The species not recorded in these papers but found in Port Hacking are listed below as new records from the Australian region:

Protoschista findens (Parker) 1870
Miliammina fusca (Brady) 1870
Ammotium cassis (Parker) 1870
Textularia candeiana d'Orbigny, 1839
Textularia sagittula atrata Cushman, 1911
Gaudryina quadrangularis Bagg, 1908
Spiroloculina canaliculata d'Orbigny, 1846
Quinqueloculina seminula jugosa Cushman, 1944
Triloculina affinis d'Orbigny, 1826
Lagena flatulenta Loeblich and Tappan, 1953
Lagena sulcata peculiaris Cushman and McCulloch, 1950
Lenticulina reniformis (d'Orbigny) 1846
Pseudonodosaria rotundata (Reuss) 1849
Guttulina pacifica (Cushman and Ozawa) 1928
Pseudopolymorphina ligua (Roemer) 1838
Bulimina gibba Fornasini, 1902
Rosalina bradyi (Cushman) 1915
Elphidium depressulum Cushman, 1933
Elphidium discoidale multiloculum Cushman and Ellisor, 1945
Elphidium simplex Cushman, 1933
Cibicides cygnorum Carter, 1964
Nonionella auris (d'Orbigny) 1839

SYSTEMATIC DESCRIPTION OF FORAMINIFERA

In the arrangement of superfamilies and families in this paper, the writer has followed Loeblich and Tappan (1964). In synonymies, the abbreviated form of each reference is given, but full references to all cited literature are given in the bibliography.

Note: An asterisk (*) following the trivial name in certain species in the following section indicates the following: The masculine ending is used here according to the Zoological Code (1958). However, the writer asserts the grammatical incorrectness of this suffix.

TABLE 3

Distribution of Rare Foraminifera Arranged in Order of Appearance on a Longitudinal Traverse of Port Hacking

	FORAMINIFERAL SPECIES	STATION	1	2	3	4	5	7	8	9	10	12	11	14	13
1.	(5)	**Ammobaculites agglutinans** (d'Orbigny) 1846	...	...	R	...	...	...	...	...	...	...	...	...	..
2.	(6)	**Ammotium cassis** (Parker) 1870	...	...	R	R	...	...	...	...	...	...	...	...	R
3.	(61)	**Sigmoidella elegantissima** (Parker and Jones) 1865	...	...	R	...	...	...	R	R	R	...	R	R	...
4.	(120)	**Trichohyalus tropicus** (Collins) 1958	...	...	...	...	R	R	...	...	...	...	R	...	...
5.	(84)	**Rosalina bradyi** (Cushman) 1915	...	...	...	...	R	R	R	...	...	...	...	...	F
6.	(55)	Polymorphinidae, formae fiistulosae	...	...	...	...	...	R	...	...	...	...	...	...	R
7.	(66)	**Buliminella elegantissima** (d'Orbigny) 1839	...	...	...	...	...	R	R	...	...	...	...	...	..
8.	(71)	**Rectobolivina raphana** (Parker and Jones) 1865 ..	...	...	...	...	...	R	R	...	R	...	...	...	...
9.	(16)	**Spiroloculina canaliculata** d'Orbigny, 1846	...	...	...	...	...	R	R	R	R	...	...	...	R
10.	(32)	**Triloculina affinis** d'Orbigny, 1826	...	...	...	...	...	R	R	R	R	R	...	R	R
11.	(105)	**Globigerina bulloides** d'Orbigny, 1826	...	...	...	...	...	R	R	R	R	...	R	...	R
12.	(22)	**Quinqueloculina lamarckiana** d'Orbigny, 1839 ...	...	...	...	...	...	...	R	...	...	...	...	...	...
13.	(35)	**Triloculina tricarinata** d'Orbigny, 1826	...	...	...	...	...	...	R	...	...	...	...	...	..
14.	(38)	**Polysegmentina circinata** (Brady) 1881	...	...	...	...	...	...	R	...	...	...	...	...	..
15.	(44)	**Lagena acuticosta** Reuss, 1861	...	...	...	...	...	...	R	...	...	...	...	...	..
16.	(47)	**Lagena striata** (d'Orbigny) 1839	...	...	...	...	...	...	R	...	...	...	...	...	...
17.	(53)	**Vaginulina patens** Brady, 1884	...	...	...	...	...	...	R	...	...	...	...	...	...
18.	(54)	**Vaginulina vertebralis** Parr, 1932	...	...	...	...	...	...	R	...	...	...	...	...	...
19.	(65)	**Fissurina** sp. cf. **F. subquadrata** Parr, 1945	...	...	...	...	...	...	R	...	...	...	...	...	...
20.	(73)	**Bulimina marginata** d'Orbigny, 1826	...	...	...	...	...	...	R	...	...	...	...	...	R
21.	(74)	**Chrysalidinella dimorpha** (Brady) 1881	...	...	...	...	...	...	R	...	...	...	...	...	...
22.	(79)	**Discorbinella planoconcava** (Chapman, Parr and Collins) 1932	...	...	...	...	...	...	R	...	...	...	...	...	...
23.	(104)	**Globorotalia truncatulinoides** (d'Orbigny) 1839 ...	...	...	...	...	...	...	R	...	...	...	...	...	...
24.	(68)	**Buliminoides williamsonianus** (Brady) 1881	...	...	...	...	...	...	R	...	R	...	...	...	...
25.	(75)	**Reussella spinulosa** (Reuss) 1850	...	...	...	...	...	...	R	...	R	...	...	R	R
26.	(19)	**Quinqueloculina anguina arenata** Said, 1949	...	...	...	...	...	...	R	R	...	...	...	...	...
27.	(49)	**Lagena sulcata** (Walker and Jacob) 1798	...	...	...	...	...	...	R	R	...	...	...	...	...
28.	(52)	**Pseudonodosaria rotundata** (Reuss) 1849	...	...	...	...	...	...	R	R	...	...	...	...	...
29.	(101)	**Globigerinella siphonifera** (d'Orbigny) 1839	...	...	...	...	...	...	R	R	...	...	...	...	R
30.	(69)	**Bolivina alata** (Seguenza) 1862	...	...	...	...	...	...	R	R	...	...	...	R	R
31.	(118)	**Cymbaloporetta bradyi** (Cushman) 1915	...	...	...	...	...	...	R	R	...	R	R	R	F
32.	(37)	**Miliolinella labiosa** (d'Orbigny) 1839	...	...	...	...	...	...	R	R	R	...	...	...	...
33.	(48)	**Lagena striatopunctata** Parker and Jones, 1865	...	...	...	...	...	...	R	R	R	...	...	...	...
34.	(50)	**Lagena sulcata peculiaris** Cushman and McCulloch, 1950	...	...	...	...	...	...	R	R	R	...	...	...	...
35.	(83)	**Rosalina bertheloti** d'Orbigny, 1839	...	...	...	...	...	...	R	R	R	...	...	...	...
36.	(111)	**Sphaeroidinella dehiscens** (Parker and Jones) 1865	...	...	...	...	...	...	R	R	R	...	...	...	...
37.	(51)	**Lenticulina reniformis** (d'Orbigny) 1846	...	...	...	...	...	...	R	R	R	...	...	...	R
38.	(58)	**Guttulina pacifica** (Cushman and Ozawa) 1928 ..	...	...	...	...	...	...	R	R	R	...	...	R	R
39.	(106)	**Globigerinoides conglobatus** (Brady) 1879	...	...	...	...	...	...	R	R	R	...	R	...	R
40.	(199)	**Nonionella auris** (d'Orbigny) 1839	...	...	...	...	...	...	R	R	R	...	R	...	R
41.	(46)	**Lagena flatulenta** Loeblich and Tappan, 1953 ...	...	...	...	...	...	...	...	R	...	...	...	...	...
42.	(60)	**Pseudopolymorphina ligua** (Roemer) 1838	...	...	...	...	...	...	...	R	...	...	...	...	...
43.	(56)	**Globulina gibba globosa** (v.Munster) 1838	...	...	...	...	...	...	...	R	R	...	...	...	...
44.	(72)	**Bulimina gibba** Fornasini, 1902	...	...	...	...	...	...	...	...	R	...	...	...	...
45.	(77)	**Siphouvigerina porrecta** (Brady) 1879	...	...	...	...	...	...	...	...	...	...	...	R	...
46.	(43)	**Dentalina mutsui** Hada, 1931	...	...	...	...	...	...	...	...	...	...	...	...	R

Order FORAMINIFERIDA
Suborder TEXTULARIINA
Superfamily AMMODISCACEA
Family AMMODISCIDAE
Genus **Ammodiscus** Reuss, 1961

1. **Ammodiscus incertus** (d'Orbigny), 1839

Operculina incerta D'ORBIGNY, 1839a, p. 49, Pl. 6, fig. 16, 17.

Ammodiscus incertus (d'Orbigny). BRADY, 1884, p. 330, Pl. 38, Figs. 1-3.

Ammodiscus incertus (d'Orbigny). CUSHMAN, 1910, p. 73.

Distribution.—Frequent specimens occur at stations 3 and 4.

Remarks.—This species has been recorded from the Hawaiian Islands; along the south coast of Japan (Cushman, l.c.); from Antarctic and Tasmania (Parr, 1950, p. 251) and from the Bass Strait (Parr, 1943).

Superfamily LITUOLACEA
Family HORMOSINIDAE
Genus **Protoschista** Eimer and Fickert, 1899

2. **Protoschista findens** (Parker), 1870

Lituola findens PARKER, 1870, p. 176, fig. 1.

Reophax findens (Parker). CUSHMAN, 1921, p. 71, Pl. 13, fig. 4.

Protoschista findens (Parker). LOEBLICH and TAPPAN, 1953, p. 25, Pl. 1, fig. 16-18.

Distribution.—Frequent specimens occur at stn. 3.

Remarks.—This species has been recorded from the Philippines (Cushman, l.c.) and the Arctic (Loeblich and Tappan, l.c.).

Family RZEHAKINIDAE

Genus **Miliammina** Heron-Allen and Earland, 1930

3. **Miliammina fusca** (Brady), 1870

Plate 7, figures 1, 2

Quinqueloculina fusca BRADY, 1870, p. 286, Pl. 11, fig. 2a-c.

Miliammina fusca (Brady). PARKER and ATHEARN, 1959, p. 340, Pl. 50, fig. 11-12.

The tests show the chambers added in quinqueloculine arrangement with finely arenaceous wall and the terminal aperture with a simple large tooth.

Figured specimen.—Stn. 3.

Dimensions.—Length 0.48 mm., breadth 0.23 mm., thickness 0.12 mm.

Remarks.—This species has been described as being a characteristic brackish-water form (Loeblich and Tappan, 1953, p. 40).

Family LITUOLIDAE

Genus **Haplophragmoides** Cushman, 1910

4. **Haplophragmoides canariensis** (d'Orbigny), 1839

Nonionina canariensis D'ORBIGNY, 1839a, p. 128, Pl. 2, figs. 33, 34.

Haplophragmoides canariensis (d'Orbigny). BRADY, 1884, p. 310, Pl. 35, fig. 1-5.

Haplophragmoides canariensis (d'Orbigny). CUSHMAN, 1920 (1918 etc.), p. 38, Pl. 8, fig. 1.

Distribution.—It is the only species present with *Trochammina inflata* at stn. 1.

Remarks.—This species has been recorded from shallow water off the Atlantic coast of North America (Cushman, l.c.); from the Antarctic and Tasmania (Parr, 1950, p. 270); from the Great Barrier Reef (Collins, 1958, p. 350); and from Barwon Heads, Victoria (Parr, 1943).

Genus **Ammobaculites** Cushman, 1910

5. **Ammobaculites agglutinans** (d'Orbigny), 1846

Spirolina agglutinans D'ORBIGNY, 1846, p. 137, Pl. 7, fig. 10-12.

Ammobaculites agglutinans (d'Orbigny). CUSHMAN, 1910, p. 115, fig. 176.

Ammobaculites agglutinans (d'Orbigny). BARKER, 1960, p. 66, Pl. 32, fig. 19-21.

The test is formed by an early planispiral part and a later one which is uncoiled. This uncoiled portion has the chambers all of the same width and with the sutures perpendicular to the axis of growth. In one specimen the uncoiled portion is as wide as the coiled one, like the specimen figured by Brady (Barker, l.c., Pl. 32, fig. 23).

Distribution.—Stns. 3, 4. Rare.

Remarks.—This species has been recorded from deep water in the North Pacific (Cushman, 1910); from shallow and warm water in the Philippines (Cushman, 1921) and from the Great Barrier Reef (Collins, 1958, p. 350).

Genus **Ammotium** Loeblich and Tappan, 1953

6. **Ammotium cassis** (Parker), 1870

Plate 7, figure 7

Lituola cassis PARKER, 1870, pp. 177, 180, fig. 3.

Haplophragmium cassis (Parker). BRADY, 1884, p. 304, Pl. 33, figs. 17-19.

Ammobaculites cassis (Parker). CUSHMAN, 1921, p. 91, Pl. 14, fig. 4.

Ammotium cassis (Parker). LOEBLICH and TAPPAN, 1953, p. 33, Pl. 2, fig. 12-18.

Ammotium cassis (Parker). BARKER, 1960, p. 68, Pl. 33, figs. 17-19.

Distribution.—Few specimens at stns. 3, 4, 6, 13.

Remarks.—This species has been recorded from the North Pacific region and from colder water of the Atlantic, in shallow waters (Cushman, 1921).

Family TEXTULARIIDAE

Genus **Textularia** Defrance, 1824

7. **Textularia candeiana** d'Orbigny, 1839

Textularia candeiana D'ORBIGNY, 1839, p. 143, Pl. 1, figs. 25-27.

Textularis candeiana d'Orbigny. CUSHMAN, 1911 (1910 etc.), p. 12, fig. 15.

Textularia candeiana d'Orbigny. CUSHMAN, 1921, p. 109.

The test shows the early chambers slightly compressed and the later ones much inflated and increasing rapidly in size. The sutures are depressed and at right angles to the axis of the test. The wall is coarsely arenaceous but smoothly finished.

Distribution.—The middle region. Common.

Remarks.—This species has been recorded from shallow water in the Hawaiian region (Cushman, 1911) and from the Philippines (Cushman, 1921). It has been recorded also from the Great Australian Bight, near Eucla (Parr, 1943).

8. **Textularia pseudogramen** Chapman and Parr, 1937

Textularia pseudogramen CHAPMAN and PARR, 1937, p. 153.

Textularia pseudogramen Chapman and Parr. BARKER, 1960, p. 88, Pl. 43, fig. 10.

The test is elongate with wall very coarsely arenaceous. The chambers, after having increased rapidly in size, remain of constant dimension for ⅔ of the test. The aperture consists of a slit at the inner margin of the last-formed chamber.

Distribution.—The middle region. Frequent.

Remarks.—Original description from SE of Tasmania: 42°38'S, 148°41'E, 1320 fms. (but not figured). It is stated by Chapman and Parr to be "a common form on the Australian Coast." It has also been recorded from Bass Strait (Parr, 1943) and from Barwon Heads (Parr, 1945).

9. **Textularia sagittula atrata** Cushman, 1911

Plate 7, figure 6

Textularia sagittula Defrance var. *atrata*. CUSHMAN, 1911 (1910 etc.), p. 7, figs. 2-5.

Textularia sagittula var. *atrata* Cushman. CUSHMAN, 1921, p. 103, Pl. 20, fig. 5.

The tests are normally small and subacute in transverse section, but not keeled. The aperture consists of a long narrow slit along the basal suture of the last-formed chamber in the centre of the terminal face. The peculiar dark material which covers the sutures is present in all specimens.

Figured specimen.—Stn. 9.

Dimensions.—Length 0.71 mm., breadth 0.36 mm., thickness 0.16 mm.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from the Philippines area (Cushman, 1921).

10. **Textularia siphonifera** Brady, 1881

Plate 7, figure 11

Textularia siphonifera BRADY, 1881, p. 53.

Textularia siphonifera Brady. BRADY, 1894, p. 362, Pl. 42, figs. 25-29.

Textularia siphonifera Brady. CUSHMAN, 1911 (1910 etc.), p. 17, fig. 28-29.

The text is elongate, with initial end somewhat flattened. The chambers are low and broad. The later portion of the test bears three or four vertical rows of projections, the ends of which are normally open, sometimes closed and rounded. The wall is arenaceous and finely polished. The aperture is at the inner margin of the chamber and consists of a simple slit.

The specimens show no trace of a triserial stage like that described by Cushman in *Gaudryina siphonifera* (Cushman, 1937, p. 83, Pl. 12, figs. 9, 10).

Figured specimen.—Stn. 8.

Dimensions.—Length 0.51 mm., breadth 0.31 mm., thickness 0.25 mm.

Distribution.—Only at stn. 8. Frequent.

Remarks.—This species has been recorded from the Indo-Pacific region and seems to be best developed in shallow water (Cushman, 1911, l.c.).

In Australian waters it has been recorded by Parr from the Great Barrier Reef (Cushman, 1937, p. 83).

Family TROCHAMMINIDAE

Genus **Trochammina** Parker and Jones, 1859

11. **Trochammina inflata** (Montagu), 1808

Plate 7, figures 3-5

Nautilus inflatus MONTAGU, 1808, p. 81, fig. 3.

Trochammina inflata (Montagu). BRADY, 1884, p. 338, Pl. 41, fig. 4,

Trochammina inflata (Montagu). CUSHMAN and MCCULLOCH, 1939, p. 102, Pl. 11, figs. 2a-c.

Most specimens are typical and agree completely with the description of this species by Cushman and McCulloch (l.c.). Several specimens, however, differ from the normal forms in having the wall of many chambers collapsed. Although clearly conspecific with the normal forms of *T. inflata*, those specimens with collapsed chambers are placed in record and figured (Pl. 7, fig. 5).

Figured specimen.—Stn. 3.

Dimensions.—Figs. 3, 4: greater diameter 0.60 mm., lesser diameter 0.50 mm., height 0.30 mm.; fig. 5: greater diameter 0.63 mm., lesser diameter 0.49 mm., height 0.15 mm.

Distribution.—This species, unknown in the middle part of Port Hacking, is quite well developed and very common in the section of Port Hacking River between Audley (stn. 1) and Gymea Bay (stn. 5). The collapsed form has the same distribution as the normal form but it is less common.

Remarks.—This species has been recorded from the Victorian coast at the mouth of Kororoit Creek and Barwon River (Parr, l.c.), in situations of lowered salinity.

Genus **Tritaxis** Schubert, 1920

12. **Tritaxis conica** (Parker and Jones), 1865

Valvulina triangularis d'Orbigny var. *conica*. PARKER and JONES, 1865, p. 406, Pl. 15, fig. 27.

Valvulina conica Parker and Jones. BRADY, 1884, p. 392, Pl. 49, fig. 15.

Tritaxis conica (Parker and Jones). BARKER, 1960, p. 100, Pl. 49, fig. 15.

Typical specimens occur at stns. 2, 3, 4, 13, 14. Common.

Remarks.—This species has been recorded from the Hawaiian Islands (Cushman, 1911, 1910 etc., p. 58) and from the Philippines (Cushman, 1921, p. 142). It has also been recorded from the Great Barrier Reef (Collins, 1958, p. 358).

Family ATAXOPHRAGMIIDAE

Genus **Gaudryina** d'Orbigny, 1839

13. **Gaudryina quadrangularis** Bagg, 1908

Gaudryina quadrangularis BAGG, 1908, Proc. U. S. Nat. Mus., vol. 34, p. 133, Pl. 5, fig. 1.

Gaudryina quadrangularis BAGG. CUSHMAN, 1911 1910 etc.), p. 64, fig. 103.

Gaudryina quadrangularis BAGG. CUSHMAN, 1932, p. 14, Pl. 3, figs. 10, 11.

The sutures, especially in the early part, are obscured. The aperture consists of a slit at the inner margin of the chamber.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from Hawaiian waters (Cushman, 1911) and from the Philippines (Cushman, 1921, p. 147).

Genus **Eggerella** Cushman, 1933

14. **Eggerella subconica** Parr, 1950

Eggerella sp. PARR, 1945, p. 105, Pl. 8, fig. 5.

Eggerella subconica PARR, 1950, p. 281, Pl. 5, figs. 22a, b.

The specimens from Port Hacking agree with Parr's description. The test is very small and it is formed by chambers arranged in a trochoidal spire; the wall is finely arenaceous and the aperture is a slit at the base of the inner margin of the last chamber. The size of the chambers increase rapidly and it gives to the test a very pronounced triangular shape. The length/breadth ratio of the specimens figured by Parr and the specimens from Port Hacking shows the last one to be slightly narrower; in this regard they are closer to the specimens figured by Parr 1945:

Figured specimen, Parr 1945: 1.333.

Figured specimen, Parr 1950: 1.182.

Specimens from Port Hacking: 1.359; 1.300; 1.454; 1.500; 1.461; 1.408; 1.615; 1.538; 1.500; 1.461; 1.384.

Distribution.—Present at stns. 2, 3.

Remarks.—This species has been recorded from Barwon Heads (Parr, 1945), and from off Maria Island, Tasmania (Parr, 1950).

Suborder MILIOLINA
Superfamily MILIOLACEA
Family NUBECULARIIDAE

Genus Spiroloculina d'Orbigny, 1826

15. **Spiroloculina antillarum** d'Orbigny, 1839

Plate 7, figure 21

Spiroloculina antillarum D'ORBIGNY, 1839a, p. 166, Pl. 9, figs. 3, 4.

Spiroloculina antillarum d'Orbigny. CUSHMAN and TODD, 1944, p. 44, Pl. 6, figs. 28-32.

The tests agree with the description by Cushman and Todd (l.c.), and they are generally very well developed. The chambers, circular in cross-section, are ornamented with many longitudinal costae. The aperture is at the end of a short circular neck and has a bifid tooth.

Figured specimens.—Stn. 8.

Dimensions.—Length 1.62 mm., breadth 1.10 mm., thickness 0.20 mm.

Distribution.—This species is common in nearly all the bay, and at some localities the specimens reach relatively large dimensions.

Remarks.—This species has been recorded from shallow water in South Australia and Victoria (Parr, 1943).

16. **Spiroloculina canaliculata** d'Orbigny, 1846

Spiroloculina canaliculata D'ORBIGNY, 1846, p. 269, Pl. 16, figs. 10-12.

Spiroloculina canaliculata d'Orbigny. CUSHMAN and TODD, 1944, p. 22, Pl. 4, figs. 1-11.

The test is flat, slightly concave in the central part. The inner and outer edges of each chamber are raised and lighter in colour than the depressed middle part. The wall is smooth and the aperture is oval, at the end of a flat and very short neck; it does not contain a tooth. The light-coloured raised edges, outlining the chambers, are a distinct feature.

Distribution.—The middle region. Rare.

Remarks.—In the Recent this species has been recorded from the British Isles, Ireland, Dunkerque, Island of Delos and off Sicily (Cushman and Todd, l.c.).

17. **Spiroloculina lucida** Cushman and Todd, 1944

Plate 7, figure 15

Spiroloculina lucida CUSHMAN and TODD, 1944, p. 70, Pl. 9, figs. 30, 31.

The test is oval, depressed in the early portion, with convex periphery and slightly angled at the margins. Chambers distinct with wall slightly roughened but glistening and with few black patches; the neck is short and contains a thin bifid tooth on the inner margin and a simple tooth on the outer margin.

Figured specimen.—Stn. 8.

