



















ALLAN HANCOCK FOUNDATION  
PUBLICATIONS

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

1939-1950

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA  
1955

## CONTENTS

	PAGES
1. A report on some arenaceous foraminifera (Plates 1-12) .....	1-114
2. Some Textulariidae of the Pacific Ocean (Plates 13-16) .....	115-144
3. Some Nonionidae in the collections of the Allan Hancock Foundation (Plates 17-20) .....	145-178
4. Some Virguliniinae in the collections of the Allan Hancock Foundation (Plates 21-28) .....	179-230
5. The species of Bulimina and related genera in the collections of the Allan Hancock Foundation (Plates 29-36) .....	231-294
6. Some Lagenidae in the collections of the Allan Hancock Foundation (Plates 37-48) .....	295-364
Station lists .....	3-30 146-152 180-184 232-234
Index .....	365-376

MAY 24 1955



58.3  
87

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 1

A REPORT ON SOME ARENACEOUS  
FORAMINIFERA

(PLATES 1-12)

BY

JOSEPH A. CUSHMAN and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

1939



REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA, AND GALA-  
PAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, AND IN 1938.

## A REPORT ON SOME ARENACEOUS FORAMINIFERA

(PLATES 1-12)

*By* JOSEPH A. CUSHMAN and IRENE McCULLOCH

THE UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6, NUMBER 1

ISSUED AUGUST 14, 1939

---

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS

LOS ANGELES, CALIFORNIA



# A REPORT ON SOME ARENACEOUS FORAMINIFERA

(PLATES 1-12)

JOSEPH A. CUSHMAN and IRENE McCULLOCH

From relatively shallow waters along the eastern edge of the Pacific from Seward, Alaska, to areas off the coast of Peru, large numbers of bottom samples have been assembled for study.

That such a collection for study exists is due almost entirely to the interest, energy, and efficiency of Captain Hancock personally.

In this connection due credit must be given to a mechanical genius, Alex Campbell, Chief Engineer of the *Velero III*, for devising all sorts of mud dippers when needed, ranging from a section of pipe to most efficient metal snappers. The sincere appreciation herein expressed means so much more when it is remembered that the several specialists on each expedition always became too engrossed in special fields to devote time and energy to collecting material outside their special interests.

From time to time additional material has been added to the collections brought back by the *Velero III*, by people who were visiting remote areas and knew the value of comparative material in connection with such extensive studies. Such aid has been invaluable and the hope is expressed that even greater amounts of such material will be available in the future for comparative studies.

Unfortunately, when the system of numbering samples was begun there was no way of anticipating the scope of the work in the future. In 1932 the plan of arbitrarily using the figure "1" for all samples off San Pedro; the figure "2" to begin the number of all samples off Mexico; "3" for South America; "4" for Galapagos; "5" for South America was adopted. Shortly afterward, a trip to Alaska resulted in a series beginning with "A"; "V" for British Columbia; "W" for Washington; "C" for one collection of samples from off the coast of northern California to Los Angeles.

Beginning northward and proceeding southward the station lists arranged in tables record the available data.

The arenaceous foraminifera recorded in the following pages do not represent all the species obtained in the dredgings. As in all similar collections there are single specimens, or incomplete ones, or specimens representing the early stages alone. While it may be evident that these

probably belong to described species not present in adult form, or possibly to undescribed ones, it is much better to wait until additional material shall be available before assigning such material to definite names.

In these arenaceous forms which, in part at least, use the materials from the bottom on which they live to form the test, there must be a considerable variation as bottom materials change. In some of the species we have attempted to illustrate examples of this varied test material. Being the most primitive group of the foraminifera it is not surprising that there is considerable variation in different characters, although it is perhaps most noteworthy that the characters of a species are so definitely held.

It is interesting to find that many of the species found along the Eastern Pacific in cold waters are similar to or identical with those described from the Arctic and Antarctic regions. Others are known as yet only from the Eastern Pacific but it is to be expected that their range will be extended by later explorations.

Collections upon which this report is based are a part of the collections of the Allan Hancock Foundation, The University of Southern California, Los Angeles. The official abbreviation is AHF used in the numbering of all specimens, including the holotypes and paratypes.

Paratypes of the new species will be deposited at Smithsonian Institution, Washington, D.C., and at Cushman Laboratory for Foraminiferal Research, Sharon, Mass.

TABLE 1 — OFF COAST OF ALASKA

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
A-1	Ketchikan, Alaska, off wharf of Alaska Steamship Co.			8	Aug. 1, 1933
A-2	Wrangell, off wharf, Alaska Steamship Co.			2	1, 1933
A-3	Juneau, off boat			10	2, 1933
A-4	Cordova, off wharf			2	4, 1933
A-5	Cordova, Observation Island			low tide	6, 1933
A-6	Knott Point, Hawkins Island			low tide	6, 1933
A-7	Dye Bay, Hawkins Island			low tide	6, 1933
A-8	Excursion Bay near Astoria Puget Sound Cannery			low tide	2, 1933
A-9	Valdez, off the Aleutian, near dock			5	4, 1933
A-10	Seward			low tide	5, 1933
A-11	Seward, near cannery			low tide	5, 1933
A-12	Seward, near wharf			low tide	5, 1933
A-13	Skagway, near wharf			6	7, 1933
A-14	Skagway, near wharf			6	7, 1933
A-15	Ketchikan, near wharf			7	9, 1933
A-16	Simpson's Bay, north arm			35	Aug. to Dec., 1933
A-17	Mile Thirteen, Copper River and Northwestern R R			surface	
A-18	Hartley Bay			med. low tide surf.	
A-19	Greenes Bay			90	Aug. to Dec., 1933
A-20	Anderson Bay			med. low tide	
A-21	Cross Wilson Slough, Copper R floats			surface	
A-22	Orca Bay			28	
A-23	Nurmay Island			med. low tide	
A-24	Cordova, local clam beds			med. low tide	

TABLE 1 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
A-25	Bearin River, Katilla			med. low tide	
A-26	Edwards River, Controller Bay			med. low tide	
A-27	Sheep Bay, near Cordova			med. low tide	

TABLE 2 — OFF COAST OF CALIFORNIA, NORTH OF LOS ANGELES

C-1	Eureka, Pier at K Street			3	Aug. 19, 1933
C-2	Shell Oil Co. Pier at Crescent City			3	19, 1933
C-3	Sausalito Pier, Golden Gate			2	26, 1933
C-4	Richmond Pier			3	27, 1933
C-5	Moss Landing			2	29, 1933
C-6	Berkeley Ferry Pier			2	28, 1933
C-7	Monterey, Fishing Pier			2	28, 1933
C-8	Park Avenue Bridge, Alameda			3	28, 1933
C-9	Arvilla Pier			8	30, 1933
C-10	Santa Cruz			1	29, 1933
C-11	Gaviota Pier			8	31, 1933
C-12	Morro Bay			2	31, 1933
C-13	Santa Barbara			4	31, 1933
C-14	Point Mugu			low tide	31, 1933
C-15	Near Ventura			low tide	31, 1933
C-16	Near Oxnard			low tide	31, 1933

TABLE 3 — OFF COAST OF BRITISH COLUMBIA

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
V-1	Vancouver station at pier, off dock near station			3	Aug. 12, 1933
V-2	Vancouver station, at park near station				12, 1933
V-3	Vancouver Harbor, off lumber pier				12, 1933

TABLE 4 — OFF COAST OF WASHINGTON

W-1	Everett, Wash., off pier			3	Aug. 11, 1933
W-2	Bellingham, south, surface			low tide	11, 1933
W-4	Puget Sound, Coliman Dock			45	13, 1933
W-5	Puget Sound, Blynn, near Johnson Creek			45	15, 1933
W-6	Tacoma, Railroad Pier			45	15, 1933
W-7	Arcata			low tide	15, 1933
W-7-2	Arcata			low tide	15, 1933

TABLE 5 — OFF COAST OF CALIFORNIA, SAN PEDRO AND VICINITY

1	25 miles southeast lighthouse, San Pedro			12	July 19, 1930
2	35 miles southeast lighthouse, San Pedro			25	19, 1930
3	40 miles south lighthouse			45	Jan. 21, 1930
4	40 miles south lighthouse			45	24, 1930
5	Off San Pedro			38	17, 1930
6	30 miles south of life buoy			21	17, 1930
7	Southeast Point Fermin			54	17, 1930
8	50 miles, south lighthouse, Long Beach			58	April 4, 1931

TABLE 5 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
9	Off Long Beach			no depth recorded	April 4, 1931
10	Palos Verdes			38	4, 1931
11	Off Long Beach			35	4, 1931
12	30 miles south Long Beach			20	4, 1931
13a	Off Palos Verdes			30	4, 1931
13b	Off Palos Verdes			35	4, 1931
14	Off Point Fermin			39	4, 1931
15	40 miles south Long Beach			54	Mar. 4, 1931
16	Isthmus Cove, Catalina			28	4, 1931
17	Off Long Beach			38	2, 1931
18	Off Long Beach			38	1, 1931
19	Off Long Beach			60	4, 1931
20	Off Point Fermin			30	1, 1931
21	Off Long Beach			35	1, 1931
22	Off Long Beach			42	1, 1931
23	Off Point Fermin			25	1, 1931
24	Long Beach			46	1, 1931
25	5 miles south of Point Fermin			170	June 13, 1931
26	34 miles southeast lighthouse			58	Feb. 28, 1931
27	# 3 location, Indian Head, San Clemente			4+	Mar. 12, 1931
28	¾ mile west Mosquito, San Clemente			40	Dec. 31, 1931
29	½ mile west Mosquito			38	30, 1931
30	1 mile west Mosquito			38	30, 1931
31	Mosquito			20	31, 1931

TABLE 5 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
32	Indian Head, San Clemente			48	Dec. 31, 1931
33	1 mile west Mosquito			40	31, 1931
34	1 mile west Mosquito			40	30, 1931
35	Cherry Valley, 1 mile west Mosquito			6	28, 1931
36	Cherry Valley, 1 mile west Mosquito			5	27, 1931
37	Cherry Valley, 1 mile west Mosquito			6	12, 1931
38	Cherry Valley, 1 mile west Mosquito			5	28, 1931
39	Cherry Valley, 1 mile west Mosquito			8	27, 1931
40	¼ mile west Indian Head			44	30, 1931
41	1 mile west Mosquito			35	30, 1931
42	¼ mile west Mosquito			35	30, 1931
43	½ mile west Mosquito			35	30, 1931
44	Zion Canyon			45	31, 1931
45	Zion Canyon			40	31, 1931
46	Indian Head			46	31, 1931
47	Indian Head			50	31, 1931
48	Mosquito			40	31, 1931
49	½ miles west Indian Head			4	31, 1931
50	Zion Canyon			40	30, 1931
101	Cherry Cove, Catalina Island			20	July 8, 1931
102	Cherry Cove, Catalina Island			22	8, 1931
103	Cherry Cove, Catalina Island			24	8, 1931
104	Cherry Cove, Catalina Island			27	8, 1931
105	White Rock Canyon, San Clemente			25	22, 1931

TABLE 5 — CONTINUED

<i>Station</i>	<i>Locality</i>	<i>Bearings</i>		<i>Fathoms</i>	<i>Date</i>
		<i>Latitude</i>	<i>Longitude</i>		
106	Mosquito, San Clemente			10	July 14, 1931
107	Mosquito, ½ mile west			10	22, 1931
108	Mosquito, ½ mile west			30	22, 1931
109	Signal Canyon, San Clemente			34	22, 1931
110	Catalina Harbor			14	29, 1931
111	Catalina Harbor			24	29, 1931
112	Catalina Harbor			18	29, 1931
113	Catalina Harbor			30	29, 1931
114	Catalina Harbor			41	29, 1931
115	Catalina Harbor			—	29, 1931
116	Catalina Harbor			—	29, 1931
117	Catalina Harbor			—	29, 1931
118	Catalina Harbor			—	29, 1931
119	Catalina Harbor			—	29, 1931
120	Catalina Harbor			—	29, 1931
121	Catalina Harbor			—	29, 1931
122	Catalina Harbor			—	29, 1931
123	Near Fisherman's Cove, Catalina			3	9, 1931
124	Near Fisherman's Cove, Catalina			3	9, 1931
125	Near Fisherman's Cove, Catalina			4	9, 1931
126	Near Fisherman's Cove, Catalina			6	9, 1931
127	Near Fisherman's Cove, Catalina			6	9, 1931
128	Near Fisherman's Cove, Catalina			7	9, 1931
129	Near Fisherman's Cove, Catalina			10	9, 1931



TABLE 5 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
130	Near Fisherman's Cove, Catalina			7	July 9, 1931
131	Near Fisherman's Cove, Catalina			12	9, 1931
132	Near Fisherman's Cove, Catalina			10	9, 1931
133	Near Fisherman's Cove, Catalina			12	9, 1931
134	Indian Head, San Clemente			50	21, 1931
135	Under Peak, San Clemente			41	22, 1931
136	Off San Clemente			50	22, 1931

TABLE 6 — MISCELLANEOUS

51	Bahia Honda, Panama	6	Dec. 21, 1931
52	Conway Bay, Indefatigable Island	low tide	Jan. 12, 1932
53	Tower Island, Darwin Bay	low tide	19, 1932
54	Espiritu Santo, L. Calif.	183	Feb. 17, 1932
55	Los Islets, North Isla Partida, Mex., bearing west	160	May 8, 1932
56	Los Frailes Point, Mex.	150	10, 1932
57	Ensenada de los Muertos	40	2, 1932
58	Asuncion Island, 283 degrees from south end	150	April 30, 1932
59	Ensenada de los Muertos	10	May 2, 1932
60	Ensenada de los Muertos	17	2, 1932
61	San Francisco Island, South West Bay, Mex.	10	6, 1932
62	Bay San Gabriel, Mex.	3	5, 1932
63	La Paz, Mex.	11	4, 1932
64	Point Puieta, Mex.	surface	2, 1932
65	Point Puieta, Mex.	surface	2, 1932

TABLE 6 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
66	Thurloe Bay, Mex.			surface	April 28, 1932
67	Santa Maria Bay, Mex.			7	May 11, 1932
68	Los Trails Point			160	10, 1932
69	Cabeza Ballena, Mex.			110	10, 1932
70	Cabeza Ballena			90	10, 1932
71	Northwest Anchorage, San Clemente			17	29, 1932
72	Guadalupe Island			17	Aug. 25, 1932
73	East of Guadalupe Island			50	25, 1932
74	East of Guadalupe Island			40	25, 1932
75	East of Guadalupe Island	28 18 11	115 34	20	26, 1932
76	East of Guadalupe Island	27 37N	114 50W	12	27, 1932
77	East of Guadalupe Island	21 50N	114 30W	11	27, 1932
78	Cedros Island	28 11N	115 9W	27	29, 1932
79	Cedros Island	28 34N	115 19W	100	30, 1932
80	Catalina, Long Point			180	Oct. 2, 1932
81	Long Point			25	2, 1932
82	Off Long Point			147	12, 1932
83	White's Cove near Long Point			16	2, 1932
84	Off Tanner Bank, San Clemente	32 42 30N	119 12W	20	2, 1932
85	Cortez Banks, Whistling Buoy			11	1933
86	Emerald Bay, Catalina			?	July 10, 1933
87	45 miles west lighthouse			27	Feb. 28, 1931
88	45 miles southeast lighthouse			27	28, 1931
89	Emerald Bay, Catalina			27	28, 1931

TABLE 6 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
90	Charles Island, Galapagos			low tide	Jan. 2, 1932
91	Santa Barbara Island	33 39 37N	119 20 15W	?	2, 1932
92	Penang, Malay Peninsula			low tide	19, 1938

TABLE 7 — OFF CALIFORNIA

1001	East side of Santa Barbara Island	33 29 07	119 01 15	11	July 12, 1933
1002	Northwest Anchorage, San Clemente			20	12, 1933
1003	North West Harbor	33 02 10	118 35 00	13	12, 1933
1004	San Nicolas	33 13 30	119 19 40	?	Sept. 11, 1933
1005	North side San Nicolas	33 20 00	119 32 10	49	11, 1933
1006	Southwest side San Nicolas	33 13 30	119 35 30	63	11, 1933
1007	2 miles west of Santa Barbara Island	33 28 02	119 04 55	54	11, 1933
1008	East Anchorage, San Clemente	32 48 31	118 23 26	38	10, 1933
1009	Off Seal Harbor	32 53 17	118 32 22	52	10, 1933
1010	Off San Nicolas		36 07	?	10, 1933
1011	Off east side of Santa Barbara	33 28 2	119 00 43	31	10, 1933
1012	Torney's Cove, Santa Cruz Island	34 02 45	119 54 38	?	10, 1933
1013		34 03 30	120 20	10	14, 1933
1014	Avila	35 10 23	120 44 10	18	13, 1933
1015	Off Tyler Bay, Santa Cruz Island	34 03 20	119 36 00	32	13, 1933
1016	Santa Cruz Island, off Tinkers Harbor	34 04 25	119 41 50	47	?
1017	Avalon Harbor, Catalina Island			?	?
1018	Santa Rosa Island, Bechen's Bay			8	17, 1933
					16, 1933

TABLE 7 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1019	San Miguel Island, Cuyler Harbor			20	Sept. 15, 1938
1020	Off Anacapa Island, Calif.	34 05	119 24	18	Aug. 1, 1938
1021	Prisoner's Harbor, Santa Cruz Island	34 01	119 41	18	1, 1938
1022	Santa Rosa Island	34 01	120 02	2	2, 1938
1023	Santa Rosa Island	34 01	120 02	16	2, 1938
1024	Santa Rosa Island	33 54	120 06	11	2, 1938
1025	San Miguel Island	34 01	120 26	16	3, 1938
1026	Port San Luis Obispo	35 10	120 44	6	3, 1938
1027	Port San Luis Obispo			8	4, 1938
1028	Half Moon Bay	37 28 31	122 31	22	5, 1938
1029	Half Moon Bay	37 32 20	122 32 40	16	5, 1938
1030	Off Burlingame	37 39	122 36 20	16	5, 1938
1031		37 45 45	122 39 30	14	5, 1938
1032		37 47	122 34 20	10	5, 1938
1033	Off Farallone Island	37 48	122 59	37	7, 1938
1034	Off Farallone Island	37 49	123 04	38	7, 1938
1035	South Farallone Island	37 26	122 53	105	7, 1938
1036	Santa Cruz Bay	36 57	122 00 45	7	7, 1938
1037	Monterey Bay, off Salinas River	36 49	121 53 30	85	8, 1938
1038	Monterey Bay, off Salinas River	36 48 50	121 53 20	50	8, 1938
1039	Monterey Bay, off Elkhorn Slough	36 47 35	121 52 00	130	8, 1938
1040	Monterey Bay, off Elkhorn Slough	36 47 25	121 53 30	194	8, 1938
1041	Monterey Bay	36 46 15	121 50 35	25	8, 1938
1042	Point Pinos	36 39 30	121 57	49	8, 1938

TABLE 7 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1043	San Simeon	35 38	121 11	7	Aug. 9, 1938
1044	Off Point Arguello	34 37 20	120 42 40	36	9, 1938
1045	San Miguel Island	34 00 40	120 20 50	14	9, 1938
1046	San Miguel Island	33 36 3	119 51	120	10, 1938
1047	San Miguel Island	33 33	119 15	165	11, 1938
1048	Off Santa Barbara Island	33 29	119 01	11	11, 1938
1049	Off Santa Barbara Island	33 29 4	118 59 3	160	12, 1938
1050	Off Point Bennett, San Miguel Island			34	Sept. 12, 1938
1051	Between Crook and Cardwell Points, San Miguel Island			bet. 12 & 19	12, 1938
1052	Off Santa Barbara City	34 22 30	119 42 30	33	13, 1938
1053	Off Santa Cruz Island	34 06	119 53	53	14, 1938

TABLE 8 — OFF MEXICO

200	Off Tangola-Tangola, W. C., Mex.	?	Jan. 4, 1933
201	Petatlan, W. C., Mex.	6	4, 1933
202	Chipequa Bay, Mex.	8½	Mar. 15, 1933
203	Tenacatita Bay, Jalisco, Mex.	?	Jan. 2, 1933
204	Santa Maria, Mex.	2	Mar. 21, 1933
205	Isabel Island, Gulf of Calif.	14	19, 1933
206	Pilot Rock, north end, Guadalupe Island	25	May 31, 1933
207	¾ mile east of Pilot Rock	65	31, 1933
208	Melpomene Cove, south end, Guadalupe Island	18	31, 1933
209	South of middle of Benito Island	13	June 1, 1933

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
210	South Bay of Cerros Island, Mex.			17	June 4, 1933
211	Thurloe Bay, L. Calif., Mex.			10	5, 1933
212	San Quentin Bay, Mex.			10	5, 1933
213	Anchorage east of Long Point, Catalina			15	10, 1933
214	Near White Friars Rocks, Mex.	17 29 20N	101 35 05W	100	
215	Tangola-Tangola, Mex.			15-20	Feb. 28, 1934
216	Petatlan Bay, Mex.			100-140	Mar. 2, 1934
217	Tenacatita Bay, Mex.			50	4, 1934
218	Santa Maria Bay, L. Calif., 1 mile west of Hughes Point			35-40	7, 1934
219	Clarion Island, Mex.	18 21N	114 44 30W	15	June 10, 1934
220	Clarion Island, Mex.	18 20N	114 44W	30	10, 1934
221	Off Cape Rule, Socorro Island, Mex.			20	8, 1934
222	Small bay west of Braithwaite Bay, Socorro Island, Mex.			4-10	8, 1934
223	Sulphur Bay, Clarion Island, Mex.			53	10, 1934
224	Benitos Island, L. Calif.			13	5, 1934
225	East side of Cedros Island			?	Nov. 27, 1934
226	Guadalupe Island	29 06 15N	118 24 30W	96	May 22, 1935
227	Guadalupe Island	29 06 15N	118 24W	200	23, 1935
228	Melpomene Cove, Guadalupe Island			17	24, 1935
229	San Benito			17	25, 1935
230	Off San Benito	28 19 40N	118 23W	121	29, 1935
231	Smugglers Cove, Santa Cruz Island			10	Sept. 16, 1933
232	San Miguel Island, Cuyler Harbor			10	7, 1933
233	Cape San Quentin Bay			9	Feb. 15, 1936

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
234	Baja Point, L. Calif., Mex.			7	Feb. 15, 1936
235	Magdalena Bay, L. Calif., Mex.	24 32 30N	112 01 10W	17	16, 1936
236		24 19 30	111 36 25	19	17, 1936
237		24 19 15	111 37 30	24	17, 1936
238	Off Point Tosca, L. Calif., Mex.			45	17, 1936
238-sp.	Off Cape San Lucas, east of Cape, L. Calif., Mex.	22 56 30	109 47	10-15	18, 1936
239	Off Cape San Lucas, L. Calif.	22 56 36	109 47 00	33	18, 1936
240	Fraille Bay, L. Calif.			30	18, 1936
241	Off Fraile Bay, L. Calif.			80	18, 1936
242	Off Lorenzo Channel	24 24 30	109 16 00	117	19, 1936
243	San Gabriel Bay, Espiritu Santo Island, L. Calif., Mex.			11	19, 1936
244	La Paz Bay, L. Calif., Mex.	24 13	110 18 30	10	20, 1936
245	La Paz Bay, L. Calif., Mex.			7	21, 1936
246	San Gabriel Bay, Espiritu Santo, mile west of Bay			35	22, 1936
247	3 miles, off San Gabriel Bay, Espiritu Santo, L. Calif., Mex.			80	22, 1936
248	Off south end of Espiritu Santo			24	22, 1936
249	Off north end of Isla Partida, L. Calif., Mex.	24 36	110 24 30	55	24, 1936
250	Off north end of Isla Partida, L. Calif., Mex.	24 37 30	110 23 45	140	24, 1936
251	Off Isla Partida, L. Calif., Mex.	24 38	110 23	225	24, 1936
252	Off San Francisco Island, L. Calif., Mex.	24 48 30	110 34	23	24, 1936
253	Agua Verde Bay, L. Calif., Mex.	25 31 00	110 04 30	17	27, 1936
254	Agua Verde Bay, L. Calif., Mex.			10	27, 1936
255	Agua Verde Bay, L. Calif., Mex.			20	27, 1936
256	Agua Verde Bay, L. Calif., Mex.	26 05	111 17	38	28, 1936

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
257	Agua Verde Bay, L. Calif., Mex.	26 16 46	111 22	50	Feb. 28, 1936
258	San Francisco Bay, L. Calif., Mex.	28 26	112 54	16	29, 1936
259	Sal Si Puedes Channel, L. Calif., Mex.	28 28	112 52 30	106	Mar. 2, 1936
260	Entrance to Angeles Bay, L. Calif., Mex.	29 05	113 20 40	42	2, 1936
261	Angeles Bay, L. Calif., Mex.	28 56 15	113 34	16	2, 1936
262	Angeles Bay, L. Calif., Mex.			20	2, 1936
263	Puerto Refugio, Angel de la Guardia, L. Calif., Mex.	29 33	113 36	8	3, 1936
264	Angeles Bay, Baja Calif., Mex.			25	2, 1936
265	Puerto Refugio, Angel de la Guardia, L. Calif., Mex.	29 33	113 34 30	16	3, 1936
266	San Francisco Bay, L. Calif., Mex.			40	2, 1936
267	Puerto Refugio, Angel de la Guardia, L. Calif., Mex.			15-30	4, 1936
268	Puerto Refugio, Angel de la Guardia, L. Calif., Mex.			65	4, 1936
269	Puerto Refugio, Angel de la Guardia, L. Calif., Mex.			125	5, 1936
270	East coast of Angel de la Guardia, L. Calif., Mex.	29 29	113 27	14	6, 1936
271	East coast of Angel de la Guardia, L. Calif., Mex.	29 31	113 28 30	10	6, 1936
272		29 23 30	113 21 40	10	6, 1936
273	Southeast coast Angel de la Guardia, L. Calif., Mex.	29 01 30	113 08 00	16	7, 1936
274	Isla Partida, L. Calif., Mex.	28 58	113 03 45	14	8, 1936
275 "A"	Raza Island, L. Calif., Mex.	28 48	113 00 00	40	9, 1936
275 "B"	Raza Island, L. Calif., Mex.	28 48	113 00 00	40	9, 1936
276	San Esteban Island, L. Calif., Mex.	28 38 30	112 36	32	9, 1936
277	Tiburón Island, L. Calif., Mex.	28 43 45	112 15 30	16	10, 1936
278	Tiburón Island, L. Calif., Mex.			55	10, 1936
279	East of Tiburón Island, L. Calif., Mex.	28 45 30	112 16	16	11, 1936



TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
280	East of Tiburon Island, L. Calif., Mex.			20	Mar. 11, 1936
281	East of Tiburon Island, L. Calif., Mex.			40	11, 1936
282	East of Tiburon Island, L. Calif., Mex.			12	11, 1936
283	San Pedro Nolasco Island, L. Calif., Mex.	27 59	111 25	60	12, 1936
284	San Pedro Nolasco Island, L. Calif., Mex.	28 01 10	111 25 40	130	12, 1936
285	San Pedro Nolasco Island, L. Calif., Mex.	27 59 25	111 25 48	84	12, 1936
286	San Pedro Nolasco Island, L. Calif., Mex.	27 25 30	111 53 30	48	12, 1936
287	San Pedro Nolasco Island, L. Calif., Mex.	27 12 45	111 58 40	193	12, 1936
288	San Pedro Nolasco Island, L. Calif., Mex.	27 12 10	111 59 45	92	12, 1936
289	San Pedro Nolasco Island, L. Calif., Mex.	27 9 45	112 03 05	12	13, 1936
290	Off San Marcos Island			25	14, 1936
291	Concepcion Bay, L. Calif., Mex.	26 44	111 51 50	10	14, 1936
292	Pulpito Rock, L. Calif., Mex.	26 30 15	111 27 20	18	15, 1936
293	Point Escondido, L. Calif., Mex.	25 48	110 18 30	20	16, 1936
294	Point Escondido, L. Calif., Mex.			24	16, 1936
295	Port Escondido			5	16, 1936
296	Agua Verde Bay, L. Calif., Mex.			30	18, 1936
297	Agua Verde Bay, L. Calif., Mex.			80	18, 1936
298	Agua Verde Bay, L. Calif., Mex.			20	18, 1936
299	San Jose del Cabo, L. Calif., Mex.	22 56 15	109 47 15	82	22, 1936
2000	Off Cape San Lucas, L. Calif., Mex.	22 55 30	109 47	133	22, 1936
2001	Off Cape San Lucas, L. Calif., Mex.	22 55 30	109 46 45	166	22, 1936
2002	Rosario Bay, L. Calif., Mex.	29 56	115 48	16	Feb. 28, 1937
2003	San Carlos Pt., L. Calif., Mex.	29 36	115 28 38	9	28, 1937