Dimensions.—Length 0.75 mm., breadth 0.49 mm., thickness 0.18 mm.

Distribution.—The middle region. Common.

Remarks.—This species has been recorded from off Watson's Bay and Port Jackson (Cushman and Todd, l.c.), and from the Great Barrier Reef (Collins, 1958, p. 364).

Genus **Vertebralina** d'Orbigny, 1826

18. **Vertebralina striata** d'Orbigny, 1826

Vertebralina striata D'ORBIGNY, 1826, p. 283, No. 1, Pl. 81.

Vertebralina striata d'Orbigny. BRADY, 1884, p. 187, Pl. 2, figs. 14-16.

Vertebralina striata d'Orbigny. CUSHMAN, 1932, p. 73, Pl. 16, figs. 8-10.

All specimens are very well developed and agree completely with Brady's and Cushman's figures and descriptions.

Distribution.—Present in the middle region. Common only at stn. 8.

Remarks.—This species has been recorded from Westernport, Victoria; Spencer Gulf, South Australia (Parr, 1943) and "from the sand obtained near Melbourne" (Chapman, 1907, p. 125). It has

been also recorded from the Great Barrier Reef (Collins, 1958, p. 373).

Family MILIOLIDAE

Genus **Quinqueloculina** d'Orbigny, 1826

19. **Quinqueloculina anguina arenata** Said, 1949

Quinqueloculina anguina (Terquem) var. *agglutinans* (Wiesner) in HERON-ALLEN and EARLAND, 1915, p. 575.

Quinqueloculina anguina (Terquem) var. *arenata*. SAID, 1949, p. 9, Pl. 1, fig. 25.

Quinqueloculina anguina arenata COLLINS, 1958, p. 358.

The test is elongate with distinct chambers and the sutures little depressed. The aperture is at the end of a short neck. The surface of the test is completely covered by arenaceous material, quite coarse with a rough appearance; the space between the grains is not filled with shell material on the outer surface.

Distribution.—Only two specimens but very well developed from stns. 8, 9.

Remarks.—This species has been recorded as common from the Pacific area (Cushman, 1932, p. 18), from the Great Barrier Reef and from as far south as Tasmania (Collins, l.c.).

20. **Quinqueloculina baragwanathi** Parr, 1945

Plate 7, figures 16, 17

Quinqueloculina baragwanathi PARR, 1945, p. 196, Pl. 8, figs. 6a-c; Pl. 12, fig. 3.

Tests small of rather irregular form. The periphery is subacute and the chambers are distinct. The surface is mat and ornamented by short costae, obliquely curved, extending inward from the periphery. The aperture is semicircular with a simple semicircular tooth.

Figured specimen.—Stn. 9.

Dimensions.—Length 0.72 mm., breadth 0.51 mm., thickness 0.28 mm.

Distribution.—The middle region. Frequent.

Remarks.—It is a common species on the south coast of Australia; it has also been recorded from shallow water, near Numea, New Caledonia (Parr, l.c.).

21. **Quinqueloculina costata** d'Orbigny, 1826

Plate 7, figures 22, 23

Quinqueloculina costata D'ORBIGNY, 1826, Vol. 7, p. 301, No. 3.

Quinqueloculina costata d'Orbigny. CUSHMAN, 1932, p. 20, Pl. 5, figs. 6, 7.

Figured specimen.—Stn. 8.

Dimensions.—Length 1.00 mm., breadth 0.68 mm., thickness 0.31 mm.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from S. Remo, Victoria (Parr, 1943); from Barwon Heads (Parr, 1945) and from the Pacific: Tonga Island, Fiji Island (Cushman, l.c.).

22. **Quinqueloculina lamarckiana** d'Orbigny, 1839

Quinqueloculina lamarckiana D'ORBIGNY, 1839a, p. 189, Pl. 11, figs. 14, 15.

Quinqueloculina lamarckiana d'Orbigny. CUSHMAN, 1921, p. 418, Pl. 87, figs. 2, 3a-c.

Quinqueloculina lamarckiana d'Orbigny. CUSHMAN, 1929 (1918 etc.), p. 26, Pl. 2, figs. 6a-c.

Only one specimen; agrees with Cushman's figures and description except for the tooth which is simple and for the unusual outwardly projecting angle of the 3rd-last chamber.

Distribution.—Only one specimen at stn. 8.

Remarks.—This species has been recorded from shallow waters of S. Australia and Victoria (Parr, 1943) and from Barwon Heads (Parr, 1945).

23. **Quinqueloculina pseudoreticulata** Parr, 1941

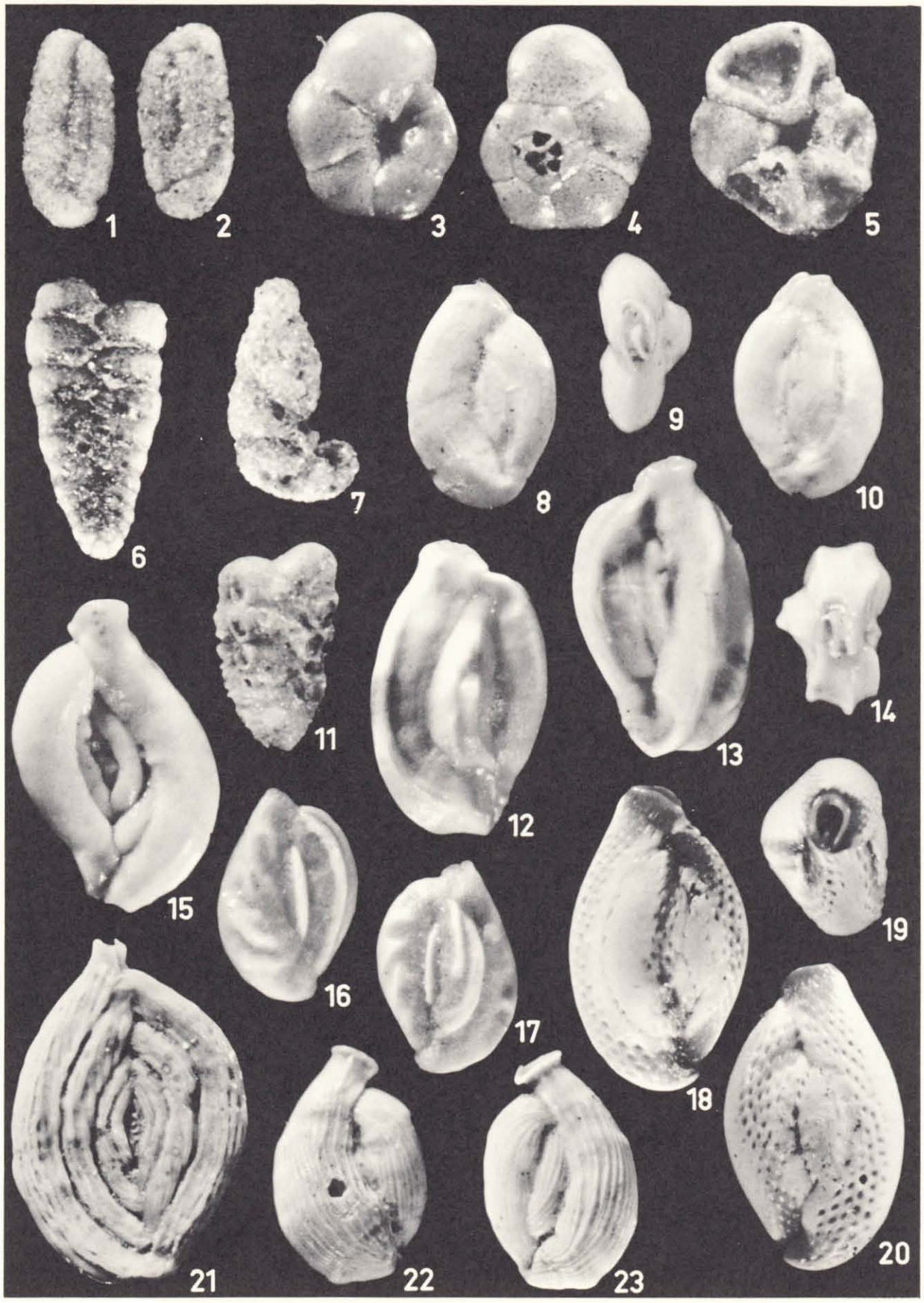
Plate 7, figures 18-20

Miliolina reticulata BRADY, 1884, p. 177, Pl. 9, figs. 2, 3.

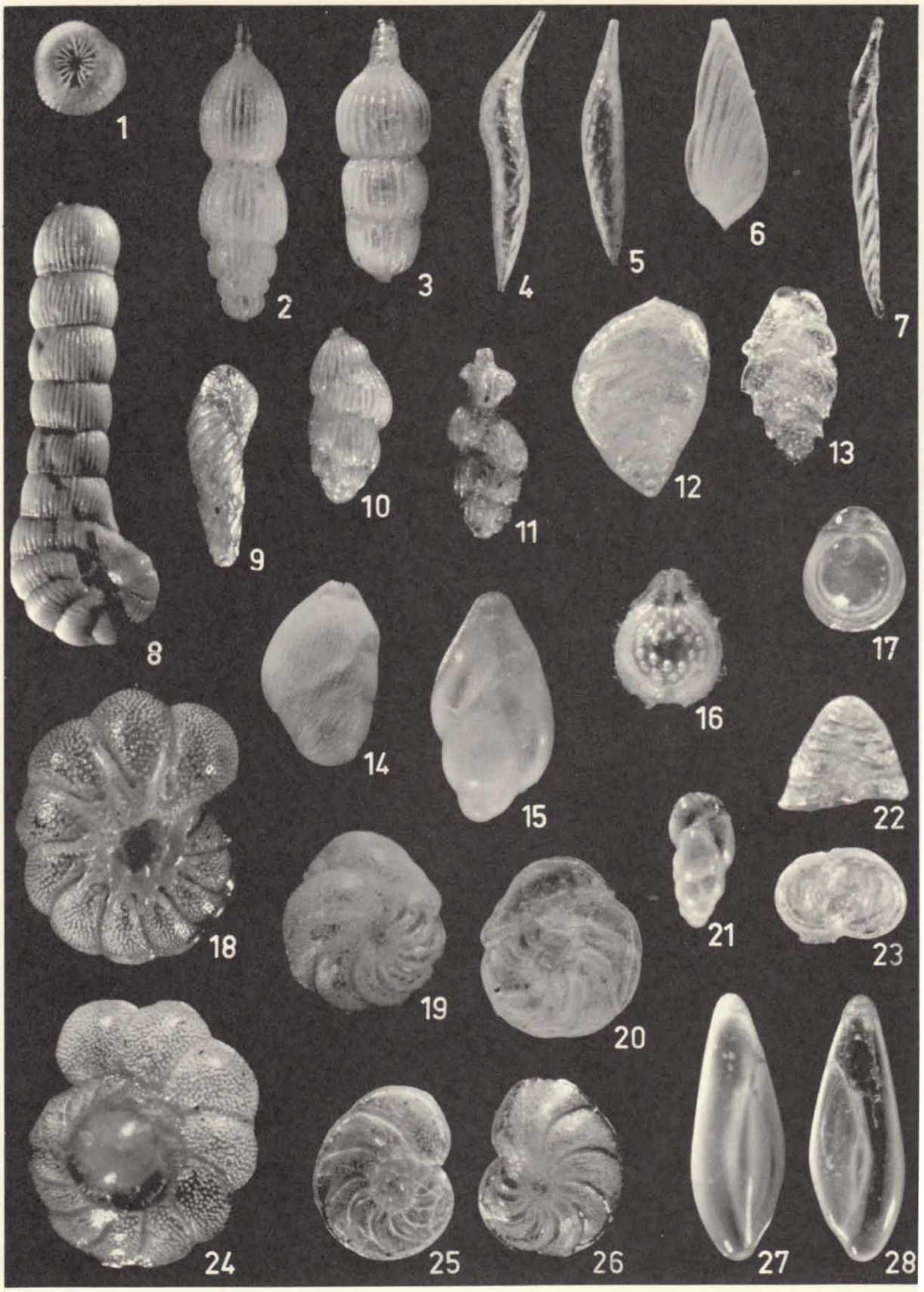
Quinqueloculina pseudoreticulata PARR, 1941, p. 305.

Quinqueloculina pseudoreticulata Parr. BARKER, 1960, p. 18, Pl. 9, figs. 2, 3.

EXPLANATION OF PLATE 7



Albani: Recent Foraminifera from New South Wales



Albani: Recent Foraminifera from New South Wales

The chambers show clearly the reticulate ornamentation. They differ from Brady's figures for the tooth which is, in the specimens of the Bay, not bifid, but simple. Specimens from Gulf of Carpentaria agree closely with Brady's figures, but specimens from Port Hacking have areas of smooth surface in the central part of each face and a smaller tooth; they are also more elongate.

Figured specimen.—Stn. 8.

Dimensions.—Length 1.37 mm., breadth 0.83 mm., thickness 0.65 mm.

Distribution.—The middle region only. Common.

Remarks.—This species has been recorded from the Great Barrier Reef (Collins, 1958, p. 361) and from the Great Australian Bight, near Eucla (Parr, 1943).

24. **Quinqueloculina seminula** (Linné), 1767

Serpula seminulum LINNÉ, 1767, p. 1264, No. 791.

Miliolina seminulum (Linné). BRADY, 1884, p. 157, Pl. 5, figs. 6a-c.

Quinqueloculina seminula (Linné). CUSHMAN, 1944, p. 13, Pl. 2, fig. 14.

The test agrees with Cushman's figure and description.

Distribution.—Present in almost all stations.

Remarks.—This species has been recorded from Barwon Heads, Victoria (Parr, 1945).

25. **Quinqueloculina seminula jugosa** Cushman, 1944

Quinqueloculina seminula (Linné) var. *jugosa.* CUSHMAN, 1944, p. 13, Pl. 2, fig. 15.

"Variety differing from the typical in having the surface with distinct, oblique costae." (Cushman, l.c.).

Distribution.—Present in few stations only.

Remarks.—This species was originally recorded from shallow water of the New England coast.

26. **Quinqueloculina subpolygona** Parr, 1945

Plate 7, figures 12-14

Quinqueloculina subpolygona PARR, 1945, p. 196, Pl. 12, figs. 2a-c.

All the tests agree completely with Parr's description. The chambers, polygonal in cross-section, have an undulate carina at each angle.

Figured specimen.—Stn. 9.

Dimensions.—Length 1.20 mm., breadth 0.75 mm., thickness 0.40 mm.

Distribution.—This species is one of the most common in Port Hacking.

Remarks.—Parr (l.c.) refers to this species as the commonest of the genus on the south coast of Australia.

27. **Quinqueloculina** sp. cf. **Q. cuvieriana queenslandica** Collins, 1958

Quinqueloculina cuvieriana d'Orbigny var. *queenslandica* COLLINS, 1958, p. 359, Pl. 2, figs. 7a-c.

The tests agree generally with the figures and description by Collins (l.c.); the chambers are nearly triangular in transverse section with periphery truncated or rounded. They differ in the aperture which is much narrower than that in Collin's figure, also in the tooth and in the lips which flank the aperture. The "2 or 3 low costae" (Collins, l.c.) are rarely present.

Distribution.—Middle region. Frequent.

Remarks.—This subspecies was originally described from the Great Barrier Reef (Collins, l.c.).

EXPLANATION OF PLATE 8

28. **Quinqueloculina** sp. cf. **Q. moynensis** Collins, 1953

Quinqueloculina moynensis COLLINS, 1953, p. 98, Pl. 1, figs. 1a-c.

The test is elongate and triangular in cross-section with angles, appearing quite similar to *Triloculina oblonga* (Montagu). Five chambers are, on the other hand, clearly shown. The intercameral sutures are displaced about 10° from the poles of the test. The aperture, without neck, has a bifid tooth.

The specimens from Port Hacking differ from *Q. moynensis* in its periphery, which is more rounded, and in its size, being bigger and more robust than *Q. moynensis*.

Distribution.—The middle region. Frequent.

Remarks.—*Quinqueloculina moynensis*, originally described from the Pleistocene of Port Fairy, Victoria (Collins, l.c.), has been recorded from recent material on the Victorian coast (Collins, personal communication).

Genus **Massilina** Schlumberger, 1893

29. **Massilina secans tropicalis** Collins, 1958

Plate 7, figures 8-10

Massilina secans (d'Orbigny). HERON-ALLEN and EARLAND, 1915, p. 582, Pl. 44, figs. 24-27.

Massilina secans (d'Orbigny) var. *tropicalis*. COLLINS, 1958, p. 362, Pl. 2, figs. 10a-c.

The test is ovate with slightly roughened surface and with sharp-edged periphery. In cross-section the test has a flat elliptical shape with the early quinqueloculine chambers projecting. The aperture is large, loop-shaped with a slight lip and with a large tooth thickened and slightly bifurcating at its tip. A few small specimens show an aboral "spine."

Figured specimen.—Stn. 7.

Dimensions.—Length 1.08 mm., breadth 0.73 mm., thickness 0.35 mm.

Distribution.—Stns. 7, 12, 13. Common.

Remarks.—Collins (l.c.) records this species from mangrove-swamp pools from the interior of Low Island. Collins has similar specimens also from Dar-es-Salaam, Tanganyika Territory; in regard to Kerimba specimens (Heron-Allen and Earland, l.c.) he considers that the figured specimens "are referable to this subspecies" (Collins, l.c.).

Genus **Pyrgo** Defrance, 1824

30. **Pyrgo depressa** (d'Orbigny), 1826

Biloculina depressa D'ORBIGNY, 1826, p. 298, No. 7, Pl. 91.

Biloculina depressa d'Orbigny. BRADY, 1884, p. 145, Pl. 3, figs. 1, 2.

Pyrgo depressa (d'Orbigny). BARKER, 1960, p. 6, Pl. 3, figs. 1, 2.

Very common in the middle region.

Remarks.—This species has been recorded from Point Lonsdale, Victoria (Parr, 1943); from off north-eastern Tasmania, from the Antarctic (Parr, 1950) and from the mangrove-swamp pools of the Great Barrier Reef (Collins, 1958).

Genus **Sigmoilina** Schlumberger, 1887

31. **Sigmoilina australis** (Parr), 1932

Miliolina subrotunda (Montagu). BRADY, 1894, p. 168, Pl. 5, figs. 10-11.

Quinqueloculina australis PARR, 1932, pt. 1, p. 7, Pl. 1, fig. 8.

Sigmoilina australis (Parr). PARR, 1945, p. 197.

In front view the test is normally circular, with periphery rounded and wall surface smooth; the aperture is crescentic. The sutures are distinct. Slight elongation of each chamber occurs in some specimens causing a marked obliquity of the sutures in relation to the vertical axis of the test.

Distribution.—The middle region. Frequent. The elongate specimens are more abundant than the circular form.

Remarks.—This species has been recorded from off the coast of New South Wales, from the Great Australian Bight (Parr, 1932), from Point Lonsdale and from Barwon Heads, Victoria (Parr, 1945), from off north-eastern Tasmania (Parr, 1950) and from deep water dredging (Sample 45, 600 metres) in the Great Barrier Reef (Collins, 1958).

Genus **Triloculina** d'Orbigny, 1826

32. **Triloculina affinis** d'Orbigny, 1826

Triloculina affinis D'ORBIGNY, 1826, p. 299, No. 2.

Triloculina affinis d'Orbigny. CUSHMAN, 1932, p. 58, Pl. 13, figs. 4a, b.

Present in the middle region.

Remarks.—This species has been recorded from Fiji (Cushman, l.c.).

33. **Triloculina oblonga** (Montagu), 1803

Vermiculum oblongum MONTAGU, 1803, p. 522, Pl. 14, fig. 9.

Miliolina oblonga Torrigi. BRADY, 1884, p. 160, Pl. 5, figs. 4a-b.

Triloculina oblonga (Montagu). CUSHMAN, 1917 (1910 etc.), p. 69, Pl. 26, figs. 3a, b; p. 69, fig. 36.

Few specimens show the biloculine form. The aperture, nearly circular, shows the tooth which is simple or bifid. The wall is smooth and polished; near the apertural end it has often a black or brownish colour; in few specimens this colouration also marks the sutures.

Distribution.—The middle region. Frequent. The biloculine forms are only present at stns. 4 and 5, where no triloculine forms have been found.

Remarks.—This species has been recorded from

Honolulu and Manila Bay (Cushman, l.c.); from Australian waters it has been recorded in shallow waters of S. Australia and Victoria (Parr, 1943), and from the Great Barrier Reef (Collins, 1958, p. 369).

34. **Triloculina striatotrigonula** Parker and Jones, 1865

Triloculina striatotrigonula PARKER and JONES, 1865, p. 438.

Miliolina insignis BRADY, 1884, p. 165, Pl. 4, fig. 10.

Triloculina striatotrigonula Parker and Jones. BARKER, 1960, p. 8, Pl. 4, fig. 10.

The test differs from *T. trigonula* in the ornamentation, which consists of a series of striae jointing the oral and aboral end of each chamber. The aperture shows a bifid tooth.

Distribution.—The middle region. Rare.

Remarks.—The fig. 10 by Brady (l.c.) has been transferred to *Triloculina striatotrigonula* by Parr (1941, p. 305). It is "a common species in shallow water on the south coast of Australia" (Parr, l.c.).

35. **Triloculina tricarinata** d'Orbigny, 1826

Triloculina tricarinata D'ORBIGNY, 1826, Vol. 7, p. 299, No. 7.

Miliolina tricarinata (d'Orbigny). BRADY, 1884, p. 165, Pl. 3, figs. 17a, b.

Triloculina tricarinata d'Orbigny. CUSHMAN, 1932, p. 59, Pl. 13, figs. 3a, b.

Distribution.—Rare at stn. 8.

Remarks.—This species has been recorded from shallow waters in S. Australia and Victoria (Parr, 1943), and from the Great Barrier Reef (Collins, 1958, p. 370).

36. **Triloculina trigonula** (Lamarck), 1804

Miliola trigonula LAMARCK, 1904, Ann. Mus. d'Hist. Nat., vol. 5, p. 351, No. 3.

Miliolina trigonula Williamson. BRADY, 1884, p. 164, pl. 3, figs. 14-16.

Triloculina trigonula (Lamarck). CUSHMAN, 1932, p. 56, Pl. 13, figs. 1a, b.

Distribution.—Large and well preserved specimens occur commonly in the central part of Port Hacking.

Remarks.—This species has been recorded from Fiji (Cushman, l.c.), Westernport Bay, Victoria (Parr, 1943), Barwon Heads and on the coast of Victoria and South Australia (Parr, 1945); east of Albany, Western Australia and from the Antarctic (Parr, 1950).

Genus **Miliolinella** Wiesner, 1931

37. **Miliolinella labiosa** (d'Orbigny), 1839

Triloculina labiosa D'ORBIGNY, 1839a, p. 178, Pl. 10, figs. 12-14.

Miliolina labiosa BRADY, 1884, p. 170, Pl. 6, figs. 3-5.

Miliolinella labiosa (d'Orbigny). BARKER, 1960, p. 12, Pl. 6, figs. 3-5.

The test is largely formed by the two last-formed chambers; the first chamber is strongly inflated and visible between the two other chambers. The shape is variable and the wall is smooth. The aperture consists of a long narrow opening. The tests agree partially with Cushman's description (1932, p. 53, Pl. 11, figs. 12a-c). The specimens of Port Hacking do not possess the lip on the inner side of the chamber, as figured by Cushman (l.c.).

Distribution.—Rare at stns. 9 and 13.

Remarks.—This species has been recorded as *Triloculina labiosa* from Fiji (Cushman, l.c.) and from shallow water in South Australia and Victoria (Parr, 1943); as *Miliolina labiosa* from Challenger stns. 135, off Tristan d'Acunha, Atlantic (100-150 fms) and *Challenger* stns. 306 west of Patagonia, Pacific (345 fms) (Brady, l.c.).

Genus **Polysegmentina** Cushman, 1946

38. **Polysegmentina circinata** (Brady), 1881

Hauerina circinata BRADY, 1881, p. 47.

Hauerina circinata Brady. CUSHMAN, 1917 (1910 etc.), p. 63, Pl. 23, figs. 3, 4.

Polysegmentina circinata (Brady). LOEBLICH and TAPPAN, 1955, p. 16, Pl. 3, fig. 1.

The test agrees with figures and descriptions by (Brady) (l.c.), Cushman (l.c.), and Loeblich and Tappan (l.c.).

Distribution.—One specimen at stn. 8.

Remarks.—This species has been recorded from Laysan Island, from "shallow-water dredgings among the islands between Australia and Borneo" (Cushman, l.c.), and from the Great Barrier Reef (Collins, 1958, p. 374).

Family SORITIDAE

Genus **Peneroplis** Montfort, 1808

39. **Peneroplis planatus** (Fichtel and Moll), 1798

Nautilus planatus FICHTEL and MOLL, 1798, p. 91, Pl. 16, figs. A-I.

Peneroplis planatus (Fichtel and Moll). CUSHMAN, 1933 (1932 etc.), p. 61, Pl. 19, figs. 1-3.

Remarks.—It has been recorded from Gulf of St. Vincent, South Australia (Parr, 1943), from Barwon Heads (Parr, 1945) and from the Great Barrier Reef (Collins, 1958, p. 375).

Genus **Spirolina** Lamarck, 1804

40. **Spirolina cylindracea** Lamarck, 1804

Plate 8, figures 1, 8

Spirolina cylindracea LAMARCK, 1804, Ann. Mus. Nat. Hist., Paris, Vol. 5, p. 245; Vol. 8 (1806), Pl. 62, figs. 15.

Spirolina cylindracea Lamarck. COLLINS, 1958, p. 376.

The tests are very elongate with initial part coiled

and slightly compressed. The uncoiled part is circular in transverse section. The sutures are clearly marked in the coiled portion and depressed in the uncoiled one; the ornamentation consists of longitudinal costae, and the aperture of a series of radiating slits.

Figured specimen.—Stn. 13.

Dimensions.—Length 2.55 mm., breadth 0.51 mm.

Distribution.—It is frequent only at stn. 13 (Gunnamatta Bay).

Remarks.—This species has been recorded from the Great Australian Bight (Chapman and Parr, 1935) and from the Great Barrier Reef (Collins, l.c.).

Genus **Sorites** Ehrenberg, 1840

41. **Sorites marginalis** (Lamarck), 1816

Orbulites marginalis LAMARCK, 1816, Syst. Anim. sand. Vert., Vol. 2, p. 196, No. 1.

Orbitolites marginalis (Lamarck). BRADY, 1894, p. 214, Pl. 15, figs. 1-5.

Sorites marginalis (Lamarck). CUSHMAN, 1933 (1932, etc.), p. 64.

Distribution.—Frequent at stn. 13.

Remarks.—This species has been recorded from Fiji (Cushman, l.c.); from the Philippine Islands, in shallow water (Cushman, 1921, p. 485). It is common in the Indo-Pacific region, inhabiting the shallow margins of warm seas (Howchin and Parr, 1938, p. 301).

Suborder ROTALIINA
Superfamily NODOSARIACEA
Family NODOSARIIDAE
Genus **Amphicoryna** Schlumberger, 1881

42. **Amphicoryna scalaris** (Batsch), 1791

Plate 8, figures 2, 3

Nautilus (*Orthoceras*) *scalaris* BATSCH, 1791, Conch. des. Seesandes, No. 4, Pl. 2, figs. a, c.

Nodosaria scalaris (Batsch). BRADY, 1884, p. 510, Pl. 63, figs. 28-31.

Amphicoryna scalaris (Batsch). BARKER, 1960, p. 134, Pl. 63, figs. 28-31.

The test consists of a straight linear series of chambers (3 to 5), with the aperture at the end of an annulated neck. The ornamentation is formed by several strong costae.

Figured specimens.—Stn. 9.

Dimensions.—Fig. 2: length 1.18 mm., breadth 0.34 mm.; fig. 3: length 0.93 mm., breadth 0.35 mm.

Distribution.—The middle region. Frequent.

Remarks.—Referred by Brady to *Nodosaria scalaris* and to *Lagenonodosaris scalaris* by Chapman (1941, p. 161); considered by Cushman as synonym of the genus *Nodosaria* Lamarck 1812 (Cushman, 1950, p. 215). Barker (l.c.) concludes that if Brady's specimens are congeneric with *N. scalaris* var. *separans* Brady they should be considered as *Lagenonodosaria* Silvestri 1900 of which the "var. *separans*" is the type species. Parr (1950, p. 327) places the genus *Lagenonodosaria* in the synonym *Amphicoryne* Schlumberger 1881. The genus *Amphicoryna* was erected by Schlumberger for those foraminifera which "dans le jeune age, il revet les formes d'un *Cristellaria* et, plus tard, celles d'une *Nodosaria*" (Milne-Edwards, 1881, p. 881). Parr (l.c.) remarks: "I have examples from Pliocene of Italy and those show conclusively that *Amphicoryne falx* is the microspheric form and Batsch's species the megalospheric form of the same species." It follows that *N. scalaris*, being congeneric with *N. scalaris* var. *separans*, must be placed in *Amphicoryna*.

The examination of the specimens collected has shown the presence of two forms of which one is considered to be the megalospheric form (fig. 3). However, it is possible that they could represent the two megalospheric forms of the trimorphic cycle (Hofker, 1951, pp. 2-5) and that no true microspheric form has been found in the material examined. Although noting the absence of the criteria of *Amphicoryna* in the material from Port Hacking, the views of Parr (1950) are accepted and the species placed in *Amphicoryna*.

As *Lagenonodosaria*, this species has been recorded from off Cape Wiles, South Australia (100 fms.); on the coast of New Zealand; the Philippines; Japan and the Hawaiian Islands (Chapman, 1941, p. 161). As *Amphicoryne*, it has been recorded from the Great Barrier Reef (Collins, 1958, p. 383).

Genus **Dentalina** d'Orbigny, 1826

43. **Dentalina mutsui** Hada, 1931

Dentalina mutsui HADA, 1931, Tohoku Imp. Univ. Sci. Repts., Vol. 6, p. 97.

Dentalina mutsui Hada. PARR, 1945, p. 201, Pl. 12, fig. 5.

The test agrees with Hada's figure and description.

Distribution.—Stn. 8 only one specimen.

Remarks.—This species, originally recorded from Mutsu Bay (15-25 fms.) Japan, has been recorded from Barwon Heads, Victoria (Parr, l.c.).

Genus **Lagena** Walker and Boys, 1784

44. **Lagena acuticosta** Reuss, 1861

Lagena acuticosta REUSS, 1861, Sitz, Akad. Wiss, Wien., Vol. 44, pt. 1, p. 305, Pl. 1, fig. 4.

Lagena acuticosta Reuss. BRADY, 1884, p. 464, Pl. 57, fig. 31.

Lagena acuticosta Reuss. CUSHMAN, 1933 (1932 etc.), p. 34, Pl. 8, fig. 12.

The test is pyriform with rounded base. The ornamentation consists of approximately 16 longitudinal costae strongly raised. Near the aperture they coalesce into a plate-like area.

Distribution.—Very rare at stn. 8.

Remarks.—This species has been recorded as very common at the *Albatross* stations of the South Pacific in deep water (Cushman, l.c.). It has also been recorded from Port Fairy, Victoria (Parr, 1943).

45. **Lagena distoma margaritifera** Parker and Jones, 1865

Plate 8, figures 4, 5

Lagena distoma-margaritifera PARKER and JONES, 1865, p. 357, Pl. 18, figs. 6a, b.

Lagena distoma-margaritifera Parker and Jones. BRADY, 1884, p. 458, Pl. 58, fig. 16.

Lagena distoma-margaritifera Parker and Jones. PARR, 1932, pt. 1, p. 11, Pl. 1, fig. 16.

The test is fusiform, closed at one end and terminating with a long neck and a circular aperture at the other end. It shows clearly the ornamentation formed by several smooth twisted costae. A small number of specimens open at both ends.

Figured specimen.—Stn. 8.

Dimensions.—Fig. 5: length, 1.16 mm., breadth 0.21 mm.; fig. 4: length 1.30 mm., breadth 0.21 mm.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from near Melbourne; off East Moncoeur Island, Bass Strait, 38 fms.; off the west coast of New Zealand at the mouth of the Port Adelaide River, South Australia (Parr, 1932) and from deep water of Bass Strait (Challenger stn. 162).

46. **Lagena flatulenta** Loeblich and Tappan, 1953

Lagena flatulenta LOEBLICH and TAPPAN, 1953, p. 60, Pl. 11, fig. 10.

Only one specimen at the stn. 9.

Remarks.—Having only one specimen, the determination is doubtful. The main typical features of this species are present, but the "shoulder angle" is much less than that of specimens figured by Loeblich and Tappan, whose specimens came from the Arctic.

47. **Lagena striata** (d'Orbigny), 1839

Oolina striata D'ORBIGNY, 1839, p. 21, Pl. 5, fig. 12.

Lagena striata d'Orbigny. SIDEBOTTOM, 1913, p. 169, Pl. 15, fig. 17.

Distribution.—Stn. 8. Only one specimen.

Remarks.—Widely distributed in deep water in south-west Pacific (Sidebottom, 1913), it has been recorded from shallow water in South Australia and Victoria (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 379).

48. **Lagena striatopunctata** Parker and Jones, 1865

Lagena sulcata var. *striatopunctata* PARKER and JONES, 1865, p. 350, Pl. 13, figs. 25-27.

Lagena striatopunctata Parker and Jones. SIDEBOTTOM, 1912, p. 392, Pl. 16, fig. 9.

The test has a pyriform shape, circular in section, very short neck and costae hollowed out, with transverse connections between costae, resulting in a reticulate pattern of ridges with deep conical pits between them.

Distribution.—Rare in the middle region.

Remarks.—The records of this species are all from deep-water (Sidebottom, l.c.). It has also been recorded from the Great Barrier Reef (Collins, 1958, p. 379).

49. **Lagena sulcata** (Walker and Jacob), 1798

Serpula (*Lagena*) *sulcata* WALKER and JACOB, 1798, p. 634, Pl. 14, fig. 5.

Lagena sulcata (Walker and Jacob). BRADY, 1884, p. 462, Pl. 57, fig. 34.

Lagena sulcata (Walker and Jacob). PARR, 1947, p. 118, Pl. 6, fig. 1.

Very few specimens which all agree with the figures by Brady and Parr.

Distribution.—The middle region.

Remarks.—This species has been recorded from Barwon Heads, Victoria (Parr, 1945) and from the Great Barrier Reef (Collins, 1958, p. 379).

50. **Lagena sulcata peculiaris** Cushman and McCulloch, 1950

Lagena sulcata (Walker and Jacob) var. *peculiaris* CUSHMAN and MCCULLOCH, 1950, in Allan Hancock Pacific Exped., Vol. 6, No. 6, p. 361.

The test shows the longitudinal costae alternating in two series: one extends the full length of the test and ends with an acute projection at the aboral end, the other series is shorter and present only in the central part of the globular chamber. The neck is ornamented with costae which are spiral.

Distribution.—The middle region. Very rare.

Remarks.—Cushman and McCulloch (l.c.) refer to this species from Southern California, off coast of Mexico, Galapagos and from one station at Wrangell, Alaska.

Genus **Lenticulina** Lamarck, 1804

51. **Lenticulina reniformis** (d'Orbigny), 1846

Cristellaris reniformis D'ORBIGNY, 1846, p. 88, Pl. 3, figs. 39-40.

Cristellaris reniformis d'Orbigny. CUSHMAN, 1913 (1910 etc.), p. 65, Pl. 30, fig. 4.

Robulus reniformis (d'Orbigny). CUSHMAN, 1933 (1932 etc.), p. 2, Pl. 1, figs. 2, 3.

Astacolus reniformis (d'Orbigny). BARKER, 1960, p. 146, Pl. 70, fig. 3.

Distribution.—The middle region. Rare.

Remarks.—This species has been recorded from the North Pacific and from off Japan (Cushman, 1913). Chapman and Parr (1937, p. 59) recorded

it from 66°19'S, 94°57'E, off Queen Mary Land, Antarctica.

Genus **Pseudonodosaria** Boomgaart, 1949

52. **Pseudonodosaria rotundata** (Reuss), 1849

Glandulina rotundata REUSS, 1849, Denkschr. Akad. Wiss, Vienne, Vol. 1, p. 366, Pl. 46, fig. 2.

Nodosaria (Glandulina) rotundata (Reuss). BRADY, 1884, p. 491, Pl. 61, fig. 18.

Rectoglandulina rotundata (Reuss). BARKER, 1960, p. 128, Pl. 61, fig. 18.

Distribution.—Only at stns. 8, 9. Very rare.

Remarks.—This species has been recorded from the North Pacific Ocean (Cushman, 1913, 1910 etc.); it has also been recorded from Antarctica (Chapman and Parr, 1937, p. 62).

Genus Vaginulina d'Orbigny, 1826

53. **Vaginulina patens** Brady, 1884

Plate 8, figure 6

Vaginulina patens BRADY, 1884, p. 533, Pl. 67, fig. 16.

Vaginulina patens Brady. CUSHMAN, 1913 (1910 etc.), p. 80, Pl. 32, fig. 7.

Vaginulina patens Brady. PARR, 1950, p. 327.

The test is elongate and complanate; the largest diameter is one-third from the aboral end which terminates in a very short spine. The aperture is radiate, the marginal spines of the aperture subdividing only the outer annulus of the aperture, leaving unrestricted a large central orifice.

Figured specimen.—Stn. 8.

Dimensions.—Length 0.64 mm., breadth 0.27 mm., thickness 0.03 mm.

Distribution.—Only one specimen at stn. 8.

Remarks.—This species "has been recorded from an area extending from the Philippines to Tasmania" (Parr, l.c.).

54. **Vaginulina vertebralis** Parr, 1932

Plate 8, figure 7

Vaginulina vertebralis PARR, 1932, pt. 2, p. 221, Pl. 22, fig. 42.

The test agrees with Parr's description. The proloculum is clearly visible as well as the bands of clear shell material into the keel. These, which correspond to the sutures, give the specific name. The aperture is radiate and at the end of a tapering neck.

Figured specimen.—Stn. 8.

Dimensions.—Length 1.65 mm., breadth 0.15 mm.

Distribution.—One specimen at stn. 8.

Remarks.—This species was recorded originally from the shore sand, Torquay, Victoria; Parr also records it from the late Cenozoic. It is also recorded from Barwon Heads, Victoria (Parr, 1945).

Family POLYMORPHINIDAE

55. **Polymorphinidae formae fistulosae**

Polymorphinidae-formae fistulosae BARKER, 1960, p. 152, Pl. 73, figs. 14-17.

Only few specimens.

Remarks.—As mentioned by Barker (l.c.), all these forms have been united under this denomination by Thalmann (Eclog. Geol. Helvet, Vol. 25, No. 2, 1932, p. 306).

Genus **Globulina** d'Orbigny, 1836

56. **Globulina gibba globosa** (v. Munster), 1838

Polymorphina globosa v. Munster in ROEMER, 1838, p. 386, Pl. 3, fig. 33.

Globulina gibba d'Orbigny var. *globosa* (v. Munster). CUSHMAN and OZAWA, 1930, p. 64, Pl. 17, figs. 8, 9.

The test is subglobular, slightly compressed, and composed of 4-7 chambers; the sutures are distinct but not depressed and the wall is smooth.

Distribution.—The middle region. Rare.

Remarks.—This species has been recorded from shallow water of South Australia and Victoria (Parr, 1943).

Genus **Guttulina** d'Orbigny, 1839

57. **Guttulina lactea** (Walker and Jacob), 1798

Serpula lactea WALKER and JACOB, 1798, p. 634, Pl. 14, fig. 4.

Guttulina lactea (Walker and Jacob). CUSHMAN and OZAWA, 1930, p. 43, Pl. 10, figs. 2-4.

The Port Hacking specimens agree closely with fig. 4 of Cushman and Ozawa (l.c.).

Distribution.—The middle region. Present.

Remarks.—This species has been recorded from the Philippines (Cushman and Ozawa, l.c.) and from Barwon Heads, Victoria (Parr, 1945).

58. **Guttulina pacifica** (Cushman and Ozawa), 1928

Plate 8, figures 27, 28

Sigmoidella pacifica CUSHMAN and OZAWA, 1928, Contr. Cushman Lab. Foram. Res., Vol. 4, p. 19, Pl. 2, fig. 13.

Guttulina (Sigmoidina) pacifica (Cushman and Ozawa). CUSHMAN and OZAWA, 1930, p. 50, Pl. 37, figs. 3-5.

Figured specimens.—Stn. 9.

Dimensions.—Length 1.15 mm., greatest breadth 0.43 mm.

Distribution.—The middle region. Few specimens.

Remarks.—This species has been recorded from New Zealand, China Sea and Japan (Cushman and Ozawa, l.c.).

59. **Guttulina regina** (Brady, Parker and Jones), 1870

Plate 8, figures 14, 15

Polymorphina regina BRADY, PARKER and JONES, 1870, p. 241, Pl. 41, figs. 32a, b.

Guttulina regina (Brady, Parker and Jones). CUSHMAN and OZAWA, 1930, p. 34, Pl. 6, figs. 1, 2.

The tests agree with the description and figures by Cushman and Ozawa. A normal microspheric specimen (fig. 15) and a young megalospheric specimen (fig. 14) are figured here.

Figured specimens.—Stn. 9.

Dimensions.—Fig. 15: length 0.82 mm., greatest breadth 0.46 mm; fig. 14: length 0.59 mm., greatest breadth 0.38 mm.

Distribution.—The middle region. Common.

Remarks.—This species, originally recorded from Storm Bay, Tasmania, has been recorded from Bass Strait, from shore sand at Newcastle Bay, N.S.W. (Cushman and Ozawa, l.c.), and from the Great Barrier Reef (Collins, 1958, p. 384).

Genus **Pseudopolymorphina** Cushman and Ozawa, 1928

60. **Pseudopolymorphina ligua** (Roemer), 1838

Polymorphina ligua ROEMER, 1838, p. 385, Pl. 3, fig. 25.

Pseudopolymorphina ligua (Roemer). CUSHMAN and OZAWA, 1930, p. 89, Pl. 22, fig. 5, 6.

Pseudopolymorphina l i g u a (Roemer). BARKER, 1960, p. 150, Pl. 72, figs. 9-11.

A single specimen, apparently megalospheric, which possesses the distinctive sutures of the lateral faces of this species figured by Brady (Barker, l.c.) and by Cushman and Ozawa (l.c.).

Distribution.—Stn. 9. One specimen.

Remarks.—This species, as *Polymorphina compressa* d'Orbigny, has been recorded by Brady from the Bass Strait (Barker, l.c.).

Genus **Sigmoidella** Cushman and Ozawa, 1928

61. **Sigmoidella elegantissima** (Parker and Jones), 1865

Polymorphina elegantissima PARKER and JONES, 1865, p. 438, Pl. 10.

Polymorphina elegantissima Parker and Jones. BRADY, 1884, p. 566, Pl. 72, fig. 13.

Sigmoidella elegantissima (Parker and Jones). CUSHMAN and OZAWA, 1930, p. 140, Pl. 39, figs. 1a-c.

The tests agree with the figures by Brady and by Cushman and Ozawa. One specimen resembling that figured by Brady (Pl. 72, fig. 12) is present and is thought to be a gerontic form, not a distinct variety as suggested by Thalmann 1932 and Barker 1960 (p. 150). Few megalospheric forms are also present. The species is rare in the middle region.

Remarks.—This species has been recorded from shore sand near Melbourne (Parr, 1943).

Family GLANDULINIDAE

Genus **Oolina** d'Orbigny, 1839

62. **Oolina globosa** (Montagu), 1803

Vermiculum globosum MONTAGU, 1803, p. 523.

Lagena globosa (Montagu). BRADY, 1884, p. 452, Pl. 56, figs. 1-3.

Oolina globosa (Montagu). BARKER, 1960, p. 114, Pl. 56, figs. 1-3.

The tests have chambers circular in transverse section, with a very short neck; the entosolenian tube is clearly visible.

Distribution.—Present in the middle region.

Remarks.—Brady referred these specimens to *Lagena*, but in accordance with Parr (1947) the name has been changed to *Oolina*. Barker (l.c.) has followed Parr's determination (Parr, 1950, p. 302).

It has been recorded from Barwon Heads, Victoria (Parr, 1945), from Tasmania and Antarctica (Parr, 1950).

Genus **Fissurina** Reuss, 1850

Plate 8, figure 17

63. **Fissurina fasciata carinata** (Sidebottom), 1906

Lagena fasciata (Egger) var. *carinata* SIDEBOTTOM, 1906, Mem. Pro. Lit. Phil. Soc. Manchester, p. 7, Pl. 1, fig. 17.

Lagena fasciata (Egger) var *carinata* Sidebottom. SIDEBOTTOM, 1912, p. 403, Pl. 17, fig. 18.

The test, compressed, has a keel which commences at the short neck. On each side of the keel one or two costae are present; they are interrupted at both ends. The surface of the test shows no ornamentation. The aperture is contained in a crescentic thickened area of the marginal flange and is narrow. The entosolenian tube is short.

Figured specimen.—Stn. 9.

Dimensions.—Length 0.32 mm., breadth 0.26 mm., thickness 0.08 mm.

Distribution.—Few specimens in the middle region.

Remarks.—The specimens agree with Sidebottom's figure except that the aboral projection of the figured test is not present on the specimen from Port Hacking. Following Parr (1947, p. 128), however, the species must be placed in the genus *Fissurina*.

This species has been recorded from deep water in the Fiji region (Sidebottom, 1912).

64. **Fissurina lacunata** (Burrows and Holland), 1895

Plate 8, figure 16

Lagena lacunata BURROWS and HOLLAND, in Jones, 1895, Pal. Soc. Vol. for 1895, p. 205, Pl. 7, figs. 12a, b.

Lagena orbignyana Seguenza var. *lacunata* Burrows and Holland. SIDEBOTTOM, 1912, p. 416, Pl. 19, figs. 16-18.

Fissurina lacunata (Burrows and Holland). PARR, 1945, p. 203.

The tests are compressed and the carination consists of a longitudinal keel which commences at the short neck and four costae, two each side of the

keel. The entosolenian tube is present. The body of the test has small protuberances which are arranged in lines and slightly elongated along these lines.

Figured specimen.—Stn. 9.

Dimensions.—Length 0.30 mm., breadth 0.20 mm., thickness 0.07 mm.

Distribution.—Present in the middle region only.

Remarks.—This species has been recorded from the Bass Strait (Parr, 1945) and from deep water in the Fiji region (Sidebottom, 1912).

65. **Fissurina** sp. cf. **F. subquadrata** Parr, 1945

Fissurina subquadrata PARR, 1945, p. 203, Pl. 9, figs. 5a, b.