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2004	Lagoon Head Anchorage, L. Calif., Mex.	28 14	114 7	9	Mar. 1, 1937
2005	San Jaime Bank, L. Calif., Mex.	22 15	110 17	75	3, 1937
2006	San Jaime Bank, L. Calif., Mex.	22 15	110 17	140	3, 1937
2007	East of Cabeza Ballena Pt., L. Calif., Mex.	22 53 12	109 50	20	3, 1937
2008	Cabeza Ballena Pt., L. Calif., Mex.			70	3, 1937
2009	Inner Gorda Bank, L. Calif., Mex.	23 00 50	109 31 45	112	4, 1937
2010	Inner Gorda Bank, L. Calif., Mex.	23 02	109 30 30	80	4, 1937
2011	Muertos Bay, L. Calif., Mex.	23 59	109 49	7	4, 1937
2012	San Gabriel Bay, Espiritu Santo Island, L. Calif., Mex.			24	6, 1937
2013	West of San Lorenzo Channel, L. Calif., Mex.			30	7, 1937
2014	Northeast of Isla Partida, L. Calif., Mex.	24 38	110 26	225	8, 1937
2015	San Francisco Island, L. Calif., Mex.	24 59	110 26	19	8, 1937
2016	Entrance to Port Escondido, L. Calif., Mex.	25 50	111 15½	138	11, 1937
2016	Pt. Escondido Bay, L. Calif., Mex.			180	12, 1937
2017	Pt. Escondido Bay, L. Calif., Mex.			20	12, 1937
2018	Pt. Escondido Bay, L. Calif., Mex.			34	12, 1937
2019	Salinas Bay, Carmen Island, L. Calif., Mex.	25 59	111 7	8	14, 1937
2020	Pulpito Rock, L. Calif., Mex.	26 30	111 27 30	17	14, 1937
2021	Pulpito Rock, L. Calif., Mex.			15	14, 1937
2022	Off Isle Ildefonso, L. Calif., Mex.	26 33 30	111 26	190	15, 1937
2023	Off Isle Ildefonso, L. Calif., Mex.	26 36 30	111 26 15	50	15, 1937
2024	Off Isle Ildefonso, L. Calif., Mex.			55	15, 1937
2025	Mouth of Concepcion Bay, L. Calif., Mex.	26 55	111 52	30	15, 1937
2026	Outside of Concepcion Bay, L. Calif., Mex.			30	15, 1937

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2027	Outside of Concepcion Bay, L. Calif., Mex.			20	Mar. 15, 1937
2028	Outside of Concepcion Bay, L. Calif., Mex.			3	15, 1937
2029	Tortuga Island, L. Calif., Mex.			45	18, 1937
2030	Entrance to Angeles Bay, L. Calif., Mex.			30	19, 1937
2031	Entrance to Angeles Bay, L. Calif., Mex.			30	19, 1937
2032	Angeles Bay, L. Calif., Mex.			15	20, 1937
2033	Angel de la Guardia, L. Calif., Mex.	29 32	113 38	46	20, 1937
2034	Angel de la Guardia, L. Calif., Mex.				
	Anchorage in Point Refugio				
2035	North of Angel de la Guardia, L. Calif., Mex.			15	20, 1937
2036	North of Angel de la Guardia, L. Calif., Mex.			60	21, 1937
2037	North of Angel de la Guardia, L. Calif., Mex.			90	21, 1937
				50-75	21, 1937
2038	Gonzaga Bay, L. Calif., Mex.	29 48	114 24	11	22, 1937
2039	San Luis Island, L. Calif., Mex.	29 57	114 25	9	23, 1937
2040	Gulf of California	30 20	114 25	35	24, 1937
2041	Gulf of California	30 48	114 26	20½	24, 1937
2042	Consag Rock, Gulf of Calif.			11	24, 1937
2043		31 12	114 01 30	34	24, 1937
2044	Rocky Point, Gulf of Calif.			8½	24, 1937
2045	Georges Island, Gulf of Calif.	31 18	113 39	9	25, 1937
2046	Gulf of Calif., Mex.	30 29	113 07	14	25, 1937
2047	Tepoca Bay, Gulf of California			12	25, 1937
2048	Off Lobos Point, Gulf of Calif.	29 55	112 48	29	26, 1937
2049	Patos Island, Gulf of Calif.			12	26, 1937

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2050	Tiburon Island, Mexico	28 48 50	112 15 45	9	Mar. 27, 1937
2051	San Pedro Nolasco Island, Gulf of Calif.	28	111 27	82	29, 1937
2052	San Francisco Bay, Gulf of Calif.	27 56	111 04		29, 1937
2053	Gulf of California	27 11	110 22	32	30, 1937
2054	Gulf of California	27 03	110 10	32	30, 1937
2055	San Ignacio Bay, Mex.	25 37	109 20	6 $\frac{3}{4}$	31, 1937
2056	San Ignacio Bay, Sinaloa, Mex.			4	31, 1937
2057	San Ignacio Bay, Farallon, Mex.	25 26	109 27	23	31, 1937
2058	San Ignacio Bay, Mex.			90	31, 1937
2059	Point Piaxtla, Sinaloa, Mex.	23 33	106 46	14	31, 1937
2060	Point Piaxtla, Sinaloa, Mex.			8	Apr. 1, 1937
2061	South of Mazatlan, Sinaloa, Mex.	22 53	106 11	13	1, 1937
2062	Isabel Island	21 52	106 54	18	2, 1937
2063	Outer Gorda Bank	23 04	109 28 30	56	4, 1937
2064	Outer Gorda Bank	23 0	109 28 30	82	4, 1937
2065	Outer Gorda Bank	23 01	109 28	50	4, 1937
2066	Fraille Bay, L. Calif., Mex.	23 21	109 24	22	4, 1937
2067	Fraille Bay, L. Calif., Mex.			10	4, 1937
2068	Fraille Bay, L. Calif., Mex.			5	4, 1937
2069	Cedros Island	28 8	115 10	10	July 13, 1937
2070	Guadalupe Island	29 8	118 17	250	17, 1937
2071	Inner Gorda Bank, Cape San Lucas, Mex.	23 01	109 33 15	345	Jan. 6, 1938
2072	Inner Gorda Bank, Cape San Lucas, Mex.	23 01	109 34	163	6, 1938
2073	Off Black Rocks, Jalisco, Mex.	19 57	105 32	20	7, 1938

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2074	Off Galera Point, Chacahua Bay, Oaxaca, Mex.	15 57	97 40	13	Jan. 9, 1938
2075	Chacahua Bay, Oaxaca, Mex.	15 56	97 41	41	9, 1938
2076	Chacahua Bay, Oaxaca, Mex.	15 55	97 41	51	9, 1938
2077	Off Chiapas, Mex.	15 41	94 08	35	10, 1938
2078	Off Acapulco, Mex.	16 39 45	99 42	11	Mar. 6, 1938
2079	Off Coronados Island, Mex.	32 24	117 09 15	14	11, 1938

TABLE 9 — OFF CENTRAL AMERICA

300	Port Culebra, Costa Rica	17	Mar. 13, 1933
301	Port Culebra, Costa Rica	17	13, 1933
302	Port Culebra, Costa Rica	17	11, 1933
303	Port Culebra, Costa Rica	17	11, 1933
304	Bahia Honda, Republic of Panama	17	Jan. 12, 1933
305	Port Culebra, Costa Rica	17	Mar. 13, 1933
306	Chatham Bay, Cocos Island	17	Feb. 28, 1933
307	Secas Island, Republic of Panama	40-80	22, 1934
308	Bahia Honda, Republic of Panama	30-35	21, 1934
309	Port Culebra, Costa Rica	15	26, 1934
310	Jicarita, Republic of Panama	24	20, 1934
311	Port Culebra, Costa Rica	3-10	25, 1934
312	Secas Island, Panama	14	4, 1935
313	Secas Island, Panama	25	5, 1935
314	Secas Island, Panama	12	6, 1935

TABLE 9 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
315	Playa Blanca Bay, Costa Rica			13	Feb. 8, 1935
316	Port Parker, Costa Rica			14	8, 1935
317	Playa Blanca Bay, Costa Rica			2-5	8, 1935
318	Playa Blanca Bay, Costa Rica			40	8, 1935
319	Port Parker, Costa Rica			5	9, 1935
320	Port Parker, Costa Rica			30	9, 1935
321	Salinas Bay, Costa Rica			9	11, 1935
322	Salinas Bay, Costa Rica			1	11, 1935
323	Salinas Bay, Costa Rica			8	11, 1935
324	Salinas Bay, Costa Rica			6	11, 1935
325	Off Guatemala	13 46	91 14	20	Jan. 11, 1938
326	Off Guatemala	13 46	91 14	20	11, 1938
327	Off Guatemala	13 53 40	91 09 40	7	11, 1938
328	Chatham Bay, Cocos Island	5 33 20	86 59 10	14	13, 1938
329	Chatham Bay, Cocos Island	5 33 50	86 59 05	40-46	14, 1938
330	Chatham Bay, Cocos Island	5 33 50	86 58 45	47	14, 1938
331	Off Cape Jabali, Panama	7 43 15	81 32 15	27	Mar. 1, 1938
332	Bahia Honda, off North Island			30-50	1, 1938
333	Secas Island, Panama			12	2, 1938

TABLE 10 — OFF GALAPAGOS ISLANDS

400	Gardner Bay, Hood Island, Galapagos	17	Jan. 24, 1933
401	Chatham Bay, Wreck Bay, Galapagos	17	30, 1933
402	Post Office Bay, Charles Island	9	27, 1933

TABLE 10—CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
403	Academy Bay, Indefatigable Island			9	Feb. 3, 1933
404	Post Office Bay, Charles Island			8	5, 1933
405		0 05 15 S	90 20 20	110	5, 1933
406		1 03 30 S	90 17 30	60	5, 1933
407	Albemarle Point			50	10, 1933
408	Albemarle Point			13	12, 1933
409	James Bay			15	11, 1933
410	Tagus Cove			9	10, 1933
411	North of Duncan Island			45	15, 1933
412	North of Duncan Island	0 59 15	90 20 30	111	5, 1933
413	North of Duncan Island	0 27 5	90 23 30	35	12, 1933
414	North of Duncan Island	0 27 S	90 03 30	68	17, 1933
415	North of Duncan Island	0 27 5	90 22	55	17, 1933
416 "A"	North of Duncan Island	0 27	90 23 30	35	17, 1933
416 "B"	North of Duncan Island			68	
417	North of Duncan Island	0 27	90 22	55	12, 1933
418	Darwin Bay, Tower Island			17	27, 1933
419	Bindloe Island			56	20, 1933
420	Darwin Bay, Entrance Tower Island			100	27, 1933
421	Anchorage, South Seymour			13	17, 1933
422	Socorro Isle			16	Jan. 2, 1934
423	Braithwaite Bay, Socorro Island, Mex.			13	3, 1934
424	Braithwaite Bay, Socorro Island, Mex.			20	4, 1934
425	Sulphur Bay, Clarion Island			17	5, 1934

TABLE 10 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
426	Sulphur Bay, Clarion Island			25	Jan. 5, 1934
427	Clipperton Island				6, 1934
428	Albemarle Point, Albemarle Island			17	12, 1934
429	Wenman Island			100	11, 1934
430	Wenman Island			150	11, 1934
431	Tagus Cove, Albemarle Island			80-100	15, 1934
432	Tagus Cove, Albemarle Island			80-100	15, 1934
433	Tagus Cove, Albemarle Island			80	15, 1934
434	Tagus Cove, Albemarle Island				
435	Wreck Bay, Chatham Island			22	21, 1934
436	Seymour Island				
437	Wreck Bay, Chatham Island			32	21, 1934
438	Chatham Island				21, 1934
439	Sullivan Bay, James Island			20	24, 1934
440	James Bay, James Island				24, 1934
441	James Bay, James Island			24	24, 1934
442	James Bay, James Island			24	24, 1934
443	James Bay, James Island			24	24, 1934
444	James Bay, James Island			70	24, 1934
445	James Bay, James Island			70	24, 1934
446	James Bay, James Island	52	90 25 30	54	26, 1934
447	Cartago Bay, Albemarle Island			32	25, 1934
448	James Bay, James Island				24, 1934
449	Cartago Bay, Albemarle Island			12	25, 1934



TABLE 10 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
450		0 55 S	90 30	60	Jan. 26, 1934
451	Post Office Bay, Charles Island			100	29, 1934
452	Post Office Bay, Charles Island			65	29, 1934
453	Gardner Island			35	31, 1934
454	Hood Island			30	31, 1934
455	Cartago Bay, Albemarle Island	0 55 S	90 30	70	26, 1934
456	Miarchena Island			20	Dec. 3, 1934
457	Academy Bay, Indefatigable Island			9	7, 1934
458	Academy Bay, Indefatigable Island			15	8, 1934
459	Tagus Cove, Albemarle Island			15	9, 1934
460	James Bay, James Island			16	11, 1934
461	Off Tagus Cove, Albemarle Island			80	10, 1934
462	Sullivan Bay, James Island			14	11, 1934
463	South Seymour Island Anchorage			16	12, 1934
464	Charles Island, Black Beach			10	14, 1934
465	Charles Island, Black Beach			15	14, 1934
466	Charles Island, Black Beach			23	14, 1934
467	Charles Island, 1/2 mile south of Black Beach			28	14, 1934
468	Charles Island, 1/2 mile south of Black Beach			20	14, 1934
469	Charles Island, 1/2 mile south of Black Beach			10	14, 1934
470	Charles Island, 1/2 mile north of Black Beach			9	14, 1934
471	Charles Island, 1/2 mile north of Black Beach			18	14, 1934
472	Hood Island, Gardner Bay			15	17, 1934
473	Off Hood Island	1 22 40 S	89 37	75	20, 1934

TABLE 10—CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
474	Off Hood Island	1 24 40 S	89 32 10	175	Dec. 20, 1934
475	Off Tower Island	0 18 N	89 59	175	Jan. 16, 1938
476	Off Tower Island	0 18 30 N	88 57 50	120	16, 1938
477	Northeast of Indefatigable Island	0 30 S	89 55 30	392	18, 1938
478	Wreck Bay, Chatham Island			26	18, 1938
479	Sullivan Bay, James Island			16	20, 1938
480	Sullivan Bay, James Island			50-60	21, 1938
481	Cartago Bay, Albemarle Island			12	21, 1938
482		1 09 S	90 36	250	23, 1938
483	Academy Bay, Indefatigable Island			10-20	25, 1938
484	Barrington Island	0 49 S	90 06 40	52	26, 1938
485	Off Barrington Island	0 43 S	90 01	73	26, 1938
486	Off Barrington Island	0 43 S	89 59 30	73	26, 1938
487	Off Chatham Island	1 01 S	89 30	400	27, 1938
488	Off Hood Island	1 17 30 S	89 40 15	160	29, 1938

TABLE 11—OFF SOUTH AMERICA

500	La Plata Island, Ecuador	10	Jan. 22, 1933
501	La Libertad, Ecuador	4	19, 1933
502	La Libertad, Ecuador	15	17, 1933
503	La Libertad, Ecuador	19	22, 1933
504	La Libertad, Ecuador	25	22, 1933
505	Gorgona Island, Colombia	32	Feb. 12, 1934

TABLE 11 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
506	Port Utria, Colombia			20	Feb. 14, 1934
507	La Libertad, Ecuador			8-12	8, 1934
508	Off coast of Colombia	3 08 S	80 49 W	35	7, 1934
509	Off coast of Colombia	1 02 30 S	81 12 W	18	10, 1934
510	At Anchorage, San Francisco Bay			4	10, 1934
511	Near Anchorage, San Francisco Bay			30	10, 1934
512	Off coast of Colombia	0 38 50 S	80 13 30 W	48	11, 1934
513	Off coast of Colombia	0 39 20 N	80 15 30 W	58	11, 1934
514	Off coast of Colombia	5 28 15 N	77 30 W	16	14, 1934
515	Off coast of Colombia	5 27 30 N	77 32 30 W	36	14, 1934
516	Off coast of Colombia	5 27 40 N	77 34 10 W	55	14, 1934
517	Off coast of Colombia	5 29 N	77 38 W	116	14, 1934
518	La Plata Island, Ecuador			45-55	10, 1934
519	La Plata Island, Ecuador			7-10	10, 1934
520	Gorgona Island, Colombia			45	12, 1934
521	Port Utria, Colombia			20	14, 1934
522	Near rocks of San Lorenzo Island, Callao			25	Jan. 11, 1935
523	Across outer end of Channel between San Lorenzo Island, Callao, Peru			13	11, 1935
524	Off Callao, Peru			25	11, 1935
525	Off Callao, Peru			35	11, 1935
526	Off Callao, Peru			48	11, 1935
527	Off Callao, Peru			58	11, 1935
528	Off Callao, Peru			75	11, 1935
529	Viejo Island, Independencia Bay, Peru			6	12, 1935

TABLE 11 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
530	East of Viejo Island, Independencia Bay, Peru			12	Jan. 12, 1935
531				20	13, 1935
532	$\frac{3}{4}$ mile off East Beach, Independencia Bay, Peru			5	14, 1935
533	East of Ballesta Island, Peru			20	15, 1935
534	North of Middle Chinca Island			18	15, 1935
535	Lobos de Afuera Island, Peru			22	16, 1935
536	Lobos de Afuera Island, Peru			12	17, 1935
537	Lobos de Afuera Island, Peru, South Bay			12	17, 1935
538	Salango Island, Ecuador			21	18, 1935
539	Salango Island, Ecuador			12	18, 1935
540	Gorgona Island, Colombia			20	21, 1935
541	Watering Place, Gorgona Island, Colombia			35	21, 1935
542	Off Monkey Point, Gorgona Island, Colombia			65-80	22, 1935
543	Port Utria, Colombia			50	24, 1935
544	1 mile south of Port Utria, Colombia			45	24, 1935
545	Port Utria, Colombia			12	25, 1935
546 "A"	Gorgona Island, shore below sandy beach				22, 1935
546 "B"	West of Port Utria, Colombia			35	25, 1935
547	West of Port Utria, Colombia			40	25, 1935
548	Cupica Bay, Colombia			12	26, 1935
549	Octavia Bay, Colombia			14	27, 1935
550	Callao, Peru			3	16, 1935
551	Station E off Callao, Peru			75	5, 1935
552	Station D off Callao, Peru			210	5, 1935

TABLE 11 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
553	Outside mid-channel, Colombia			50	Jan. 27, 1935
554	Octavia Bay, Colombia			45	27, 1935
555	Octavia Bay, Colombia			75	27, 1935
556	Pinas Bay, Panama			12	28, 1935
557	Pinas Bay, Panama			29	29, 1935
558	Pinas Bay, Panama			15	29, 1935
559	Port San Juan, Peru			16	Feb. 6, 1938
560	San Nicolas Bay, Peru			10-25	6, 1938
561	San Juan Bay, Peru			30-40	7, 1938
562	San Juan Bay, Peru			20-30	7, 1938
563	Independencia Bay, Peru			45	10, 1938
564	Independencia Bay, Peru, south end of buoy			18	10, 1938
565	Independencia Bay, Peru			21	10, 1938
566	Independencia Bay, Peru, in entrance			8	10, 1938
567	W. of Chincha Island, Peru	13 37 30 S	76 41 31 W	100	11, 1938
568	W. of Chincha Island, Peru	13 37 S	76 48 30 W	220	11, 1938
569	Hormigas de Afuera, Peru	11 57 S	77 47 W	45	12, 1938
570	Hormigas de Afuera, Peru	11 58 S	77 47 W	45	12, 1938
571	Off Mazorca Island, Peru	11 29 30 S	77 45 W	52	12, 1938
572	South Guanape Island, Peru, Anchorage			18	13, 1938
573	Lobos de Afuera, Peru, Anchorage			15	14, 1938
574	Off Lobos de Tierra Island, Peru	6 45 S	80 49 W	100	15, 1938
575	Sechura Bay, Peru	5 40 S	81 00 W	25	15, 1938
576	Sechura Bay, Peru	5 38 S	80 58 W	17	15, 1938

TABLE 11 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
577	Sechura Bay, Peru	5 37 S	80 57 W	9	Feb. 15, 1938
578	Sechura Bay, Peru	5 33 S	80 58 W	10	15, 1938
579	Sechura Bay, Peru	5 26 30 S	81 03 W	12	15, 1938
580	9½ miles S. Zorillos Light	3 04 S	80 48 W	18	16, 1938
581	9½ miles S. Zorillos Light			12	16, 1938
582	Off Puna, Ecuador	2 48 20 S	77 50 45 W	6	16, 1938
583	San Francisco Bay, Ecuador	0 45 30 S	80 11 W	10	13, 1938
584	North side Gorgona Island, Colombia			32	24, 1938
585	Gorgona Island, Colombia			10-20	24, 1938
586	Cape San Francisco, Ecuador			15	23, 1938
587	Gorgona Island, Colombia			40-60	24, 1938

Family **Astrorhizidae**Genus **ASTRORHIZA** Sandahl, 1858**Astrorhiza hancocki** Cushman and McCulloch, new species

Plate 1, Fig. 1

Test comparatively large, compressed, consisting of a central body and numerous (10-12), somewhat irregularly conical projections from the periphery; wall arenaceous, consisting of fine sand with included fragments of various kinds with occasionally whole tests of small foraminifera, exterior rather rough; apertures at the ends of the peripheral projections. Diameter 3.00-4.50 mm.

Holotype (AHF no. 1), Station 296, Agua Verde Bay, Lower California, Mexico, 30 fms., type locality.

*Distribution.*—Our present investigations record it only from the type locality.

This species differs from *A. limicola* Sandahl in the shorter, more regularly conical peripheral projections and more flattened test.

Genus **RHABDAMMINA** M. Sars, 1869**Rhabdammina abyssorum** W. B. Carpenter

Plate 1, Figs. 2, 3

*Rhabdammina abyssorum* M. Sars, Förh. Vid. Selsk. Christiania, 1868, p. 248 (*nomen nudum*).—W. B. Carpenter, Ann. Mag. Nat. Hist., ser. 4, vol. 4, 1869, p. 288; Proc. Roy. Soc. London, vol. 18, 1869, p. 60.—G. O. Sars, Förh. Vid. Selsk. Christiania, 1871, pp. 250, 251.—Carpenter, The Microscope, ed. 6, 1881, pp. 562, 563, figs. 321c, d (in text).—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 266, pl. 21, figs. 1-13.—De Folin, Le Naturaliste, vol. 9, 1887, p. 127, fig. 12a.—A. Agassiz, Bull. Mus. Comp. Zoöl., vol. 15, 1888, pp. 162, 163, figs. 492, 493 (in text).—Neumayr, Stämme Thierreichs, vol. 1, 1889, p. 173, fig. 17a (in text).—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 255, pl. 4, fig. 31.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 19, pl. 4, figs. 67, 68.—Schlumberger, Mém. Soc. Zool. France, vol. 7, 1894, p. 254.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 21.—Kiaer, Norske Nordhavs. Exped., no. 25, 1899, p. 4.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 271, pl. 12, fig. 2.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 264, fig. 108 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 24, figs. 8-10 (in text).—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, no. 3, 1911, p. 10.—

Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 998.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 221.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 15, pl. 6, fig. 1; pl. 7, fig. 1; l. c., Bull. 100, vol. 4, 1921, p. 36, pl. 1, fig. 2.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 91.—Chapman, Union of So. Africa, Fish. Mar. Biol. Surv., Rept. no. 3, for 1922 (1924), p. 8.—Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 128.—Lacroix, Bull. Institut. Oceanographique, no. 527, 1928, p. 5, fig. 1 (in text).—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 77.—Hofker, *Siboga*-Exped., Mon. IVa, 1930, p. 107, pl. 42, figs. 5-11; pl. 43, figs. 3, 4, 6.—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 334.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 4; Special Publ. no. 5, Cushman Lab. Foram. Res., 1933, pl. 1, fig. 9.—Earland, *Discovery* Rep'ts, vol. X, 1934, p. 76; vol. XIII, 1936, p. 30.

*Rhabdammina abyssorum*, var. *robusta* Goës, Königl. Svensk. Vet. Akad. Handl., vol. 19, no. 4, 1882, p. 143, pl. 12, figs. 430, 431.

*Astrorhiza abyssorum* Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 666.

Test free, consisting of a central subglobular chamber with typically three radiating arms, varying in number to five, of nearly uniform diameter, with no divisions; when three, usually in the same plane but the accessory arms above this number often added in a different plane; wall of sand grains, firmly cemented, with a reddish-brown cement often giving a decided tinge of color to the whole test, interior fairly smooth and reddish from the color of the cement, exterior roughly finished; apertures formed by the circular openings at the ends of the tubular arms. Our specimens with the arms measure up to 8.00 mm or more.

The species occurs rarely at localities 82, 290, 482, 488.

*Distribution*.—Off Long Point, Catalina, 147 fms.; southeast of San Marcos Island, Lower California, Mexico, 25 fms.; Galapagos Islands.

### Family Rhizamminidae

Genus RHIZAMMINA H. B. Brady, 1879

*Rhizammina* sp?

There are fragments which seem to belong to this genus from stations 481 and 488, but in each case only a single specimen was found. They resemble *R. indivisa* H. B. Brady.



*Distribution.*—Galapagos Islands: Cartago Bay, Albemarle Island, 12 fms.; off Hood Island, 160 fms.

Genus **MARSIPELLA** Norman, 1878

**Marsipella elongata** Norman

*Proteonina*, species, W. B. Carpenter, Proc. Roy. Soc. London, vol. 18, 1869, p. 60.

*Marsipella elongata* Norman, Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 281, pl. 16, fig. 7.—Carpenter, The Microscope, ed. 6, 1881, p. 561, figs. 320*d-f*.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 265, pl. 24, figs. 10-19.—Chapman, Proc. Zool. Soc. London, 1895, p. 13.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 12, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 365, fig. 110 (in text); Plankton Exped., Foraminiferen, pt. 1, 1909 (1911), pl. 2, fig. 21; pt. 2, 1913, p. 382.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 23, pl. 8, figs. 2, 3.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 90, pl. 3, figs. 10-12; Lacroix, Bull. Institut. Oceanographique, no. 527, 1928, p. 15, figs. 14, 15 (in text).—Hofker, *Siboga*-Exped., Mon. IVa, 1930, p. 110, pl. 45, figs. 15*a, b*.—Cushman, Special Publ. no. 5, Cushman Lab. Foram. Res., 1933, pl. 1, fig. 22.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 73.

Test elongate, somewhat fusiform, irregularly curved, thickest in the central portion and gradually tapering toward the ends; walls composed of sponge spicules with the central thicker portion covered with sand grains, spicules almost exclusively forming the ends of the tubes, laid together lengthwise and cemented firmly in place; aperture at the ends of the tube.

Our largest specimens measure nearly 7.00 mm.

These Pacific specimens are almost entirely composed of sponge spicules with very little arenaceous material added. The central portion, however, is usually much greater in diameter than the ends.

It has occurred in some numbers at Station 487 but was not seen elsewhere.

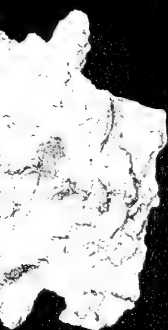
*Distribution.*—At Station 487, off Chatham, Galapagos Islands, in 400 fms.

All illustrations were made by Miss Ann Shepard.

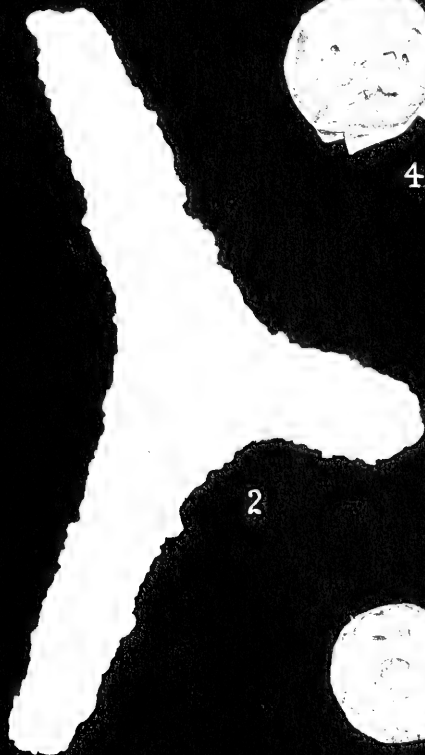
EXPLANATION OF PLATE 1

FIGS.

1. *Astrorhiza hancocki* Cushman and McCulloch, new species. X 13.
- 2, 3. *Rhabdammina abyssorum* W. B. Carpenter. X 13.
4. *Psammosphaera parva* Flint. X 60.
5. *Proteonina difflugiformis* (H. B. Brady). X 70. *a*, front view; *b*, apertural view.
6. *Proteonina difflugiformis* (H. B. Brady), var. *lagenarium* (Berthelin). X 70. *a*, front view; *b*, apertural view.
- 7-9. *Proteonina longicollis* Wiesner. X 30. *a, a, a*, front views; *b, b, b*, apertural views.
10. *Proteonina compressa* Cushman and McCulloch, new species. X 90. *a*, front view; *b*, apertural view.



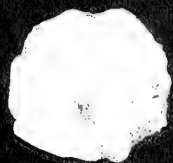
1



2



4



5b



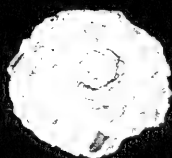
5a



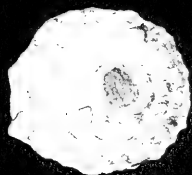
3



6b



7b



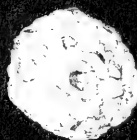
8b



6a



7a



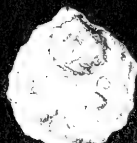
9b



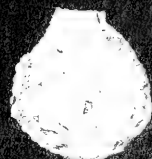
10b



8a



9a



10a



## EXPLANATION OF PLATE 2

## FIGS.

- 1, 2. *Millettella spinata* Cushman and Cahill. X 70. 1a, front view; 1b, side view.
3. *Millettella glabrella* Cushman and McCulloch, new species. X 70. a, front view; b, side view.
4. *Pseudarcella arenata* Cushman. X 70. a, front view; b, side view.
5. *Pelosina variabilis* H. B. Brady. X 8.
6. *Tholosina bulla* (H. B. Brady). X 25. Attached to *Hyperammina*.
- 7-9. *Hyperammina friabilis* H. B. Brady. X 25. a, a, front views; b, b, apertural views.
- 10, 11. *Hyperammina spiculifera* Lacroix. X 30. a, front view; b, apertural view.
12. *Reophax curtus* Cushman. X 30. a, front view; b, apertural view.
13. *Reophax scorpiurus* Montfort. X 25.

Family **Saccamminidae**Genus **PSAMMOSPHAERA** Schulze, 1875**Psammosphaera fusca** Schulze (?)

There are specimens from but one station which can be referred to this species, and that doubtfully. They are from Station 227, and are larger than the following species and much more coarsely formed.

*Distribution.*—Off Guadalupe Island, Mexico, in 200 fms.

**Psammosphaera parva** Flint

Plate 1, Fig. 4

*Psammosphaera parva* Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 268, pl. 9, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 242, fig. 77 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 36, figs. 29, 30 (in text); Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 35, pl. 12, figs. 4-6; Proc. U. S. Nat. Mus., vol. 56, 1919, p. 594, pl. 75, fig. 3; l. c., Bull. 100, vol. 4, 1921, p. 47, pl. 2, fig. 7.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 83.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 80.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 60.—Hada, Sci. Rept. Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 52, fig. 3 (in text).—Earland, *Discovery* Rep'ts, vol. X, 1934, p. 63; vol. XIII, 1936, p. 26.

*Psammosphaera fusca* (part) H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 250, pl. 18, figs. 2-4 (not 1, 5-8).—Heron-Allen and Earland, Journ. Quekett Micr. Club, ser. 2, vol. 10, 1909, pl. 35, fig. 13.

*Psammosphaera fusca* Schulze, var. *parva* Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1913, p. 17, pl. 2, figs. 7, 8.

Test free, usually with a single long acerose sponge spicule incorporated in the test, which is small, rounded, single chambered; wall of sand grains firmly cemented by a reddish-brown cement; aperture indefinite, probably provided for by fine interstitial openings between the sand grains.

Diameter, usually between 0.30 and 0.75 mm.

There are specimens from a number of stations in our material some very typical with the included sponge spicule, others of the same shape and color without the spicule. It is a widely distributed species from the records. Stations: 505, 546, 506, 514, 513, 2017, 2070.

*Distribution.*—Off Mexico, Point Escondido Bay, 20 fms.; off Chiapas, Mexico, 35 fms.; off Colombia, Port Utria, 12 fms.

**Psammospaera rustica** Heron-Allen and Earland

*Psammospaera rustica* Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1912, p. 383, pl. 5, figs. 3, 4; pl. 6, figs. 2-4.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 37, pl. 9, figs. 3, 4; pl. 10, figs. 2-4.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 84.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 60, pl. 1, fig. 27.

Specimens very similar to those figured by Heron-Allen and Earland occur at Station 487. They are made of fragments of sponge spicules neatly cemented with longer spicules at the angles.

*Distribution*.—Off Chatham, Galapagos Islands, 400 fms.

Genus **SACCAMMINA** M. Sars, 1869

**Saccammina sphaerica** M. Sars

There are numerous specimens, all very similar in size, shape and material, from Station 2070 that probably belong in this species. A small aperture is present.

*Distribution*.—Off Mexico, Guadalupe Island, 250 fms.

Genus **PROTEONINA** Williamson, 1858

**Proteonina difflugiformis** (H. B. Brady)

Plate 1, Fig. 5

*Reophax difflugiformis* H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 51, pl. 4, figs. 3a, b; Denkschr. Akad. Wiss. Wien, vol. 43, pt. 2, 1882, p. 99; Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 715; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 289, pl. 30, figs. 2-4 (not 1, 5).—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 26, pl. 6, figs. 196-198; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 28.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 272, pl. 16, fig. 2.—Millett, Journ. Roy. Micr. Soc., 1899, p. 252.—Dakin, Rep. Ceylon Pearl Oyster Fisheries, vol. 5, 1906, p. 232.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, no. 64, 1913, p. 42; Trans. Zool. Soc., vol. 20, 1915, p. 612; Trans. Linn. Soc. London, vol. 11, 1916, p. 222; Journ. Roy. Micr. Soc., 1916, p. 40.

*Saccammina difflugiformis* Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 671.

*Proteonina difflugiformis* Rhumbler, Arch. Prot., vol. 3, 1903, p. 245, figs. 80a, b, (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt.

1, 1910, p. 42, figs. 40, 41 (in text).—Rhumbler, *Foram. Plankton-Exped.*, pt. 1, 1911, pl. 2, figs. 7-14; pt. 2, 1913, p. 378.—Pearcey, *Trans. Roy. Soc. Edinburgh*, vol. 49, 1914, p. 1000.—Cushman, *Bull. 104, U. S. Nat. Mus.*, pt. 1, 1918, p. 47, pl. 21, figs. 1, 2; l. c., *Bull. 100*, vol. 4, 1921, p. 49; *Bull. Scripps Instit. Oceanography, Tech. Ser.*, vol. 1, no. 10, 1927, p. 130.—Wiesner, *Deutsche Süd-Polar-Exped.*, vol. XX, *Zool.*, 1929, p. 82, pl. 5, figs. 53, 54.—Hada, *Trans. Sapporo Nat. Hist. Soc.*, vol. XI, pt. 1, 1929, p. 10.—Lacroix, *Bull. Instit. Oceanographique*, no. 545, 1929, p. 9, text figs. 16, 17.—Cushman and Parker, *Proc. U. S. Nat. Mus.*, vol. 80, art. 3, 1931, p. 2, pl. 1, fig. 1.—Hada, *Sci. Rep't Tohoku Imp. Univ.*, ser. 4, *Biol.*, vol. VI, 1931, p. 52, fig. 4 (in text).—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 328.—Blake, *Biol. Surv. Mt. Desert Region*, pt. 5, 1933, p. 71.—Earland, *Discovery Rep'ts*, vol. VII, 1933, p. 61.—Cushman, *Special Publ. no. 5, Cushman Lab. Foram. Res.*, 1933, pl. 2, fig. 9.—Earland, *Discovery Rep'ts*, vol. X, 1934, p. 64; vol. 13, 1936, p. 26.

Test free, consisting of a single elongate oval or pyriform chamber with a more or less distinct tubular neck usually tapering gradually from the body of the chamber, undivided; wall fairly thick, of sand grains of variable size, firmly cemented or in small specimens with an excess of cement and fairly smooth; aperture circular, simple, terminal.

This is a common and well-distributed species in our collections occurring at the following stations: 213, 253, 14, 414, 298, 538, 253, 512, 573, 583, 1021, 511, 2014, 325, 2066, 1024, 1034, 2026, 2029, 61, 2063, 506, 106, 2050, 516, 517, 508, 509. There is a considerable amount of variation particularly in the material of the test, evidently somewhat dependent upon the character of the bottom on which it lives and the kind of building material available. The figured specimen is one which has used comparatively few sand grains but is mostly composed of other foraminiferal tests.

*Distribution.*—Numerous stations from near San Francisco, California, southward to stations off South America.

***Proteonina difflugiformis* (H. B. Brady)  
var. *lagenarium* (Berthelin)**

Plate 1, Fig. 6

*Haplophragmium lagenarium* Berthelin, *Mem. Soc. Geol. France*, vol. 1, no. 5, 1880, p. 21, pl. 24, fig. 2.



*Reophax difflugiformis* (part) H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 289, pl. 30, figs. 1, 5 (not 2-4).

*Reophax difflugiformis*, var. *lagenarium* Millett, Journ. Roy. Micr. Soc., 1899, p. 253, pl. 4, fig. 8.

*Proteonina difflugiformis-lagenarium* Rhumbler, Arch. Prot., vol. 3, 1903, p. 247, fig. 80c (in text).

*Proteonina difflugiformis* (H. B. Brady), var. *lagenarium* Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 42, fig. 42 (in text).

Variety differing from the typical by lacking the distinction between body and neck; elongate, exterior rough, usually smaller than the typical and more nearly cylindrical.

A few specimens from Station A-1 may represent this variety. They are shorter and broader than the typical form with a very slight and very broad neck with a large aperture.

*Distribution*.—Off wharf in 8 fms. at Ketchikan, Alaska.

### *Proteonina fusiformis* Williamson

*Proteonina fusiformis* Williamson, Recent Foraminifera of Great Britain, 1858, p. 1, pl. 1, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 248, fig. 84 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 41, fig. 39 (in text).—Rhumbler, Foram. Plankton-Exped., pt. 1, 1911, pl. 2, fig. 15; pt. 2, 1913, p. 379.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 47; l. c., Bull. 100, vol. 4, 1921, p. 49.—Cushman and Kellett, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 2, pl. 1, fig. 1.—Rhumbler, Schrift. Nat. Ver. für Schleswig-Holstein, vol. 21, 1935, p. 180, pl. 9, fig. 120.

*Reophax fusiformis* H. B. Brady, Denkschr. Königl. Akad. Wiss. Wien, vol. 43, pt. 2, 1882, p. 99; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 290, pl. 30, figs. 7-11.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 217, pl. 41, fig. 18.—Millett, Journ. Roy. Micr. Soc., 1899, p. 253, pl. 4, fig. 11.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 125.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, no. 64, 1913, p. 42.—Chapman, Zool. Results *Endeavour*, vol. 3, pt. 1, 1915, p. 15.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, 1916, p. 222.

*Lituola fusiformis* J. Wright, Rep. Belfast Club, 1876-77, Append., table.

*Lituola nautiloidea*, var. *scorpiurus* W. B. Carpenter, in Parker and Jones, Introduction to the Study of the Foraminifera, 1862, Append., p. 309.

Test free, fusiform, asymmetrical, chamber usually single, sometimes incompletely divided by projections of the wall; wall composed of coarse sand grains, rough on the exterior, firmly cemented; aperture terminal, circular.

The only specimens in our material are from stations 5 and 61. Specimens are much more elongate and more fusiform than in the preceding species.

*Distribution*.—Off San Pedro, California, in 38 fms.; off Mexico, San Francisco Island, Southwest Bay, in 17 fms.

### **Proteonina longicollis** Wiesner

Plate 1, Figs. 7-9

*Proteonina longicollis* Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 82, pl. 6, fig. 55.

Test globular, free, consisting of a single chamber, prolonged at one end into an elongate, tubular neck sometimes of considerable length; wall of coarse and fine sand grains firmly cemented; aperture rounded, at the end of the elongate neck. Diameter 0.60-0.80 mm.

Specimens from stations 55 and 251 are apparently identical with the species described and figured by Wiesner from the Antarctic. The elongate neck is conspicuous but easily broken.

*Distribution*.—Off Mexico; Gulf of California, Los Islets, North Isla Partida, in 186 and 225 fms.

### **Proteonina compressa** Cushman and McCulloch, new species

Plate 1, Fig. 10

Test free, small, much compressed, periphery rounded, nearly circular in front view, prolonged into a short, very broad neck; wall with a mixture of coarse and fine sand grains, rather neatly cemented; aperture broadly elliptical at the end of the short neck.

Diameter 0.25-0.30 mm; thickness 0.12-0.15 mm.

Holotype (AHF no. 2) from Station A-1.

This species differs from *Proteonina diffugiformis* (H. B. Brady) in the compressed test, short broad neck, and large, elliptical aperture. It occurred in some numbers at the type locality but not elsewhere. It holds its characters well with little variation.

*Distribution*.—Off wharf, in 8 fms. at Ketchikan, Alaska.

Genus **MILLETTELLA** Rhumbler, 1903**Millettella spinata** Cushman and Cahill

Plate 2, Figs. 1, 2

*Millettella spinata* Cushman and Cahill, U. S. Geol. Survey, Prof. Paper 175A, 1933, p. 5, pl. 1, figs. 3a-c.

Test free, much compressed, in front view widest toward the base, thence gradually tapering toward the somewhat broadly truncated or slightly rounded apertural end, the base with two or three spinose projections usually one at each angle and one in the middle; wall arenaceous with much chitin, smoothly finished except at the base; aperture in a large depression toward the apertural end, extending down into the upper portion of the front face of the test.

Length 0.20-0.25 mm; breadth 0.20 mm; thickness 0.15 mm.

This species was originally described from the Miocene, Duplin marl, North Carolina. The recent Pacific material is apparently identical. It is a small species and shows little variation except in the amount of spinosity at the base.

It occurs at the following localities: A-1, 510, 521.

*Distribution*.—Off wharf, in 8 fms. at Ketchikan, Alaska; off Colombia, Port Utria, in 20 fms.

**Millettella glabrella** Cushman and McCulloch, new species

Plate 2, Fig. 3

Test small, flattened at one side, the other broadly convex, consisting of a single chamber, thickest toward the base, thence gradually becoming compressed toward the apertural end, nearly circular in front view; wall arenaceous, smooth, with much chitin; aperture in a distinct depression on the flattened or concave face.

Length 0.25 mm; breadth 0.20-0.22 mm; thickness 0.15 mm.

Holotype (AHF no. 3) from Station 510.

This species differs from *Millettella spinata* in the more compressed test, more nearly circular front view, and in the smooth base.

It occurs at the following stations: 510, 521, 539, 557, 583.

*Distribution*.—Off wharf at Ketchikan, Alaska; off Panama, Colombia, and Ecuador in shallow waters, from 10 to 25 fms.

Genus **PSEUDARCELLA** Spandel, 1909**Pseudarcella arenata** Cushman

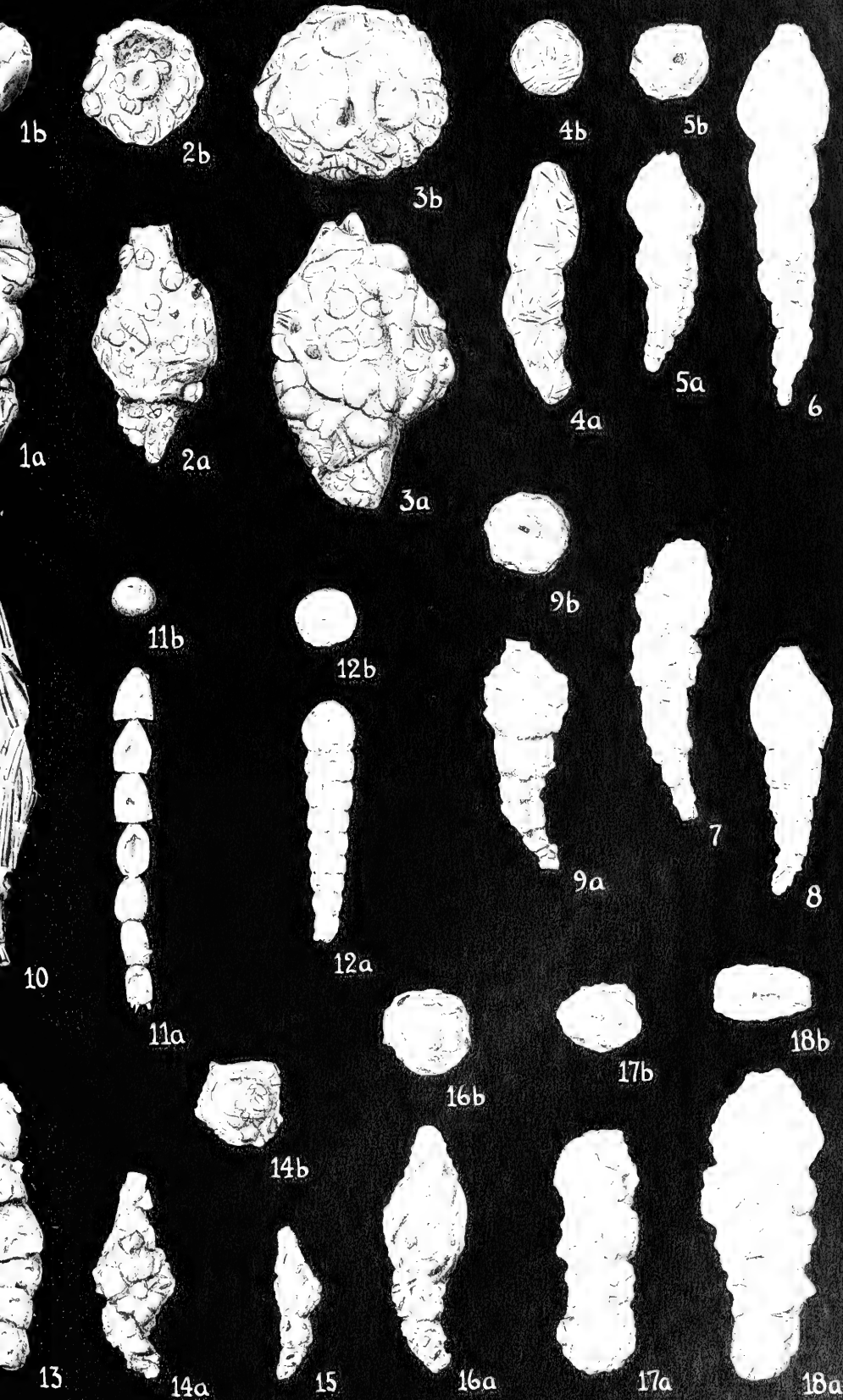
Plate 2, Fig. 4

*Pseudarcella arenata* Cushman, Florida Geol. Surv., Bull. 4, 1930, p. 15, pl. 1, figs. 3a, b.—Cushman and Ponton, l. c., Bull. 9, 1932, p. 39.

## EXPLANATION OF PLATE 3

## FIGS.

- 1-3. *Reophax agglutinatus* Cushman. 1, X 8. 2, 3, X 18. *a, a, a*, front views; *b, b, b*, apertural views.
- 4-9. *Reophax excentricus* Cushman. X 25. *a, a, a*, front views; *b, b, b*, apertural views.
10. *Reophax spiculotestus* Cushman. X 50.
11. *Reophax scottii* Chaster. X 90. *a*, front view; *b*, apertural view.
12. *Reophax communis* Lacroix. X 90. *a*, front view; *b*, apertural view.
13. *Reophax* sp. (?) X 90.
- 14-16. *Reophax subfusiformis* Earland. 14, X 30. 15, 16, X 40. *a, a*, front views; *b, b*, apertural views.
- 17, 18. *Reophax depressus* Natland. X 25. *a, a*, front views; *b, b*, apertural views.





## EXPLANATION OF PLATE 4

## FIGS.

- 1-5. *Reophax dentaliniformis* H. B. Brady. 1, X 30. 2, X 25. 3, 5, X 18. 4, X 50. *a, a, a, a, a*, front views; *b, b, b, b, b*, apertural views.
6. *Reophax pilulifer* H. B. Brady. X 18.
- 7-13. *Ammofrondicularia compressa* Cushman and McCulloch, new species. X 25. 12, Holotype. *a*, front view; *b*, apertural view.

Test free, about twice as broad as high, planoconvex in side view, dorsal side strongly convex, ventral side flattened and slightly concave in the middle, circular in outline; wall very thin, composed of fine sand grains firmly cemented, with much chitin; aperture circular, with a simple flattened tooth or somewhat radiate with several triangular teeth.

Diameter 0.20-0.25 mm; height 0.15-0.18 mm.

Our specimens apparently are identical with this species described from the Miocene of Florida. Specimens are fairly numerous at some of our localities but due to its very small size may easily be overlooked. Localities: 510, 539, 546a, 582, 583.

*Distribution*.—Off Ecuador from 10 to 20 fms.

Genus **PELOSINA** H. B. Brady, 1879

***Pelosina variabilis*** H. B. Brady

Plate 2, Fig. 5

*Pelosina variabilis* H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 30, pl. 3, figs. 1-3; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 235, pl. 26, figs. 7-9.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 266, pl. 4, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 239, fig. 74 (in text).—Chapman, Trans. New Zealand Inst., vol. 38, 1905, p. 83.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 47, fig. 52 (in text).—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 218.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 53, pl. 22, figs. 1-4.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 77.—Chapman, Union of So. Africa, Fish. Mar. Biol. Surv., Rep't no. 3, for 1922 (1924), p. 6.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 84, pl. 6, fig. 69.—Lacroix, Bull. Institut. Oceanographique, no. 545, 1929, p. 7, text fig. 10.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 55; vol. X, 1934, p. 55.

Test irregular, consisting of a single fusiform chamber or of two or three independent chambers, irregularly associated, but usually attached near the apertural end of the main chamber; wall thick, irregular but usually fairly smooth composed of fine mud with more or less irregularly placed foreign bodies at the surface; basal layer thin and membranaceous, chitinous, sometimes extended into a tubular neck at the apertural end; chamber in general conforming to the shape of the



whole test; aperture terminal, circular; in some cases multiple and irregularly placed; color of test grayish.

Length up to 6.00 mm; diameter 1.00-1.25 mm.

Specimens very variable in character but apparently all included under this species have been found at the following stations: 281, 248, 294, 298, 2009, 2008, 2024.

*Distribution.*—Off San Miguel Island, California, in 120 fms.; in the Gulf of California from the entrance northward to Angel de la Guardia Island in 24 to 112 fms.; off Lobos de Afuera Island, Peru, in 100 fms.

Genus **THOLOSINA** Rhumbler, 1895

**Tholosina bulla** (H. B. Brady)

Plate 2, Fig. 6

*Placopsilina bulla* H. B. Brady, Quart. Journ. Micr. Soc., vol. 21, 1881, p. 51; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 315, pl. 35, figs. 16, 17.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 28, pl. 6, figs. 213-215 (not figs. 211-212=*Ammolagena*); Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 25.—Millett, Journ. Roy. Micr. Soc., 1899, p. 361, pl. 5, fig. 11.

*Tholosina bulla* Rhumbler, Nachr. Köngl. Ges. Wiss. Göttingen, 1895, p. 82.—Kiaer, Norske Nordhavs Expedition, no. 25, 1899, p. 4.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 227, fig. 52 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 49, fig. 55 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1002.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 63, pl. 25, fig. 6; Rep't Canad. Arctic Exped. 1913-18, vol. 9, pt. M, 1920, p. 5, pl. 1, figs. 1, 2; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 51, pl. 3, figs. 1, 2; pl. 4, fig. 4; Contrib. Canadian Biol., 1921 (1922), p. 6.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 104.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 86, pl. 7, figs. 77, 78.—Heron-Allen and Earland, *Discovery Reports*, vol. IV, 1932, p. 330.—Cushman, Special Publ. no. 5, Cushman Lab. Foram. Res., 1933, pl. 2, fig. 24.—Earland, *Discovery Rep'ts*, vol. VII, 1933, p. 63.—Blake, Biol. Surv. Mt. Desert Region, pt. 5, 1933, p. 71.—Earland, *Discovery Rep'ts*, vol. X, 1934, p. 68.—Rhumbler, Schrift. Nat. Ver. für Schleswig-Holstein, vol. 21, 1935, p. 164, pl. 4, figs. 63-65.—Earland, *Discovery Rep'ts*, vol. XIII, 1936, p. 27.

*Pseudoplacopsilina bulla* Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 672.

Test adherent, hemispherical or at least strongly convex, base flattened or irregular to conform to the surface to which it is attached; on a narrow base the test is usually somewhat elongate in the direction of the length of the attachment; chamber single, usually undivided; wall thick, composed of sand grains or fine amorphous material with much calcareous cement, outer surface somewhat uneven, interior fairly smooth; aperture simple, circular, elliptical, or crescentiform, one or two, at either end near the base; color grayish white.

Diameter, not usually exceeding 1.00 mm.

This widely distributed species is very rare in our material having been found at but a single station: 2067.

*Distribution*.—Fraile Bay, Lower California, Mexico, in 10 fms.

### Family Hyperamminidae

Genus **HYPERAMMINA** H. B. Brady, 1878

**Hyperammina elongata** H. B. Brady (?)

A very few fragmentary specimens may belong to this rather widely distributed species but no complete specimens were found.

*Distribution*.—San Pedro Nolasco Island, Lower California, Mexico, in 60 fms.; Point Escondido Bay, Lower California, Mexico, in 34 fms.

### **Hyperammina friabilis** H. B. Brady

Plate 2, Figs. 7-9

*Hyperammina elongata* H. B. Brady (part), Ann. Mag. Nat. Hist., ser. 5, vol. 1, 1878, p. 433; Quart. Journ. Micr. Sci., vol. 19, 1879, p. 32.

*Hyperammina friabilis* H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 258, pl. 23, figs. 1-3, 5, 6.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 17, pl. 4, fig. 59; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 22.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 269, pl. 10, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 258, figs. 99a, b (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 62, fig. 76 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 75, pl. 29, figs. 1-3; Bull. 100, vol. 4, 1921, p. 54, pl. 3, fig. 4.—Lacroix, Bull. Institut. Oceanographique, no.

527, 1928, p. 10, fig. 9 (*a-f*) (in text).—Wiesner, *Deutsche Süd-Polar-Exped.*, vol. XX, Zool., 1929, p. 87, pl. 8, fig. 86.—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 332.—Earland, l. c., vol. X, 1934, p. 74; vol. XIII, 1936, p. 29.

Test elongate, subcylindrical, often somewhat tapering toward the apertural end, straight or nearly so, composed of a rather large globular proloculum and elongate cylindrical or slightly tapering second chamber slightly less in diameter than the proloculum; wall thick, loosely cemented especially on the exterior, rough, composed usually of fine sand, sometimes mixed with coarse sand particles, occasionally with a varying amount of sponge spicules, interior commonly smoother, with a yellowish-brown cement; aperture circular, at the distal end of the second chamber.

Diameter, 2.00 mm; length, up to 10.00 mm.

There is a considerable amount of variation in the material of which the test is made, undoubtedly depending much on the character of the bottom. Some of our specimens have a considerable proportion of sponge spicules included at certain stations and this is shown in our figured specimens.

Localities: 415, 487, 447, 2026. Specimens are abundant at 447.

*Distribution.*—Off Guadalupe Island, Mexico, in 200 fms.; outside of Concepcion Bay in 30 fms. and in Fraile Bay, in 10 fms. Lower California, Mexico; off the Galapagos Islands, in depths ranging from 32 to 400 fms., with an abundance at Cartago Bay, Albemarle Island, in 32 fms.

### *Hyperammina laevigata* J. Wright

*Hyperammina elongata* H. B. Brady (part), *Rep. Voy. Challenger*, Zoology, vol. 9, 1884, p. 257, pl. 23, figs. 9, 10 (not 3, 7, 8).—Goës, *Köngl. Svensk. Vet. Akad. Handl.*, vol. 25, no. 9, 1894, p. 17, pl. 4, fig. 55 (not 56-58).—Flint, *Rep. U. S. Nat. Mus.*, 1897 (1899), p. 270, pl. 10, fig. 2 (in part).—Rhumbler, *Arch. Prot.*, vol. 3, 1903, p. 258 (part).

*Hyperammina elongata* H. B. Brady, var. *laevigata* J. Wright, *Proc. Roy. Irish Acad.*, ser. 3, vol. 1, 1891, p. 466, pl. 20, fig. 1.—Cushman, *Bull. 71, U. S. Nat. Mus.*, pt. 1, 1910, p. 61, fig. 75 (in text).—Heron-Allen and Earland, *British Antarctic Exped.*, Zoology, vol. 6, 1922, p. 88.

*Hyperammina laevigata* Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 77, pl. 29, figs. 5, 6; Proc. U. S. Nat. Mus., vol. 56, 1919, p. 596.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 87, pl. 8, figs. 88, 89.—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 332.—Earland, l. c., vol. VII, 1933, p. 72; vol. X, p. 74; vol. XIII, 1936, p. 29.

Test elongate, subcylindrical, straight or more often slightly curved, proloculum ovoid or somewhat fusiform, gradually passing into the tubular chamber which is of smaller diameter than the proloculum; wall smooth both without and within, composed of fine or occasional coarse sand grains with an abundance of cement; yellowish or reddish brown in color; aperture circular, at the open end of the tube.

Fragmentary specimens occurred at Station 2070 showing the proloculum and the base of the tube. Enough is present to show the characteristic elongate proloculum and the very smoothly finished surface.

*Distribution*.—Off Guadalupe Island, Mexico, in 350 fms.

### ***Hyperammina clavigera* Heron-Allen and Earland**

*Hyperammina clavigera* Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 332, pl. 7, figs. 12-15.—Earland, l. c., vol. X, 1934, p. 74.