The test is broadly elliptical in outline, with "flattened ends," almost subquadrate in shape and very compressed. The surface has two grooves on each side and parallel to the periphery. The aperture consists of an elongate opening. It differs from *F. subquadrata* in its rounded extremities and in its entosolenian tube which is much shorter.

Distribution.—Few specimens at stn. 8.

Remarks.—*Fissurina subquadrata* has been recorded by Parr (1945) from Barwon Heads, Victoria.

Superfamily BULIMINACEA

Family TURILLINIDAE

Genus **Buliminella** Cushman, 1911

66. **Buliminella elegantissima** (d'Orbigny), 1839

Bulimina elegantissima D'ORBIGNY, 1839, p. 51, Pl. 7, figs. 13-14.

Buliminella elegantissima (d'Orbigny). BARKER, 1960, p. 104, Pl. 50, figs. 20-22.

Only two small specimens at stations 7 and 8.

Remarks.—This species has been recorded from Hobson Bay, Victoria (Parr, 1943).

67. **Buliminella gracilis** Collins, 1953

Plate 8, figure 9

Buliminella gracilis COLLINS, 1953, p. 102, Pl. 1, figs. 8a, b.

The tests are elongated, subcylindrical and truncated obliquely at the oral end; the aperture consists of a small opening in the centre of the apertural face which is ornamented by numerous radial striae. The chambers are numerous and arranged in a close spiral, the suture of which is distinct and depressed. The sutures are limbate.

Figured specimen.—Stn. 8.

Dimensions.—Length 0.61 mm., breadth 0.21 mm.

Distribution.—Stn. 8. Frequent.

Remarks.—This species has been originally recorded from the Pleistocene of Port Fairy (Collins, l.c.). Note that "a closely related form occurs in the Recent shore sands of the Victorian coast" (Collins, l.c.).

Genus **Buliminoides** Cushman, 1911

68. **Buliminoides williamsonianus** (*) (Brady), 1881

Bulimina williamsoniana BRADY, 1881, p. 56.

Bulimina williamsoniana Brady. BRADY, 1884, p. 408, Pl. 51, figs. 16, 17.

Buliminoides williamsoniana (Brady). CUSHMAN, 1922 (1918) etc., p. 113.

Buliminoides williamsoni (Brady). HOFKER, 1951, p. 133, figs. 81-84.

Very few typical specimens occur in the middle region.

Remarks.—This species has been recorded from shallow water of the Indo-Pacific region (Cushman, l.c.); and from shallow water of Victoria, Tasmania and South Australia (Parr, 1943). "This species is well distributed and common in the warmer waters of the Australian region" (Collins, 1958, p. 388).

Family BOLIVINITIDAE

Genus **Bolivina** d'Orbigny, 1839

69. **Bolivina alata** (Seguenza), 1862

Valvulina alata SEGUENZA, 1862, Atti. Acc. Gioenia Sci. Nat., ser. 2, Vol. 18, p. 115, Pl. 2, figs. 5, 5a.

Bolivina alata (Seguenza). CUSHMAN, 1937, p. 106, Pl. 13, figs. 4, 10.

Bolivina alata (Seguenza). PARR, 1939, p. 68, fig. 11.

The specimens agree with Parr's figure (l.c.). The keel and spines are less prominently developed than in the specimens from the Pliocene of Lakes Entrance, Victoria.

Distribution.—The middle region. Rare.

Remarks.—This species has been recorded "off Gabo Island in water of moderate depth and elsewhere on the east coast of Australia" (Parr, l.c.).

70. **Bolivina robusta** Brady, 1881

Bolivina robusta BRADY, 1881, p. 57.

Bolivina robusta Brady. BRADY, 1884, p. 421, Pl. 53, fig. 7.

Bolivina robusta Brady. CUSHMAN, 1911 (1910 etc.), p. 36, fig. 59.

All specimens are small and none shows the aboral spine. It is present only at stations 8 and 13.

Remarks.—This species has been recorded from shallow water in South Australia and Victoria (Parr, 1943).

Genus **Rectobolivina** Cushman, 1927

71. **Rectobolivina raphana** (Parker and Jones), 1865

Uvigerina (Sagrina) raphanus PARKER and JONES, 1865, p. 364, Pl. 18, figs. 16, 17.

Sagrina raphanus BRADY, 1884, p. 585, Pl. 75, figs. 21-24.

Siphogenerina raphanus (Parker and Jones). CUSHMAN, 1923 (1918 etc.), p. 174, Pl. 42, fig. 14.

It is rare in the middle region. The biserial arrangement of the early chamber has been recognised in fluoride replacements.

Remarks.—The views of Loeblich and Tappan (1964, pp. 553, 569-571) have been followed, the species placed in the genus *Rectobolivina*.

As *Siphogenerina*, this species has been recorded from shallow water of various islands from the *Albatross* collection in the South Pacific region (Cushman, 1942-1932 etc., p. 55) and from Port Fairy, Victoria (Parr, 1943).

Family BULIMINIDAE

Genus **Bulimina** d'Orbigny, 1826

72. **Bulimina gibba** Fornasini, 1902

Plate 8, figure 21

Bulimina gibba FORNASINI, 1902, Mem. R. Acc. Sci., Bologna, Vol. 9, p. 378, Pl. O, figs. 32-34.

Bulimina gibba Fornasini. BARKER, 1960, p. 102 Pl. 50, Figs. 1-4.

The tests agree with figure and description by Fornasini (l.c., fig. 32).

Figured specimen.—Stn. 10.

Dimensions.—Length 0.36 mm., greatest breadth 0.20 mm.

Distribution.—Stn. 10. Rare.

Remarks.—This appears to be the first Australian record of this species.

73. **Bulimina marginata** d'Orbigny, 1826

Bulimina marginata D'ORBIGNY, 1826, p. 269, Pl. 12, figs. 10-12.

Bulimina marginata d'Orbigny. HOFKER, 1951, p. 154, figs. 95, 96.

The test is ovate with numerous chambers, inflated. The lower margin of each chamber extends with a free edge which is crenulate or even spinose. The wall is thin and transparent.

The most spiny specimens are very close to *B. aculeata* Brady.

Distribution.—Rare at stns. 8, 13.

Remarks.—This species has been recorded from Japan (Cushman, 1911-1910 etc., p. 83), from Hobson Bay, Victoria (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 388).

Genus **Chrysalidinella** Schubert, 1907

74. **Chrysalidinella dimorpha** (Brady), 1881

Chrysalidina dimorpha BRADY, 1881, p. 24.

Chrysalidina dimorpha Brady. HERON-ALLEN and EARLAND, 1915, p. 632, Pl. 47, figs. 29-31.

Chrysalidinella dimorpha (Brady). HOFKER, 1951, p. 175, figs. 110-112.

Chrysalidinella dimorpha (Brady). COLLINS, 1958, p. 390.

The only specimen found is broken and shows the form of the foramen which consists of the original pores of the aperture and also of large openings apparently formed by the absorption of part of the former apertural face. The shape of the test is very similar to the figures by Heron-Allen and Earland (l.c.), i.e., with edges parallel. The specimen found shows 8-9 chambers uniserially arranged.

Distribution.—One specimen at stn. 8.

Remarks.—This species has been recorded from the Great Barrier Reef (Collins, l.c.) and from Barwon Heads, Victoria (Parr, 1945).

Genus **Reussella** Galloway, 1933

75. **Reussella spinulosa** (Reuss), 1850

Plate 8, figures 12, 13

Verneuilina spinulosa REUSS, 1850, Denkschr. Akad. Wiss. Wien, Vol. 1, p. 374, Pl. 47, fig. 12.

Verneuilina spinulosa Reuss. BRADY, 1884, p. 384, Pl. 47, fig. 2.

Verneuilina spinulosa Reuss. CUSHMAN, 1911 (1910 etc.), p. 55, fig. 88.

Verneuilina spinulosa Reuss. CUSHMAN, 1921, p. 141, Pl. 27, fig. 5.

Reussella spinulosa (Reuss). COLLINS, 1958, p. 390.

The test is triangular in transverse section and has flat sides. Two forms of this species have been described and figured by Cushman (1911, 1921, l.c.): One has chambers possessing points at their outer corners (Cushman, 1911) resulting in serrated angles of the test (form a); in the other form (b) (Cushman, 1921), the angles are smooth and slightly thickened. Both these forms are present in the Port Hacking samples.

Figured specimens.—Stn. 8.

Dimensions.—Form a: length 0.49 mm., breadth 0.26 mm.; form b: length 0.53 mm., breadth 0.38 mm.

Distribution.—Occasionally present in the middle region.

Remarks.—This species has been recorded from the Philippines (Cushman, 1921); from *Challenger* stations and from the North Pacific (Cushman, 1911); from the Great Barrier Reef (Collins, 1958), and from the Great Australian Bight, near Eucla (Parr, 1943).

Family UVIGERINIDAE

Genus **Uvigerina** d'Orbigny, 1826

76. **Uvigerina bassensis** Parr, 1950

Plate 8, figure 10

Uvigerina bassensis PARR, 1950, p. 340, Pl. 12, figs. 19-20.

The specimens possess the typical short neck and the costae which are not continuous from one chamber to another. The general shape of the test agrees with Parr's description.

Figured specimen.—Stn. 10.

Dimensions.—Length 0.58 mm., greatest breadth 0.29 mm.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from S. Australia as *U. pigmaea* by Chapman (1915, p. 26). It is common in the Bass Strait and off the coast of New South Wales (Parr, l.c.).

Genus **Siphouvigerina** Parr, 1950

77. **Siphouvigerina porrecta** (Brady), 1879

Plate 8, figure 11

Uvigerina porrecta BRADY, 1879, p. 60, Pl. 8, figs. 15, 16.

Uvigerina porrecta Brady. BRADY, 1884, p. 577, Pl. 74, figs. 21-23.

Uvigerina porrecta Brady. CUSHMAN, 1913 (1910 etc.), p. 99, Pl. 44, fig. 2.

Neouvigerina porrecta (Brady). HOFKER, 1951, p. 213, figs. 140-142.

Figured specimen.—Stn. 14.

Dimensions.—Length 0.54 mm., breadth 0.24 mm.

Distribution.—Only one specimen at stn. 14.

Remarks.—The present specimen has been compared with specimens of the original *Challenger* stn. 185 sample in the collection of Mr. A. C. Collins. From these it differs in having the early part of the test more compact and the sutures less deeply incised. The ornamentation of ridges and grooves occur on the Port Hacking specimen, but its ornamented chamber walls are orientated parallel to and not obliquely to the longitudinal axis of the test (as in the topotypes).

The specimen found appears to belong to the form A_2 of Hofker in having only one chamber, uniserially arranged.

This species has been recorded from New Guinea and Guam (Cushman, l.c.), from the Great Barrier Reef (Collins, 1958, p. 392) and from off the coast of New South Wales (Sidebottom, 1918, p. 147).

Superfamily DISCORBACEA

Family DISCORBIDAE

Genus **Discorbis** Lamarck, 1804

78. **Discorbis dimidiatus** (Jones and Parker), 1862

Plate 8, figures 18 and 24

Discorbina dimidiata JONES and PARKER, in Carpenter, Jones and Parker, 1862, Intro. Foram., p. 201, text-fig. 32b.

Discorbina vesicularis (Lamarck). BRADY, 1884, p. 651, Pl. 97, fig. 2.

Discorbis vescicularis (Lamarck) var. *dimidiata* Jones and Parker). PARR, 1932, pt. 2, p. 228, Pl. 21, figs. 27 a-c.

Discorbis dimidiatus (Parker and Jones). PARR, 1950, p. 353.

Discorbis dimidiatus (Jones and Parker). CARTER, 1964, p. 76, Pl. 3, figs. 67-69.

The tests are plano-convex with flattened ventral side. Dorsal walls of most chambers are smooth and translucent, except for the last few chambers, whose walls are coarsely perforated.

A small keel is present in the early-formed chambers, but it disappears with the last-formed ones which are strongly inflated. On the ventral side the umbilical region is covered by the "astral flaps" (Parr, 1932, pt. 2, p. 228) or "toothplate" (Hofker, 1951).

Figured specimen.—Stn. 9.

Dimensions.—Greater diameter 1.47 mm., lesser diameter 1.16 mm., height, 0.70 mm.

Distribution.—Very common in the middle region only.

Remarks.—Parr (l.c.) refers to this species as being typical of shallow waters and the commonest representative of the genus of the Australian coast south of the latitude of Sydney.

Genus **Discorbinella** Cushman and Martin, 1935

79. **Discorbinella planoconcava** (Chapman, Parr and Collins), 1932

Planulina biconcava (Jones and Parker) var. *planoconcava.* CHAPMAN, PARR and COLLINS, MS., in Parr, 1932, p. 232, Pl. 22, figs. 34a-c.

Discorbinella planoconcava (Chapman, Parr and Collins). PARR, 1945, p. 211, Pl. 11, figs. 1, 2. The test agrees completely with Parr's figures.

Distribution.—Only a few specimens at stn. 8.

Remarks.—This species, described from the Middle Miocene of Victoria, is recorded from shore sand, Point Lonsdale, Victoria (Parr, l.c.).

Genus **Patellinella** Cushman, 1928

80. **Patellinella inconspicula** (Brady), 1884

Plate 8, figures 22, 23

Textularis inconspicua BRADY, 1884, p. 357, Pl. 42, figs. 6a-c.

Patellinella inconspicua (Brady). PARR and COLLINS, 1930, p. 92, Pl. 4, fig. 7.

The tests agree completely with the figures and descriptions of several authors.

Figured specimen.—Stn. 8.

Dimensions.—Greater diameter 0.34 mm., lesser diameter 0.23 mm., height 0.27 mm.

Distribution.—The middle region. Only few specimens.

Remarks.—This species has been recorded from Point Lonsdale, Torquay, Port Fairy, Victoria (Parr and Collins, l.c.), and off East Moncoeur Island, Bass Strait (Parr, 1943).

Genus **Rosalina** d'Orbigny, 1826

81. **Rosalina anglica** (Cushman), 1931

Plate 9, figures 3, 4

Discorbis globularis (d'Orbigny) var. *anglica.*

CUSHMAN, 1931 (1918 etc.), p. 23, Pl. 4, figs. 10 a-c.

Discorbis globularis (d'Orbigny) var. *anglica* Cushman. PARR, 1945, p. 209, Pl. 9, figs. 11a-c.

Discorbis globularis (d'Orbigny) var. *anglica* Cushman. PARR, 1950, p. 354.

The test is trochoid, compressed, with distinct sutures. The ventral side shows the apertural flap of the last-formed chamber extending inward. All chambers of the last whorl possess open umbilical foramina and apertural flaps. The chambers of the last whorl show a thin keel extending around the periphery of the test; sometimes this keel shows many irregularities.

Figured specimen.—Stn. 8.

Dimensions.—Diameter 0.48 mm., height 0.12 mm.

Distribution.—The middle region. Frequent.

Remarks.—The ventral side and its peculiar lip, the thickness of the test and the typical thin keel seem to justify the separation of this form from *R. globularis.*

As *Discorbis globularis* var. *anglica,* it has been recorded from Barwon Heads, Victoria (Parr, 1945) and from off Maria Island, Tasmania (Parr, 1950).

82. **Rosalina australis** (Parr), 1932

Plate 9, figure 8

Discorbis australis PARR, 1932, pt. 2, p. 227, Pl. 22, fig. 31.

Rosalina australis (Parr). CARTER, 1964, p. 73, Pl. 3, figs. 51-53.

The test agrees with Parr's description (l.c.).

Figured specimen.—Stn. 8.

Dimensions.—Greater diameter 0.70 mm., lesser diameter 0.62 mm., height 0.34 mm.

Distribution.—The middle region. Common.

Remarks.—Recorded by Parr (l.c.) as common, from shallow waters on the southern coast of Australia.

83. **Rosalina bertheloti** d'Orbigny, 1839

Plate 8, figures 19, 20, 25, 26

Rosalina bertheloti D'ORBIGNY, 1839b, p. 135, Pl. 1, figs. 28-30.

Discorbina bertheloti (d'Orbigny). BRADY, 1884, p. 650, Pl. 89, figs. 10-12.

Discorbis bertheloti (d'Orbigny). CUSHMAN, 1921, p. 305, Pl. 59, figs. 1a-c.

Only few specimens.

Figured specimen.—Stn. 10.

Dimensions.—Figs. 25, 26: greater diameter 0.38 mm., lesser diameter 0.31 mm., height 0.09 mm.; figs. 19, 20: greater diameter 0.51 mm., height 0.16 mm.

Distribution.—The middle region. Rare.

Remarks.—The generic placement of this form is upheld for the following reasons. The apertural flaps are free at their umbilical ends and are not fused either to adjacent flaps or to any umbilical plug or cover plate. The flaps are not as well developed nor are the dorsal sutures as deeply depressed as in the type species *R. globularis.*

Loeblich and Tappan (1964) place *Discopulvinulina* Hofker 1951 (type species *R. bertheloti*) as a synonym of *Discorbinella* Cushman and Martin, 1935, but the present form lacks the supplementary aperture on the convex side which occurs in *Discorbinella* s.s.

The relationships of *R. bertheloti* are not believed to be with *Hanzawaia* Asano 1944, in which the apertural flaps are fused to the umbilical area of the previous whorl (Loeblich and Tappan, l.c., Pl. 623, figs. 2b) and to one another (*Ibid.*, Pl. 623, fig. 1).

As *Discorbis bertheloti,* it has been recorded from Barwon Heads, Victoria (Parr, 1943) and from Tasmania (Parr, 1950); as *Discopulvinulina,* from the Great Barrier Reef (Collins, 1958, p. 403).

84. **Rosalina bradyi** (Cushman), 1915

Plate 9, figures 1, 2, 5, 6

Discorbis globularis (d'Orbigny) var. *bradyi.* CUSHMAN, 1915 (1910 etc.), pt. 5, p. 12, Pl. 8, figs. 1a-c.

Discopulvinulina bradyi (Cushman). HOFKER, 1951, p. 452, fig. 310.

Rosalina bradyi (Cushman). BARKER, 1960, p. 178, Pl. 86, fig. 8.

The ventral side shows clearly the lip which extends inward from the periphery of the last formed chamber; the ventral wall is thinner than the dorsal wall and less densely perforated. Close examination of many specimens has shown that the "milled edge" (Cushman, l.c.) when seen in transverse view through the thin ventral wall, consists of the peripheral pores in the thicker wall of the dorsal side. At stn. 13 three specimens with the float chamber have been found.

Figured specimen.—Stn. 13.

Dimensions.—Figs. 1, 2: greater diameter 0.72 mm., lesser diameter 0.56 mm., thickness 0.27 mm.; figs. 5, 6: greater diameter 0.43 mm., lesser diameter 0.34 mm., total thickness 0.35 mm.

Distribution.—Generally rare. Frequent only at stn. 13.

Remarks.—As Hofker remarks (1951, p. 477) for *Cymbaloporetta* and *Tretomphalus,* the float chamber appears not to be a generic characteristic but rather a structure formed at a certain stage in the life cycle.

Brady (in Barker, l.c.) records this species from *Challenger* stn. 205A, off Hong Kong, Pacific, in shallow waters (7 fms) and Cushman (l.c.) re-

cords it from *Albatross* station D4893 in 106 fms, off Japan.

Genus **Baggina** Cushman, 1826

85. **Baggina philippinensis** (Cushman), 1921

Pulvinulina philippinensis CUSHMAN, 1921, p. 331, Pl. 58, figs. 2a-c.

Baggina philippinensis (Cushman). BARKER, 1960, p. 218, Pl. 106, fig. 7.

Remarks.—This species is common in the middle region. It has been recorded from seven *Challenger* stations in the South Pacific (Cushman, l.c.) and from Barwon Heads, Victoria (Parr, 1945).

Family GLABRATELLIDAE

Genus **Glabratella** Dorreen, 1948

86. **Glabratella australensis** (Heron-Allen & Earland), 1932

Discorbis australensis HERON-ALLEN and EARLAND, 1932, *Discovery* Repts., vol. 4, pt. 1, p. 416.

Pileolina (?) *australensis* (Heron-Allen and Earland). BARKER, 1960, p. 184, Pl. 89, figs. 2-4.

All specimens occur as plastogamic pairs.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded, by Brady, as *Discorbina pileolus* in Port Jackson, *Challenger* stn. 163B.

87. **Glabratella patelliformis** (Brady), 1884

Plate 9, figures 11, 15

Discorbina patelliformis BRADY, 1884, p. 647, Pl. 89, figs. 1a-c.

Discorbis patelliformis (Brady). CUSHMAN, 1951 (1910 etc.), p. 17, Pl. 5, figs. 5a-c.

Pileolina (?) *patelliformis* (Brady). BARKER, 1960, p. 184, Pl. 89, figs. 1a-c.

This species is present in the middle region with typical specimens.

Remarks.—This species has been recorded from shallow water among the islands of the South Pacific (Cushman, l.c.), from Glenelg, South Australia, from Bass Strait (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 404).

Superfamily SPIRILLINACEA

Family SPIRILLINIDAE

Genus **Spirillina** Ehrenberg, 1843

88. **Spirillina vivipara** Ehrenberg, 1843

Spirillina vivipara EHRENBERG, 1843, Abhandl. K. Akad. Wiss. Berlin, p. 422, Pl. 3, fig. 41.

Spirillina vivipara Ehrenberg. BRADY, 1884, p. 630, Pl. 85, Figs. 1-4.

Spirillina vivipara Ehrenberg. CUSHMAN, 1931 (1918 etc.), pt. 8, p. 3, Pl. 1, figs. 1-4.

Common only at stn. 3; present at stns. 7 and 8.

Remarks.—This species has been recorded as fairly common in the West Indian region (Cushman, l.c.). In Australia it has been recorded from Barwon Heads, Victoria (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 399).

Superfamily ROTALIACEA

Family ROTALIIDAE

Genus **Rotalia** Lamarck, 1804

89. **"Rotalia" perlucida** Heron-Allen and Earland, 1913

Plate 9, figure 12, 16

Rotalia perlucida HERON-ALLEN and EARLAND, 1913, Proc. Roy. Irish Acad., 31, pt. 64, 64, p. 139, Pl. 13, figs. 7-9.

Rotalia perlucida Heron-Allen and Earland. PARR, 1932, Pt. 2, p. 231, Pl. 22, figs. 35a-c.

The test is hyaline and coarsely perforated. The ventral side, slightly convex, has a deep umbilicus. The sutures are incised and on the dorsal side are often filled with clear imperforate shell material, especially in the earlier whorls. On the ventral side the umbilical area is covered with irregular overlapping plates of shell material. Thin, short, narrow extensions of these plates cover the deeply-incised ventral sutures enclosing sutural canals. The periphery is lobulate and the aperture is at the inner margin of the last-formed chamber. The central area of the apertural face is imperforate.

Figured specimen.—Stn. 9.

Dimensions.—Greater diameter 0.43 mm., lesser diameter 0.35 mm., height 0.15 mm.

Distribution.—Present in many stations but common only at stn. 11.