This species was originally described from off the Falkland Islands. Very elongate specimens nearly 10.00 mm in length occurred at several stations. They are made up entirely of sponge spicules and apparently closed at one end as in the type figures. It is difficult to distinguish between the broken portions of this species and those of *Marsipella*. There is a possibility that *Marsipella elongata* may have been described from the tubular portions of this species. Stations: 414, 299(?), 450, 451, 465(?).

*Distribution*.—Gulf of California, San Jose de Cubo, 82 fms.; Galapagos Islands, north and south of Duncan Island, south of Albemarle Island; Post Office Bay and Black Beach, Charles Island, in depths ranging from 15 to 68 fms.

### ***Hyperammina spiculifera* Lacroix**

Plate 2, Figs. 10, 11

*Hyperammina spiculifera* Lacroix, Bull. Institut. Oceanographique, no. 527, 1928, p. 14, fig. 13a-d (in text).

Our figured specimens show a peculiar species made up of broken sponge spicules and arranged in sections, the lines of growth appearing almost as sutures but not showing any sign of division in the interior. Lacroix has described a species from the Mediterranean which is so similar in its characters that it seems, in spite of the long distance between the localities, that the two may be identical. Our specimens occurred at stations 414, 415, and 417.

*Distribution.*—Galapagos Islands, several stations near Duncan Island, in 55 to 68 fms.

Genus **SACCORHIZA** Eimer and Fickert, 1899

**Saccorhiza ramosa** (H. B. Brady)

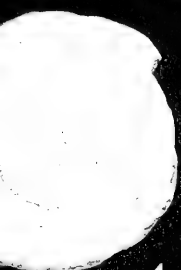
*Hyperammia ramosa* H. B. Brady, Quart. Journ. Micr. Sci., vol. 19, 1879, p. 33, pl. 3, figs. 14, 15; Denkschr. Akad. Wiss. Wien, vol. 42, 1881, p. 98; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 261, pl. 23, figs. 15-19.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc. London, vol. 12, no. 7, 1888, p. 217, pl. 41, figs. 1-4, 13.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 255, pl. 4, fig. 15.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 18, pl. 4, figs. 61, 62.—Chapman, Proc. Zool. Soc., London, 1895, p. 13.—Goës, Bull. Mus. Comp. Zool., vol. 29, 1896, p. 22.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 270, pl. 11, fig. 1.—Rhumbler, Arch. Prot., vol. 3, 1903, p. 260, figs. 101a, b, (in text).—Chapman, Biol. Results Fishing Experiments *Endeavour* 1909-14, vol. 3, pt. 1, 1915, p. 13.—Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 220.

*Saccorhiza ramosa* Eimer and Fickert, Zeitschr. Wiss. Zool., vol. 65, 1899, p. 670.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 65, fig. 81 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1004.—Cushman Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 81, pl. 30, figs. 3, 4; Bull. 100, vol. 4, 1921, p. 54, pl. 4, fig. 5; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 132.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 88, pl. 8, fig. 94.—Lacroix, Bull. Institut. Oceanographique, no. 545, 1929, p. 2, fig. 1 (in text).—Hofker, Publ. Sta. Zool. Napoli, vol. XII, fasc. 1, 1932, p. 76, fig. 8 (in text).—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 325.—Blake, Biol. Surv. Mt. Desert Region, pt. 5, 1933, p. 71.—Earland, *Discovery* Rep'ts, vol. VII, 1933,

## EXPLANATION OF PLATE 5

## FIGS.

- 1, 2. *Ammodiscus pacificus* Cushman and Valentine. 1, X 10. Microspheric. 2, X 13. Megalospheric. *a, a*, front views; *b, b*, apertural views.
- 3, 4. *Ammodiscus minutissimus* Cushman and McCulloch, new species. 3, X 50. *a*, front view; *b*, apertural view. Holotype. 4, X 90. Microspheric. Paratype.
- 5, 6. *Glomospira gordialis* (Jones and Parker). 5, X 110. 6, X 70. *a, a*, front views; *b, b*, apertural views.
7. *Haplophragmoides advenum* Cushman. X 18. *a*, front view; *b*, apertural view.
- 8-10. *Haplophragmoides columbiense* Cushman. 8, 10, X 50. 9, X 70. *a, a*, front views; *b, b*, apertural views.
- 11, 12. *Haplophragmoides columbiense* Cushman, var. *evolutum* Cushman and McCulloch, n. var. 11, X 40. Holotype. 12, X 70. Paratype. *a*, front view; *b*, apertural view.



1a



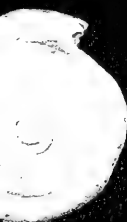
1b



2a



2b



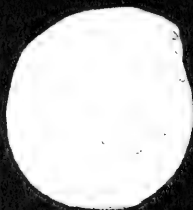
3a



3b



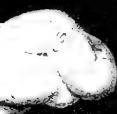
4



5a



5b



6b



7a



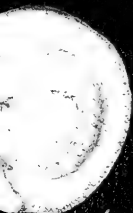
7b



8b



8a



6a



9a



9b



10



11



12b



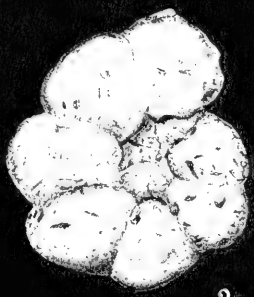
12a



1a



1b



2a



2



3b



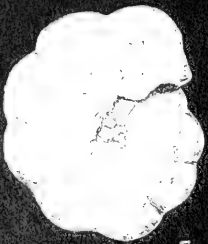
3a



4a



4



5a



5b



6



7a



7



8a



8b



9a



9



10b



10a



11b



11a



## EXPLANATION OF PLATE 6

## FIGS.

- 1, 2. *Haplophragmoides columbiense* Cushman, var. *evolutum* Cushman and McCulloch, new variety. 1, X 45. 2, X 70. *a, a*, front views; *b, b*, apertural views. 2, Paratype.
3. *Haplophragmoides planissimum* Cushman. X 18. *a*, front view; *b*, apertural view.
4. *Haplophragmoides scitulum* (H. B. Brady). X 30. *a*, front view; *b*, apertural view.
- 5, 6. *Haplophragmoides hancocki* Cushman and McCulloch, new species. 5, X 45. Holotype. *a*, front view; *b*, apertural view. 6, X 70. Paratype.
- 7, 8. *Haplophragmoides subglobosum* (G. O. Sars). X 90. *a, a*, front views; *b, b*, apertural views.
- 9-11. *Haplophragmoides trullissatum* (H. B. Brady). 9, X 50. 10, 11, X 25. *a, a, a*, front views; *b, b, b*, apertural views.

p. 73; vol. X, 1934, p. 75.—Rhumbler, *Schrift. Nat. Ver. für Schleswig-Holstein*, vol. 21, 1935, p. 181, pl. 9, figs. 124, 125.—Earland, *Discovery Rep'ts*, vol. XIII, 1936, p. 29.

Test free, consisting of an ovoid proloculum passing into a short, tubular chamber, soon becoming branched, of nearly uniform diameter throughout; wall composed of sand grains, firmly cemented with numerous sponge spicules fixed in the outer layer, giving a bristling appearance to the whole test; apertures formed by the open ends of the tubular chamber; color reddish or yellowish brown or gray.

Rare specimens show the proloculum. There is a considerable range in the material of which the test is made. At one station, 2070, there is a series of very small, slender specimens that are assigned here but they are very minute compared with the usual run of material. Localities: 2034, 2035, 2024, 2063, 299, 246, 290, 226.

*Distribution*.—Off Guadalupe Island, Mexico, in 96 to 250 fms.; in the Gulf of California, Mexico, one record north of Angel de la Guardia Island in 60 fms.

### Family **Reophacidae**

Genus **REOPHAX** Montfort, 1808

**Reophax curtus** Cushman

Plate 2, Fig. 12

*Reophax curtus* Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 8, pl. 2, figs. 2, 3; *Contrib. Canadian Biol.*, 1921 (1922), p. 7.—Hada, *Sci. Rep't Tohoku Imp. Univ.*, ser. 4, *Biol.*, vol. VI, 1931, p. 57, fig. 8 (in text).—Earland, *Discovery Rep'ts*, vol. X, 1934, p. 79; vol. XIII, 1936, p. 30.

Test short and thick, composed typically of three chambers, increasing rapidly in size as added, last-formed chamber making up a large proportion of the test, fusiform or elliptic, axis of the test straight or more often slightly curved; wall composed of angular quartz sand grains with a considerable amount of gray cement between; apertural end slightly tapering, without a definite neck, the aperture being an opening between three or more sand grains at the end of the chamber.

Our material shows a very great variation in the type of material of which the test is built but the general form remains fairly constant. Specimens from sandy bottoms such as that figured very closely resemble the type specimens. Others in different conditions use in addition fragments of mollusca and occasionally other foraminifera. Localities:

80, 58, 217, 225, 239, 241, 247, 248, 292, 290, 296, 298, 284, 318, 264, 459, 506, 511, 513, 514, 516, 540, 542, 543, 546, 548, 555, 584, 1035, 1044, 2005, 2009, 2012, 2013, 2008, 2015, 2017, 2023, 2026, 2052, 2053, 2057, 2058, 2062, 2065, 2067, 2070, 2074, 2075, 299.

*Distribution.*—These studies record this species as far north as the South Farallone Island, San Francisco, California, in 38 fms.; as far south as Gorgona Island, Colombia, in 32 fms. A single record for the Galapagos Islands is Cartago Bay, Albemarle Island, in 12 fms. Numerous localities off southern California and Mexico have this species. In the Gulf of California it has been recorded as far north as San Pedro Nolasco Island, in 32 fms.

### **Reophax scorpiurus** Montfort (?)

Plate 2, Fig. 13

Under this species have been placed very many elongate and irregular forms of *Reophax*. Brady's figures in the *Challenger* Report assigned to this species cover a wide range of form and building materials in the tests. There are numerous specimens in our collections ranging from the very coarse test figures (Pl. 2, Fig. 13) to those of pure sand grains. It is difficult to tell how much of the variation is due to the difference in the kind of ocean bottom and how much due to the selective power of the animal itself. It has seemed best, therefore, to leave this somewhat heterogeneous series under this name. Localities: 79, 215, 223, 226, 229, 230, 225, 246, 249, 253, 264, 265, 281, 283, 284, 286, 290, 293, 298, 304, 308, 320, 316, 409, 410, 411, 413, 414, 416, 421, 423, 425, 426, 456, 460, 461, 462, 465, 468, 467, 471, 472, 473, 504, 505, 519, 539, 545, 546, 554, 547, 555, 1042, 2007, 2017, 2012, 2018, 2029, 2032, 2034, 2054, 2066.

*Distribution.*—The numerous station records indicate a range as far north as Point Pinos, California, and as far south as Gorgona Island, Colombia, in shallow waters.

### **Reophax agglutinatus** Cushman

Plate 3, Figs. 1-3

*Reophax agglutinatus* Cushman, Proc. U. S. Nat. Mus., vol. 44, 1913, p. 637, pl. 79, fig. 6; Bull. 104, pt. 2, 1920, p. 9, pl. 2, figs. 4, 5; Bull. 100, vol. 4, 1921, p. 73, pl. 14, figs. 2a, b; Bull. 161, pt. 1, 1932, p. 4, pl. 1, figs. 1-3.

Test large and stout, composed of several chambers, nearly globular or slightly pyriform; wall composed almost entirely of agglutinated foraminiferal tests with a light grayish cement; aperture with a slightly protuberant neck.

Length up to 5.00 mm.

Under this species have been placed numerous specimens such as those figured here, which are built largely from other foraminiferal tests. Such specimens vary considerably in form but in general have rapidly enlarging chambers with a pyriform shape and a distinct protuberant neck. Localities: 290, 296, 447, 266, 278, 458, 251, 2001, 284, 281, 546, 238, 272, 55, 265, 2014, 2009, 82, 487, 331, 2072, 328.

*Distribution.*—Station 546 places this species in shallow waters, low tide, off the coast of Ecuador. In the Galapagos Islands, off Chatham, it has been found at 400 fms. Off Central America and Mexico, numerous records indicate a depth range of 10 to 400 fms.

### **Reophax excentricus** Cushman

Plate 3, Figs. 4-9

*Reophax excentricus* Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 92, fig. 134 (in text); Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 133, pl. 1, fig. 3.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 51.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 58, fig. 10 (in text).

Under this name are placed a large series of specimens which in general are elongate, the chambers increasing rather rapidly in size as added and the aperture rather large and usually at one side of the longitudinal axis. The materials of the wall vary considerably, from pure sand to tests largely composed of sponge spicules or of other material. On the whole, however, the apertural characters and the shape of the chambers remain fairly constant. Localities: 294, 293, 298, 284, 266, 265, 249, 2001, 290, 257, 239, 296, 3, 2070, 539, 261, 275, 227, 547, 74, 80, 82, 447, 25, 444, 217, A-7, 225, 474, 2034, 416, 517, 413, 207-2, 414, 2067, 2014, 2053, 2069, 2030, 2037, 2032, 2023, 2029, 2018, 2014, 2010, 2008, 2005, 2063, 2009, 2017, 2064, 251, 487, 488, 481, 475, 585, 2065, 329, 2072, 299.

*Distribution.*—Off San Pedro in 45 fms.; at low tide in Dype Bay, near Cordova, Alaska; in the Gulf of California and off Mexico, off Central America, off the Galapagos Islands, and as far south as Gorgona Island, Colombia, in 10 to 15 fms.

**Reophax spiculotestus** Cushman

Plate 3, Fig. 10

*Reophax spiculotestus* Cushman, Proc. U. S. Nat. Mus., vol. 38, 1910, p. 438 (in text); Bull. 100, vol. 4, 1921, p. 72, pl. 11, fig. 1; pl. 13, fig. 2.

Test of medium size, composed of a linear series of elongate chambers, oval, in a straight or more often slightly curved line, contracted at the ends of each chamber, increasing rapidly in size toward the apertural end; perfect adult specimens with six or more chambers; wall thin, composed largely of siliceous sponge spicules, for the most part laid lengthwise of the test and firmly cemented; some sand grains present, usually neatly cemented; aperture fairly large; color grayish.

Length up to 2.00 mm.

The types of this species were from the Pacific in the Philippine region. Similar specimens have occurred in our material from several stations: 412, 410, 411, 414, 478, 481, 488.

*Distribution.*—All of the station numbers listed are localities of the Galapagos Islands; Tagus Cove, 9 fms. in and around the region of Duncan Island, 45 to 111 fms.; Cartago Bay, Albemarle Island, 12 fms.; off Hood Island in 160 fms.

**Reophax scottii** Chaster

Plate 3, Fig. 11

*Reophax nodulosa* (?) Scott, 8th Ann. Rep't Fisheries Board of Scotland, pt. 3, 1890, p. 314.

*Reophax scottii* Chaster, First Rep't Southport Soc. Nat. Sci., 1890-91 (1892), p. 57, pl. 1, fig. 1.—Millett, Journ. Roy. Micr. Soc., 1899, p. 255, pl. 4, fig. 13.—Sidebottom, Mem. Proc. Manchester Lit. and Philos. Soc., vol. 49, no. 5, 1905, p. 2; vol. 54, pt. 3, no. 16, 1910, p. 8.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 44; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 222; Journ. Roy. Micr. Soc., vol. 50, 1930, p. 67.—Lacroix, Bull. Institut. Oceanographique, no. 549, 1930, p. 6, fig. 8 (in text).

Test very elongate, slender, composed of a large number of chambers, the early ones subcylindrical, later becoming pyriform in the adult with a truncate base and very narrow neck at the outer end; wall largely composed of chitin, flexible; aperture small, terminal.

Length 1.00 mm or more; diameter 0.08-0.10 mm.

This species is best known from about the British Isles but is recorded from the Mediterranean and from off the Malay region. Our specimens are very similar to those from off the British Isles. Localities: 248, 2070, A-16.

*Distribution.*—The records now place this species in the Pacific. Alaska, Simpson's Bay, north arm, in 35 fms.; Mexico, off the Guadalupe Island in 250 fms.; off the north end of Espiritu Santo Island in 24 fms.

### **Reophax subfusiformis** Earland

Plate 3, Figs. 14-16

*Reophax subfusiformis* Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 74, pl. 2, figs. 16-19; vol. X, 1934, p. 80.

Test elongate, fusiform, axis usually curved; chambers three to six, usually four, rapidly increasing in size as added so that the last-formed one in the adult makes up a large part of the test, fusiform in shape, the apertural end much prolonged into a slightly tapering neck; wall with numerous large sand grains often with a large proportion of cement; aperture rounded at the end of the tubular neck.

Length 1.25-2.00 mm; diameter 0.40-0.60 mm.

This species was originally described from off South Georgia and recorded also from the Falklands. Our specimens are very similar in shape and surface characters. They occur at numerous stations often in considerable abundance. Localities: A-6, A-7, A-16, A-5, A-4, 299, 284, 283, 35, 249, 506, 2014, 539, 463, 556, 418, 2037, 558, 513, 2052.

*Distribution.*—Alaska, off Cordova, at low tide and in 3 fms.; California, Catalina, in 6 fms.; Mexico, numerous stations in the Gulf of California, 15 to 222 fms.; off Panama and Colombia in 12 to 20 fms.

### **Reophax depressus** Natland

Plate 3, Figs. 17, 18

*Reophax depressus* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, no. 5, 1938, pl. 3, figs. 1, 2.

Test elongate, proloculum spherical, later chambers usually somewhat compressed, the sides of the test usually somewhat flaring as growth progresses, chambers fairly distinct, usually four to six in number; wall coarsely arenaceous but fairly smooth on the surface; aperture usually elongate, terminal. Length 1.50-2.50 mm; breadth 0.50-0.75 mm.

This species is a peculiar one, in its noncompressed form resembling *R. moniliformis* Siddall. In the adult, however, the later portion and often all but the proloculum is much flattened and spreading. It differs from *R. dentaliniformis* H. B. Brady in the shorter chambers, compression of the test and elongate aperture without a neck.

The species occurs at numerous stations and often in considerable numbers retaining its characters unusually well for this genus. Localities: 535, 298, 296, 250, 2000, 57, 505, 2009, 482, 2035, 2016, 2075, 290, 241, 293, 230, 278, 474, 294, 257, 242, 546, 540, 2018.

*Distribution*.—Numerous stations in the Gulf of California, with a depth range, 20 fms. in Agua Verde Bay to 140 fms. at the north end of Isla Partida; off Lobos de Afuera Island, Peru, and Gorgona Island, Colombia, with a depth range of shore to 22 fms.

### *Reophax* sp. (?)

Plate 3, Fig. 13

A very few specimens from locality 216 give characters which makes it seem different from any described species but material is not at present sufficient to warrant a full description and name. The specimens are very small and slender. They may possibly be allied to *R. scottii* Chaster.

*Distribution*.—Type locality is Petatlan Bay, Mexico, in 100 to 140 fms.

### *Reophax dentaliniformis* H. B. Brady

Plate 4, Figs. 1-5

A few specimens in our collections have been placed under this specific name with some uncertainty. As the figures show, they represent a considerable range in the amount of overlapping of the chambers, but all have the short neck and rather large aperture characteristic of this species and some of them seem rather close to Brady's type figures. A glance at the literature will show what diverse series of forms have been placed by various authors under this name. Our specimens seem nearer to Brady's types than many which have been referred here. Localities: 55, 251, 226, 286, 249, 241.

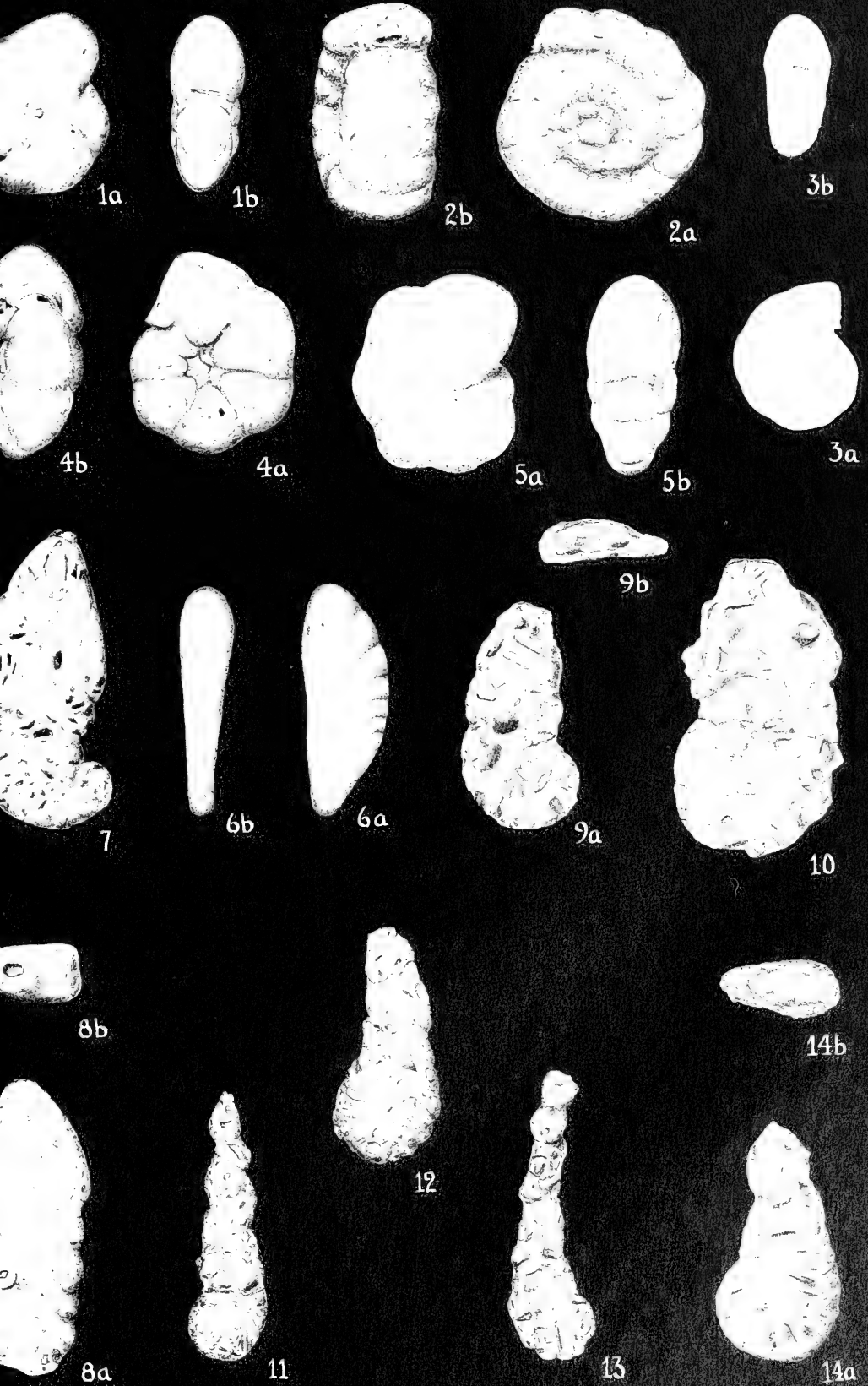
*Distribution*.—Mexico, off Guadalupe Island in 96 fms.; large numbers off North Isla Partida in 55 to 225 fms.; in the Gulf of California this species has been recorded as far north as San Pedro Nolasco Island in 48 fms.

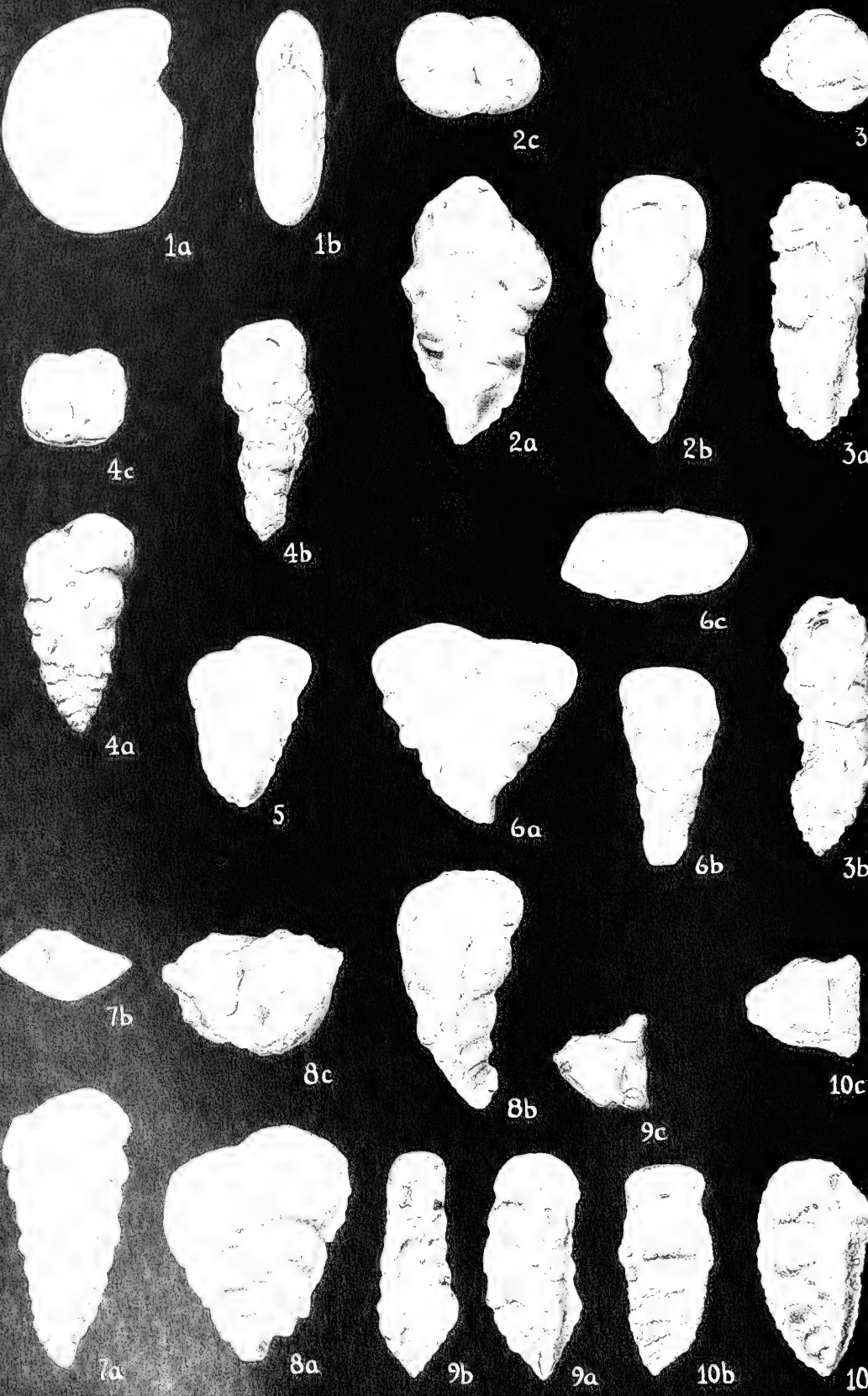
## EXPLANATION OF PLATE 7

## FIGS.

1. *Haplophragmoides tenuum* Cushman. X 45. *a*, front view; *b*, apertural view.
2. *Haplophragmoides veleronis* Cushman and McCulloch, new species. X 40. *a*, front view; *b*, apertural view.
- 3-5. *Haplophragmoides subinvolutum* Cushman and McCulloch, new species. 3, 4, X 70. 5, X 45. *a*, *a*, *a*, front views; *b*, *b*, *b*, apertural views. 5, Holotype.
6. *Ammobaculites ineptus* Cushman and McCulloch, new species. X 90. *a*, front view; *b*, apertural view.
- 7, 8. *Ammobaculites cassis* (Parker). X 25. *a*, front view; *b*, apertural view.
- 9, 10. *Ammobaculites foliaceus* (H. B. Brady). 9, X 40. *a*, front view; *b*, apertural view. 10, X 60.
- 11-14. *Ammobaculites catenulatus* Cushman and McCulloch, new species. 11-13, X 60. 14, X 90. *a*, front view; *b*, apertural view. 11, Holotype.







## EXPLANATION OF PLATE 8

## FIGS.

1. *Cyclammmina pusilla* H. B. Brady. X 25. *a*, front view; *b*, apertural view.
- 2, 3. *Gaudryina arenaria* Galloway and Wissler. 2, X 45. Smooth form. 3, X 30. Rough form. *a*, *a*, front views; *b*, *b*, apertural views.
4. *Gaudryina pauperata* Earland. X 70. *a*, front view; *b*, side view; *c*, apertural view.
- 5-7. *Gaudryina subglabrata* Cushman and McCulloch, new species. 5, 6, X 50. 6, Holotype. *a*, front view; *b*, side view; *c*, apertural view. 7, X 40. *a*, front view; *b*, apertural view.
8. *Gaudryina subglabrata* Cushman and McCulloch, var. X 30. *a*, front view; *b*, side view; *c*, apertural view.
- 9, 10. *Gaudryina (Pseudogaudryina) atlantica* (Bailey). 9, X 30. 10, X 18. *a*, *a*, front views; *b*, *b*, side views; *c*, *c*, apertural views.

**Reophax pilulifer** H. B. Brady

Plate 4, Fig. 6

A very few specimens are referred to this species. Most of them are incomplete but they strongly suggest this in their form. They are from localities: 55, 216, 522, 2016.

*Distribution*.—Mexico, in the Gulf of California off Point Escondido Bay in 138 fms. and North Isla Partida in 180 fms. Off the rocks of San Lorenzo Island, Callao, Peru, in 25 fms.

**Reophax communis** Lacroix

Plate 3, Fig. 12

*Reophax communis* Lacroix, Bull. Institut. Oceanographique, no. 549, 1930, p. 4, figs. 5-7 (in text).—Earland, *Discovery Rep'ts*, vol. X, 1934, p. 81, pl. 2, figs. 29, 30.

Lacroix has described and figured a tiny species from the Mediterranean and the Atlantic. Earland also records it from off the Falklands. Occasional specimens in our collections in size and general characters seem to fit well with this species but specimens are very rare. They are from stations 577, 586.

*Distribution*.—Off Cape San Francisco, Ecuador, in 15 fms.; Sechura Bay, Peru, in 10 fms.

Genus **AMMOFRONDICULARIA** Schubert, 1902**Ammofrondicularia compressa** Cushman and McCulloch,  
new species

Plate 4, Figs. 7-13

Test one and one-half to two and one-half times as long as broad, very much compressed, generally rhomboid in front view, greatest breadth somewhat above the middle, periphery subacute; chambers indistinct from the exterior, increasing rapidly in size as added, earlier ones narrow, later becoming very broad and chevron shaped; wall composed of sand grains and large flakes of calcareous fragments, surface rough; aperture narrow, elongate, terminal, without distinct neck.

Length up to 3.00 mm; diameter 1.00-2.25 mm.

Holotype (AHF no. 4) from locality 447.

This species differs from *Ammofrondicularia angusta* Schubert in the broadly rhomboid form and much greater increase in size of chambers.

Our species is characterized by its very rough wall composed of calcareous flakes rather roughly cemented and in some respects resembling *Flabellamina* but the earlier chambers are not coiled. Schubert has described a peculiar form for which he has erected the genus *Ammofrondicularia*. His specimen, however, consists of a section only and details of its full characters are lacking. Our species is very unique and we have referred it tentatively at least to *Ammofrondicularia*. It has occurred at numerous stations as follows: 248, 290, 296, 264, 299, 318, 447, 546, 2013, 2031, 2032, 2057, 256, 2018.

*Distribution.*—Type locality, Cartago Bay, Albemarle, Galapagos Islands, in 32 fms. On the shore below sandy beach of Gorgona Island, Colombia; numerous stations in the Gulf of California in depths ranging from 15 to 81 fms.

### Family Ammodiscidae

Genus AMMODISCUS Reuss, 1861

*Ammodiscus pacificus* Cushman and Valentine

Plate 5, Figs. 1, 2

*Ammodiscus pacificus* Cushman and Valentine, Contr. Dept. Geol. Stanford Univ., vol. 1, no. 1, 1930, p. 7, pl. 1, fig. 1.

Test large, planispirally coiled, proloculum nearly spherical, later coils covering about two fifths of the previous coil; chamber tubular, not compressed, the coils increasing slightly in diameter as added; suture distinct, depressed; wall smoothly finished, consisting largely of reddish-brown cement with numerous fine angular particles of sand; aperture semicircular.

Diameter up to 3.15 mm.

This species was originally described from the Pacific and has proved to be rather common in our material occurring at the following localities: 136, 444, 328, 482, 488, 411, 207-2, 403, 73.

*Distribution.*—This investigation extends the range of this species from off San Pedro, California, southward along Mexico and into the region of Galapagos Islands where a number of records show a depth range of 9 fms. in James Bay, James Island, to 250 fms. at Cartago Bay, Albemarle Island.

***Ammodiscus minutissimus*** Cushman and McCulloch, new species  
Plate 5, Figs. 3, 4

Test very small, composed of comparatively few coils, periphery rounded, coils considerably overlapping; wall largely chitinous with few very fine sand grains, surface polished; aperture rounded, at the free end of the tubular chamber.

Diameter 0.15-0.30 mm; thickness 0.10-0.15.

Holotype (AHF no. 6) from locality 534.

This species differs from *Ammodiscus pacificus* in the very minute size and the highly polished chitinous wall. It has proved to be a rather common and widely distributed species along the eastern coast of the Pacific occurring at the following localities: 57, 80, 82, 266, 281, 293, 299, 409, 410, 421, 460, 461, 462, 466, 534, 573, 574, 585, 1033, 1035, 1042, 2005, 2008, 2037, 2057, 2062, 2070.

*Distribution*.—Type locality, north of the Middle Chincha Island, off Peru in 18 fms. Numerous station records outline a range from San Francisco, California, in 37 to 105 fms.; in the Gulf of California, a depth range of 18 to 75 fms.; in the region of the Galapagos Islands, 9 to 80 fms.; off Peru from 18 to 100 fms.

Genus **GLOMOSPIRA** Rzehak, 1889

***Glomospira gordialis*** (Jones and Parker)

Plate 5, Figs. 5, 6

*Trochammina squamata*, var. *gordialis* Jones and Parker, Quart. Journ. Geol. Soc., vol. 16, 1860, p. 304.—Parker and Jones, Philos. Trans., vol. 155, 1865, p. 408, pl. 15, fig. 32.

*Trochammina gordialis* W. B. Carpenter, Parker, and Jones, Intr. Foram., 1862, p. 141, pl. 11, fig. 4.—Jones, Parker, and Kirkby, Ann. Mag. Nat. Hist., ser. 4, vol. 4, 1869, p. 390, pl. 13, figs. 7, 8.—Wright, Proc. Belfast Field Club, 1876-77 (App.), pl. 4, fig. 3.—Haeusler, Ann. Mag. Nat. Hist., ser. 5, vol. 10, 1882, p. 55, pls. 3 and 4, figs. 8-20.

*Trochammina (Ammodiscus) gordialis* Haeusler, Neues Jahrb., 1883, p. 59, pl. 4, figs. 2, 3.

*Ammodiscus gordialis* Siddall, Cat. Brit. Rec. For., 1879, p. 5.—Butschli, in Bronn's Klassen und Ordnungen des Thierreichs, vol. 1, 1880, p. 196, pl. 5, fig. 22.—H. B. Brady, Denkschr. Akad. Wiss. Wein, vol. 42, 1881, p. 100; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 333, pl. 38, figs. 7-9.—Haeusler, Neues Jahrb., Beil.-Bd. 4,

1885, p. 24, pl. 3, figs. 10-22, 31.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc., vol. 12, 1888, p. 218, pl. 42, fig. 22.—J. Wright, Proc. Roy. Irish Acad., vol. 1, 1891, p. 469.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 264, pl. 5, figs. 39, 40.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 279, pl. 24, fig. 1.

*Ammodiscus (Glomospira) gordialis* Rzehak, Verh. k. k. geol. Reichs., 1888, p. 191.

*Gordiammina gordialis* Rhumbler, Nachr. Ges. Wiss. Göttingen, 1895, p. 84; Arch. Prot., vol. 3, 1903, p. 282, fig. 132 (in text).—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 76, figs. 88-90 (in text).—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1005.

*Glomospira gordialis* Cushman, Bull. 104, U. S. Nat. Mus., pt. 1, 1918, p. 99, pl. 36, figs. 7-9.—White, Journ. Pal., vol. 2, 1928, p. 187, pl. 27, fig. 8.—Cushman and Jarvis, Contr. Cushman Lab. Foram. Res., vol. 4, 1928, p. 87, pl. 12, figs. 7, 8.—Storm, Lotus, Prag, vol. 77, 1929, p. 56 (list).—Lacroix, Bull. Institut. Oceanographique, no. 545, 1929, p. 21, text fig. 31.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 93, pl. 11, fig. 128.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 62, fig. 14 (in text).—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 3, pl. 1, fig. 2.—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 343, pl. 8, figs. 21, 22.—Cushman and Jarvis, Proc. U. S. Nat. Mus., vol. 80, art. 14, 1932, p. 9, pl. 2, figs. 6, 7.—Cushman, Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 9, fig. 7; l. c., no. 5, pl. 4, fig. 5.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 83; l. c., vol. X, 1934, p. 97; l. c., vol. XIII, 1936, p. 37.

Test composed of a subglobular proloculum and long undivided second chamber, at first planispiral like *Ammodiscus*, but soon leaving the one plane and becoming irregularly coiled; wall of fine arenaceous material with cement predominating; color reddish or yellowish brown.

Diameter 0.25-0.40 mm.

This species in our material shows considerable variation in the material of the test from a nearly purely chitinous wall to one composed largely of fine arenaceous material on a chitinous base. Some of the very smooth thin forms resemble *Ammodiscus minutissimus* in the characters of the wall. The species occurs at numerous stations as follows: 585, 579, 333, 1046, 2005, 2057, 2037, 2052, 2029, 2065, 253, 510, 280, 265, 255, 205, 299, 254, 258, 226, 298, 461, 319, 2066, 2048, 2020.

*Distribution.*—The stations listed above show that this species occurs off San Miguel Island, California; along Mexico, in the Gulf of California, off Costa Rica, off Panama, near Albemarle, Galapagos Islands; Gorgona Island, Colombia, and Sechura Bay, Peru. The depth range is from 10 fms. in the Gulf of California to 226 fms. off Guadalupe Island, Mexico.

### Family Lituolidae

Genus **HAPLOPHRAGMOIDES** Cushman, 1910

**Haplophragmoides advenum** Cushman

Plate 5, Fig. 7

*Haplophragmoides advena* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 38, pl. 6, figs. 1*a*, *b*; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 135.—Hanna and Church, Journ. Pal., vol. 1, 1928, p. 198.—Church, Journ. Pal., vol. 3, 1929, p. 304.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, pt. 3, 1930, p. 51, pl. 7, fig. 4.

Test compressed, involute, close coiled, umbilicate, periphery broadly rounded; last-formed coil consisting of about ten chambers, only slightly inflated; sutures distinct, slightly depressed, very slightly curved; wall arenaceous, mostly of fine material but with numerous angular fragments; aperture a low, curved slit in the base of the apertural face.

Length up to 1.50 mm; diameter 1.10 mm; thickness 0.55 mm.

This species was originally described from off British Columbia but has been recorded from numerous stations from British Columbia to southern California. There is comparatively little variation shown in our material and this species seems to be well characterized in this area. Localities: 5, 7, 3, 4, 39, 226, 232, 225, 207, 323, 25, A-13, 1034, 1042, 1044, 2069.

*Distribution.*—From a record of 6 fms. at Skagway, Alaska, to 96 fms. off Guadalupe Island, Mexico. The local stations show a depth range from 8 to 170 fms.

### **Haplophragmoides columbiense** Cushman

Plate 5, Figs. 8-10

*Haplophragmoides columbiense* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 39, pl. 6, figs. 2*a*, *b*.

Test somewhat compressed, close coiled, becoming somewhat umbilicate in the adult, periphery rounded; chambers distinct, usually 6



or 7 in the adult, slightly inflated, sides flattened, increasing rather uniformly in size as added, generally triangular in side view; sutures distinct, somewhat depressed, usually sigmoid; wall composed of angular arenaceous fragments imbedded in a finer-grained cement, smoothly finished, usually yellowish brown in color; aperture in the adult elongate, transverse to the axis of growth, in the median face of the chamber, with distinct lip-like processes.

Length 0.35-0.70 mm; breadth 0.25-0.50 mm; thickness 0.15-0.20 mm.

The types of the species were from Queen Charlotte Sound in 25 fms. It has proved to be one of the most common species in our material as will be seen by the list of stations. There is considerable variation. Typical specimens have somewhat triangular chambers in side view which are usually flattened on the sides. The following variety is apparently related to these but has much more rounded chambers and a more open coil. Localities: C-11, 292, 282, 280, 272, 217, 82, 2?, C-7, 2052, 2044, 2046, 2045, 2050, 416, 1042, 1035, 1023, 1022, 2070, 2009, 2054, 2035, 2063, 574, ???38, 299, 259, 241, A-6, A-15, V-2, 216, 106, 319, 56, 553, 543, 547, 29, C-10, C-13, 2058, 39.

*Distribution.*—These studies extend the range of this species northward from the type locality of Queen Charlotte Sound in 25 fms. to Hawkins Island, near Cordova, Alaska, in 6-8 fms.; southward to Octavia Bay and Port Utria, Colombia, in 40 to 50 fms., including records off Central America and the Galapagos Islands.

**Haplophragmoides columbiense** Cushman, var.  
**evolutum** Cushman and McCulloch, new variety

Plate 5, Figs. 11, 12; Plate 6, Figs. 1, 2

Variety differing from the typical in the more open coiling, particularly in the adult, and the chambers becoming more globular and inflated, umbilical region depressed.

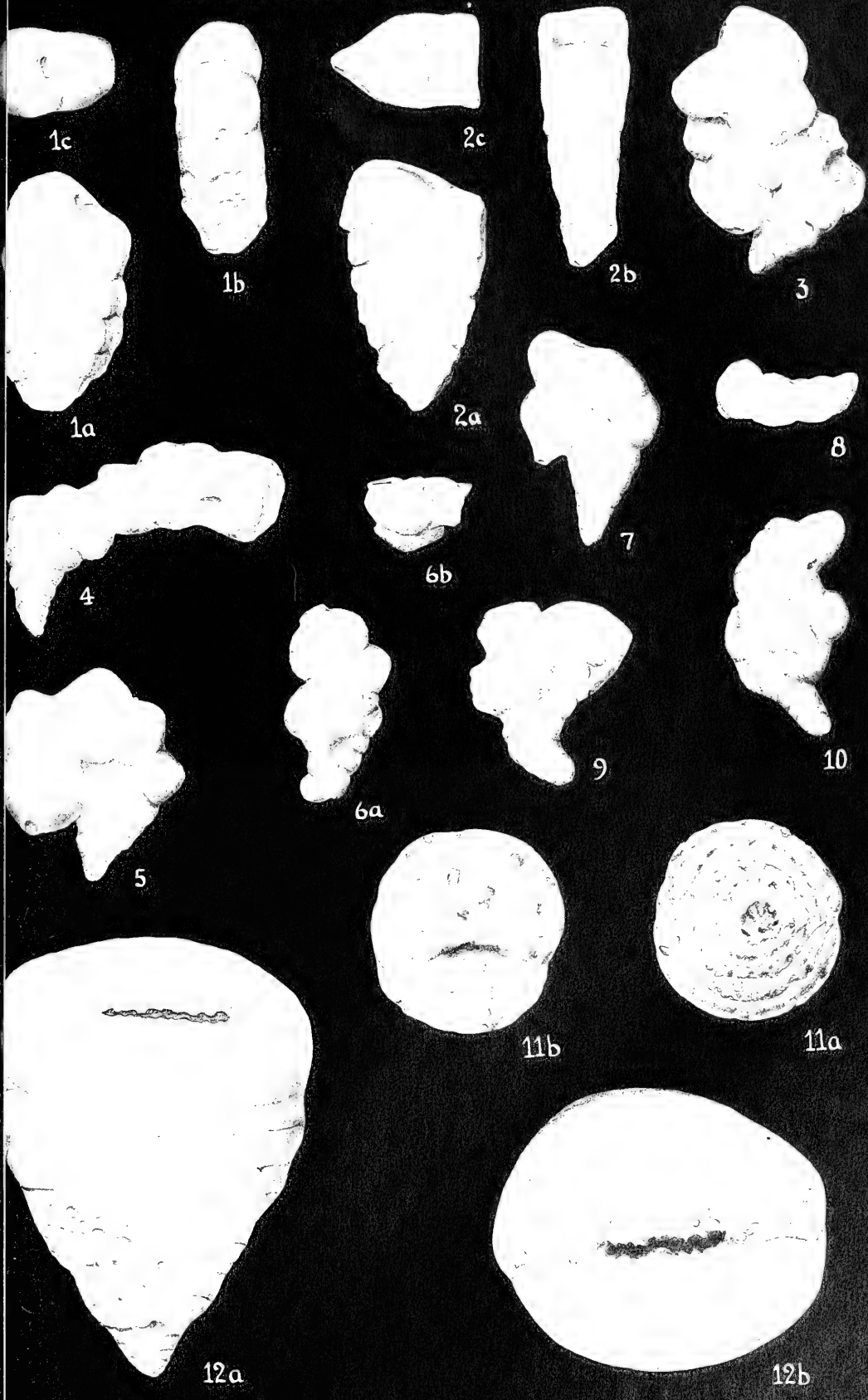
Holotype of variety (AHF no. 7) from Station 299.

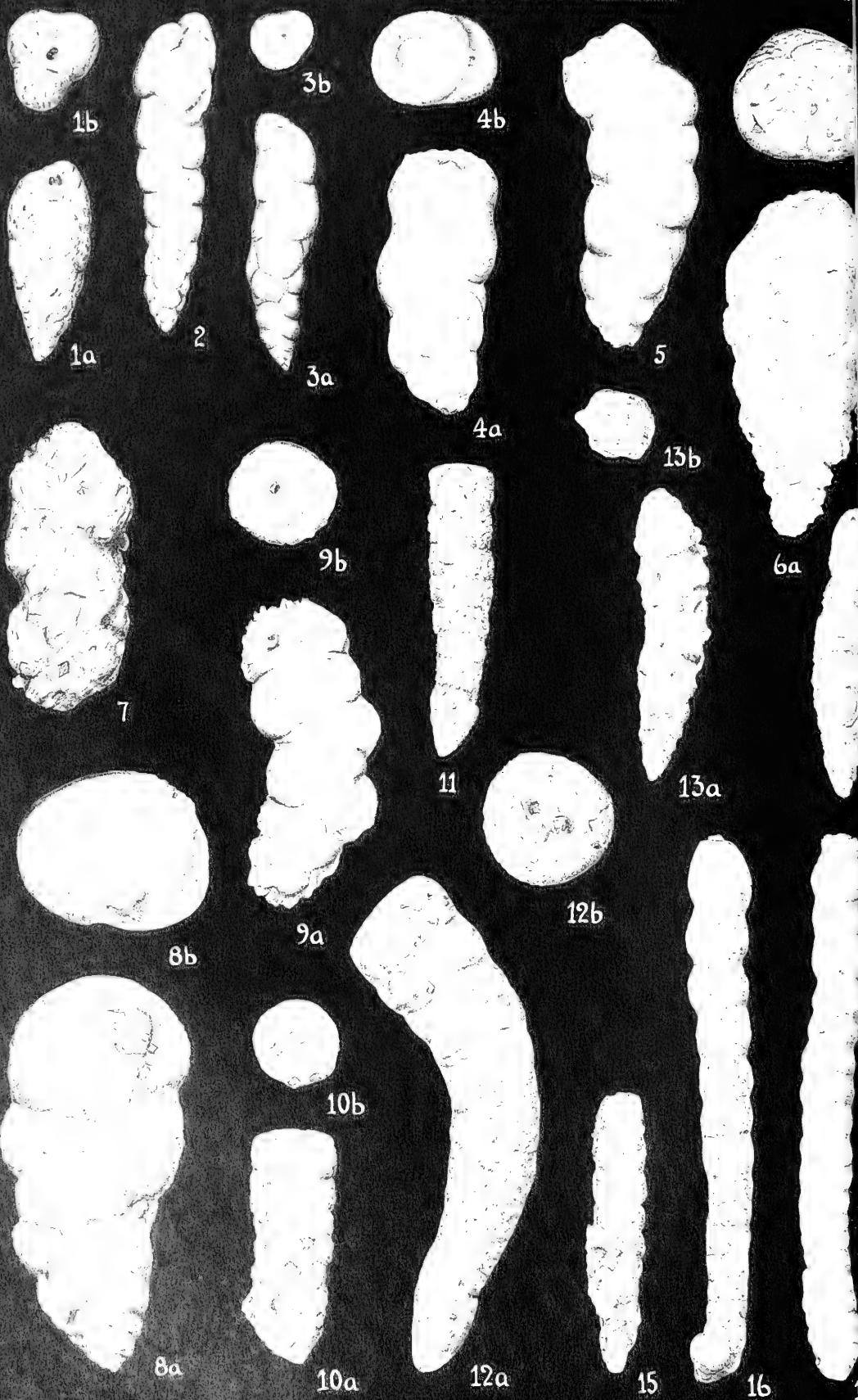
This variety, while there are some specimens showing the relationships to the typical form of the species, nevertheless seems distinct in much of our material. It is more numerous than the typical and probably has been referred to in the eastern Pacific as "*H. canariensis* d'Orbigny." It occurs in our material from the following localities: 409, 460, 317, 546, 299, 76, 240, 410, 459, 292, 519, 2067, 2066, 2017, 2065, 2008, 416, 226, 505, 463, 227, 2007, 266, 298, 290, 504, 413, 421, 238, 252, 255, 260, 239, A-6, 5.

## EXPLANATION OF PLATE 9

FIGS.

- 1, 2. *Gaudryina (Pseudogaudryina) atlantica* (Bailey), var. *pacifica* Cushman and McCulloch, new variety. X 70. *a, a*, front views; *b, b*, side views; *c, c*, apertural views. 2, Holotype.
- 3-10. *Rudigaudryina inepta* Cushman and McCulloch, new genus and new species. X 40. 3, Holotype. *6a*, front view; *6b*, apertural view.
- 11, 12. *Textulariella pacifica* Cushman. 11, X 25. *a*, apical view; *b*, apertural view. 12, X 18. *a*, front view; *b*, apertural view.





## EXPLANATION OF PLATE 10

## FIGS.

1. *Eggerella advena* (Cushman). X 70. *a*, front view; *b*, apertural view.
- 2, 3. *Eggerella pusilla* (Goës). X 90. *a*, front view; *b*, apertural view.
- 4-9. *Goësella flintii* Cushman. 4-6, 8, X 40. 7, X 25. 9, X 18.
- 10-12. *Cribragoësella pacifica* Cushman and McCulloch, new species. 10, X 25. 11, 12, X 18. 12, Holotype. *a, a*, front views; *b, b*, apertural views.
- 13, 14. *Goësella parva* Cushman and McCulloch, new species. X 150. 13, Holotype. *a*, front view; *b*, apertural view.
- 15, 16. *Listerella bradyana* Cushman. 15, X 40. 16, X 25.
17. *Listerella pallida* (Cushman). X 25.

*Distribution*.—Type locality, San Jose del Cabo, Lower California, Mexico, in 82 fms. Numerous station records, beginning with Hawkins Island, near Cordova, Alaska, at low tide and extending southward to Ecuador.

### **Haplophragmoides planissimum** Cushman

Plate 6, Fig. 3

*Haplophragmoides planissima* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 135, pl. 1, fig. 6.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, pt. 3, 1930, p. 51, pl. 7, fig. 3.

Test large, slightly longer than broad, much compressed, involute, close coiled, slightly umbilicate, periphery acute; chambers and sutures indistinct; wall composed of a single layer of rather coarse, angular sand grains with a large amount of grayish-white cement, exterior rough, wall fragile. Maximum length, 1.50 mm; breadth, 1.25 mm.

This species has been described and recorded only from off the southern coast of California. It is interesting to find typical specimens of this species from the following localities: 58, 79, 80, 316.

*Distribution*.—Off the coast of southern California with an extension of the range of this species as far south as Port Parker, Costa Rica, in 14 fms.

### **Haplophragmoides scitulum** (H. B. Brady)

Plate 6, Fig. 4

*Haplophragmium scitulum* H. B. Brady, Quart. Jour. Micr. Sci., vol. 21, 1881, p. 50; Proc. Roy. Soc. Edinburgh, vol. 11, 1882, p. 711; Rept. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 308, pl. 34, figs. 11-13.—Chapman, Proc. Zool. Soc. London, 1895, p. 16.—Flint, Ann. Rept. U. S. Nat. Mus., 1897 (1899), p. 276, pl. 20, fig. 2.—Chapman, Rept. British Antarctic Exped. Geol., vol. 2 (1916), 1917, p. 64, pl. 3, fig. 22.—Heron-Allen and Earland, British Antarctic Exped. Zool., vol. 6, 1922, p. 99.

*Haplophragmoides scitulum* Cushman, Bull. 100, U. S. Nat. Mus., pt. 1, 1910, p. 103, figs. 153-155.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1008.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 42, pl. 8, fig. 2; l. c., Bull. 100, vol. 4, 1921, p. 80; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 134.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929,

p. 96, pl. 12, fig. 141.—Lacroix, Bull. Institut. Oceanographique, no. 549, 1930, p. 10, fig. 12 (*a, b*) (in text).—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 340.—Earland, l. c., vol. VII, 1933, p. 78, pl. 3, figs. 11, 12.—Cushman, Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 10, fig. 2.—Blake, Biol. Surv. Mt. Desert Region, pt. 5, 1933, p. 72.—Earland, *Discovery Rep'ts*, vol. X, 1934, p. 88, pl. 10, figs. 20, 21; l. c., vol. XIII, 1936, p. 34.

Test planispiral, somewhat compressed, excavated in the umbilical region, composed of about three coils, partially involute, periphery broadly rounded, not lobulated; chambers 8-11 in the last-formed coil, broad and low, sutures slightly if at all depressed; wall arenaceous, firmly cemented, smoothly finished; aperture a simple curved slit at the base of the last-formed chamber.

There are a very few specimens from locality 82 (or 205) which seem to belong to this species and it has not been noted elsewhere.

Diameter 0.55 mm.

*Distribution*.—Off Catalina near Long Point, from 147 to 215 fms.

### **Haplophragmoides hancocki** Cushman and McCulloch, new species

Plate 6, Figs. 5, 6

*Haplophragmoides advena* Cushman and Valentine (not Cushman, 1925), Contr. Dept. Geol. Stanford Univ., vol. 1, no. 1, 1930, p. 7, pl. 1, figs. 5*a, b*.

Test comparatively small, much compressed, periphery rounded, sides flattened, coils in the adult somewhat evolute, exposing the earlier coils, very slightly umbilicate; chambers very distinct, 8-10 in the adult coil, increasing very gradually in size as added, not greatly inflated; sutures distinct, slightly depressed, sigmoid; wall finely arenaceous with a few larger fragments but exterior of the test smooth and polished; aperture semicircular to elongate at the base of the last-formed chamber in the median line.

Diameter 0.50-0.65 mm; thickness 0.20 mm.

Holotype (AHF no. 8) from Station A-1.

In some respects this species resembles *H. columbiense* but is usually smaller, very much more compressed and more evolute. It has occurred at numerous stations, specimens frequently abundant: A-1, 559, 2074, 329, 546, 537, 278, 232, 562, 577, 579, 583, 566, 473, 2037, 2057, 2063, A-15, 1034, 1033, 2033, 284, 266, 553, 531, A-5, A-4, 258, 529, 205, 2053.

*Distribution*.—Type locality is Ketchikan, Alaska, off the wharf in 7 fms. Additional records show continuous distribution southward into the Gulf of California with a record of 130 fms. at San Pedro Nolasco Island and a record of 10 fms. in Sechura Bay, Peru. In the Galapagos Islands one record off Hood Island in 73 fms. has been recorded.

### *Haplophragmoides subglobosum* (G. O. Sars)

Plate 6, Figs. 7, 8

*Lituola subglobosa* M. Sars. Förh. Vid. Selsk. Christiania, 1868 (1869), p. 250 (*nomen nudum*).—G. O. Sars, l. c., 1871 (1872), p. 253.

*Haplophragmium subglobosum* H. B. Brady, Denkschr. Akad. Wiss. Wien., vol. 43, 1881, p. 100; Ann. Mag. Nat. Hist., ser. 5, vol. 8, 1881, p. 406.

*Haplophragmium latidorsatum* H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 307, pl. 34, figs. 7, 8, 10, 14 (?) (not fig. 9), (not *Nonionina latidorsatum* Bornemann, 1855).—Chapman, Journ. Roy. Micr. Soc., 1892, p. 323, pl. 5, figs. 12*a*, *b*.—Goës, Köngl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 21, pl. 5, figs. 102-123.—Chapman, Proc. Zool. Soc. London, 1895, p. 15.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 29.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 276, pl. 20, fig. 1.—Millett, Journ. Roy. Micr. Soc., 1899, p. 360.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1911, p. 308; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 46, pl. 2, figs. 15, 16.

*Haplophragmoides subglobosum* Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 105, figs. 162-164.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1008.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 45, pl. 8, fig. 5; l. c., Bull. 100, vol. 4, 1921, p. 81, pl. 15, figs. 1*a*, *b*.—Lacroix, Bull. Institut. Oceanographique, no. 549, 1930, p. 11, fig. 13 (*a-c*) (in text).—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 64, fig. 16 (in text).—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 341.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 78; l. c., vol. X, 1934, p. 89; l. c., vol. XIII, 1936, p. 34.