Remarks.—The original assignment of this species to *Rotalia* is retained, though the generic name is placed in quotation marks. The umbilical plates of this species render it unlike the type species of both *Rotalia* and *Ammonia*; in this regard it resembles *Asterorotalia*, the ventral structure of *R. perlucida* being distinctly similar to that of juvenile specimens of *A. inflata*. It is noted that *Pseudoeponides anderseni* which, as illustrated by Warren, (1957, p. 39, Pl. 4, figs. 12-15) resembles *R. perlucida*, has been made the type species of *Helenina* Saunders, 1961. The relationships of *Helenina* do not yet appear to have been reliably established. *R. perlucida* has been recorded previously from off the coast of New Zealand and from Hardwicke Bay, South Australia (Parr, l.c.).

Genus **Ammonia** Brunnich, 1772

90. **Ammonia beccarii** (Linné) 1767

Plate 9, figures 7, 9, 10

Nautilus beccarii LINNÉ, 1767, p. 1162.

Rotalia beccarii (Linné). CUSHMAN, 1928, p. 104, Pl. 15, figs. 3-7.

Ammonia beccarii (Linné). CIFELLI, 1962, p. 119, Pl. 21; Pl. 22, figs. 1-6.

The specimens of Port Hacking agree completely

with Cifelli's and with Cushman's descriptions (l.c.).

Figured specimens.—Stn. 9.

Dimensions.—Figs. 9, 10: greater diameter 0.71 mm., lesser diameter 0.61 mm., height 0.35 mm.; fig. 7: greater diameter 0.66 mm., lesser diameter 0.58 mm., height 0.31 mm.

Distribution.—Common in nearly all stations.

Remarks.—From the distributional point of view, the presence of the umbonal plug does not seem to have any importance; in each station the quantity of specimens with and without plugs is nearly the same. Also the size of the umbonal plug is variable.

This species has been recorded in Australia as *Streblus beccarii* from the south coast (Parr, 1943).

Family ELPHIDIIDAE

Genus **Elphidium** Montfort, 1808

91. **Elphidium advenum** (Cushman), 1922

Plate 10, figure 6

Polystomella subnodosa BRADY, 1884, p. 734, Pl. 110, figs. 1a-b.

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

Elphidium advenus (Cushman). CUSHMAN, 1933 (1932 etc.), p. 50, Pl. 12, figs. 1-3.

Elphidium advenus (Cushman). CUSHMAN, 1939, p. 60, Pl. 16, figs. 31-35.

The test is small in size and moderately inflated, the umbilical region is depressed and has a small central boss. The chambers are slightly inflated and the sutures are marked by short retral processes. Between the bands of pores along the sutures, the faces of the chambers are smooth and highly polished (in this respect resembling *E. pseudonodosum*). The aperture consists of a series of small pores at the base of the apertural face.

Figured specimen.—Stn. 7.

Dimensions.—Greater diameter 0.58 mm., thickness 0.16 mm.

Distribution.—Rare in the main part of Port Hacking; common only near the head of Gunnamatta Bay.

Remarks.—This species is recorded as widely distributed in warm waters of Pacific and Atlantic Oceans. It is present off Fiji (Cushman, 1939, l.c.).

In Australia it is recorded from Port Fairy, Victoria (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 420).

92. **Elphidium craticulatum** (Fichtel and Moll), 1798

Plate 9, figures 19, 20

Nautilus craticulatus FICHTEL and MOLL, 1798, p. 51, Pl. 5, figs. h-k.

Elphidium craticulatum (Fichtel and Moll). CUSHMAN, 1939, p. 56, Pl. 15, figs. 14-17.

Elphidium craticulatum (Fichtel and Moll). BARKER, 1960, p. 228, Pl. 110, figs. 16-17.

Figured specimen.—Stn. 10.

Dimensions.—Greater diameter 1.35 mm., thickness 0.64 mm.

Distribution.—The middle region. Very common.

Remarks.—This species is a typical Recent species of the Indo-Pacific region (Cushman, l.c.). In Australian waters it has been recorded from the Great Australian Bight (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 420).

93. **Elphidium crispum** (Linné), 1758

Plate 10, figure 7

Nautilus crispus LINNÉ, 1758, p. 709.

Polystomella crispa (Linné). BRADY, 1884, p. 736, Pl. 110, figs. 6-7.

Elphidium crispum (Linné). CUSHMAN, 1939, p. 50, Pl. 13, figs. 17-21.

The specimens of Port Hacking are identical with the figure by Cushman (1933, 1932 etc., Pl. 11, figs. 4a, b).

Figured specimen.—Stn. 8.

Dimensions.—Greater diameter 0.75 mm., thickness 0.18 mm.

Distribution.—It is common in many stations.

Remarks.—This species has been recorded from the Mediterranean Sea, the Red Sea, the Philippines, Fiji and the Caroline Islands (Cushman, l.c.); in Australian waters, from Glenelg, South Australia (Parr, 1943) and from the Great Barrier Reef (Collins, 1958, p. 420).

94. **Elphidium depressulum** Cushman, 1933

Elphidium advenum (Cushman) var. *depressulum*. CUSHMAN, 1933 (1932 etc.), p. 51, Pl. 12, figs. 4a, b.

Elphidium advenum (Cushman) var. *depressulum* Cushman. CUSHMAN, 1939, p. 61, Pl. 17, fig. 1.

It differs from *E. advenum* in the umbilical region, which is depressed and without a central boss. The periphery is more lobulate and the retral processes are longer. The surface of the chambers is matte and granular, but in *E. advenum* is smooth and highly polished.

Distribution.—The middle region. Rare to frequent.

Remarks.—The longer retral processes, the surface of the chambers and the umbilical region are so clearly different that I think it justifiable to consider this form not a subspecies of *Elphidium advenum*.

It has been recorded from Tonga Island and from shallow waters of Fiji (Cushman, 1939).

95. **Elphidium discoidale multiloculum** Cushman and Ellisor, 1945

Plate 9, figure 18

Elphidium discoidale (d'Orbigny) var. *multiloculum* CUSHMAN and ELLISOR, 1945, Journ. Paleont., vol. 19, No. 6, p. 561, Pl. 75, fig. 9.2.

The test is small and relatively thick. The chambers, averaging about 16, are not inflated; their sutures are slightly depressed and clearly marked by short retral processes; the umbilical region is occupied by a mass of slightly protruding shell material and shows several large pores. The wall is smooth; the aperture consists of a series of rounded openings at the base of the apertural face.

Figured specimen.—Stn. 3.

Dimensions.—Greater diameter 0.69 mm., thickness 0.31 mm.

Distribution.—Stns. 3 and 4. Frequent.

Remarks.—The specimens agree with figures and description by Cushman and Ellisor (l.c.). They differ, in fact, from *Elphidium discoidale*, in the number of the chambers (which in *E. discoidale* is about 10), in the umbilicus (which is less prominent) and in the chambers (which are not inflated).

The original description of the variety is for specimens of the Oligocene of Texas; but it is the opinion of the writer that many species recorded as *E. discoidale* should be considered to be this variety, as, for instance, the specimens figured in Cushman (1939, p. 56, Pl. 15, fig. 5 and 7) which differ from the original figure by d'Orbigny (Cushman, 1939, Pl. 15, fig. 6) in the same characteristics that distinguish *E. discoidale* var. *multiloculum*.

96. **Elphidium imperatrix** (Brady), 1881

Plate 9, figures 13, 14, 17

Polystomella imperatrix BRADY, 1881, p. 66.

Elphidium imperatrix (Brady). CUSHMAN, 1939, p. 61, Pl. 17, Figs. 5-7.

Both the microspheric and megalospheric forms are present, quite different from one another in general appearance. Both are figured. The megalospheric form, which has been described as *Polystomella imperatrix* by Brady, has a relatively small test, compressed, slightly keeled and with 4 or 5 short spines. The chambers have distinct sigmoid sutures and numerous long retral processes. The umbilical region, not very distinctly umbonate, shows few papillae. The microspheric form has a large, thick test with rounded periphery, very narrow keel and lacks spines. Its umbilical region is similar to that of the megalospheric form, but, being larger, it shows many more papillae. The internal structure, observed in fluoride replacement, shows the two forms to be conspecific.

Figured specimen.—Stn. 8.

Dimensions.—Fig. 13: greater diameter 1.56 mm., thickness 0.35 mm.; fig. 17: greater diameter 0.96 mm., thickness 0.26 mm.; fig. 14: greater diameter 1.06 mm., thickness 0.30 mm.

Distribution.—Common in the middle region, the microspheric form much more abundant than the megalospheric one.

Remarks.—The megalospheric form has been recorded from Port Jackson, N.S.W.; from Storm Bay, Tasmania; Stanley Harbour, Falkland Island, in 2-10 fms (Cushman, 1939).

The specimen of fig. 14 was found in an aquarium at the C.S.I.R.O. Fisheries, Cronulla, and is here reproduced to show the main feature of the species. The fig. 13 shows a specimen like the microspheric in number of chambers and size of the umbilical region, but like the megalospheric in spines. It could represent the other megalospheric form of a trimorphic cycle (Hofker, 1951).

97. **Elphidium jenseni** (Cushman), 1924

Plate 10, figure 8

Polystomella macella (Fichtel and Moll), var. JENSEN, 1904, Proc. Linn. Soc. N.S.W., Vol. 29, p. 817, Pl. 23, fig. 4.

Polystomella jenseni CUSHMAN, 1924, Carnegie Inst. Washington Publ. 342, p. 49, Pl. 16, figs. 4, 6.

Elphidium jenseni (Cushman). CUSHMAN, 1939, p. 62, Pl. 17, figs. 14-15.

Typical specimens occur as common in the middle region.

Figured specimen.—Stn. 9.

Dimensions.—Greatest diameter 0.60 mm., thickness 0.03 mm.

Remarks.—Cushman (1939) remarked that this species was originally recorded by Jensen from 100 fms off the central coast of New South Wales. It is also recorded from shallow water off Samoa; Vavau Anchorage, Tonga Island, Fiji, Marshall Islands and in a few *Albatross* stations in the South Pacific.

98. **Elphidium milletti** (Heron-Allen and Earland), 1915

Polystomella milletti HERON-ALLEN and EARLAND, 1915, p. 735, Pl. 53, figs. 38-42.

Elphidium milletti (Heron-Allen and Earland). CUSHMAN, 1939, p. 58, Pl. 16, figs. 20-22.

Only few specimens; the test is compressed with rounded periphery. The ornamentation of the wall consists of very fine, but clearly visible, raised costae.

Distribution.—It is common only at stn. 13.

Remarks.—According to Cushman (l.c.) this species has a wide distribution in the Indo-Pacific region. Sidebottom (1918, p. 263) recorded it off the coast of New South Wales.

99. **Elphidium poeyanum** (d'Orbigny), 1839
Plate 10, figure 3

Polystomella poeyana D'ORBIGNY, 1839a, p. 55, Pl. 6, figs. 25, 26.
Elphidium poeyanum (d'Orbigny). CUSHMAN, 1939, p. 54, Pl. 14, fig. 26.
Elphidium poeyanum (d'Orbigny). TODD and LOW, 1961, p. 20, Pl. 22, fig. 7.

This species is quite common in almost all the stations.

Figured specimen.—Stn. 6.

Dimensions.—Greater diameter 0.39 mm., thickness 0.07 mm.

Remarks.—Cushman (l.c.) has stated that this species is the most common of the genus *Elphidium* in the West Indian region. In Australian waters it has been recorded off the south coast of New South Wales (Chapman, 1941, p. 183).

100. **Elphidium simplex** Cushman, 1933
Plate 10, figure 4

Elphidium simplex CUSHMAN, 1933 (1932 etc.), p. 52, Pl. 12, figs. 8, 9.
Elphidium simplex Cushman. CUSHMAN, 1939, p. 62, Pl. 17, fig. 10.

The test is approximately circular in side view with a rounded periphery and numerous chambers, 10-12 in the last formed whorl. The umbilical region is slightly depressed and occupied by a large flat boss. The wall is smooth and thin; the sutures are distinct and curved; the retral processes are visible only in the last-formed chambers. On a few specimens the development of retral processes is comparable to that in Cushman's figure of a large specimen (1933, Pl. 12, fig. 8a), but in many others no retral processes can be seen and the radial sutures are deeply incised in the area adjacent to the umbilicus, suggesting an alternative and much simplified type of canal system. The sutures appear to be limbate towards the umbilical region.

Figured specimen.—Stn. 5.

Dimensions.—Greater diameter 0.52 mm., thickness 0.17 mm.

Distribution.—Very common in many stations.

Remarks.—Cushman (l.c.) has recorded this species from a number of localities close to islands in the central Pacific Ocean.

Superfamily GLOBIGERINACEA
Family HANTKENINIDAE
Genus **Globigerinella** Cushman, 1927

101. **Globigerinella siphonifera** (d'Orbigny), 1839

Globigerina siphonifera D'ORBIGNY, 1839a, p. 83, Pl. 4, figs. 15-18.
Globigerina aequilateralis Brady. BRADY, 1884, p. 605, Pl. 80, figs. 18-21.
Globigerinella siphonifera (d'Orbigny). PARKER, 1962, p. 228, Pl. 2, figs. 22-28.

Remarks.—This species has been recorded from many stations in the North Pacific Ocean from deep waters (Cushman, 1914-1910 etc., p. 12). It also has been recorded from the Great Australian Bight, near Eucla (Parr, 1943), and from the Great Barrier Reef (Collins, 1958, p. 422).

Family GLOBOROTALIIDAE
Genus **Globorotalia** Cushman, 1927

102. **Globorotalia hirsuta** (d'Orbigny), 1839

Rotalina hirsuta D'ORBIGNY, 1839a, p. 131, Pl. 1, figs. 37-39.
Globorotalia hirsuta (d'Orbigny). BARKER, 1960, p. 212, Pl. 103, figs. 8a-c.

The tests agree with figures and descriptions by several authors.

Distribution—The middle region. Frequent.

Remarks.—As *Globorotalia hirsuta* this species has been recorded from Port Fairy, Victoria (Parr, 1943).

103. **Globorotalia inflata** (d'Orbigny), 1839

Globigerina inflata D'ORBIGNY, 1839b, p. 134, Pl. 2, figs. 7-9.
Globigerina inflata d'Orbigny. CUSHMAN, 1914 (1910 etc.), p. 8, Pl. 4, figs. 4-8.
Globigerina inflata d'Orbigny. BARKER, 1960, p. 164, Pl. 79, figs. 8-10.

The specimens agree with Cushman's description.

Distribution.—The middle region. Common.

Remarks.—This species has been recorded from Tasmania (Parr, 1950, p. 366), from the Bass Strait, and the Great Australian Bight (Parr, 1943).

104. **Globorotalia truncatulinoides** (d'Orbigny), 1839

Rotalina truncatulinoides D'ORBIGNY, 1939b, p. 132, pl. 2, figs. 25-27.
Pulvinulina micheliana (d'Orbigny). BRADY, 1884, p. 694, Pl. 104, figs. 1-2.
Pulvinulina truncatulinoides (d'Orbigny). CUSHMAN, 1915 (1910 etc.), p. 59, Pl. 23, fig. 4.
Globorotalia truncatulinoides (d'Orbigny). CUSHMAN, 1931 (1918 etc.), p. 97, Pl. 17, figs. 4a-c.
Globorotalia truncatulinoides (d'Orbigny). BARKER, 1960, p. 214, Pl. 104, figs. 1a-c.

Only one specimen at stn. 8.

Remarks.—This species has been recorded from the Atlantic Ocean (Cushman, 1931), from the North Pacific Ocean (Cushman, 1915) and from the Philippines (Cushman, 1921). It has also been recorded off the East Coast of Australia (lat. 29° 22′S) (Sidebottom, 1918, p. 259).

The present occurrence lies south of the species' range of distribution, recorded by Parker (1962) (i.e., latitude 10°S to 25°S), but in the region in-

fluenced by the south-flowing eastern Australian current a record such as the present one is unimportant.

Family GLOBIGERINIDAE

Genus **Globigerina** d'Orbigny, 1826

105. **Globigerina bulloides** d'Orbigny, 1826

Globigerina bulloides D'ORBIGNY, 1826, p. 277, No. 1, Pls. 17, 76.

Globigerina bulloides d'Orbigny. CUSHMAN, 1914 (1910 etc.), p. 5, Pl. 2, figs. 7-9; Pl. 9.

Globigerina bulloides d'Orbigny. BARKER, 1960, p. 160, Pl. 77; p. 164, Pl. 79, figs. 3-7.

Typical but small specimens occur in the middle region.

Remarks.—This species has been recorded as very common from the *Challenger* stations by Brady (1884, p. 593). Also recorded from Bass Strait and the Great Australian Bight (Parr, 1943).

Genus **Globigerinoides** Cushman, 1927

106. **Globigerinoides conglobatus** (*) (Brady), 1879

Globigerina conglobata BRADY, 1879, p. 72.

Globigerina conglobata Brady. BRADY, 1884, p. 603, Pl. 80, figs. 1-5.

Globigerinoides conglobata (Brady). BARKER, 1960, p. 166, Pl. 80, figs. 1-5.

Rare in the middle region.

Remarks.—This species has been referred by Brady to *Globigerina* and to *Globigerinoides* by Cushman (Bull. Scripps Inst. Oceanogr., Tech. Ser., vol. 1, No. 10, 1927, p. 173) (Barker, l.c.).

As *Globigerina conglobata* it has been recorded from the North Pacific (Cushman, 1914) and off the North Coast of New South Wales (Sidebottom, 1918, p. 150); as *Globigerinoides conglobata* it has been recorded from the Great Barrier Reef (Collins, 1958, p. 422).

107. **Globigerinoides quadrilobatus sacculifer** (*) (Brady), 1877

Globigerina sacculifera BRADY, 1877, Geol. Mag., dec. 2, vol. 4, Pl. 4, figs. 1-6.

Globigerina sacculifera Brady. CUSHMAN, 1924 (1918 etc.), p. 21, Pl. 4, figs. 1-6.

Globigerinoides sacculifera (Brady). BARKER, 1960, p. 166, Pl. 10, figs. 11-17.

Globigerinoides quadrilobatus sacculifer (Brady). PARKER, 1962, p. 229, Pl. 3, figs. 6-10.

The tests agree with Cushman's description and figures (l.c.). Several specimens possess a last-formed chamber which is elongate and sometimes compressed.

Distribution.—The middle region. Common.

Remarks.—This species has been widely recorded from both the Atlantic and Pacific Oceans. In Australian waters it has been recorded from the Great Barrier Reef (Collins, 1958, p. 422) and, as *Globigerina sacculifera*, off the North Coast of New South Wales (Sidebottom, 1918, p. 149).

108. **Globigerinoides ruber** (*) (d'Orbigny), 1839

Globigerina rubra D'ORBIGNY, 1839a, p. 94, Pl. 4, figs. 12-14.

Globigerina rubra d'Orbigny. BRADY, 1884, p. 602, Pl. 79, figs. 12-13.

Globigerinoides rubra (d'Orbigny). BARKER, 1960, p. 164, Pl. 79, figs. 12-13.

All the specimens agree with the figures and description of several authors.

Distribution.—The middle region. Common only at stn. 8.

Remarks.—This species has been recorded from Barwon Heads, Victoria and from Cape Wiles (40 miles south), S. Australia (100 fms) (Parr, 1943).

Genus **Globoquadrina** Finlay, 1947

109. **Globoquadrina dutertrei** (d'Orbigny), 1839

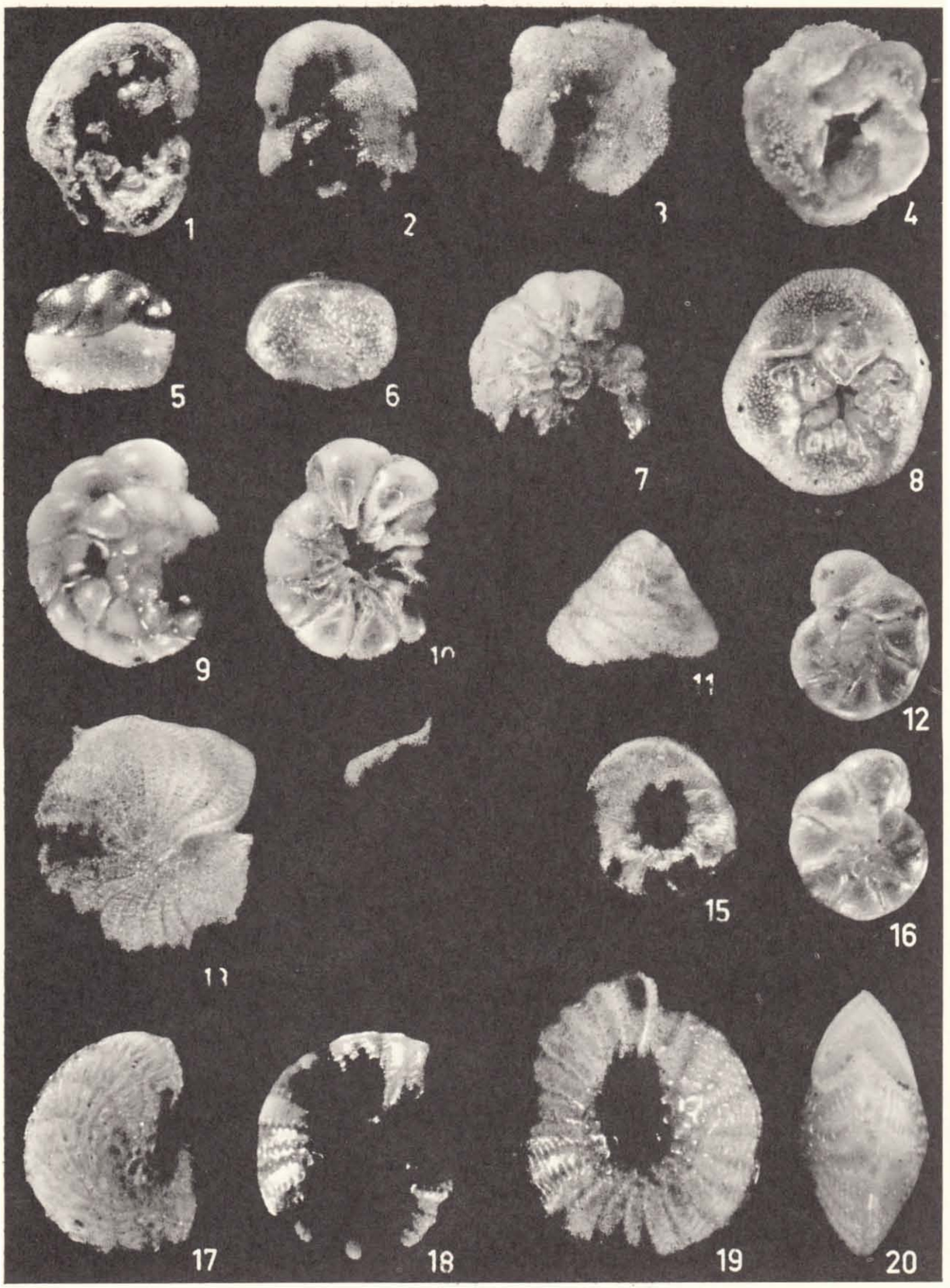
Globigerina dutertrei D'ORBIGNY, 1839a, p. 84, Pl. 4, figs. 19-21.

Globoquadrina dutertrei (d'Orbigny). PARKER, 1962, p. 242, Pl. 7, figs. 1-8; Pl. 6, figs. 1-4.