Test subglobose, usually planispiral, consisting of two or more coils, involute, umbilical region depressed, periphery very slightly if at all lobulated, 5-8 chambers in the last-formed coil, broad and low, sutures



very slightly depressed; wall arenaceous, somewhat roughened, usually smooth within; aperture a more or less elongated, curved slit at the base of the apertural face of the chamber, simple; color gray or brown.

Diameter 0.45-0.65 mm.

There are specimens from two localities only which may belong to this species; for the most part they are small and have only 5 chambers in the last-formed coil similar to our figure. Localities: 227, 2071.

At some of our other localities the wall of the species has a considerable proportion of sponge spicules but this is apparently due to the condition of the ocean bottom at these localities. This form occurs at the following stations: 461, 226, A-16. It is particularly marked at stations: 416, 413, 461.

*Distribution*.—Off Guadalupe Island, Mexico, in 200 fms. and off Cape San Lucas in 345 fms. The forms having sponge spicules show a range from Cordova, Alaska, to the Galapagos Islands, off Albemarle and Duncan islands.

### **Haplophragmoides trullissatum** (H. B. Brady)

Plate 6, Figs. 9-11

*Trochammina trullissata* H. B. Brady, Quart. Jour. Micr. Sci., vol. 19, 1879, p. 56, pl. 5, figs. 10*a*, *b*, 11; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 342, pl. 40, figs. 14-16 (not fig. 13).—Haeusler, Abh. Schweiz. Pal. Ges., vol. 17, 1890, p. 64, pl. 10, figs. 9, 11.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, p. 265, pl. 5, figs. 25, 26 (?).—Chapman, Proc. Zool. Soc. London, 1895, p. 18.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 33.—Millett, Journ. Roy. Micr. Soc., 1899, p. 364.—Bagg, Bull. 513, U. S. Geol. Surv., 1912, p. 34, pl. 7, figs. 2*a*, *b*.

*Haplophragmoides trullissata* Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 100, figs. 148*a*, *b*.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1008.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 43, pl. 9, fig. 5.

Test small, planispiral, composed of about three coils, not completely involute, the chambers of earlier coils visible at the center in the umbilical region which is also depressed, periphery slightly lobulated, chambers numerous, 7-9 in the last-formed coil, subglobular, sutures distinct, slightly depressed, wall of fine sand grains with an excess of yellowish or reddish-brown cement, smooth and polished; aperture a short narrow slit slightly above the base of the chamber; color yellowish or reddish brown.

Diameter 0.50-1.25 mm.

This species has been found common in our material from locality 2070 but has not been seen elsewhere.

The very smooth form shown in our pl. 6, fig. 9, occurs abundantly at Station 2014 and somewhat similar ones at 2001. These have been included in above species.

*Distribution.*—It is probable that material from depths equal to the record off Guadalupe Island in 250 fms. will show a wide range for this species. The records for the smooth form are from near North Isla Partida in 225 fms.

### **Haplophragmoides tenuum** Cushman

Plate 7, Fig. 1

*Haplophragmoides tenuis* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 135, fig. 5, pl. 1.

Test planispiral, close coiled, compressed, involute, umbilicate, periphery rounded, chambers few, usually six in the last-formed coil, sutures radial, distinct, slightly depressed; wall very thin, composed of fine quartz grains with grayish cement giving a translucent appearance, smoothly finished; aperture a curved slit at the base of the apertural face.

Length 0.45 mm; breadth 0.35 mm.

This species is described from off the west coast of America and occurs very commonly in our material from this same general region. It is completely involute and the umbilical region very slightly depressed. The color is usually gray in all our specimens as in the types. It occurs at a large number of stations but shows very little variation: 80, 299, 509, 508, 513, 519, 504, 554, 516, 447, 1037, 2066, 2075, 1043, 2010, 2008, 2067, 332, 575, 2063, 59, 278, 290, 296, 298, 241, 237.

*Distribution.*—From Monterey Bay off Salinas River, south to Sechura Bay, Peru, and at Cartago Bay, Albemarle, Galapagos Islands.

### **Haplophragmoides veleronis** Cushman and McCulloch,

new species

Plate 7, Fig. 2

Test planispiral, very evolute, the last-formed coil overlapping only slightly, deeply umbilicate, periphery broadly rounded; chambers fairly distinct, numerous, 10-12 in the last-formed coil, increasing very gradually in size as added, in the adult the last-formed chambers sometimes

smaller than the preceding ones as the last-formed whorl decreases in height; sutures fairly distinct, depressed only in the latest portion; wall finely arenaceous, smoothly finished; aperture a narrow elliptical opening near the base of the last-formed chamber, often with a slight lip.

Diameter 0.65-0.80 mm; thickness 0.50 mm.

Holotype (AHF no. 9) from Station 2070.

This species differs from *H. trullissatum* in the very much more evolute form, lower coils in the adult and usually a larger number of chambers. It has occurred only at Station 2070 but they appear in considerable numbers showing very little variation in its characters.

*Distribution*.—Type locality is Guadalupe Island, in 250 fms.

**Haplophragmoides subinvolutum** Cushman and McCulloch,  
new species

Plate 7, Figs. 3-5

Test close coiled, somewhat depressed, sutures umbilicate, mostly involute, periphery rounded or somewhat angled; chambers distinct, 7 or 8 in the adult coil, slightly inflated, triangular in side view, increasing rather evenly in size as added; sutures distinct, depressed, sigmoid; wall finely arenaceous, with much cement and occasionally larger fragments, very smoothly finished on the exterior; aperture a low arched opening at the base of the apertural face in the median line with a distinct overhanging lip.

Diameter 0.40-0.65 mm; thickness 0.15-0.30 mm.

Holotype (AHF no. 10) from Station A-8.

This species differs from *H. columbiense* in the more involute test, less compressed and in having the aperture at the base instead of in the apertural face. Localities: A-8, 557, 521, 510, 552, 2014, 55.

*Distribution*.—Type locality, Excursion Bay, near Astoria, Puget Sound Cannery, collected at low tide. This species is recorded in 180 fms. off North Isla Partida, Mexico, and in 210 fms. at Callao, Peru.

Genus **AMMOBACULITES** Cushman, 1910

***Ammobaculites cassis*** (Parker)

Plate 7, Figs. 7, 8

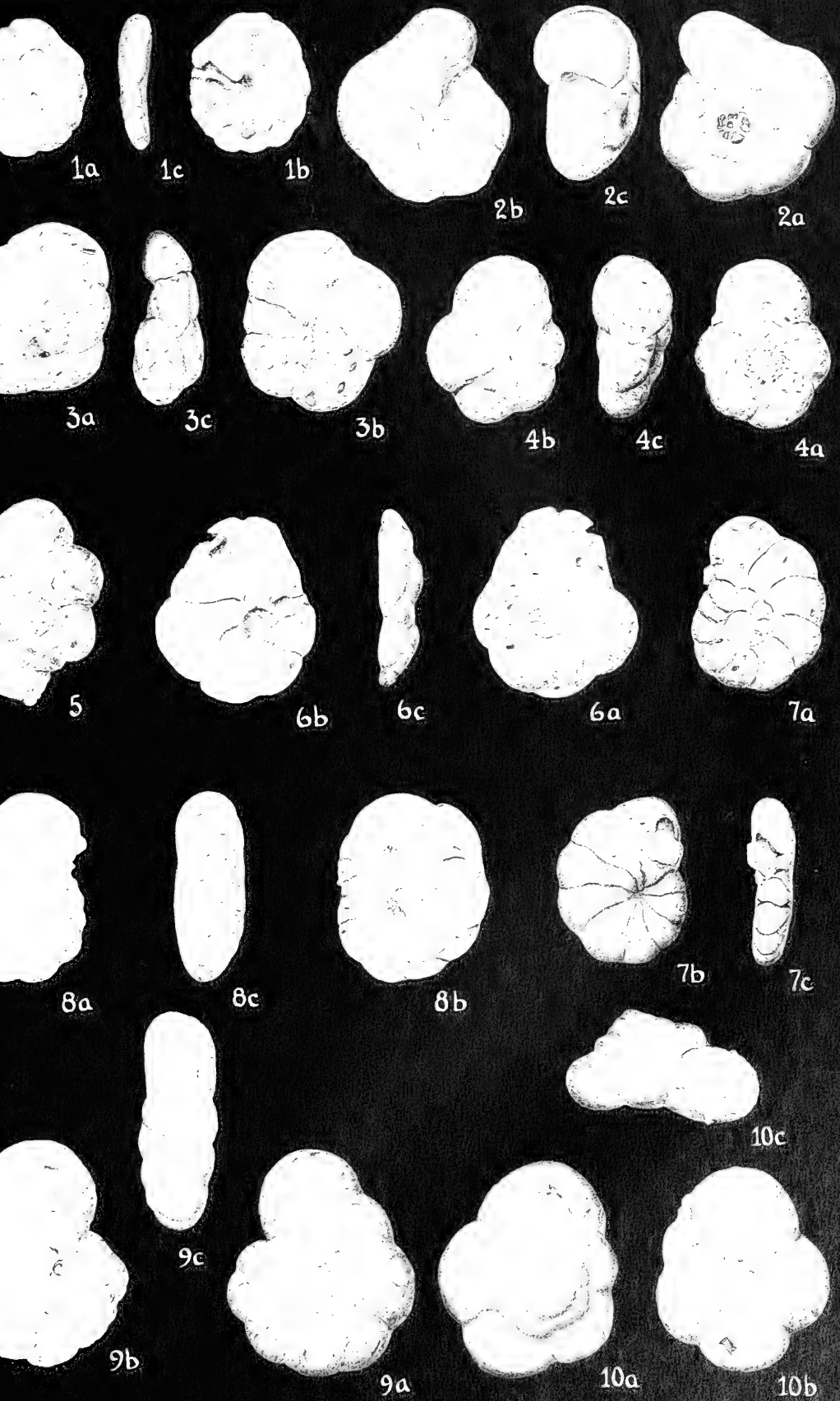
*Lituola cassis* Parker, in Dawson, Canad. Nat., vol. 5, 1870, pp. 177, 180, fig. 3.

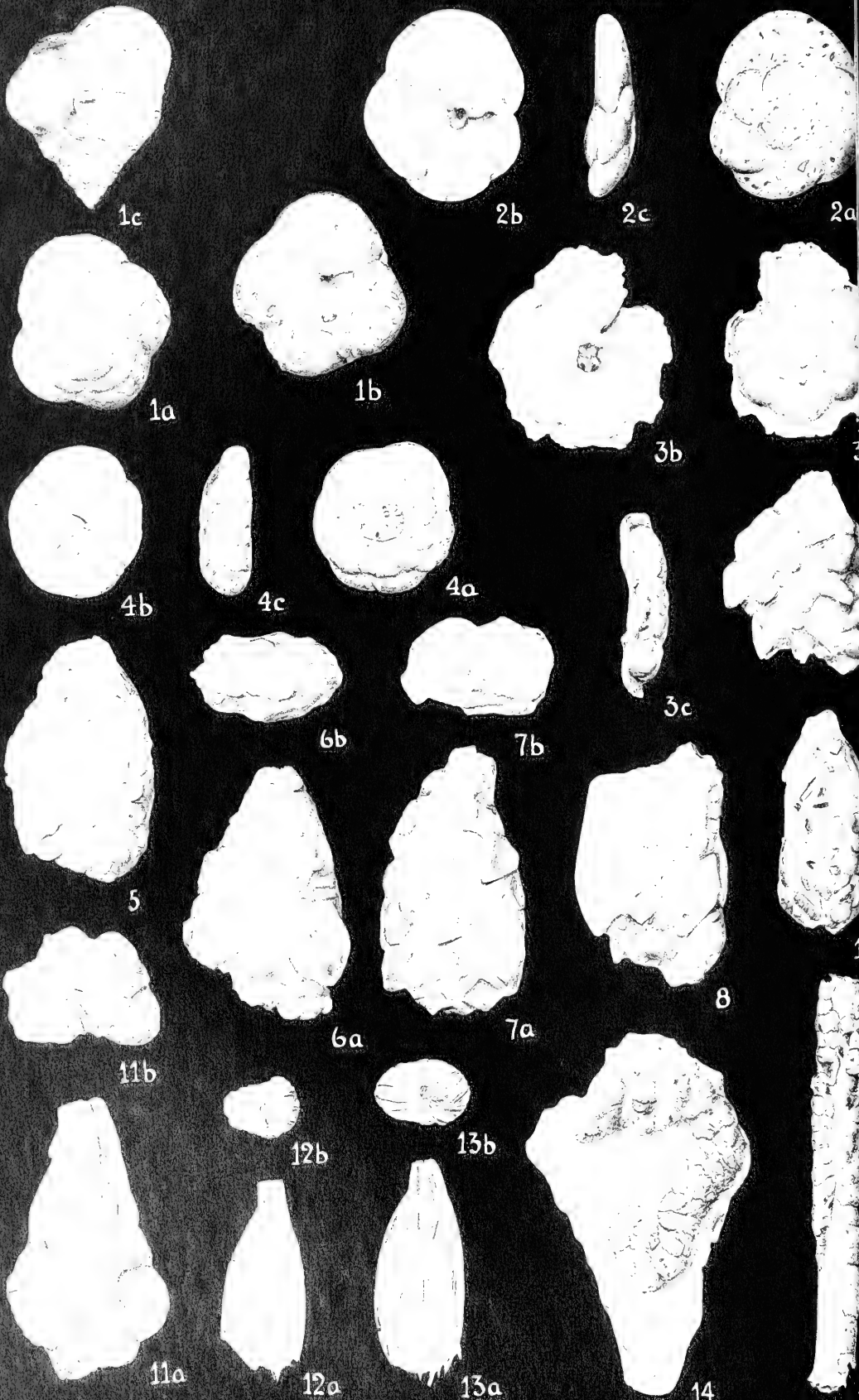
*Haplophragmium cassis* H. B. Brady, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 304, pl. 33, figs. 17-19.—Egger, Abh. Bay.

## EXPLANATION OF PLATE 11

## FIGS.

1. *Trochammina kellestae* Thalmann. X 90. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
2. *Trochammina inflata* (Montagu). X 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
3. *Trochammina pacifica* Cushman. X 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
4. *Trochammina pacifica* Cushman, var. *simplex* Cushman and McCulloch, new variety. X 70. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- 5, 6. *Trochammina charlottensis* Cushman. X 50. 6*a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- 7-9. *Trochammina nitida* H. B. Brady. X 60. *a*, *a*, *a*, dorsal views; *b*, *b*, *b*, ventral views; *c*, *c*, *c*, peripheral views.
10. *Trochammina discorbis* Earland. X 90. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.





## EXPLANATION OF PLATE 12

## FIGS.

1. *Trochammina vesicularis* Goës. X 90. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
2. *Trochammina rotaliformis* J. Wright. X 50. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
3. *Trochammina carinata* Cushman and McCulloch, new species. X 70. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
4. *Trochammina squamiformis* Cushman and McCulloch, new species. X 90. *a*, dorsal view; *b*, ventral view; *c*, peripheral view.
- 5-10. *Nouria polymorphinoides* Heron-Allen and Earland. 5-7, X 45. 8, 10, X 40. 9, X 25. *a*, *a*, front views; *b*, *b*, apertural views.
- 11-13. *Nouria harrisii* Heron-Allen and Earland. X 70. *a*, *a*, *a*, front views; *b*, *b*, *b*, apertural views.
- 14, 15. *Placopsilina bradyi* Cushman and McCulloch, new species. 14, X 25. Holotype. Attached to shell fragment. 15, X 30. Attached to echinoid spine.

Akad. Wiss. München, vol. 18, 1893, p. 261, pl. 5, figs. 55, 56.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 24, pl. 5, figs. 152-157.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 275, pl. 19, fig. 4.—Millett, Journ. Roy. Micr. Soc., 1899, p. 359, pl. 5, figs. 4-6, 7?—Chapman, Journ. Linn. Soc., vol. 28, 1902, p. 408, pl. 36, fig. 8.—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, no. 3, 1911, p. 20.

*Ammobaculites cassis* Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 63, pl. 12, fig. 5; Contrib. Canadian Biol., 1921 (1922), p. 8; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 91, pl. 14, fig. 4.—Hada, Trans. Sapporo Nat. Hist. Soc., vol. XI, pt. 1, 1929, p. 11; Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 67, fig. 19 (in text).—Blake, Biol. Surv. Mt. Desert Region, pt. 5, 1933, p. 72.

Test planispiral, compressed, early portions coiled, later chambers uncoiled but obliquely placed, periphery rounded, chambers comparatively few, only four or five in the uncoiled portion, sutures distinct but slightly depressed; wall composed of coarse sand grains but smoothly finished, with a yellowish brown cement; aperture simple at the distal or peripheral end of the chamber in the uncoiled portion; color yellowish brown.

Length up to 1.50 mm.

This typical Arctic species occurs in some numbers in our collections from the Alaska region as follows: A-4, A-7, A-13, A-14, A-15. It shows, as usual, considerable variation in the amount of uncoiling.

*Distribution*.—Cordova, Alaska, in 2 fms.; Skagway, in 6 fms.; at Ketchikan, in 7 fms.

### *Ammobaculites foliaceus* (H. B. Brady)

Plate 7, Figs. 9, 10

*Haplophragmium foliaceum* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 50; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 304, pl. 33, figs. 20-25.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 276, pl. 19, fig. 6.

*Ammobaculites foliaceus* Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 116, figs. 177-179; l. c., Bull. 104, pt. 2, 1920, p. 64, pl. 13, figs. 1, 2.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 97.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 81; l. c., vol. X, 1934, p. 93.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 151.—Earland, *Discovery* Rep'ts, vol. XIII, 1936, p. 36.



Test much compressed, elongate, early portion close coiled, planispiral, consisting of two or three coils; later portion uncoiled, straight, uniserial; chambers distinct, sutures usually well marked, but not depressed; wall coarsely arenaceous but with a smooth surface; aperture in the uncoiled portion of the adult simple, terminal, elongate; color reddish or yellowish brown.

Length up to 1.25 mm.

Specimens referable to this species occur from numerous stations in our material. They are never so well developed as in some parts of the Atlantic but may be included under this name. The spiral suture in the coiled portion is well marked and the earlier coils are visible. Specimens occur at the following stations: 2054, 514, 318, 2061, 64, 321, 248, 2042, 2045, 245, 253, 280, 298, 2012, 2027, 215, 506, 2046, 2044, 2038, 2042, 52, 244, 255, 281, 294, 546, 325, 583, 2075.

*Distribution.*—The present records indicate a depth range from shore to 163 fms.; a geographical range from Point Prieta, Mexico, in the Gulf of California to Consag Rock, and on south to Gorgona Island and Port Utria, Colombia.

### ***Ammobaculites ineptus* Cushman and McCulloch, new species**

Plate 7, Fig. 6

Test in the early portion coiled, later with the chambers very elongate, each making up one entire side of the test; chambers distinct, very slightly inflated in the upper part, greatly increasing in size and length as added; sutures distinct, slightly depressed at the upper end; wall finely arenaceous, smoothly finished, usually yellowish brown in color.

Length 0.30-0.40 mm; breadth 0.12-0.15 mm; thickness 0.08-0.10 mm.

Holotype (AHF no. 11) from locality 557.

This species is a unique one differing from *A. cassis* (Parker) in the greatly elongate later chambers enveloping the entire ventral side in the adult and the very smooth wall. This in some respects resembles the peculiar form figured by Millett [Journ. Roy. Micr. Soc., 1899, pl. 5, fig. 6 (not 4, 5, 7)] from the Malay Archipelago. In our collection the species occurs at localities 557 and 582.

*Distribution.*—Type locality, Piñas Bay, Panama, in 12 fms. Additional material was collected off Puna, Ecuador, in 6 fms.

***Ammobaculites catenulatus*** Cushman and McCulloch, new species  
Plate 7, Figs. 11-14

Test in the early stages close coiled, planispiral, involute, in the adult uncoiling and the chambers often becoming small and beadlike in an irregular linear series; chambers indistinct throughout, except in the last portion where they are somewhat inflated and separated from one another; sutures mostly indistinct; wall rather coarsely arenaceous, surface somewhat roughened; aperture rounded, terminal. Length 0.50-0.75 mm; breadth 0.20-0.30 mm; thickness 0.10-0.12 mm.

Holotype (AHF no. 12) from locality 2017.

This species differs from *A. cassis* (Parker) in the involute coiled portion, obscure sutures and chambers, and the very slender adult portion.

This species in some respects resembles *A. calcareus* (H. B. Brady) but is a much smaller species and much more irregular. It is widely distributed in our collections and shows considerable variation as indicated in our figures. The final chambers sometimes appear as if irregularly biserial. Localities: 252, 250, 293, 2029, 244, 298, 2054, 2017, 296, 2018, 2066, 2057, 2014, 2007, 2039, 255, 333, 583, 585, ???38.

*Distribution*.—Type locality, Point Escondido Bay, Lower California, Mexico, in 20 fms. Numerous stations in the Gulf of California and southward to San Francisco Bay, Ecuador.

***Ammobaculites agglutinans*** (d'Orbigny)

From a single locality "Penang," Station 92, there are three specimens that probably belong to this species. They are close coiled at the base with an umbilical depression, the later portion uncoiled, cylindrical, and the wall rather coarsely arenaceous.

*Distribution*.—Penang, Malay Peninsula, low tide.

Genus **CYCLAMMINA** H. B. Brady, 1876

***Cyclammina pusilla*** H. B. Brady

Plate 8, Fig. 1

*Cyclammina pusilla* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 53.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 32, pl. 6, figs. 242-244.—Chapman, Proc. Zool. Soc. London, 1895, p. 18.—Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 32.—Flint, Rep. U. S. Nat. Mus., 1897 (1899), p. 282, pl. 28, fig. 2.—

Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 111, fig. 172.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1009.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 56, pl. 11, figs. 4-6; l. c., Bull. 100, vol. 4, 1921, p. 87, pl. 16, figs. 4a, b.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 115.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 97, pl. 13, fig. 151.—Earland, *Discovery* Rep'ts, vol. X, 1934, p. 108; l. c., vol. XIII, 1936, p. 39, pl. 1, figs. 25, 26.

Test small, compressed, planispiral, periphery sharply angled, slightly lobulated, consisting of about three coils, involute, but not completely so, the previous coil slightly exposed in the umbilical region; chambers numerous, about 15 in the last-formed coil, triangular in face view, sutures slightly sigmoid, distinct, slightly depressed; wall arenaceous, porous within and showing a tendency to become labyrinthic, surface smooth; aperture a curved slit at the base of the apertural face; color reddish brown.

Diameter, 0.50-1.50 mm.

Rather typical material of this small species occurs at localities 227 and 2070.

*Distribution*.—Both of the station records indicated are located off the Guadalupe Island, Mexico, in 200 to 250 fms.

### Family Verneulinidae

Genus GAUDRYINA d'Orbigny, 1839

*Gaudryina arenaria* Galloway and Wissler

Plate 8, Figs. 2, 3

*Gaudryina arenaria* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 68, pl. 11, fig. 5.

*Gaudryina triangularis* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 138.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 52, pl. 7, fig. 5.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 51, pl. 1, fig. 2.—Cushman, Special Publ. No. 7, Cushman Lab. Foram. Res., 1937, p. 60, pl. 9, figs. 9, 10.

This species is a very variable one and widely distributed along the eastern shore of the Pacific. The specimens range from very rough to rather smooth, and there is considerable difference in the relative breadth. Our two figures show the extremes.

It has occurred at the following stations: 1042, 1044, 1037, 1034, 1025, 1022, 80, 57, 201, 7, 543, 515, A-2, 25.

*Distribution*.—Wrangell, Alaska, in 8 fms. to Port Utria, Colombia, in 50 fms. with an intermediate record at Monterey Bay, California, of 85 fms.

### *Gaudryina pauperata* Earland

Plate 8, Fig. 4

*Gaudryina pauperata* Earland, *Discovery* Rep'ts, vol. X, 1934, p. 121, pl. 5, figs. 47-49.—Cushman, Special Publ. No. 7, Cushman Lab. Foram. Res., 1937, p. 71, pl. 10, figs. 8, 9.

"Test minute, consisting of 2-3 sets of chambers arranged triserially, followed by 3-4 pairs of biserial chambers increasing rather quickly in size. Apex rounded; sutures depressed; chambers thick and rather inflated, giving a lobulate margin. Aperture normally textularian on the inner edge of final chamber. Walls thin and fragile, constructed of sand grains, rather coarse for the size of the organism, with a little grey cement. Colour dark grey. Length 0.23 mm; width 0.12 mm; thickness 0.10 mm."

Specimens similar to Earland's species in form and size as well as in other characters are rather common in our material. The species is a minute one and easily overlooked. It occurs at the following localities: 2011, 2017, 2019, 2020, 2028, 2058, 2066, 2057, 2046, 2042, 2067, 322, 500, 501, 221, 534, 581, 583, 556, 2070, 241.

*Distribution*.—Off Guadalupe Island in 250 fms.; numerous stations in the Gulf of California from Consag Rock south; off Middle Chincha Island, Peru, in 18 fms.

### *Gaudryina subglabrata* Cushman and McCulloch, new species

Plate 8, Figs. 5-7

Test comparatively small, earliest portion triserial, very early becoming biserial, and very much compressed with one face nearly flat, the other slightly convex, periphery subacute; chambers distinct, slightly inflated, low and broad, increasing in breadth more rapidly than in height as added; sutures distinct, depressed; wall finely arenaceous with much cement, surface smooth; aperture an elongate, low opening in a re-entrant of the inner margin of the last-formed chamber.

Length 0.60-1.15 mm; breadth 0.50-0.60 mm; thickness 0.30 mm.

Holotype (AHF no. 13) from locality C-9.

This species differs from *G. arenata* Galloway and Wissler in the more flattened and more flaring test, lower and more numerous chambers, very small proportion of triserial chambers and smoother surface.

The species varies in its relative length and breadth as shown by our figures. It also occurs at the following localities: 2005, 2065, 2010, 2009, 2006, 2064, 2063, 230, 232.

*Distribution.*—Type locality, off the coast of California at Arvila Pier in 7 fms. In 10 fms. Cuyler Harbor, San Miguel Island, and southward in 180 fms. off Inner Gorda Banks, Mexico.

***Gaudryina subglabrata* Cushman and McCulloch, new species, var.**  
Plate 8, Fig. 8

The figured specimen shows an extreme form in which the periphery is carinate and the chambers somewhat higher than in the typical form. The figured specimen is from locality 239 and there are other somewhat intermediate forms from localities 241 and 2000.

*Distribution.*—Type locality, off Fraile Bay in 80 fms. and off Cape San Lucas, Mexico, in 33 to 133 fms.

***Gaudryina (Pseudogaudryina) atlantica* (Bailey)**

Plate 8, Figs. 9, 10

*Textularia atlantica* Bailey, Smithsonian Contr., vol. 2, art. 3, 1851, p. 12, figs. 38-43.

*Gaudryina atlantica* Cushman, Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 70, pl. 13, figs. 1-3; Special Publ. No. 7, Cushman Lab. Foram. Res., 1937, p. 95, pl. 14, figs. 4, 5.

*Gaudryina rugosa* Flint (not d'Orbigny), Rep't U. S. Nat. Mus., 1897 (1899), p. 288, pl. 33, fig. 3.

*Verneuilina triquetra* Goës (not Münster), Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 38.

Test elongate, triangular in section, the angles acute, triserial portion short, biserial portion mostly triangular, the last-formed one or two chambers often rounded, tapering gradually from the blunt initial end to the broadly rounded apertural end; chambers distinct, not inflated; sutures distinct throughout; wall coarsely arenaceous, of angular sand grains with a large proportion of whitish cement, surface rather smoothly finished; aperture elongate, slightly arched, in a deep re-entrant of the ventral inner border of the chamber; color light gray.

Length up to 2.50 mm; breadth up to 1.25 mm.

This is one of the most common species in our collections. Except that the specimens are consistently smaller than the Atlantic ones, the other characters appear to be the same and hardly warrant any varietal status. Localities: 2008, 2017, 2048, 2037, 2069, 2018, 2024, 2023, 505, 541, 546, 553, 2010, 2005, 2009, 2016, 2070, 555, 296, 519, 504, 113, 508, 2035, 256, 2029, 2012, 2064, 2058, 2051, 2043, 2065, 2036, 2063, 2033, 2057, 2025, 2026, 294, 225, 298, 239, 290, 241, 286, 242, 283, 246, 249, 252, 285, 278, 253, 223, 584, 332, 587, ???38, 217, 250, 540.

*Distribution*.—Catalina Harbor in 30 fms.; numerous stations off Mexico, in the Gulf of California, southward to La Libertad, Ecuador.

**Gaudryina (Pseudogaudryina) atlantica** (Bailey) var. **pacifica**  
Cushman and McCulloch, new variety

Plate 9, Figs. 1, 2

Variety differing from the typical in the much smoother surface, smaller size and more nearly horizontal sutures.

Holotype of var. (AHF no. 14) from locality 230. The variety also occurs at localities 2005, 2010, 2064, 2065, 230, C-9.

There is a considerable amount of variation in this form as our figures indicate and there are intermediate specimens that seem to indicate that it is but a varietal form.

*Distribution*.—Type locality, off San Benito Island, in 121 fms. Additional stations off Mexico, including the Inner and Outer Gorda Banks, in 50-82 fms. At Arvila Pier, California, it was collected in 7 fms.