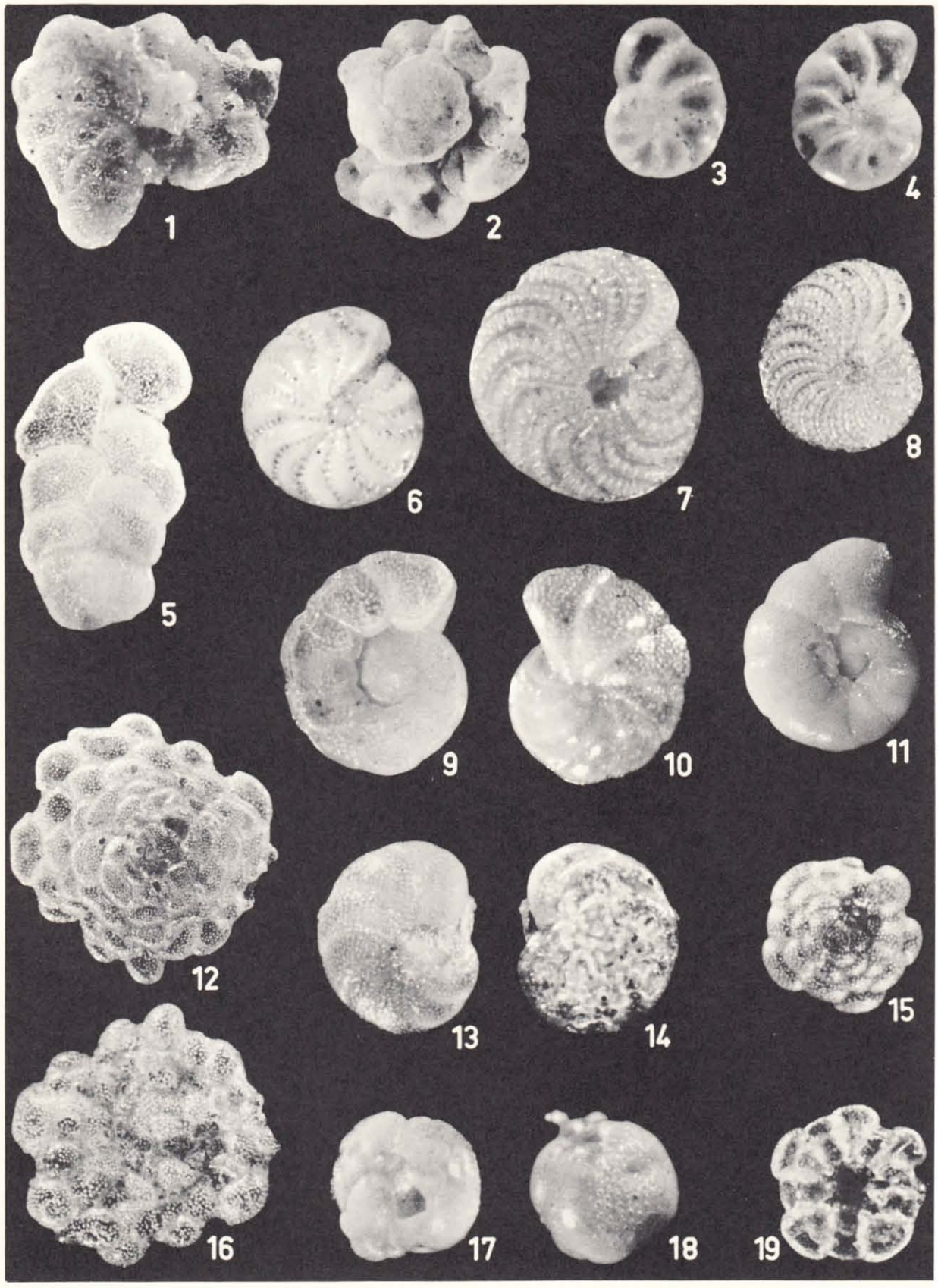
Frequent to common in the middle region.

Remarks.—This species has been recorded from deep waters in the North Pacific Ocean and from several stations of the *Albatross* off the Hawaiian Islands (Cushman, l.c.). In Australian waters it has been recorded, as *Globigerina dutertrei,* off the north coast of New South Wales (Sidebottom, 1918, p. 150).

EXPLANATION OF PLATE 9



Albani: Recent Foraminifera from New South Wales



Albani: Recent Foraminifera from New South Wales

Genus **Pulleniatina** Cushman, 1927

110. **Pulleniatina obliquiloculata** (Parker and Jones), 1865

Pullenia obliquiloculata PARKER and JONES, 1865, p. 368, Pl. 19, figs. 4a-b.

Pullenia obliquiloculata Parker and Jones. BRADY, 1884, p. 618, Pl. 84, figs. 16-20.

Pulleniatina obliquiloculata (Parker and Jones). BARKER, 1960, p. 174, Pl. 84, figs. 16-20.

The tests agree with figures and description by Brady (l.c.).

Distribution.—The middle region. Frequent at stn. 8.

Remarks.—"Referred by Brady to *Pullenia* and by Cushman (C.C.L.F.R., vol. 3, pt. 1, 1927, p. 90) to *Pulleniatina* as genotype" (Barker, l.c.).

It is considered to be one of the most common and widely distributed species of the North Pacific Ocean (Cushman, 1914, 1910 etc.). It has been recorded from the Great Barrier Reef (Collins, 1958, p. 422) and off the north coast of New South Wales (Sidebottom, 1918, p. 151).

Genus **Sphaeroidinella** Cushman, 1927

111. **Sphaeroidinella dehiscens** (Parker and Jones), 1865

Sphaeroidina bulloides d'Orbigny var. *dehiscens.* PARKER and JONES, 1965, p. 369, Pl. 19, fig. 5.

Sphaeroidina dehiscens Parker and Jones. CUSHMAN, 1914 (1910 etc.), p. 19, Pl. 13, fig. 1a-c.

Sphaeroidinella dehiscens Parker and Jones. PARKER, 1962, p. 234, Pl. 5, fig. 1-2.

Young specimens only.

Distribution.—Very rare at stns. 8, 9 and 10.

Remarks.—This species has been recorded from the North Pacific (Cushman, l.c.), from the Great Barrier Reef (Collins, 1958, p. 422) and off the north coast of New South Wales (Sidebottom, 1918, p. 152).

Genus **Orbulina** d'Orbigny, 1839

112. **Orbulina universa** d'Orbigny, 1839

Orbulina universa D'ORBIGNY, 1839a, p. 3, Pl. 1, fig. 1.

Orbulina universa d'Orbigny. BRADY, 1884, p. 608, Pl. 81, figs. 8, 9, 11, 25; Pl. 82, fig. 1.

Orbulina universa d'Orbigny. CUSHMAN, 1914 (1910 etc.), p. 14, Pl. 6, fig. 7.

Very common in the middle region.

Remarks.—This is one of the commonest of the pelagic species; it is recorded from the Great Australian Bight and from the Bass Strait (Parr, 1943).

Superfamily ORBITOIDACEA

Family CIBICIDAE

Genus **Cibicides** Montfort, 1808

113. **Cibicides cygnorum** Carter, 1964

Plate 10, figures 9, 10

Cibicides cygnorum CARTER, 1964, p. 98, Pl. 7, fig. 139-144.

The tests are plano-convex with periphery acute in early part of the test while on later chambers it is secondarily thickened and less acute. The chambers are numerous, with 10-12 in the last formed whorl. The ventral side is strongly convex, completely involute and with a shallow umbilicus; the sutures are depressed and thickened in early portion of the test. The dorsal side is moderately involute and flat; the sutures are depressed or secondarily thickened. The wall is coarsely perforated. The aperture is a narrow slit that extends from the dorsal side to the ventral margin of the chamber.

Figured specimen.—Stn. 9.

Dimensions.—Greater diameter 0.61 mm., lesser diameter 0.50 mm., height 0.20 mm.

Remarks.—This species was originally described from the Miocene of Victoria.

114. **Cibicides refulgens** Montfort, 1808

Cibicides refulgens MONTFORT, 1808, Conch. Syst., vol. 1, p. 122.

Truncatulina refulgens (Montfort). CUSHMAN, 1915 (1910 etc.), p. 30, fig. 33.

Cibicides refulgens Montfort. CUSHMAN, 1931 (1918 etc.), p. 116, Pl. 21, figs. 2a-c.

Typical specimens occur in the middle region.

Remarks.—This species has been recorded from Torquay, Victoria (Parr, 1943).

EXPLANATION OF PLATE 10

Genus **Cibicidella** Cushman, 1927

115. **Cibicidella variabilis** (d'Orbigny), 1826

Plate 10, figures 1, 2

Truncatulina variabilis D'ORBIGNY, 1826, p. 279, No. 8.

Truncatulina variabilis d'Orbigny. CUSHMAN, 1921, p. 314, Pl. 65, fig. 2.

Cibicidella variabilis (d'Orbigny). CUSHMAN, 1950, p. 339, Pl. 36, figs. 20a-b.

The test is similar to *Dyocibicides*; it differs only in the irregular arrangement of the chambers.

Figured specimens.—Stn. 8.

Distribution.—The middle region. Common.

Remarks.—This species has been recorded south of Tasmania (Chapman and Parr, 1937, p. 122).

Genus **Dyocibicides** Cushman and Valentine, 1930

116. **Dyocibicides biserialis** Cushman and Valentine, 1930

Plate 10, figure 5

Dyocibicides biserialis CUSHMAN and VALENTINE, 1930, Stanford Univ. Contr. Dept. Geol., vol. 1, No. 1, p. 31, Pl. 10, figs. 1, 2.

Dyocibicides biserialis Cushman and Valentine. CUSHMAN, 1931 (1918 etc.), p. 126, Pl. 24, fig. 2.

Many typical specimens occur in the middle region.

Figured specimen.—Stn. 9.

Dimensions.—Length 1.10 mm., breadth 0.62 mm., thickness 0.20 mm.

Distribution.—The middle region. Common.

Remarks.—This species has been recorded from Port Fairy, Victoria, in recent sediments (Parr, 1943); it occurs sparsely off the coast of Australia (Chapman, 1941, p. 177).

Family PLANORBULINIDAE

Genus **Planorbulina** d'Orbigny, 1826

117. **Planorbulina mediterranensis** d'Orbigny, 1826

Plate 10, figures 12, 16

Planorbulina mediterranensis D'ORBIGNY, 1826, p. 280, Pl. 14, figs. 4-6.

Planorbulina mediterranensis d'Orbigny. CUSHMAN, 1931 (1918 etc.), p. 129, Pl. 24, figs. 5-8.

Planorbulina mediterranensis d'Orbigny. BARKER, 1960, p. 190, Pl. 92, figs. 1-3.

Figured specimen.—Stn. 9.

Dimensions.—Diameter 1.20 mm., thickness 0.25 mm.

Distribution.—The middle region. Frequent.

Remarks.—This species has been recorded from shallow water in South Australia and Victoria (Parr, 1943).

Family CYMBALOPORIDAE

Genus **Cymbaloporetta** Cushman, 1928

118. **Cymbaloporetta bradyi** Cushman, 1915

Plate 10, figures 15, 17-19

Cymbalopora poeyi (d'Orbigny) var. BRADY, 1884, p. 637, Pl. 102, fig. 14.

Cymbalopora poeyi var. *bradyi* CUSHMAN, 1915 (1910 etc.), p. 25, Pl. 10, figs. 2a-c; Pl. 14, figs. 2a-c.

Cymbaloporetta bradyi (Cushman). CUSHMAN, 1931 (1918 etc.), p. 85.

Cymbaloporetta bradyi (Cushman). HOFKER, 1951, p. 477, fig. 331.

The test is conical, composed of numerous chambers; the early ones are spirally arranged, the later ones alternating and cyclic. On the ventral side, this alternation separates the chambers of the last annulus from one another by depressions. The dorsal wall is coarsely perforated, the ventral one less intensively so. The early chambers are very often brownish in colour. One specimen shows the globular float chamber.

Figured specimen.—Stn. 13.

Dimensions.—Figs. 15, 19; greatest diameter 0.46 mm., height 0.14 mm., figs. 17, 18: greatest diameter 0.41 mm., height 0.40 mm.

Distribution.—Present in the middle region; frequent only at stn. 13.

Remarks.—As stated by Hofker (l.c.) "there is no reason whatever to distinguish the genera *Cymbaloporetta* and *Tretomphalus*. The float chamber of the latter is a reproduction-chamber which cannot be a generic characteristic."

This species has been recorded from the Hawaiian Islands, as *Cymbalopora* and as *Tretomphalus* (Cushman, 1915, l.c.); and from Philippines (Cushman, 1921, pp. 308, 309). It has been recorded from Barwon Heads as *Tretomphalus* (Parr, 1945) and from the Great Barrier Reef as *Cymbaloporetta* and *Tretomphalus* (Collins, 1958, p. 149).

Superfamily CASSIDULINACEA

Family NONIONIDAE

Genus **Nonionella** Cushman, 1926

119. **Nonionella auris** (d'Orbigny), 1839

Valvulina auris D'ORBIGNY, 1839, p. 47, Pl. 2, figs. 15-17.

Nonionella auris (d'Orbigny). CUSHMAN, 1933 (1932 etc.), p. 45, Pl. 10, figs. 10, 11.

The tests are asymmetrical and have a rounded periphery. The chambers, 9 or 10 in number, are slightly inflated; the last-formed one extends over the umbilicus on one side. The sutures are distinct and depressed, the wall smooth. The aperture is at the base of the apertural face of the last-formed chamber.

Distribution.—Very few specimens in the middle region.

Remarks.—Cushman (l.c.) records it as rare from Vavau Anchorage, Tonga Island and Rutavu.

Family ALABAMINIDAE

Genus **Trichohyalus** Loeblich and Tappan, 1953

120. **Trichohyalus tropicus** (Collins), 1958

Plate 10, figures 13, 14

Discorinopsis tropica COLLINS, 1958, p. 406, Pl. 5, figs. 7a-c.

The test is trochospiral with dorsal side rounded and showing all chambers, the wall is coarsely perforated and the sutures are depressed and slightly limbate. The ventral side is flat and all chambers, except the last two, are masked by irregular outgrowths of shell material. 9-10 chambers in the last-formed whorl. The periphery is very slightly keeled and the aperture consists of a slit on the ventral side of the periphery.

Figured specimen.—Stn. 7.

Dimensions.—Greater diameter 0.50 mm., lesser diameter 0.42 mm., thickness 0.2 mm.

Distribution.—Rare in few stations only.

Remarks.—Collins (l.c.) recorded this species from Plum Beach, New Caledonia.

Family ANOMALINIDAE

Genus **Anomalina** d'Orbigny, 1826

121. **Anomalina nonionoides** Parr, 1932

Plate 10, figure 11

Anomalina nonionoides PARR, 1932, Pt. 2, p. 231, Pl. 22, figs. 38a-c.

The specimens agree with Parr's figures and description.

Figured specimen.—Stn. 8.

Dimensions.—Greater diameter 1.09 mm., thickness 0.36 mm.

Distribution.—Fairly common in the middle region.

Remarks.—This species has been recorded as common in shore sand from the vicinity of Sydney, N.S.W., and from the Victorian coast (Parr, 1943).

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CONTRIBUTIONS FROM THE CUSHMAN FOUNDATION
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VOLUME XIX, PART 3, JULY, 1968

351. *ANDERSENIA RUMANA*, N. GEN., N. SP., AND SOME TAXONOMIC OBSERVATIONS ON THE SUBFAMILY VALVULININAE

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A new genus and a new species (**Andersenia rumana**) are described from Barremian (Lower Cretaceous) reefs of Dobrogea, Rumania, and a new subfamily (Chrysalidininae) is suggested for the family Ataxophragmiidae.

INTRODUCTION

Intercalations of very soft marls occur frequently in the reef facies of the Barremian (Lower Cretaceous) of Southern Dobrogea, Rumania, limestones rich in corals, pelecypods, gastropods and echinoids. Verneuilinids are abundant in the numerous outcrops near Ostrov, on the shores of Lake Gîrliţa (text fig. 1). A detailed study of this rich suite from a level containing many pachiodonts (mainly *Toucasia carenata*) has led to the erection of a new subfamily, genus and species, a taxonomic decision prompted, in part, by dissatisfaction with the assignment of *Chrysalidina* and *Minouxia* to the *Valvulininae*.

This study was conducted in the Micropaleontological Laboratory of Louisiana State University, Baton Rouge, under the direction of Professor H. V. Andersen. I would like to express my gratitude to him for his help, which has been essential to the study.

SYSTEMATIC DESCRIPTION

Suborder TEXTULARIINA Delage & Howard, 1896
Superfamily LITUOLACEA de Blainville, 1825
Family ATAXOPHRAGMIIDAE Schwager, 1877
Subfamily CHRYSALIDININAE Neagu, n. subfam.

Test triserial to biserial, finely agglutinated, with globular chambers and straight, deep sutures; aperture represented by a large area containing numerous pores, located on the internal side of the last chamber.

Genotype.—Chrysalidina d'Orbigny.

Remarks.—The characters of the two known genera (*Chrysalidina* and *Minouxia*) of this subfamily are clearly shown by Loeblich and Tappan (1964, pp. 279, 283). It would appear, however, that these two genera do not show the essential difference referred to by those two authors. In our opinion, this required a very careful revision of the original material. According to the literature it seems that the difference, if indeed, any is present, only appears at the species level. The dominance and persistence of the cribrate aperture, the total absence of the principal apertural trace in the adult stage, and, also, the total absence of a valvular tooth are the most important characters of this new subfamily. The fact that the cribrate aperture does not represent a secondary character (observed by us on the studied material, in which we found different stages of development) justifies the taxonomic distinction here proposed of this foraminiferal group. The presence of an interiomarginal aperture in the early stage of *Chrysalidina* and *Minouxia* (after Loeblich and Tappan, 1964) shows, in our opinion, that a phylogenetic relationship exists between the Chrysalidininae and the Valvulininae.

The subfamily Chrysalidininae includes the following genera: *Chrysalidina* d'Orbigny, 1839 (Upper Cretaceous, Cenomanian, France); *Minouxia* Marie, 1955 (Upper Cretaceous, Senonian, France); *Andersenia* Neagu n. gen. (Lower Cretaceous, Barremian, Rumania).

Genus **Andersenia** Neagu, n. gen

(*Genotype.—Andersenia rumana* Neagu, n. gen., n. sp.).

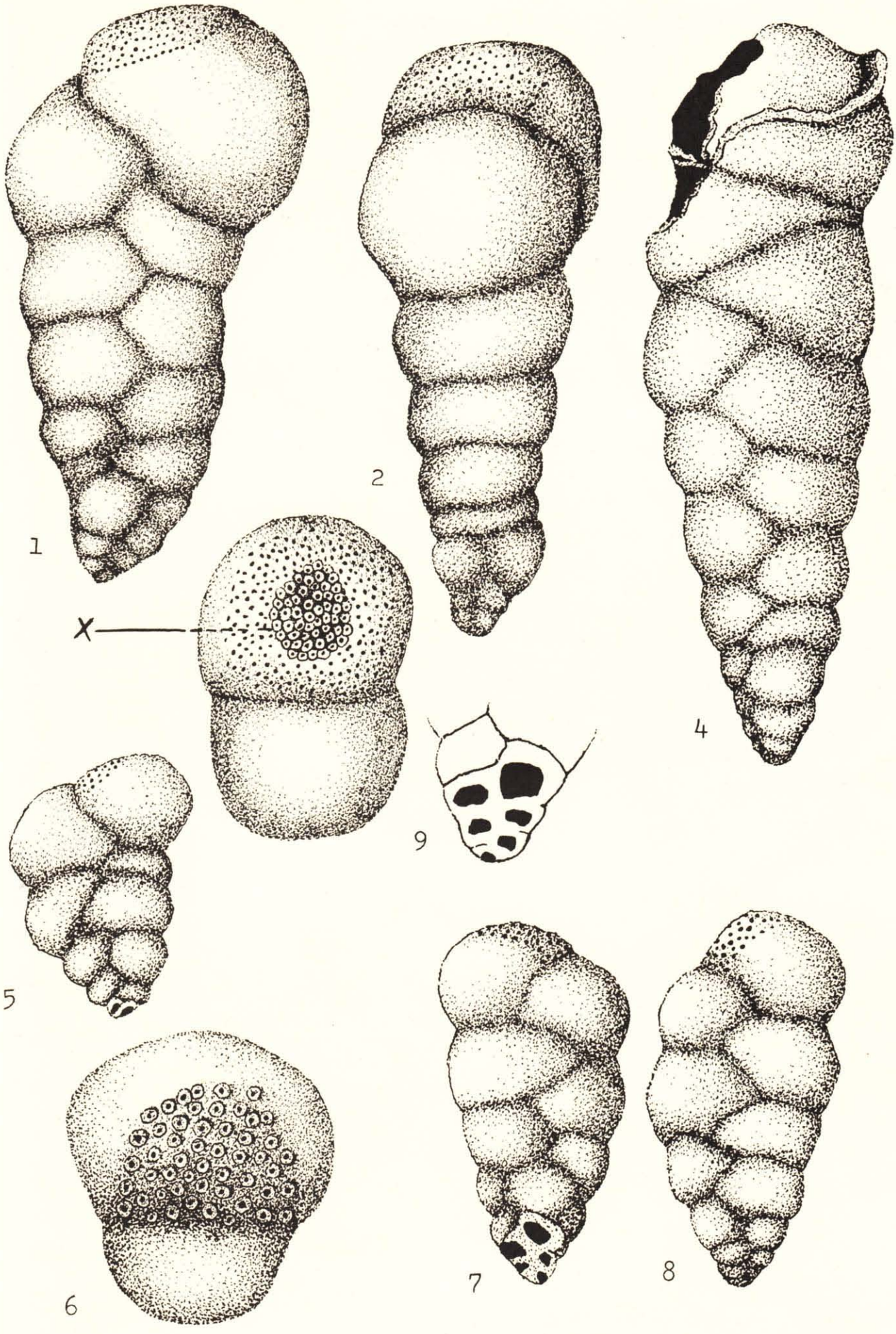
Test free, with a short triserial stage, followed by an adult biserial (textulariform) stage, which sometimes tends to become irregularly biserial; wall finely agglutinated. Chambers have a globulous

EXPLANATION OF PLATE 11

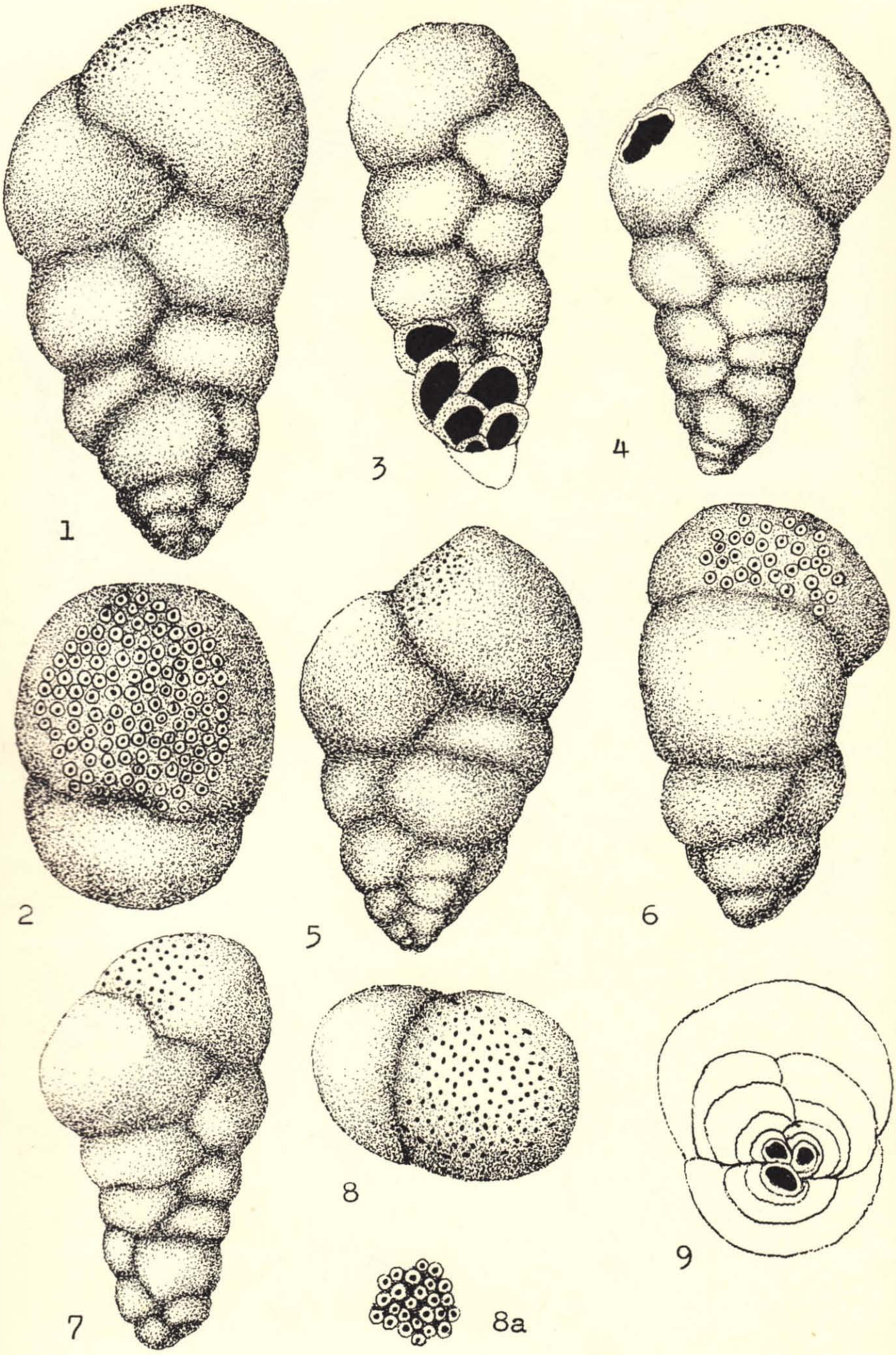
FIGS. PAGE

1-9. *Andersenia rumana* Neagu, n. gen., n. sp. 121

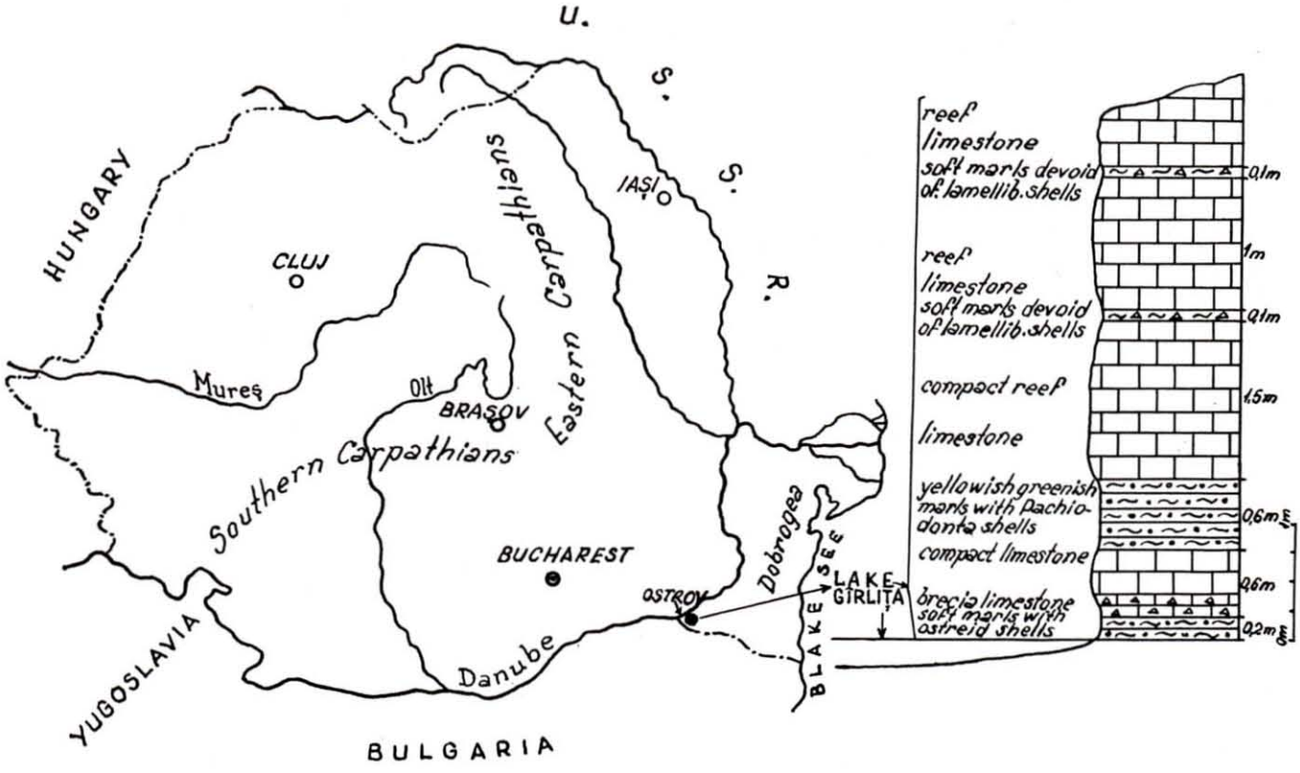
1-3. Holotype (L.S.U., 8099) × 100; 3, apertural view showing the perforations (central part × 170).
4. Paratype (L.S.U., 8100) × 110, specimen with an irregular uniserial aspect.
5-6. Paratype (L.P.B. 9004); 5, × 100; 6, × 200; apertural view showing the short collarette of the apertural perforations.
7-9. Paratype (L.S.U., 8100); 7-8, × 100; 9, × 150; showing the early stage (tangential section).



Neagu: *Andersenia rumana,* n. sp., n. gen.



Neagu: *Andersenia rumana,* n. sp., n. gen.



TEXT FIGURE 1

aspect and straight, deep sutures. Aperture typically cribrate and located on the upper part of the last chamber.

Occurrence.—Barremian (Lower Cretaceous) Ostrov, Southern Dobrogea, Rumania.

Andersenia rumana Neagu, n. gen., n. sp.

Plate 11, figures 1-9; plate 12, figures 1-9

Test with a short early triserial stage, composed of 3-5 ranges of chambers, followed by an adult textulariform stage. Some specimens have a slightly irregular biserial or an irregular uniserial aspect in the last 2-3 chambers. Chambers typically globulous, with straight, deep sutures and without internal structure. Wall finely agglutinated, formed from very fine particles of quartz and calcareous cement. Final chamber convex; on the upper part is located the apertural area with its numerous perforations, each circular and possessing a short collarette.

Dimensions.—Holotype: length 0.82 mm., thickness 0.42 mm.; paratype: length 0.42 mm.-1.00 mm., thickness 0.32 mm.-0.37 mm.

Remarks.—This genus is like *Gaudryina* in general appearance, but the presence of a cribrate aperture in the former distinguishes the two. The adult biserial stage of the new genus distinguishes it from the two other genera in the subfamily.

The genus is named after Professor H. V. Andersen of Louisiana State University to whom we would like to dedicate this form in profound homage to his micropaleontological activity. The trivial name is based on the Latin *rumanus*, meaning Rumanian.

Holotype.—Louisiana State University, Department of Geology, H. V. Howe collection no. 8099.

Paratypes.—L. S. U., H. V. Howe collection no. 8100; Laboratory of Paleontology, Bucharest no. 9004.

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EXPLANATION OF PLATE 12

FIGS. PAGE

1-9. *Andersenia rumana* Neagu, n. gen., n. sp. 121

1-4. Paratype (L.S.U., 8100) × 130.

5-8. Paratype (L.S.U., 8100) × 100; 8a, × 200; apertural view showing the short collarette of the apertural perforations.

9. Paratype (L.S.U., 8100) × 130; view of early stage showing the triserial aspect.

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RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the Foraminifera that have come to hand.

ADAMS, C. G. A revision of the foraminiferal genus *Austrotrillina* Parr.—Bull. Brit. Mus. (Nat. Hist.), Geol., v. 16, No. 2, Feb. 6, 1968, p. 71-97, pls. 1-6, text figs. 1-3 (range chart, map, columnar sections, diagrams), table 1.—Five species, 1 new.

ANDREOLI, M. Foraminiferi planctonici delle "Marne di Monte Piano" (Serie di Antognola, Appennino Settentrionale Parmense).—Boll. Soc. Paleont. Ital., v. 4, No. 2, 1965, p. 245-262, pls. 31-33, tables 1, 2.—Twenty-four species (none new) from the upper Eocene.

ARNOLD, ZACH M. Observations on the sexual generation of *Gromia oviformis* Dujardin.—Journ. Protozoology, v. 13, No. 1, 1966, p. 23-27, text figs. 1-8 (photomicrographs, life cycle drawing).—Life cycle consists of an alternation between a small naked amoeboid form and the larger well known shelled form which undergoes plastogamy.

Biological observations on the foraminifer *Calcituba polymorpha* Roboz.—Arch. Protistenk., Band 110, 1967, p. 280-304, pls. 1, 2, text figs. 1, 2 (diagram of apparatus, drawings), table 1.—Culture populations show milioline and spiroloculine stages of this fragile dendritic species indicating it should be transferred from the Ophthalmidiidae to the Miliolidae.

Utilization des antibiotiques dans la réalisation des cultures de Foraminifères sous faible volume. II. Application a la technique des cultures des Foraminifères.—Vie et Milieu, ser. A: Biol. marine, tome 18, fasc. 1-A, 1967, p. 36-45, text fig. 1 (apparatus diagram).—Antibiotics to restrict bacterial growth without inhibiting normal growth of Foraminifera.

BANDY, ORVILLE L. Problems of Tertiary foraminiferal and radiolarian zonation, Circum-Pacific Area, *in* Tertiary correlations and climatic changes in the Pacific.—Pacific Sci. Congr., 11th, Pacific Sci. Assoc., Tokyo, Aug.-Sept. 1966 (Feb. 28, 1967), p. 95-102, text figs. 1-5 (diagrams, correl. chart).—The *Orbulina* datum is time-transgressive because orbulines arose from different genera and species. Polar assemblages of planktonics expanded far into temperate regions during later Miocene, middle Pliocene, and much of the Pleistocene. In the Los Angeles Basin the stage boundaries based upon benthonics do not coincide with zonation based upon coiling characteristics of *Globigerina pachyderma*. Radiometric dates are given for changes and extinctions in various regions.

Foraminiferal definition of the boundaries of the Pleistocene in southern California, U.S.A., *in* The Quaternary history of the ocean basins.—Progress in Oceanography, editor M. Sears, v. 4, 1967, p. 27-49, text figs. 1-7 (map, graphs).—Sinistral coiling of *Globigerina pachyderma* in the Pleistocene (based on radiometric control) and dextral in the Recent and upper Pliocene can define the upper and lower boundaries of the Pleistocene, whereas sequences of benthic indices have significantly different positions with relation to age boundaries. Boundary between upper Pleistocene and Recent is also marked by appearance of dextral *G. subcretacea* and by an increase in orbulines and radiolarians. Study based on Los Angeles basin wells and deep-sea cores from offshore basins.

BANDY, ORVILLE L., and WADE, MARY E. Miocene-Pliocene-Pleistocene boundaries in deep-water environments, *in* The Quaternary history of the ocean basins.—Progress in Oceanography, editor M. Sears, v. 4, 1967, p. 51-66, pl. 1, text figs. 1-6 (range charts, maps).—Study based on a deep-sea core in the western Atlantic off South America and on restudied outcrop sequences in the Philippines. Miocene-Pliocene boundary marked by extinction of *Globoquadrina, Sphaeroidinellopsis, Globorotalia tumida miocenica*, and vast reduction in discoasters. Top of lower Pliocene marked by extinction of *Globorotalia tumida multicamerata*. Pliocene-Pleistocene boundary marked by *menardii* reduction datum (disappearance of dextral forms). *Globorotalia inflata, G. truncatulinoides*, and *Sphaeroidinella dehiscens* first appear at Miocene-Pliocene boundary, and *Pulleniatina obliquiloculata* is characteristic of Pliocene and Quaternary (very rare in Miocene).

BARKER, R. WRIGHT, and BROWN, NOEL K., JR. On the type locality of *Globorotalia fohsi* Cushman and Ellisor.—Micropaleontology, v. 14, No. 1, Jan. 1968, p. 114-116, text fig. 1 (map).

BARR, F. T. Late Cretaceous planktonic Foraminifera from the coastal area east of Susa (Apollonia), northeastern Libya.—Journ. Pal., v. 42, No. 2, March 1968, p. 308-321, pls. 37-40, text figs. 1-5 (map, geol. sections, distrib. chart, drawing).—Fourteen species, none new.

Upper Cretaceous stratigraphy of Jabal al Akhdar, northern Cyrenaica, *in* Geology and archaeology of northern Cyrenaica, Libya.—Petrol. Explor. Soc., Libya, April 1968, p. 131-147, pls. 1-3, text figs. 1-9 (map, drawings, photos, range chart, geol. section).—Typical Foraminifera species are illustrated.

BARUT, C., and BONNEFOUS, J. Présence de Danien au Djebel Sidi Kralif (Tunisie Centrale).—Bull. Centre Recherches de Pau, v. 1, No. 1, May 31, 1967, p. 55-63, pls. 1, 2, text fig. 1 (map).—On the evidence of planktonic Foraminifera.

BARUT, C., BOUROULLEC, J., and VILLATTE, J. Sur la présence de *Nummulitoides sindensis* (Davies, 1927) dans le Thanétien de l'Ariège (Pyrénées Centrale, France).—Bull. Centre Recherches de Pau, v. 1, No. 2, Dec. 31, 1967, p. 383-403, pls. 1-3.

BASSOV, V. A. Foraminifery Rodov *Marginulina* i *Marginulinopsis* iz Volzhskikh i Berriasskikh Otlozhenij Bassejna Reki Khety (Khatangskaja Vpadina).—Russia Nauchno-issl. instit. geol. Arktiki, Uchenye Zapiski, ser. paleont. i biostrat., vyp. 18, 1967, p. 38-90, pls. 1-8, text figs. 1-3 (range chart, drawings), tables 1-12.—Twelve species (8 new) and a new subspecies from Upper Jurassic and Lower Cretaceous.

BELJAEVA, N. V. Quantitative distribution of planktonic foraminiferal tests in Recent sediments of the Pacific Ocean (English summary of Russian text).—Okeanologija, tom 8, vyp. 1, 1968, p. 111-115, text figs. 1, 2 (map, graphs).

BERGER, WOLFGANG H. Planktonic Foraminifera: selective solution and paleoclimatic interpretation.—Deep-Sea Research, v. 15, No. 1, Feb. 1968, p. 31-43, text figs. 1-3 (graphs, maps), table 1.—Movement of abyssal water masses can drastically alter composition of ocean-floor planktonics, thereby altering the evidence upon which intepretations of paleoclimatology are traditionally based.

BIEDA, FRANCISZEK. The beginnings of micropaleontology in the Flysch of the Polish Carpathians.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 283-292, text figs. 43-45 (correl. chart, photo of Grzybowski, holograph letter).—Historical background.

BIEDA, FRANCISZEK, JEDNOROWSKA, ANTONINA, and KSIAZKIEWICZ, MARIAN. Stratigraphy of the Magura series around Babia Gora.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 293-324, pls. 1-5, text figs. 46-55 (maps, sections, columnar sections).—Foraminifera listed and illustrated from many different assemblages.

BLAICHER, JADWIGA. Assemblages of small Foraminifera from the Sub-Menilite Globigerina marls in the Carpathians.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 355-364, text figs. 61, 62 columnar sections), pls. 1-5.—Determined as uppermost upper Eocene.

BLANC, R., and DELOFFRE, R. Decouverte de *Mesoendothyra izjumiana* Dain (Foraminifère) en Aquitaine (France Sud-ouest).—Bull. Centre Recherche de Pau, v. 1, No. 1, May 31, 1967, p. 65-75, pls. 1, 2, text fig. 1 (stratigraphic section), table 1.—Of Dogger age.

BLONDEAU, ALPHONSE. Les Nummulites de l'Éocène de Belgique.—Bull. Soc. Géol. France, ser. 7, tome 8, No. 6, 1966 (Nov. 1967), p. 908-919, pls. 28, 29, 1 text fig. (graph), tables 1-5.—Five species, none new.

BOSTWICK, DAVID A., and NESTELL, MERLYND K. Permian Tethyan fusulinid faunas of the northwestern United States.—Systematics Assoc. Publ. No. 7, 1967, p. 93-102, text figs. 1, 2 (map, check list).

BRÖNNIMANN, PAUL. Re-examination of the morphology of *Nautiloculina circularis* (Said and Barakat), 1959, from the Upper Jurassic of Egypt and Israel.—Compte Rendu des Séances, Soc. Physique Hist. Nat. Genève, n. ser., v. 2, fasc. 1, 1967 (Jan. 1968), p. 62-73, pls. 1, 2.—An endothyroid species.

Re-examination of the morphology of *Nautiloculina oolithica* Mohler, 1938.—Compte Rendu des Séances, Soc. Physique Hist. Nat. Genève, n. ser., v. 2, fasc. 1, 1967 (Jan. 1968), p. 48-61, pls. 1, 2, text figs. 1-4 (columnar sections, graph, photomicrographs).—Species placed in Lituolacea or Endothyracea.

BRÖNNIMANN, PAUL, and JAYET, ADRIEN. Sixième note sur les Foraminifères du Crétacé inférieur de la région genevoise. Sur la présence d'un Foraminifère arénacé, *Acruliammina longa*

(Tappan), dans l'Hauterivian inférieur de la Clie-du-Vuarne (Chaînon de la Dôle, Jura vaudois, Suisse).—Compte Rendu des Séances, Soc. Physique Hist. Nat. Genève, n. ser., v. 2, fasc. 1, 1967 (Jan. 1968), p. 5-23, 1 pl., text figs. 1-9 (map, drawings).

BUTTERLIN, JACQUES. Révision d'espèces du genre *Pseudophragmina* H. Douvillé 1923.—Eclogae Geol. Helvetiae, v. 60, No. 2, Dec. 31, 1967, p. 543-551, pls. 1-3.—Four species.

CHRISTODOULOU, G. Tyrrhenian foraminiferal faunas from different localities of southern Greece (in Greek with English abstract).—Bull. Geol. Soc. Greece, v. 7, No. 1, 1966 (1967), p. 27-35.—Species listed.

CHURCH, CLIFFORD C. Shallow water Foraminifera from Cape San Lucas, Lower California. —Proc. Calif. Acad. Sci., 4th Ser., v. 30, No. 17, Feb. 23, 1968, p. 357-380, text figs. 1, 2 (drawings).—Systematic catalog includes 79 species, 2 new.

Lower Cretaceous Foraminifera of the Orchard Peak-Devils Den area, California.—Proc. Calif. Acad. Sci., 4th Ser., v. 32, No. 18, Feb. 23, 1968, p. 523-580, pls. 1-8, text figs. 1-3 (correl. chart, drawings).—Illustrated catalog includes 91 species (12 new and 25 indeterminate). *Menkenina* n. gen. (type species *M. berryi* n. sp.) erected in the Nodosariidae, with Menkeninae n. subfam. proposed.

CITA, MARIA BIANCA, and D'ONOFRIO, SARA. Climatic fluctuations in submarine cores from the Adriatic Sea (Mediterranean), *in* The Quaternary history of the ocean basins.—Progress in Oceanography, editor M. Sears, v. 4, 1967, p. 161-178, text figs. 1-4 (maps, graphs), tables 1-5.—Study based on 6 deep-sea cores in the Lower Adriatic Basin. Cold-warm fluctuations cannot be certainly assigned to glacial-interglacial stages but may be due to post-glacial climatic fluctuations.

CLOSS, DARCY. The presence and stratigraphical importance of the *Orbulina* surface in southern Brazil.—Escola de Geologia, Notas e Estudos, v. 1, No. 2, Dec. 1966, p. 3-8.—In the Pelotas Basin.

CONKIN, JAMES E., and CONKIN, BARBARA M. Arenaceous Foraminifera as a key to Upper Devonian-Lower Mississippian relationships in the type Mississippian area.—Kansas Univ., Dept. Geol., Spec. Publ. 2, 1967, p. 85-101, text figs. 1-6 (diagrams, map, range chart, photomicrographs of specimens).

CONTINI, DANIEL, and RABBE, MICHELLE. Répartition stratigraphique des Foraminifères du Lias des Avants-Monts du Jura et de la dépression de Vesoul (Note préliminaire).—Ann. Sci. Univ. de Besançon, ser. 3, Geol., fasc. 3, 1967, p. 29-35, range chart.—Ranges shown for 45 species.

CRESPIN, IRENE. Recollections on growth of Commonwealth interest in geological sciences.—Australia Bureau Min. Resources, Geol. and Geophysics, Record No. 1967/157, 39 p. (mimeo.).

DALLAN, L., and SALVATORINI, G. Biostratigrafia del Pliocene della Toscana Marittima.—Atti Soc. Toscana Sci. Nat., Mem., ser. A, v. 74, fasc. 2, Anno 1967 (Feb. 1968), p. 570-578, 1 table.—Foraminifera zonation of the lower and middle Pliocene.

DESSAUVAGIE, T. F. J. Cenomanian Trocholinas from Nigeria.—Micropaleontology, v. 14, No. 1, Jan. 1968, p. 64-72, pls. 1, 2, text figs. 1-4 (map, drawing, graph, diagram).—A new species and a new diagnosis of the genus.

EADE, J. V. A checklist of Recent New Zealand Foraminifera.—New Zealand Dept. scient. industr. Res. Bull. 182, New Zealand Oceanographic Instit. Mem. No. 44, 1967, p. 1-72, frontispiece, map, 4 portraits.

New Zealand Recent Foraminifera of the families Islandiellidae and Cassidulinidae.—New Zealand Journ. Marine and Freshwater Research, v. 1, No. 4, Sept. 1967, p. 421-454, text figs. 1-9 (map, drawings, graph), table 1.—Nineteen species, 4 new. *Evolvocassidulina* gen. nov. (type species *Cassidulina orientalis* Cushman 1922) is similar to *Cassidulinoides* except for its granular wall.

EAMES, F. E., CLARKE, W. J., BANNER, F. T., SMOUT, A. H., and BLOW, W. H. Some larger Foraminifera from the Tertiary of central America.—Palaeontology, v. 11, pt. 2, March 1968, p. 283-305, pls. 49-59.—Thirty-two species and subspecies (4 species and 1 subspecies new). Subgenera *Vlerkina* and *Vlerkinella* proposed in *Heterostegina*.