Genus **RUDIGAUDRYINA** Cushman and McCulloch, new genus

Test in the early stages triserial, at least in the microspheric form, followed by a biserial series as in *Gaudryina* and in the adult with the chambers in an irregular spreading series; wall finely arenaceous, firmly and smoothly cemented; aperture in the adult chambers generally terminal, rounded, often with a slight lip.

Genoholotype, **Rudigaudryina inepta** Cushman and McCulloch,  
new species

This genus is evidently derived from *Gaudryina* by the addition of the peculiar irregular growth which is often much greater in size than the original biserial portion.

**Rudigaudryina inepta** Cushman and McCulloch, new species

Plate 9, Figs. 3-10

Test in the earliest stages triserial, at least in the microspheric form, followed by a series of biserial chambers increasing rather rapidly in size and breadth, these in turn in the adult followed by a series of very irregular chambers in a single series or variously placed, usually making up the larger part of the test, later chambers inflated; sutures oblique, not depressed in the earlier portion, often deeply depressed in the adult, irregular portion; wall finely arenaceous, with much cement, smoothly finished; aperture in the adult rounded with a slight neck.

Length up to 1.00 mm.

Holotype (AHF no. 15) from locality 433.

This is a very peculiarly formed species as the figures will show. It was at first thought this might be purely an abnormal form but no normal specimens like the early stages were found in any numbers and the form has occurred at numerous stations as follows: 418, 207, 447, 433, 227, 226, 82, 216, 414, 114, 553.

*Distribution.*—Type locality, Tagus Cove, Albemarle Island, in 80-100 fms.; off Catalina, off Guadalupe Island, Mexico, southward to the Galapagos Islands.

Family **Valvulinidae**Genus **EGGERELLA** Cushman, 1933**Eggerella advena** (Cushman)

Plate 10, Fig. 1

*Verneuilina polystropha* Heron-Allen and Earland (not Reuss) minute form, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 55 (part), pl. 4, figs. 3-5 (not figs. 1, 2).

*Verneuilina advena* Cushman, Contr. Canad. Biol., no. 9, 1921 (1922), p. 9; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 57, pl. 9, figs. 7-9; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 137.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 52, pl. 7, fig. 6.—MacFadyen, Geol. Mag., vol. 69, 1932, pl. 34, fig. 2.—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 348.—Earland, l. c., vol. VII, 1933, p. 99, pl. 3, figs. 43-46.—Blake, Biol. Survey Mt. Desert Region, pt. 5, 1933, p. 72.

*Eggerella advena* Cushman, Special Publ. No. 8, Cushman Lab. Foram. Res., 1937, p. 51, pl. 5, figs. 12-15.

Test minute, elongate, tapering, earliest whorl with four or five chambers, remainder of test triserial, broadest near the apertural end; chambers numerous, as many as twenty-five, inflated; sutures depressed; wall arenaceous, exterior smoothly finished, amount of cement and fine material proportionately large; aperture in a deep depression at inner margin of last-formed chamber.

Length up to 0.65 mm; diameter 0.20 mm.

This species is known mostly from cold waters. In our material it is rather common and widely distributed, showing some variation in size and material of the wall. It occurs at the following stations: 278, 547, 475, 543, 411, 329, 508, 413, 461, 213, 1022, 1034, 1021, 1033, 1023, 585, 466, 511, A-6, 2008, 2065, 2005, 2017, 2063, 2057, 2024, 2046, 414, 111, 275, 271, 573, 258, 330, A-1, 473, A-3, A-4, 540, 553, 244, 569.

There are a number of specimens in our material that may be the young of this species which are not recorded here. They seem shorter and stouter than the young stages of *E. advena* usually show but are left until more material is available.

*Distribution*.—From Cordova, Alaska, in 2 fms. to Peru in 45 fms. off Hormigas de Afuera.

### ***Eggerella pusilla* (Goës)**

Plate 10, Figs. 2, 3

*Verneuilina pusilla* Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 39, pl. 5, figs. 6-8.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 57, text fig. 92.

*Eggerella pusilla* Cushman, Special Publ. No. 8, Cushman Lab. Foram. Res., 1937, p. 51, pl. 5, figs. 16, 17.

Test elongate, very slightly tapering, rounded in transverse section, sides nearly parallel for most of their length, earliest whorls with more than three chambers, soon developing three chambers in a whorl which continues throughout the rest of the development; chambers distinct, slightly inflated, increasing very slightly in size as added in the adult; sutures distinct, depressed, sometimes filled and obscured; wall finely arenaceous, with a few coarse grains and much cement; aperture at the inner margin of the last-formed chamber, arched.



Length up to 1.10 mm; breadth 0.25-0.28 mm.

This is a more slender species than *E. advena* (Cushman) and the texture of the wall is much finer as there is a larger amount of cement. It occurs at the following stations: 508, 114, 285, A-19, 232, 283, 299, 275, 207, 238, 2070, 416, 2066, 2029, 413, 553, 227, 474, 226, 519, 2037, 2024, 2063, 285, 2065, 2061, 2033.

*Distribution.*—From Cordova, Alaska, in 90 fms. to Octavia Bay, Colombia, in 50 fms.

Genus **TEXTULARIELLA** Cushman, 1927

**Textulariella pacifica** Cushman

Plate 9, Figs. 11, 12

*Textulariella pacifica* Cushman, Special Publ. No. 8, Cushman Lab. Foram. Res., 1937, p. 67, pl. 7, figs. 11-13.

Test short and broad, circular in transverse section, tapering throughout except in the last two pairs of chambers in the largest adults, where the sides are nearly parallel, earliest whorl with four or five chambers, later with a short triserial stage, and the adult biserial, apertural end convex; chambers distinct, not inflated, in the adult of rather uniform size and shape, not overlapping, the interior divided by numerous radiating partitions near the periphery; wall coarsely arenaceous, finely perforate, with an outer thin coating, smoothly finished, often polished; aperture a low, arched opening, at the inner margin of the last-formed chamber.

Length 2.20 mm; diameter 1.35 mm.

This species is close to *T. barrettii* (Jones and Parker) which occurs in the tropical Atlantic but the Pacific form is smaller, and the test is more coarsely arenaceous. The interior shows the early stages more primitive, with the divisions of the chambers not developed as early as in the Atlantic species. It has occurred at a number of our stations: 226, 228, 553, 554, 541, 275, 286, 73, 283, 285, 505, 227, 540, 207, 426, 223, 278, 2024, 2065, 2063, 2064, 2033, 2035, 2010, 2029, 2005, 584, 587, 332.

*Distribution.*—Off Guadalupe Island in 65 fms., southward to Gorgona Island, Colombia, in 20-60 fms.

Genus *GOËSELLA* Cushman, 1933*Goëssella flintii* Cushman

Plate 10, Figs. 4-9

*Goëssella flintii* Cushman, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 34, pl. 5, fig. 8; l. c., no. 8, 1937, p. 118, pl. 13, figs. 17-19.

Test in the earliest stages composed of 4 or 5 chambers in a whorl, rapidly reducing to 3, in the adult usually with a short, biserial stage followed by a few uniserial chambers, often only 1-3; chambers distinct, inflated; sutures distinct, depressed; wall very coarsely arenaceous, with large, angular fragments, but rather smoothly finished; aperture in the adult large, rounded.

Length up to 1.50 mm; diameter 0.50-0.60 mm.

The types of this species are from 185 fms. off San Pedro, California. The species is widely distributed in our material. The megalospheric form quickly attains the uniserial stage and shows but a few triserial chambers in the earlier stages after the initial whorl of four or five. In the microspheric form the triserial stage is held much longer and some of our specimens are not yet uniserial and might be mistaken for *Eggerella scabra* (Williamson) if it were not for the large series available. The species occurs in our material from the following stations: 82, 80, 57, 25, 215, 217, 509, 2069, 69, 56, 67, 299, 241, 552, 2000, 1042, 1035, 2070, 242, 251, 227, 2016, 2008, 2009, 2014.

Some of the specimens as shown in our plate 10, fig. 5, are much smoother with a larger amount of cement and a deep reddish-brown color. These resemble *G. rotundata* (Cushman) in some respects but have the typical aperture of *G. flintii* and probably represent different bottom conditions. There seem to be intermediate stages between the coarsely arenaceous specimens and those with the smoother wall.

*Distribution*.—From the locality of the holotype, off San Pedro, California, in 185 fms., the range is now extended to Farallone Islands, San Francisco, northward in 38 fms. and southward to Callao, Peru, in 210 fms.

*Goëssella parva* Cushman and McCulloch, new species

Plate 10, Figs. 13, 14

Test minute, the whole elongate and cylindrical or elongate fusiform, the triserial stage continued often for nearly one third or one half the length; chambers fairly distinct, somewhat overlapping, increasing in height toward the apertural end, the last-formed chamber in the adult somewhat pyriform with a rapid reduction in diameter

toward the apertural end; sutures only slightly depressed; wall rather coarsely arenaceous for the size of the test; aperture terminal, rounded.

Length up to 0.30 mm; diameter 0.08-0.10 mm.

Holotype (AHF no. 16) from locality 236.

This species differs from *G. flintii* Cushman in its very small size, more slender test and fusiform shape. It is a fairly common species as the list of localities shows and at some stations seems to be abundant. It may easily be overlooked on account of its small size. It occurs at the following stations: C-9, 558, 416, 76, 216, 64, 2057, 2004, 2007, 500, 263, 292, 255, 2028, 271, 238, 235, 236, 258, 2067.

*Distribution*.—Type locality is near Magdalena Bay, Mexico, in 19 fms. From Arvila, California, in 7 fms. to La Plata, Ecuador, in 10 fms.

#### Genus CRIBROGOËSELLA Cushman, 1935

#### *CribrogoëSELLA pacifica* Cushman and McCulloch, new species

Plate 10, Figs. 10-12

Test elongate, subcylindrical, increasing in size slowly, often slightly reduced in diameter immediately after the triserial stage, uniserial stage making up much the greater part of the test, often distinctly curved; chambers fairly distinct, especially in the later portion, 2 or 3 times as broad as high, slightly overlapping, increasing in size only very gradually as added; sutures mostly indistinct except in the later portion where they are slightly depressed; wall rather coarsely arenaceous but smoothly finished; aperture in the adult becoming multiple, in some specimens with as many as 6 or 8 rounded openings in the terminal face of the last-formed chamber.

Length up to 4.00 mm or more; diameter up to 1.00 mm.

Holotype (AHF no. 17) from locality 2070.

This species differs from *C. robusta* (H. B. Brady) in the much smaller proportion of the triserial stage, more coarsely arenaceous test, larger pores in the cribrate aperture, and the curved test in the larger forms.

The early stages have but a single aperture but the larger curved forms have several and a very long uniserial stage. This is the first record of this genus in the Pacific. It occurs at the following stations: 474, 475, 488, 2070, 487.

*Distribution*.—Type locality is off Guadalupe Island, in 250 fms. In the Galapagos Islands; stations show a range from off Tower at 120 fms., off Hood, 160-170, and off Chatham, a depth range of 400 fms.

Genus **LISTERELLA** Cushman, 1933**Listerella pallida** (Cushman)

Plate 10, Fig. 17

*Clavulina communis* d'Orbigny, var. *pallida* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 138, pl. 2, fig. 1.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 52, pl. 1, figs. 7, 8.—R. E. and K. C. Stewart, Bull. Amer. Assoc. Petr. Geol., vol. 14, 1930, p. 1448.

*Listerella pallida* Cushman, Special Publ. No. 8, Cushman Lab. Foram. Res., 1937, p. 147, pl. 16, figs. 37-39.

Test elongate, slender, the early portion fusiform, later cylindrical, earliest stage with 4 or 5 chambers, later triserial, then irregularly biserial, and in the adult uniserial, rounded in transverse section; chambers distinct throughout, slightly inflated, those of the adult stage rather low but somewhat irregular in height; sutures distinct, slightly depressed; wall finely arenaceous, of light-colored, chalky material, smoothly finished; aperture central, terminal, with a slight neck.

Length 2.00 mm; diameter 0.40 mm.

The types of this species are from off the west coast of America but typical species have occurred at only two of our stations 2070 and 227 but there are good series from both stations.

*Distribution*.—In this investigation this species has been found only off Guadalupe Island, Mexico, in 200-250 fms.

**Listerella bradyana** Cushman

Plate 10, Figs. 15, 16

*Listerella bradyana* Cushman, Special Publ. No. 6, Cushman Lab. Foram. Res., 1936, p. 40, pl. 6, fig. 11; l. c., no. 8, 1937, p. 151, pl. 17, figs. 21-23.

*Clavulina communis* H. B. Brady (part) (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 394, pl. 48, figs. 1, 2, 5 (not 3, 4, 7-12).—Cushman, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 16, pl. 4, figs. 3a, b.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 51, pl. 1, figs. 5, 6.

Test elongate, cylindrical, not tapering; chambers numerous, fairly distinct, increasing somewhat in height as added, the apertural face strongly convex; sutures fairly distinct, slightly if at all depressed; wall arenaceous, slightly roughened on the exterior; aperture terminal, central, with a distinct neck.

Length up to 3.50 mm; diameter 0.25-0.30 mm.

This species may be distinguished from the preceding by the smoother test without depressed areas at the sutures and the triserial stage shorter with the sutures indistinct. It occurs at the following stations: 487, 482, 475, 579.

*Distribution*.—Off Tower Island in 175 fms.; in Cartago Bay, Albemarle, in 250 fms.; off Chatham, in 400 fms.; off Peru, in Sechura Bay, in 12 fms.

### Family Trochamminidae

Genus TROCHAMMINA Parker and Jones, 1860

*Trochammina kellettae* Thalmann

Plate 11, Fig. 1

*Trochammina peruviana* Cushman and Kellett, Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 4, pl. 1, figs. 8a, b.—Cushman and Parker, l. c., vol. 80, art. 3, 1931, p. 6, pl. 2, figs. 7a-c.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 176.

*Trochammina kellettae* Thalmann, Eclog. Geol. Helv., vol. 25, no. 2, 1932, p. 313.

Test trochoid, spire greatly flattened, dorsally very slightly convex, ventrally slightly concave, consisting of three or four whorls; chambers numerous, 10 or more in the last-formed whorl, of rather uniform size and shape increasing slowly in size as added; sutures on the dorsal side gently curved, very slightly depressed, only those of the last-formed whorl distinct, on the ventral side gently curved or with a sinuous, lobed condition especially in later portions, distinct; wall finely arenaceous with much chitin, thin, very flexible when wet; aperture ventral, along the inner margin of the last-formed chamber.

Diameter 0.25-0.40 mm.

This species was originally described from off Eten, Peru. The ventral side has peculiar lobes on the edge of the chambers and in spite of its small size this seems to be a distinctive species, rather widely distributed. It occurred at the following stations: 215, 210, 241, 238, 222, 252, 244, 239, 232, 256, 272, 280, 257, 299, 292, 275, 2000, 577, 523, 537, 572, 554, 566, 579, 2067, 2059, 2066, 530, 531, 557, 76, 319, 458, 2049, 2003, 2019, 2037, 410.

*Distribution*.—Widely distributed, with station records showing a range from Peru northward to San Pedro, California.

**Trochammina inflata** (Montagu)

Plate 11, Fig. 2

*Nautilus inflatus* Montagu, Test. Brit., Suppl., 1808, p. 81, pl. 18, fig. 3.

*Rotalina inflata* Williamson, Rec. Foram. Great Britain, 1858, p. 50, pl. 4, figs. 93, 94.—Parker and Jones, Ann. Mag. Nat. Hist., ser. 3, vol. 4, 1859, p. 347, fig. F.—Williamson, Pop. Sci. Rev., vol. 4, 1865, p. 174, pl. 8, fig. 8.

*Trochammina inflata* W. B. Carpenter, Parker, and Jones, Int. Foram., 1862, p. 141, pl. 11, fig. 5.—H. B. Brady, Nat. Hist. Trans. Northumberland and Durham, vol. 1, 1865, p. 95.—Haeusler, Ann. Mag. Nat. Hist., ser. 5, vol. 10, 1882, p. 351, pl. 15, figs. 5-7; Neues Jahrb., 1883, pl. 1, fig. 60; pl. 4, figs. 6, 7.—H. B. Brady, Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 338, pl. 41, figs. 4a-c.—Haeusler, Abh. Schweiz. Pal. Ges., vol. 17, 1890, p. 65, pl. 10, figs. 25, 26.—J. Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 469.—Woodward and Thomas, Geol. and Nat. Hist. Surv. Minn., vol. 3, 1893, p. 28, pl. D, fig. 31.—Egger, Abh. Bay. Akad. Wiss. München, vol. 18, 1893, pl. 5, figs. 10-12, 16-18.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 29, pl. 6, figs. 222-224.—Millett, Journ. Roy. Micr. Soc., 1899, p. 364.—Fornasini, Mem. Real. Acad. Sci. Ist. Bologna, vol. 8, 1900, p. 367, fig. 15.—Sidebottom, Mem. and Proc. Manchester Lit. and Philos. Soc., vol. 49, no. 5, 1905, p. 6, pl. 1, fig. 9.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 203.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1909, p. 324.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 1, 1910, p. 121, fig. 188a, b.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 52; Trans. Zool. Soc. London, vol. 20, 1915, p. 620; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 227.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 73.—Heron-Allen and Earland, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 126; British Antarctic Exped., Zoology, vol. 6, 1922, p. 112.—Hanna and Church, Journ. Pal., vol. 1, 1929, p. 201.—Wiesner, Deutsche Süd-Polar-Exped., vol. XX, Zool., 1929, p. 111, pl. 17, fig. 201.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 71.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 90, fig. 43 (in text).—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 345.—Blake, Biol. Surv. Mt. Desert Region, pt. 5, 1933, p. 75.—Cushman,

Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 18, figs. 3a-c.—Earland, *Discovery Rep'ts*, vol. VII, 1933, p. 86; l. c., vol. X, 1934, p. 99, pl. 3, figs. 41-43; vol. XIII, 1936, p. 37.

Test trochoid, low spired, composed of about three volutions, the last-formed one consisting of five or six chambers, umbilicate, all chambers visible from above, only those of the last-formed coil from below; chambers inflated, subglobose, sutures distinct and deep, nearly at right angles to the periphery; wall of fine sand with an excess of cement, smooth and dully shining; aperture small, a small arched slit where the chamber meets the previous volution on the ventral side and slightly in from the periphery, color clear yellowish brown, the spire often darker than the outer whorl.

Diameter up to 1.00 mm.

This species has been seldom recorded in the Pacific but it has occurred in our material at the following localities: 225, C-14, C-10, W-3, 539, 227, 510, 505, 2066, 2067, 2070, 582, 583, 586, 558, A-8, 557, 554.

*Distribution*.—Off the coast of Alaska, at low tide to the coast of Ecuador, in 15 fms.

### **Trochammina pacifica** Cushman

Plate 11, Fig. 3

*Trochammina pacifica* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 39, pl. 6, figs. 3a-c; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 142.

Test small, trochoid, composed of several coils, 4-5 chambers in the last-formed one, ventrally umbilicate, periphery rounded; sutures distinct, slightly depressed, nearly radial; wall finely arenaceous, smoothly finished; aperture a narrow slit at the base of the ventral face of the last-formed chamber.

Diameter 0.35-0.50 mm.

This species was originally described from Virago Sound off British Columbia and has been recorded from Queen Charlotte Sound and from off the southern coast of California. It is rather common in our material and occurs at numerous stations as follows: A-2, A-4, A-1, C-10, 2, 3, 4, 5, 22, 35, 14, 39, 73, 83, 79, 136, A-15, 300, 317, 322, 319, 462, 253, 241, 239, 237, 225, 256, 258, 234, 240, 238, 232, 294, 298, 292, 293, 282, 278, 266, 265, 290, 280, 277, 272, 267, 241, 316, 409, 320,

323, 557, 554, 547, 553, 521, 546, 519, 508, 500, 504, 509, 514, 558, 281, 313, 529, 547, 579, 577, 576, 583, 585, 333, 325, ???38, 292, 259, 1044, 1047, 1025, 1033, 2027, 2044, 2035, 2045, 2042, 2034, 2032, 2026, 2025, 2017, 2013, 2066, 2062, 2054, 2067, 2046, 2002, 2008, 2048, 2037, 2033, 2075, 2007, 2012, 2033, 2069, 2070, 275.

*Distribution.*—From the type locality, Virago Sound, off British Columbia, these investigations extend the range northward to Cordova, Alaska, and southward to Sechura Bay, Peru.

***Trochammina pacifica* Cushman, var. *simplex* Cushman and McCulloch, new variety**

Plate 11, Fig. 4

Variety differing from the typical in the smaller size, more globular chambers, radial sutures on the ventral side and more rounded periphery.

Holotype of variety (AHF no. 18) from locality 298.

This varietal form is related to the typical but may be distinguished where the two occur together. It occurs at the following stations: 562, 573, 569, 566, 215, 263, 1034, 2061, 2033, 2008, 2065, 2024, 266.

*Distribution.*—Type locality is Agua Verde Bay, Lower California, Mexico, in 20 fms. Other records indicate a range as far north as San Francisco, California, in 38 fms. and southward to Peru, Lobos de Afuera, in 15 fms.

***Trochammina charlottensis* Cushman**

Plate 11, Figs. 5, 6

*Trochammina charlottensis* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 39, pl. 6, figs. 4a, b.

Test somewhat compressed, the periphery rounded, all the chambers visible from the dorsal side, those of the ventral side of the last-formed coil visible, very slightly umbilicate, 4 or 5 chambers in the last-formed coil; sutures very distinct, much curved on the dorsal side, slightly so on the ventral, the suture representing the line of growth of the coils also sharply distinct but not depressed; wall smoothly finished, dark reddish brown; aperture narrow, ventral near the umbilicus.

Diameter 0.30 mm.

While this species is not as common as *T. pacifica* Cushman it has occurred at numerous stations as follows: 223, 227, 466, 432, 285, Lowe-1, 232, 2065, 2019, 584, 585, C-10, ???38, 322, 330, 1034,



1043, 546, 2045, 1046, 2038, 2027, 2046, 2002, 2033, 2057, 2059, 2003, 2065, 2029, 2058, 2037, 2053, 2067, 2054, 2008, 2033.

The species is usually flatter than *T. pacifica* and the chambers are higher in the whorl, with the sutures more curved. The base is also flatter.

*Distribution.*—The records in this investigation indicate a range from San Francisco, California, to the Galapagos Islands, and Gorgona Island, Colombia.

### ***Trochammina nitida* H. B. Brady**

Plate 11, Figs. 7-9

*Trochammina nitida* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 52; Denkschr. Akad. Wiss. Wien, vol. 43, 1881, p. 100; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 339, pl. 41, figs. 5, 6.—Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 30, pl. 6, figs. 225-230.—Millett, Journ. Roy. Micr. Soc., 1899, p. 363.—Awerinzew, Mem. Acad. Imp. Sci. St. Petersburg, ser. 8, vol. 29, no. 3, 1911, p. 21.—Pearcey, Trans. Roy. Soc. Edinburgh, vol. 49, 1914, p. 1011.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 620; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916, p. 228, pl. 40, figs. 19-21.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 75, pl. 15, fig. 2.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 112.—Earland, *Discovery* Rep'ts, vol. VII, 1933, p. 86; l. c., vol. X, 1934, p. 101.—Hada, Zool. Mag., vol. 48, Oct., 1936, p. 855, text fig. 11.

Test small, trochoid, depressed, composed of about three volutions, flattened above, convex below, somewhat umbilicate, periphery evenly rounded; chambers numerous, about 9 in the last-formed whorl, all visible from above, only those of the last whorl from below, sutures straight or slightly curved, nearly at right angles to the periphery, slightly depressed; wall arenaceous, smoothly finished; aperture a curved slit near the base of the chamber; color gray brown, the last-formed chamber often light gray.

Diameter up to 0.50 mm.

This species resembles *T. inflata* (Montagu) in its wall characters. It is usually yellowish brown in color due to the excessive amount of cement but some specimens have a considerable amount of arenaceous material. The coil is very open on the dorsal side and the chambers unusually distinct for species of this genus. It has occurred in consider-

able numbers at some of the stations: A-4, A-5, A-6, A-9, A-21, 235, 227, 256, 265, 267, 268, 269, 274, 275, 292, 473, 474, 426, 330, 573, 579, 577, 534, 537, 535, 2067, 2033, 2051, 2037, 2070, 2065, 2062, 207, 39, 283, 73, 500, 412, 226, 1046, 290, 535.

*Distribution.*—From Cordova, Alaska, to Sechura, Peru.

### *Trochammina vesicularis* Goës

Plate 12, Fig. 1

*Trochammina vesicularis* Goës, Königl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 31, pl. 6, figs. 235-237.—Kiaer, Rep't Norwegian Fish. and Mar. Invest., vol. 1, no. 7, 1900, p. 44.—Heron-Allen and Earland, Journ. Linn. Soc. Zool., vol. 35, 1924, p. 616.—Earland, *Discovery* Rep'ts, vol. X, 1934, p. 103, pl. 3, figs. 44-46.

Test small, high spired, the height typically greater than the breadth, apex pointed, base rounded, composed of several whorls, with 4 or 5 chambers to the whorl, umbilicate; chambers distinct, inflated, of uniform shape, increasing rather rapidly in size as added, much rounded at the base; sutures distinct, somewhat depressed; wall arenaceous, with some larger fragments but smoothly finished; aperture ventral, a low opening at the base of the last-formed chamber.

Diameter 0.25-0.30 mm; height 0.35-0.40 mm.

Goës described this species from off Spitzbergen and Kiaer records it from off Norway and the Arctic. The other records are from off Lord Howe Island in the Pacific and from the Falklands sector of the Antarctic. It occurs at numerous stations along the Pacific Coast in cold water. The spire is much higher and the chambers more rotund than in the following species. It occurs at the following stations: 258, 535, 471, 275, 462, 534, 2070, 2063, 1025, 2029, 2005, 2002, 2065, 2033, 2024, 207, 226, 298.

*Distribution.*—An extensive range from San Miguel in 16 fms., to Lobos de Afuera Island, Peru, in 22 fms., with numerous intermediate stations off Mexico, in the Gulf of California, and off the Galapagos Islands.

### *Trochammina discorbis* Earland

Plate 11, Fig. 10

*Trochammina discorbis* Earland, *Discovery* Rep'ts, vol. X, 1934, p. 104, pl. 3, figs. 28-31.

“Test free, minute, a trochoid spiral of 3-4 convolutions, with five or sometimes only four chambers in the final convolution. Dorsal sur-

face highly convex, exhibiting all convolutions, which are slightly 'stepped' one below another. Ventral surface nearly flat but with a deeply sunk umbilicus, exhibiting only the chambers of the final convolution. Sutural lines recurved on dorsal side, straight on ventral, slightly depressed. Peripheral edge subacute. Aperture a small slit on inner edge of final chamber on ventral side. Constructed of very fine sand with much cement. Colour dark ferruginous brown, sometimes nearly black, but occasionally lighter. Surface smooth but not highly polished."

Diameter 0.20-0.35 mm; height 0.12-0.18 mm.

Earland described this species from the Falklands sector of the Antarctic. We have a very similar form in our material from the cold water of the eastern Pacific at a number of localities. Our specimens are minute but average a little larger than the measurements given by Earland. The ventral surface is much flatter than *T. vesicularis* Goës and the spire much lower. *T. discorbis* occurs at the following stations: 2065, 2005, 275, 2063, 2029, 2024, 2070, 583, 2057, A-1, 1046, 2063, 332, 299, 283, 226, 106, 113, 285, 268, 227, 258, 284, 534, 413, 420, 460, 461, 465, 471, 506, 223, 275, 2024, 2033, 1037, 2037, 299, 456, 258, 416, 473, 466, 462, 459, 456, 418, 410, 409, 557, 547, 553, 555, 519, 539, 532, 517, 501.

*Distribution*.—From Ketchikan, Alaska, in 8 fms. to Octavia Bay, Colombia, in 50 fms., with numerous intermediate stations for the Gulf of California, and for the Galapagos Islands.

### **Trochammina rotaliformis** J. Wright

Plate 12, Fig. 2

*Trochammina inflata* (Montagu), var., Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28 (Science), 1885, p. 331, pl. 13, figs. 11, 12.

*Trochammina rotaliformis* J. Wright, in Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1911, p. 309.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 52, pl. 3, figs. 11-13; Trans. Zool. Soc. London, vol. 20, 1915, p. 620.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 77, pl. 16, figs. 1, 2; Contrib. Canadian Biol., 1921 (1922), p. 8.—Heron-Allen and Earland, Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 126; British Antarctic Exped., Zoology, vol. 6, 1922, p. 114; Journ. Linn. Soc. Zool., vol. 35, 1924, p. 616.—Lacroix, Compte rendu Congres Lyon, Assoc. Fr. Avan. Sci. 1926, p. 421, text-fig. 5; Comptes rendus Acad. Sci., vol. 183, August 17, 1926, pp. 430, 431.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50,

1930, p. 71.—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 6, pl. 2, figs. 5a-c.—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 344.—Earland, l. c., vol. VII, 1933, p. 85; l. c., vol. X, 1934, p. 99.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 176.