FUCHS, WERNER. Die Foraminiferenfauna eines Kernes des höheren Mittel-Alb der Tiefbohrung Delft 2—Niederlande.—Austria Jahrbuch Geol. Bundes., Band 110, Heft 2, 1967, p. 255-341, pls. 1-19.—Illustrated systematic catalog includes over 150 species, 31 new. Eight new genera are described: *Discospirella* (type species *D. obscura* n. sp.), *Pseudopyrulinoides* (type species *P. magnus* n. sp.), *Edithaëlla*

(type species *E. sessilis* n. sp.), *Cornusphaera* (type species *C. grandis* n. sp.), *Grillita* (type species *G. planispira* n. sp.), *Echinoporina* (type species *E. erinaceus* n. sp.), *Oberhauserina* (type species *O. morator* n. sp.), and *Clarella* (type species *Nodosarella articulata* Brotzen 1936). New subfamily *Edithaëllinae* of the Polymorphinidae is proposed.

FUNNELL, B. M. Foraminifera and Radiolaria as depth indicators in the marine environment.—Marine Geology, v. 5, No. 5/6, Oct. 1967, p. 333-347.—Factors affecting depth distribution are hydrostatic pressure, density, illumination, water motion, temperature, viscosity, chemical factors, pH, oxygen content, carbon dioxide content, silicon dioxide content, and biological factors.

GERKE, A. A. O Morfologicheskykh Priznakakh Dvusimmetrichnykh Nodozariid (Foraminifery) i Soderzhanii Vidovykh Opisanij.—Russia Nauchno-issl. instit. geol. Arktiki, Uchenye Zapiski, ser. paleont. i biostrat., vyp. 19, 1967, p. 5-34, text figs. 1-13 (diagrams, graphs), tables 1-9.—Morphology of uniserial forms.

GEROCH, STANISLAW. Some assemblages of microfauna from the Silesian series of the western Polish Carpathians.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 369-381, text fig. 66 (columnar sections).—Between Tithonian and Turonian.

GEROCH, STANISLAW, JEDNOROWSKA, ANTONINA, KSIAZKIEWICZ, MARIAN, and LISZKOWA, JANINA. Stratigraphy based upon microfauna in the western Polish Carpathians.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 185-282, text figs. 35-42 (maps, geol. sections, correl. charts, facies maps).—Cretaceous to Eocene zonation by smaller Foraminifera.

GHEORGHIAN, MIHAELA, IVA, MARIANA, and GHEORGHIAN, MUSAT. *Transylvanina* et *Hidina*, Foraminifères nouveaux dans le Miocène de Transylvanie (Roumania).—Revue de Micropaléontologie, v. 10, No. 3, Dec. 1967, p. 193-199, pls. 1-3.—*Transylvanina* n. gen. (generotype *T. sigali* n. sp.) in the Pseudoparrellidae and *Hidina* n. gen. (generotype *H. variabilae* n. sp.) in *incertae familiae* of the Buliminidea.

GRAHAM, JOSEPH J., and CLARK, DANA K. Notes on the types of California species of the foraminiferal genus *Orthokarstenia* Dietrich, 1935.—Calif. Div. Mines Geol., Short Contribs. to Calif. Geol., Spec. Rept. 91, 1967, p. 55-60, 1 pl.—Restudy of types results in only two species, *O. clarki* and *O. whitei*.

GRÜNDEL, JOACHIM. Mechanische Gehäusedeformationen im Zusammenhang mit der phylogenetischen Entwicklung in der Gattung *Spiroplectinata* (Foraminifera, Unterkreide).—Freiberger Forschungshefte, C213, Paläontologie, 1967, p. 63-71, pls. 1, 2, table 1.—Pathological deformation in several species of *Spiroplectinata* and in *Vaginulina* sp.

HANZAWA, SHOSHIRO. *Nummulites* from Iran.—Trans. Proc. Palaeont. Soc. Japan, n. ser., No. 68, Dec. 25, 1967, p. 174-176, pl. 16.—*Nummulites perforatus* (de Montfort).

HEDLEY, R. H., PARRY, D. M., and WAKEFIELD, J. ST. J. Fine structure of *Shepheardella taeniformis* (Foraminifera: Protozoa).—Journ. Roy. Micros. Soc., v. 87, pts. 3/4, Dec. 1967, p. 445-456, text figs. 1-15 (photomicrographs).

Reproduction in *Boderia turneri* (Foraminifera).—Journ. Nat. Hist., v. 2, 1968, p. 147-151, text figs. 1-10 (photomicrographs).—*Boderia* produces biflagellate gametes.

HEDLEY, R. H., and WAKEFIELD, J. ST. J. A collagen-like sheath in the arenaceous foraminifer *Haliphysema* (Protozoa).—Journ. Roy. Micros. Soc., v. 87, pts. 3/4, Dec. 1967, p. 475-481, text figs. 1-7 (photomicrographs).—The flexibility provided by the fibrous protein sheath enables it to survive under agitated conditions.

HONJO, SUSUMU, and OKADA, HISATAKE. Scanning electron microscopy of planktonic Foraminifera: a preparation technique.—Journ. Fac. Sci. Hokkaido Univ., ser. 4, Geol. & Min., v. 14, No. 1, Feb. 1968, p. 71-76, pls. 17-19, text figs. 1, 2 (diagrams).

HUANG, TUNYOW. Foraminiferal study of the Tungliang Well TL-1 of the Penghu Islands.—Petroleum Geology of Taiwan, No. 5, June 1967, p. 131-149, pls. 1-4, text figs. 1-4 (maps, columnar section, geol. section), tables 1, 2.—Recognition of Plio-Pleistocene and Miocene is based on Foraminifera. Two new species are described; numerous others are illustrated and their occurrence plotted.

IACCARINO, SILVIA. Ricerche sui Foraminiferi contenuti in sei carote prelevate nel Mar Ligure (La Spezia).—Boll. Soc. Geol. Ital., v. 86, fasc. 1, 1967, p. 59-88, text figs. 1-9 (map, graphs), tables 1-8.—Six Ligurian Sea cores quantitatively studied.

INGLE, JAMES C., JR. Foraminiferal biofacies variation and the Miocene-Pliocene boundary in

southern California.—Bull. Amer. Pal., v. 52, No. 236, Oct. 20, 1967, p. 209-394, pls. 33-43, text figs. 1-43 (maps, correl. charts, graphs, columnar sections, range charts, diagram), tables 1-14.—Taking the radiometric date of ten million years B.P. as the Miocene-Pliocene boundary, quantitative analyses were made of microfaunas from bathyal sediments on both sides of the boundary. Varied contemporary paleoecologic settings were then determined. Dissimilar but contemporaneous events and biofaces were correlated and it was shown that benthic foram stages traditionally used as subdivisions are inherently time-transgressive. Late Tertiary temperature fluctuations are interpreted in light of the present temperature-controlled distribution of planktonics along the North Pacific coast. About 25 planktonic species are illustrated from various parts of the section.

JANNIN, FRANÇOISE. Les "Valvulineria" de l'Albien de l'Aube.—Revue de Micropaléontologie, v. 10, No. 3, Dec. 1967, p. 153-178, pls. 1-4, text figs. 1-7 (map, diagram, graphs, phylogenetic chart).—Five species (1 new and 2 indeterminate).

JURKIEWICZ, HENRYK. Foraminifers in the Sub-Menilitic Palaeogene of the Polish Middle Carpathians (English summary of Polish text).—Poland Instyt. Geol. Biul. 210, Strat.-Paleont. Invest. in Poland, v. 4, 1967, p. 5-128, pls. 1-8, text figs. 1-21 (map, columnar sections, drawings), tables 1-3.—About 100 species of agglutinating forms, 2 subspecies new.

KENAWY, A. I., and NYIRO, REKA M. Zwei neue Foraminiferen aus dem Oberoligozän in Eger (Nordungarn).—Ann. Hist.-Nat. Musei Nat. Hungarici, tom. 59, 1967, p. 103-105, pls. 1, 2.—Two new species, one in *Pseudopatellina*, nov. gen.

KHOREVA, I. M. Novyj Vid *Elphidiella urbana* i ego Stratigraficheskoe Polozhenie.—Akad. Nauk SSSR, Biul. Komissii po Izucheniju Chetvertichnogo Perioda, No. 34, 1967, p. 135-139, text figs. 1, 2 (graph, photomicrographs).—*Elphidiella urbana* sp. n. from the Quaternary.

KIMOTO, SIZUO, and HONJO, SUSUMU. Scanning electron microscope as a tool in geology and biology.—Journ. Fac. Sci. Hokkaido Univ., ser. 4, Geol. & Min., v. 14, No. 1, Feb. 1968, p. 57-69, pls. 11-16, text figs. 1-5 (diagrams, graphs).

KOCH, WILHELM. Zur Mikropaläontologie und Biostratigraphie der Oberkreide und des Alttertiärs vom Jordanien. I. Oberkreide.—Geol. Jahrb., Hannover, Band 85, Jan. 1968, p. 627-668, pls. 58-62, text figs. 1-4 (map, diagram, drawings).—Over 40 species (5 new) from Cenomanian to upper Maestrichtian in Jordan.

KOEHN-ZANINETTI, LOUISETTE, and BRÖNNIMANN, PAUL. *Angulodiscus? gaschei*, n. sp., un Foraminifère de la Dolomie principale des Alpes Calcaires septentrionales (Autriche).—Compte Rendu des Séances, Soc. Physique Hist. Nat. Genève, n. ser., v. 2, fasc. 1, 1967 (Jan. 1968), p. 74-80, pls. 1, 2, text figs. 1-5 (photo, map, drawings, panorama).

Triasina oberhauseri, n. sp., un Foraminifère nouveau de la Dolomie principale des Alpes Calcaires septentrionales (Autriche).—Instit. Paléont., Univ. Genève, March 1968, p. 1-8 (mimeo.), pl. 1, text fig. 1 (drawings).—Both of Late Triassic (Norian) age.

LE CALVEZ, YOLANDE, and BOILLOT, GILBERT. Étude des Foraminifères contenus dans les sédiments actuels de la Manche occidentale.—Revue Géogr. Physique et Géol. Dynamique, ser. 2, v. 9, fasc. 5, Nov.-Dec. 1967, p. 391-408, pls. 1-3, text figs. 1-3 (map, graphs), table 1.—Quantitative tabulation of species in the western part of the British Channel. A few species illustrated.

LEUTZE, W. P. Stratigraphic utility of *Sphaeroidinella* Cushman in Louisiana.—Trans. Gulf Coast Assoc. Geol. Soc., v. 17, 1967, p. 152-158, pl. 1, text figs. 1, 2 (diagrams, range chart).—Six unnamed species are differentiated and illustrated and their different ranges in the Miocene and Pliocene are shown. Evolution proceeded from a trochospiral single-aperture form with discrete chambers to the Recent species *S. dehiscens*.

LISZKOWA, JANINA. A microfauna of the Upper Cretaceous marls in the Sub-Silesian series of the Wadowice region (Western Carpathians).—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 341-354, pls. 1-5, text figs. 57-60 (columnar sections, maps, geol. sections).—Foraminifera assemblages listed and illustrated.

LUCZKOWSKA, EWA. Remarks on Foraminifers described from the Miocene of Wieliczka by A. E. Reuss in 1867.—Poland Instyt. Geol., Biul. 211, Z badan mikropaleont., Tom V, cz. 2, Xth European Micropal. Colloquium in Poland, 1967, p. 328-336, pls. 1-5.—Assignment of current names to Reuss' species.

LUDBROOK, N. H. Permian deposits of South Aus-

tralia and their fauna.—Trans. Roy. Soc. South Australia, v. 91, 1967, p. 65-87, pls. 1-5, text figs. 1, 2 (map, geol. section).—Twenty-three species (5 new) from several Lower Permian basins.

LUKINA, T. G. On the distribution of calcareous Foraminifera fauna over the central part of the Pacific (in Russian).—Doklady Akad. Nauk SSSR, tom 177, No. 5, 1967, p. 1205-1207.

DE MIRO, MONTSERRAT D., and MARVAL, JOSE ANA. Foraminiferos planctonicos vivos de la Fosa de Cariaco y del talud continental de Venezuela.—Mem. Soc. Ciencias Nat. La Salle, tomo 27, No. 76, Jan.-April 1967, p. 11-34, text figs. 1-4 (maps, graphs), tables 1-5.—Counts of specimens, total and living, taken at different levels between the surface and 700 meters at 3 stations.

MURRAY, JOHN W. The living Foraminiferida of Christchurch Harbour, England.—Micropaleontology, v. 14, No. 1, Jan. 1968, p. 83-96, pl. 1, text figs. 1-9 (maps, graphs).—Thirty-seven species. Four ecologic groups.

MYERS, DONALD A. *Schwagerina crassitectoria* Dunbar and Skinner, 1937, a fusulinid from the upper part of the Wichita group, Lower Permian, Coleman County, Texas.—U. S. Geol. Survey Prof. Paper 600-B, 1968, p. 133-139, text figs. 1-4 (map, photomicrographs, graphs).

OBERHAUSER, R. Zum Vorkommen der Foraminiferengattung *Austrocolomia* in der ostalpinen Trias.—Verhandl. Geol. Bundesanstalt, 1967, Heft 1/2, p. 193-199, fig. 1 (pl.).—Four species, 2 new.

OZAWA, TOMOWO. *Pseudofusulinella*, a genus of Fusulinacea.—Trans. Proc. Palaeont. Soc. Japan, n. ser., No. 68, Dec. 25, 1967, p. 149-173, pls. 14, 15, text figs. 1-6 (graphs, phylogenetic diagrams, migration map, ontogenetic diagram), tables 1-3.—One new species.

PESSAGNO, EMILE A., JR., and MIYANO, KEI. Notes on the wall structure of the Globigerinacea.—Micropaleontology, v. 14, No. 1, Jan. 1968, p. 38-43, pls. 1-7, text figs. 1, 2 (diagrams).—Illustrated by electron micrographs.

PFLAUMANN, UWE. Zur Ökologie des bayerischen Flysches auf Grund der Mikrofossilführung.—Geol. Rundschau, Stuttgart, Band 56, Heft 1, 1967, p. 200-227, pls. 1, 2, text figs. 1-5 (outcrop photo, occurrence chart, diagrams, graphs), table 1.—Examples of foram facies in the Cretaceous.

SAIDOVA, H. M. Depth changes in Bering Sea during the Upper Quaternary, as indicated by benthonic Foraminifera, *in* The Bering Land Bridge, edited by D. M. Hopkins.—Stanford Univ. Press, 1967, p. 364-368, text figs. 1, 2 (graphs, map).—Study of Bering Sea cores presents evidence of a formerly shallower sea floor.

Sediment stratigraphy and paleogeography of the Pacific Ocean by benthonic Foraminifera during the Quaternary, *in* The Quaternary history of the ocean basins.—Progress in Oceanography, editor M. Sears, v. 4, 1967, p. 143-151, text figs. 1-4 (diagram, maps).—Study based on deep-sea cores from northern Pacific. Evidence of depth changes in Wisconsin.

SALAJ, JOZEF, BIELY, ANTON, and BYSTRICKY, JAN. Trias-Foraminiferen in den Westkarpaten.—Geol. Prace, Bratislava, Zpravy 42, 1967, p. 119-136, pls. 1-8, tables 1-4.—Eighteen species (14 new), illustrated by thin sections. *Rakusia* nov. gen. is erected in the Involutinidae and *Meandrospiranella* nov. gen. in the Fischerinidae.

SCHROEDER, MARVIN L. Lower Triassic Foraminifera from the Thaynes Formation in southeastern Idaho and western Wyoming.—Micropaleontology, v. 14. No. 1, Jan. 1968, p. 73-82, pl. 1, text figs. 1, 2 (columnar section, map).—Ten species, 4 new.

SCHROEDER, ROLF, CONRAD, MARC-A., and CHAROLLAIS, JEAN. Sixième note sur les Foraminifères du Crétacé Inférieur de la region Genevoise. Contribution a l'étude des Orbitolinidae: *Valserina brönnimanni* Schroeder & Conrad, n. gen., n. sp.; *Paleodictyoconus barremianus* (Moullade) et *Paleodictyoconus cuvillieri* (Foury).—Archives des Sciences, v. 20, fasc. 2, May-August 1967 (1968), p. 199-221, pls. 1-5, text figs. 1-4 (graphs, diagrams).

SEN GUPTA, BARUN K. Distribution of Foraminifera in the sediments of the Grand Banks: a preliminary report.—Maritime Sediments, v. 3, Nos. 2, 3, April-July 1967, p. 61-63 (mimeo.), text figs. 1, 2 (maps).—Species listed, and 2 are areally plotted.

SERPAGLI, E., and SIROTTI, A. Gli strati a *Lepidocyclina* e *Miogypsina* ai Sassi di Rocca Malatina e a Monte-gibbio (Appennino settentrionale modenese).—Boll. Soc. Paleont. Ital., v. 5, No. 1, 1966, p. 79-91, pls. 30-32, text figs. 1-5 (maps, columnar section, graph, drawings).—Two species of late Oligocene age.

Growth anomalies in *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé.—Boll. Soc. Paleont. Ital., v. 5, No. 1, 1966, p. 58-61, pls. 25, 26, text figs. 1, 2 (drawings).—Specimens have 3 spokes of equatorial chambers.

Additional remarks on growth anomalies in *Lepidocyclina* (*Nephrolepidina*) *morgani* Lemoine & R. Douvillé.—Boll. Soc. Paleont. Ital., v. 5, No. 1, 1966, p. 99, 100, text fig. 1.—Specimen consisting of 2 individuals fused together.

SIROTTI, A. Nummulitidae and Orbitoididae from the "Molasse di Rio Giordano" (Middle-Upper Eocene, northern Modenese Apennines).—Boll. Soc. Paleont. Ital., v. 5, No. 1, 1966, p. 62-78, pls. 27-29, text figs. 1-10 (map, graphs, drawings).—Seventeen species, none new.

SKINNER, HUBERT C. Modern paleoecological techniques: an evaluation of the role of paleoecology in Gulf Coast exploration.—Trans. Gulf Coast Assoc. Geol. Soc., v. 16, 1966, p. 59-79, text figs. 1-28 (maps, diagrams, zonal chart, depth chart, range chart), tables 1-8.—A compilation.

SKINNER, HUBERT C., and EPPERT, HERBERT C., JR. A bibliography of foraminiferal ecology and paleoecology (with annotations).—Trans. Gulf Coast Assoc. Geol. Soc., v. 16, 1966, p. 355-372.

SOLOVJEVA, M. F. Novye Dannye o Foraminiferakh Roda *Eoendothyranopsis* iz Nizhnego Karbona Vostochnogo Tajmyra.—Russia. Nauchno-issl. instit. geol. Arktiki, Uchenye Zapiski, ser. paleont. i biostrat., vyp. 18, 1967, p. 24-37, pls. 1-3.—Four species (3 new) and a new subspecies.

SRINIVASAN, M. S. Middle Eocene to Oligocene Foraminifera, Tukituki River, Hawke's Bay.—New Zealand Journ. Geol. Geophysics, v. 10, No. 4, Oct. 1967, p. 982-988, text fig. 1 (map), table 1.—Five stages distinguished by smaller Foraminifera.

STEWART, WENDELL J. Schubertellinae from the Wolfcamp, Lower Permian, Franklin Mountains, Texas.—Journ. Pal., v. 42, No. 2, March 1968, p. 322-328, pls. 41, 42, text fig. 1 (map).—Seven species, 1 new. This paper is a translation from the Russian.

SZTEJN, JANINA. Micropalaeontological stratigraphy of the Lower Cretaceous in Kujawy (English summary of Polish text).—Poland Instyt. Geol., Biul. 200, Strat.-Paleont. Invest. in Poland, v. 2, 1967, p. 237-269, pls. 1, 2, text fig. 1 (map), table 1 (range chart).—Nine species, 2 new.

TAMBAREAU, YVETTE. Sur une nouvelle espèce d'Operculine *Operculina tenuis*.—Bull. Soc. Hist. Nat. Toulouse, tome 103, fasc. 3, 4, 1967, p. 425-430, pl. 1, text figs. 1-3 (drawings, graph).—From the Ypresian.

THOMPSON, M. L. American fusulinacean faunas containing elements from other continents.—Kansas Univ., Dept. Geol., Spec. Publ. 2, 1967, p. 102-112, text fig 1 (map).

TIBBS, JOHN F. On some planktonic Protozoa taken from the track of drift station ARLIS I, 1960-61.—Arctic, Journ. Arctic Instit. No. America, v. 20, No. 4, Dec. 1967, p. 247-254, text figs. 1, 2 (track, bathymetry), tables 1, 2.—*Globigerina bulloides* the only foraminiferan found.

TINOCO, IVAN M. Foraminiferos do Atol das Rocas.—Trab-s. Inst. Oceanogr. Univ. Fed. Pe., Recife, v. 7, 8: 1965/6, p. 91-113, pls. 1-3, text fig. 1 (map), table 1.—Twenty-three species, none new, from around Atol das Rocas off Brazil.

Contribuicao a Sedimentologia e Microfauna da Baia de Sepetiba (Estado do Rio de Janeiro). 2. Foraminiferos.—Trab-s. Inst. Oceanogr. Univ. Fed. Pe., Recife, v. 7, 8: 1965/6, p. 123-135, pl. 1.—Fifteen species, none new.

TOUMARKINE, MONIQUE. Une nouvelle espèce d'Orthophragmine de l'Éocène marin du Mont-Cayla (Oude): *Discocyclina neumannae*.—Revue de Micropaléontologie, v. 10, No. 3, Dec. 1967, p. 209-214, pl. 1.

TRIFONOVA, E. Foraminifera from the pebbles included in the early Palaeozoic breccia conglomerates in NW Bulgaria (English summary of Bulgarian text).—Review Bulgarian Geol. Soc., v. 25, pt. 2, 1964, p. 117-127, pls. 1, 2.—Upper Devonian species in a Permian breccia.

Some new Triassic Foraminifera in Bulgaria.—Ann. Univ. Sofia, Fac. Geol. Geogr., v. 60, livre 1, Geol., 1965/1966 (1967), p. 1-7, pls. 1, 2.—Nine new species.

WALL, JOHN H. Paleoecology of Cretaceous marine microfaunas in the Rocky Mountain foothills of Alberta and British Columbia.—Symposium "Paleoenvironments of the Cretaceous seaway in the western interior," Colorado School of Mines, Golden, May 1967, p. 173-196, text figs. 1-3 (map, zonal chart, diagram), tables 1, 2.—Zonation by Foraminifera between Albian and Campanian.

WEBBY, B. D. Tube fossils from the Triassic of south-west Wellington, N. Z.—Trans. Roy. Soc. New Zealand, Geol., v. 5, No. 7, Nov. 2, 1967,

p. 181-191, text fig. 1 (map).—Related to *Terebellina* and thus possibly to *Bathysiphon*.

WILES, WILLIAM W. Pleistocene changes in the pore concentration of a planktonic foraminiferal species from the Pacific Ocean, *in* The Quaternary history of the ocean basins.—Progress in Oceanography, editor M. Sears, v. 4, 1967, p. 153-160, text figs. 1-3 (graphs).—In core samples where climatic variations are established, pore concentration per unit area in *Globigerina eggeri* was found to be high during interglacial stages, low during glacial stages. Pore concentration changes in a deep-sea core from north of Easter Island, where temperatures remained warm throughout Pleistocene, lead to their interpretation as a non-temperature response.

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CORRECTION IN PAGINATION OF VOLUME 18

The numbers 41-54 were accidentally overlooked in assigning page numbers in Part 2 (April, 1967) of Volume 18. The editor apologizes for any inconvenience caused the reader thereby.