This species was originally described from about the British Isles and from the records is a species of cold water. In our collections are numerous specimens which may be referred to this species. The ventral side is flattened, the dorsal side usually with a low spire. The wall is very variable, either of fine sand grains smoothly cemented or with included sponge spicules. The form is distinctly variable but the number of chambers in the adult varies little. It has occurred at the following stations: 288, 285, 284, 283, 256, C-11, A-1, 286, 275, 259, 249, 226, 2008, 2005, 2004, 2010, 2070, 2029, 2051, 2063, 2065, 2037, 1042, 411, 412, 413, 414, 416, 423, 447, 478, 481, 330, 461, 39.

*Distribution*.—From Ketchikan, Alaska, in 8 fms. to Sechura Bay, Peru, in 10 fms., with a number of stations between these two records.

**Trochammina squamiformis** Cushman and McCulloch, new species

Plate 12, Fig. 4

Test small, scalelike, dorsal side convex, ventral side concave, periphery rounded to subacute; chambers distinct in the earlier whorls which have 8-10 chambers, higher than broad, in the adult with the chambers becoming much lower than broad in the whorl and much reduced in number, on the ventral side triangular, often with a slightly raised liplike portion over the aperture; sutures curved, little if at all depressed on the dorsal side, ventrally radial or slightly tangential, often somewhat sigmoid; wall finely arenaceous, smoothly finished, with much cement, giving a yellowish-brown color, especially to the earlier whorls; aperture a low opening at the inner end of the margin of the ventral face of the last-formed chamber.

Diameter 0.25-0.30 mm; height 0.10 mm.

Holotype (AHF no. 19) from locality W-3.

This is a very small but abundant species and one which keeps its characters well. It differs from *T. rotaliformis* J. Wright in the smaller size, concave ventral side, and in the decided reduction in the number of chambers in the final whorl. It occurs at the following stations: W-3, 238, 241, 531, 2070, 1023, 1034, 2024, 2011, 2015, 2066, 2067, 2008, 2000, A-23, 457, 232, 263, 252, 462, 466, 258, 423, 473, 562, 579.

*Distribution.*—Type locality, Station W-3, Port Angeles, Washington, off Milwaukee Pier, in 2 fms. The range of this species in so far as the present investigations go, begins off the coast of Alaska, at Nurmy Island, medium low tide, and continues southward to Sechura Bay, Peru, in 12 fms.

**Trochammina carinata** Cushman and McCulloch, new species

Plate 12, Fig. 3

Test small, planoconvex, dorsal side convex, ventral side flattened or slightly concave, umbilicate, periphery typically with a thin platelike carina about the basal edge of the chamber, of the same material as that of the wall; chambers distinct, inflated, well set off from one another on the dorsal side, about six in the adult whorl, ventrally flattened, triangular, the inner end often with a distinct lobe; sutures distinct, nearly radial, depressed; wall finely arenaceous, smoothly finished; aperture ventral, a low opening at the inner end of the margin of the last-formed chamber.

Diameter 0.35-0.45 mm.

Holotype (AHF no. 20) from locality 226.

This species differs from *T. rotaliformis* J. Wright in the more rounded chambers, nearly radial sutures and the peripheral keel. The keel is very thin and delicate, and is easily broken away. The species occurs at the following stations: 226, 2064, 2063, 2067, 2065, 2036, 2070, 2005, 461, 275.

*Distribution.*—Type locality, off Guadalupe Island, in 96 fms. From this region southward, including the Gulf of California, to Tagus Cove, Albemarle Island, in 80 fms.

**Trochammina plicata** (Terquem)

*Patellina plicata* Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, p. 72, pl. 8, figs. 9a, b.

*Trochammina plicata* Balkwill and Wright, Journ. Micr., vol. 3, 1884, p. 26, pl. 1, fig. 8.—Halkyard, Trans. Ann. Rept. Manchester Micr. Soc., 1889, p. 69, pl. 1, fig. 11.—J. Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 469.—Millett, Journ. Roy. Micr. Soc., 1899, p. 363, pl. 5, fig. 13.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 51; Trans. Zool. Soc. London, vol. 20, 1915, p. 619; Trans. Linn. Soc. London, vol. 11, pt. 13, 1916,

p. 227.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 2, 1920, p. 76, pl. 15, fig. 4.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 112.—Lacroix, Bull. Institut. Oceanographique, no. 549, 1930, p. 16, fig. 21a, b, (in text).—Sidebottom, Journ. Roy. Micr. Soc., 1918, p. 17, pl. 2, fig. 18.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 71.

There is a single specimen from Station 2008 that is evidently this species. Most of the records for the species are from about the British Isles or in the Atlantic or Mediterranean. There are records for it from off Australia and a single specimen is recorded by Heron-Allen and Earland from the Antarctic.

*Distribution*.—Cabeza Ballena Point, Lower California, Mexico, in 70 fms.

Genus **CARTERINA** H. B. Brady, 1884  
**Carterina spiculotesta** (Carter)

*Rotalia spiculotesta* Carter, Ann. Mag. Nat. Hist., ser. 4, vol. 20, 1887, p. 470, pl. 16; ser. 5, vol. 3, 1879, p. 144; ser. 5, vol. 5, 1880, p. 452.

*Carterina spiculotesta* H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 346, pl. 41, figs. 7 to 10.—Millett, Journ. Roy. Micr. Soc., 1899, p. 365.—Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, p. 184.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., 1905, p. 6, pl. 1, fig. 10.—Heron-Allen and Earland, Trans. Linn. Soc. Zool., vol. 20, 1915, p. 620.—Cushman, Carnegie Instit. Washington, Publ. no. 311, 1922, p. 21, pl. 1, fig. 5.—Heron-Allen and Earland, Journ. Linn. Soc. Zool., vol. 35, 1924, p. 616.—Cushman, Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 18, figs. 4, 5.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 177.

Test normally adherent, rotaliform, biconvex, the dorsal side rounded, ventral side slightly rounded, flattened or concave in the central portion, umbilicate, composed of 3 or 4 volutions, the earlier ones regular, the later ones becoming irregular; chambers distinct; walls thin, translucent, composed largely of fusiform calcareous spicules, with a calcareous cement; aperture small, at the umbilical margin of the ventral side of the last-formed chamber, with a slight lip; color of the central part dark brown, the later-formed portion white.

Diameter 0.25-0.35 mm.

This species has been recorded almost entirely from the Pacific. Single specimens were found at stations: 462, 260, 271, 275, 424, 425, 2033, 2035, 2037.

*Distribution.*—The records so far place this species in the Gulf of California, Angel de la Guardia; southward into the region of the Galapagos Islands with one record at Sullivan Bay, James Island, in 14 fms.

Genus **NOURIA** Heron-Allen and Earland, 1914  
**Nouria polymorphinoides** Heron-Allen and Earland

Plate 12, Figs. 5-10

*Nouria polymorphinoides* Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1914, p. 376, pl. 37, figs. 1-15; 1915, p. 615.—Cushman, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 601, pl. 75, figs. 4, 5.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 103.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 3, pt. 4, 1927, p. 189; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 142.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. VI, 1931, p. 93, fig. 45 (in text).—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 346, pl. 8, figs. 25, 26.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 1, 1932, p. 78, pl. 17, figs. 9a, b; Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 18, figs. 12, 13.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 177.

Our series of figures shows the very great amount of range in materials of which the wall of the test is made in this species. This varies from nearly pure, coarse sand grains to large, flaky, calcareous fragments. When compared with the same stations from which *Reophax* and other arenaceous forms show similar characters, it is evident that bottom conditions and the available material very largely account for this wide range. The sutures are almost completely hidden in those specimens with very rough flaky exteriors and often in those composed largely of sand grains, but enough specimens show the sutures and chambers to warrant placing the whole series under this specific name. This is one of the most common and widely distributed species in our collections occurring at the following stations: 2027, 2026, 2046, 2013, 2061, 2062, 2044, 2067, 298, 245, 255, 244, 2047, 248, 2028, 557, 300, 323, 324, 286, 320, 215, 319, 254, 547, 546, Lowe-1, 290, 265, 253, 241, 200, 2017, 317, 311, 321, 264, 284, 285, 503, 2012, 281, 2021,

2025, 2030, 2032, 2038, 2055, 2057, 2035, 2046, 2054, 282, 217, 519, 409, 413, 513, 534, 509, 254, 238, 278, 260, 264, 508, 237, 271, 272; 305, 554, 555, 539, H-25, 583, 252, 280, 296, 268, 258, 266, 239, 292; 2048, 2050, 2042, 2045, 2039, 2037, 2031, 2034, 2023, 2029, 2015, 2020, 2007, 2008, 584, 585, 331, 330, 2075, 333, 581, 473, 249.

*Distribution*.—Widely distributed off Mexico, the Gulf of California, off Central America, Galapagos Islands, and South America, at various depths.

### *Nouria harrisii* Heron-Allen and Earland

Plate 12, Figs. 11-13

*Nouria harrisii* Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1914, p. 376, pl. 37, figs. 16-20.—Cushman, Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 100.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 103.—Cushman, Publ. 342, Carnegie Instit., 1924, p. 10, pl. 1, fig. 1.—Heron-Allen and Earland, *Discovery* Rep'ts, vol. IV, 1932, p. 346.—Earland, l. c., vol. VII, 1933, p. 88, pl. 3, figs. 14-16.

This species differs from the preceding in the characters of the wall, being made almost entirely of sponge spicules. This seems to be a definitely selective character as both species were found occasionally at the same station without any real intermediate stages. It has a wide distribution according to the published records. In our material it has occurred at the following stations: 1047, 1046, 226, 283, 299, 441, 461, 227, 80, 2070, 2005, 2051, 2063, 2064, 2010, 2065, 1037.

*Distribution*.—In Monterey Bay in 85 fms.; in Tagus Cove, Albe-marle Island, Galapagos, in 80 fms.; in the Gulf of California, off San Pedro Nolasco Island, in 60 fms.; off Catalina, at Long Point in 120 fms.

### Family Placopsilinidae

Genus **PLACOPSILINA** d'Orbigny, 1850

**Placopsilina bradyi** Cushman and McCulloch, new species

Plate 12, Figs. 14, 15

*Placopsilina cenomana* H. B. Brady (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 315, pl. 36, figs. 1-3.

Test attached, the early portion coiled, trochoid, later uncoiling and uniserial in an irregular course over the base of attachment; chambers distinct, increasing very little in size as added and of fairly uniform



shape; sutures slightly depressed; wall composed of sand grains, some rather coarse but with much cement and the surface fairly smooth; aperture at or above the base in the outer wall of the last-formed chamber. Length up to 3.00 mm.

Holotype (AHF no. 21) from locality 2024.

There are several specimens from the type locality attached to shell fragments. These seem in every way identical with the specimens figured by Brady in the *Challenger* Report. There are numerous Recent records for this species but most of them are unaccompanied by figures. The Recent species is not the same as the Cretaceous one described by d'Orbigny. It occurs also at localities 2034, 2065, 2017, 2009, 2044, 2070, 2057.

In our material there are a very few specimens attached to echinoid spines or to sponge spicules, one of which is figured. These are very slender, perhaps due to the small amount of surface and may represent another species. Material was not in sufficient quantity to be certain of this.

The slender forms are from localities 2005, 1046.

*Distribution.*—Type locality, off Idefonso Island, Mexico, in 55 fms. The range continues as far as Consag Rock in the Gulf of California; off Lower California, Mexico, on the ocean side northward to San Miguel, in 120 fms. for the slender form of this species.



08.3  
87

3-4-40

# ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 2

## SOME *TEXTULARIIDAE* OF THE PACIFIC OCEAN

(PLATES 13-16)

BY

C. G. LALICKER and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA  
1940



REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA, AND GALA-  
PAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, AND IN 1938.

SOME *TEXTULARIIDAE* OF THE  
PACIFIC OCEAN

(PLATES 13-16)

By C. G. LALICKER and IRENE McCULLOCH

THE UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS  
ALLAN HANCOCK PACIFIC EXPEDITIONS  
VOLUME 6, NUMBER 2  
ISSUED JANUARY 10, 1940

---

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

8,3  
7

## SOME *TEXTULARIIDAE* OF THE PACIFIC OCEAN

(PLATES 13-16)

C. G. LALICKER and IRENE McCULLOCH

This is the second report of a series of papers presenting the results of studies being made on the foraminiferal collections of the Allan Hancock Foundation, The University of Southern California. Most of the foraminifera discussed in this paper were collected in shallow waters on the seven major cruises of the *Velero III*, under the command of Captain Allan Hancock, into tropical waters of the eastern Pacific beginning at San Pedro, California, and continuing southward to the Bird Islands off Peru. The stations where specimens of Textulariidae were found are listed at the end of the discussion for each of the species described in this paper. Such lists refer to the tables of stations for bottom samples given in the first report. (See pp. 3-30, J. A. Cushman and Irene McCulloch, A report on some Arenaceous Foraminifera, Allan Hancock Pacific Expeditions, 1939, Vol. 6, no. 1, pp. 1-113, pls. 1-12.)

Some very interesting facts concerning the distribution and migration of a number of species of foraminifera have come to our attention in the course of this study. *Textularia articulata* d'Orbigny, which has been reported as living off the west coast of France, is living also off the west coast of the Americas from California southward to Peru. This species, which is common in Miocene sediments of the Vienna Basin, France, Florida, and New Zealand, is established as one of the group having world-wide distribution. *T. calva* Lalicker, which has been noted only in the vicinity of the West Indies and in the Caribbean Sea, has a wide distribution in the Pacific Ocean. *T. lythostrota* (Schwager), which is present in Pliocene sediments of Kar Nicobar and New Guinea, has been found in these collections. Of still greater interest is the presence of so many of d'Orbigny's species from the vicinity of the West Indies. *T. agglutinans*, *T. candeiana*, *T. conica*, and *T. saulcyana* are rather common in these collections. These species may have migrated before the uplift of a land bridge between North and South America during Pliocene time or during one of the warm interglacial stages of Pleistocene time when the level of the sea was higher than at the present time.

The results of studies on the extensive collections of the Allan Hancock Pacific Expeditions in other fields are pointing in the same general direction, particularly with reference to new species. The results so far indicate that the majority of new species is to be expected in the Gulf of California and in the vicinity of the Galapagos Islands. *T. astutia* is restricted to the waters of the Gulf of California. *T. orbica*, *T. lauta*, *T. ramosa*, and *T. vola* have been found only in the vicinity of the Galapagos Islands.

Since there is a possibility of collecting more material from year to year, a certain amount of material containing new species has been set aside for the time being to avoid later difficulties.

The holotypes and paratypes of the new species described in this report are a part of the collections of the Allan Hancock Foundation, The University of Southern California, Los Angeles. Paratypes are to be deposited in the U. S. National Museum, Washington, D.C., and in the Cushman Laboratory for Foraminiferal Research, Sharon, Mass.

### ***Textularia abbreviata* d'Orbigny**

Plate 13, Figs. 1a, b, c

*Textularia abbreviata* d'Orbigny, Foram. Fossiles Vienne, 1846, p. 249, pl. 15, figs. 9-12; Egger, Neues Jahrb., 1857, p. 293, pl. 12, figs. 17, 18; Fornasini, Boll. Soc. Geol. Ital., vol. 6, 1887, pl. 11, figs. 1, 3; Terrigi, Atti R. Accad. Lincei, ser. 4, Mem. vol. 6, 1893, p. 109, pl. 5, fig. 3; Egger, Jahresb. Nat. Ver. Passau, vol. 16, 1895, p. 8, pl. 1, figs. 2a-c; Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 10, 1903, p. 9, pl. O, fig. 10; Cushman, U. S. Nat. Mus. Bull. 71, pt. 2, 1911, p. 14, fig. 20 (in text); U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 122, pl. 21, figs. 2a, b.

Test very short, subrhomboidal in front view, almost as thick as wide, periphery subacute to rounded; chambers numerous, increasing very rapidly in height as added, wider than high, inflated slightly; sutures distinct, depressed, nearly straight, but curving downward slightly near peripheral margin, much oblique; wall coarsely arenaceous with a moderate amount of cement, smoothly finished; aperture a broad low slit at the inner margin of the last-formed chamber. Length, up to 1.00 mm.; greatest width, 1.00 mm.; thickness, about 0.85 mm.

This species has been noted from the Miocene of central Europe, the Pliocene of Italy, and many localities in the present oceans. It has been



found at the following Hancock Expedition stations: 25, 239, 415, 417, 482, 1023, 1042, and 1044.

*Distribution.*—Off Point Arguella, California, in 36 fms.; off San Pedro in 170 fms.; off Cape San Lucas, Mexico, in 33 fms.; in the region of Duncan Island, Galapagos, in 55 to 250 fms.

### ***Textularia agglutinans* d'Orbigny**

Plate 13, Figs. 2a, b, c

*Textularia agglutinans* d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères," 1839, p. 136, pl. 1, figs. 17, 18, 32, 34; H. B. Brady, Rep. Voy. *Challenger*, Zoöl., vol. 9, 1884, pl. 43, figs. 1a, b; Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 41; Flint (part), Rep. U. S. Nat. Mus., 1897, p. 284, pl. 29, fig. 4; Cushman, U. S. Nat. Mus. Bull. 71, pt. 2, 1911, p. 9, figs. 10a, b (in text); Proc. U. S. Nat. Mus., vol. 59, 1921, p. 49, pl. 11, figs. 1-3; U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 106, pl. 20, fig. 8; Carnegie Inst. Washington Publ. 311, 1922, p. 22, pl. 1, fig. 6; U. S. Nat. Mus. Bull. 104, pt. 3, 1922, p. 7, pl. 1, figs. 4, 5; Carnegie Inst. Washington Publ. 344, 1926, p. 76; U. S. Nat. Mus. Bull. 161, pt. 1, 1932, p. 10, pl. 2, figs. 5-7; Lacroix, Bull. Institut. Oceanogr. no. 591, 1932, p. 16, fig. 14 (in text).

Test elongate, tapering, very little compressed, periphery rounded, the increase in diameter from the initial end rather uniform, sides in adult portion nearly parallel; chambers inflated, wider than high, increasing somewhat in height toward the apertural end rather uniformly; sutures distinct, depressed, usually about at right angles to the long axis of the test; wall rather coarsely arenaceous, but smoothly finished; aperture an elongate slit in a definite re-entrant at the base of the inner margin of the last chamber, with a slight upper lip. Length, 0.80-1.00 mm.; width, 0.50-0.60 mm.

This species is especially common in the shallow waters adjacent to the West Indies. It has been reported from many localities in the Tropical Pacific. It is common in the Miocene of Florida and is present in the Pliocene of Italy. It has been noted at the following Hancock Expedition stations: 423, 469, 472, and 507. It is not common at any locality in the Hancock Collections.

*Distribution.*—Braithwaite Bay, Socorro Island, Mexico, in 13 fms.; Charles and Hood islands, Galapagos, in 10 fms.; off La Libertad, Ecuador, in 8-12 fms.

**Textularia articulata** d'Orbigny

Plate 13, Figs. 3a, b, c, d

*Textularia articulata* d'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, 1846, p. 250, pl. 15, figs. 16-18; Hosi-us, Naturhist. Ver. Preuss. Rheinlande Verh., vol. 50, 1893, p. 109; Bagg, Bull. Am. Pal., vol. 2, no. 10, 1898, p. 19; Maryland Geol. Survey, Miocene, 1904, p. 471, pl. 132, figs. 6, 7; Cushman, U. S. Geol. Surv. Bull. 676, 1918, p. 46; Cushman and Valentine, Contr. Dept. Geol. Stanford Univ., vol. 1, no. 1, 1930, p. 8, pl. 1, figs. 4a, b; Cushman and Cahill, U. S. Geol. Surv. Prof. Paper 175-A, 1933, p. 8, pl. 1, figs. 12a, b.

*Textularia mariae* d'Orbigny, Foraminifères fossiles du bassin tertiaire de Vienne, 1846, p. 246, pl. 14, figs. 29-31.

*Plecanium mariae* (d'Orbigny), var. *inermis* Reuss, Sitz. k. Ak. Wiss. Wien, vol. 55, Abth. 1, 1867, p. 64, pl. 1, figs. 5-7.

*Plecanium spinulosum* Reuss, Sitz. k. Ak. Wiss. Wien, vol. 55, Abth. 1, 1867, p. 65, pl. 1, figs. 3a, b.

*Plecanium elegans* Hantken, Magyar. Földt. Társ. Munkalátai, vol. 4, 1869, p. 83, pl. 1, figs. 5a, b.

*Plecanium lanceolatum* Karrer, Sitz. k. Ak. Wiss. Wien, vol. 58, Abth. 1, 1868, p. 129, pl. 1, fig. 2.

*Textularia lobata* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 263; Fornasini, Riv. Ital. Pal., vol. 7, 1901, p. 105, pl. 3, fig. 5.

*Textularia acuta* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 263; Fornasini, Riv. Ital. Pal., vol. 7, 1901, p. 105, pl. 3, fig. 2.

*Textularia consecta* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 262; Fornasini, Riv. Ital. Pal., vol. 7, 1901, p. 104, pl. 3, fig. 1.

*Textularia elongata* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 263; Fornasini, Riv. Ital. Pal., vol. 7, 1901, p. 105, pl. 3, fig. 4.

Test elongate, two to five times as long as broad, typically compressed, but may be rounded in the adult portion, sides nearly parallel, periphery acute and slightly keeled, in some cases marked by short spines; chambers distinct, high and increasing in height toward the apertural end; sutures distinct, straight to somewhat curved, oblique; wall distinctly arenaceous, with much cement, but usually very smoothly finished; aperture rather large, a high arched slit at the base of the inner margin of the last-formed chamber. Length, up to 2.50-3.00 mm.; width, 0.30-0.45 mm.; thickness, 0.18-0.24 mm.

This species is widely distributed and ranges from Miocene to Recent. It was originally described by d'Orbigny from the Miocene of the Vienna Basin and has been recorded from the Miocene of Germany, Hungary, France, Florida, and New Zealand. It is living off the west coast of France and has been noted at the following Hancock Expedition stations: 39, 62, 76, 81, 83, 101, 208, 213, 215, 231, 259, 260, 263, 265, 272, 280, 295, 306, 324, 414, 437, 473, 504, 535, 573, 577, 579, 585, 1022, 1023, 2007, 2012, 2020, 2025, 2027, 2034, 2035, 2044, 2046, 2047, 2048, 2050, 2061, 2066, 2067, 2073, and 2075.

*Distribution.*—Numerous station records off the Channel Islands, California, southward into the Gulf of California and to Sechura Bay, Peru, with a depth range of 5 to 106 fms. off Mexico.

### **Textularia astutia** Lalicker and McCulloch, new species

Plate 13, Figs. 4a, b, c

Test small, subtriangular in front view, biconvex in top view, compressed, periphery acute, slightly keeled, lobulate; chambers slightly inflated, wider than high, the peripheral portion compressed into a keel, with a suggestion of a spine at the lower margin; sutures distinct, depressed, curving upward gently in the middle portion of the chamber and sharply downward near the periphery; wall rather thick, finely arenaceous, smoothly finished, composed of fine arenaceous grains cemented with calcareous cement; aperture a somewhat narrow, low opening at the inner margin of the chamber, in a well-developed re-entrant. Length of holotype, 0.58 mm.; width, 0.44 mm.; thickness, 0.23 mm.

Holotype (AHF no. 22) from Hancock Expedition Station 2013, west of San Lorenzo Channel, Lower California, Mexico, approximately in latitude 24° N., longitude 110° W., depth 30 fms. It has also been noted at stations 2030, 2043, and 2057.

*Distribution.*—In shallow waters of the Gulf of California, Mexico.

### **Textularia aura** Lalicker and McCulloch, new species

Plate 13, Figs. 5a, b, c

Test small, compressed, somewhat club shaped in front view, sub-ovate in top view, peripheral margin subacute in early portion, rounded in later chambers; chambers numerous, low and broad except the last pair, which are as high as broad, inflated; sutures distinct, depressed, straight, and oblique to the transverse axis; wall finely arenaceous and

smoothly finished; aperture a low, broad slit at the base of the last chamber, in a deep re-entrant. Length of holotype, 0.54 mm.; maximum width, 0.37 mm.; maximum thickness, 0.26 mm.

Holotype (AHF no. 23) from Hancock Expedition Station 516, Gulf of Guayaquil, Ecuador, latitude  $2^{\circ} 59' S.$ , longitude  $81^{\circ} 12' W.$ , depth 12 fms. It has also been noted at stations 7, 39, 55, 111, 136, 331, 332, 503, 505, 509, 516, 517, 531, 540, 543, 547, 553, 558, 584, 2008, 2036, 2043, 2057, 2058, and 2079.

This species is somewhat like *Textularia candeiiana* d'Orbigny, but differs in being much smaller, in having more and lower chambers, in increasing in thickness gradually instead of flaring much in the apertural chambers, and in being subovate in top view instead of rounded as in *T. candeiiana*.

*Distribution.*—In shallow waters from California southward into the Gulf of California and off the coast of Peru.

### ***Textularia calva* Lalicker**

Plate 13, Figs. 6a, b, c, d

*Textularia calva* Lalicker, Smithsonian Misc. Coll., vol. 91, no. 22, 1935, p. 1, pl. 1, figs. 1, 2.

Test very large, elongate, roughly triangular in front and side views, broadly ovate in end view, initial end slightly compressed, pointed in the microspheric form, and rounded in the megalospheric form; chambers numerous, low and broad, increasing in height gradually as added; sutures indistinct except in early portion, somewhat depressed, straight, and slightly oblique; wall coarsely arenaceous, composed of sand grains and calcareous fragments, very roughly finished except on apertural face, where it is rather smoothly finished; aperture a very low, broad opening at the base of the inner margin of the last-formed chamber; color gray. Length, up to 1.75 mm.; width, up to 1.10 mm.; thickness, up to 1.04 mm.

This species was first noted in the waters of the West Indies and is especially common in the Caribbean Sea. It is common in the collections of the Hancock Expeditions, having been found at the following stations: 238, 245, 246, 252, 253, 254, 258, 265, 266, 277, 280, 292, 319, 322, 324, 545, 555, 2007, 2012, 2013, 2020, 2032, 2034, 2039, 2044, 2045, 2046, 2048, 2052, 2053, 2065, and 2067.

*Distribution.*—Numerous station records in the Gulf of California, southward to Colombia in 1 to 75 fms.

**Textularia candeiana** d'Orbigny

Plate 13, Figs. 7a, b, c

*Textularia candeiana* d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères," 1839, p. 143, pl. 1, figs. 25-27; Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 10, 1903, pl. O, fig. 8; Chapman, Rep. Foram. Subantarctic Islands, New Zealand, 1909, p. 329; Cushman, U. S. Nat. Mus. Bull. 71, pt. 2, 1911, p. 12, figs. 14-17 (in text); Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, pt. 2, 1915, p. 627, pl. 47, figs. 10-16; Trans. Linn. Soc. London, vol. 11, ser. 2, 1916, p. 230, pl. 41, figs. 1, 2; Journ. Roy. Micr. Soc., 1916, p. 41; Cushman, Carnegie Inst. Washington Publ. 291, 1922, p. 32; Proc. U. S. Nat. Mus., vol. 59, 1921, p. 50, pl. 11, figs. 7, 8; U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 109; Carnegie Inst. Washington Publ. 311, 1922, p. 32, pl. 2, fig. 2; U. S. Nat. Mus. Bull. 104, pt. 3, 1922, p. 8, pl. 1, figs. 1-3; Heron-Allen and Earland, British Antarctic Exped., Zool., vol. 6, 1922, p. 119; Journ. Linn. Soc. Zool., vol. 35, 1924, p. 618; Hanzawa, Jap. Journ. Geol. Pal., vol. 4, 1925 (1926), p. 38 (table); Cushman, Carnegie Inst. Washington Publ. 344, 1926, p. 76; U. S. Nat. Mus. Bull. 161, pt. 1, 1932, p. 9, pl. 2, figs. 4a, b.

*Textularia sagittula* Defrance, var. *candeiana* Millet, Journ. Roy. Micr. Soc., 1899, p. 562, pl. 7, fig. 2.

Test elongate, roughly triangular in front view, club shaped in side view, ovate in top view, the early portion slender and compressed, expanding gradually to the rounded adult portion, the peripheral margin subacute in the early portion and broadly rounded in the upper portion; chambers numerous, low, broad, and flat in the early portion, later chambers enlarge rapidly, the final ones being much inflated; sutures distinct, slightly depressed, straight and oblique; wall rather coarsely arenaceous, being composed of fine and coarse sand grains embedded in a matrix of calcareous cement, smoothly finished; aperture a broad, low slit at the base of the inner margin of the last-formed chamber. Length, up to 1.00 mm.; maximum width, 0.65 mm.; maximum thickness, 0.50 mm.

This species, which is common in the waters adjacent to the West Indies, has been found at the following Hancock Expedition stations: 113, 213, 238, 243, 278, 300, 311, 314, 315, 316, 317, 320, 325, 409, 410, 421, 425, 426, 447, 459, 465, 468, 511, 545, 573, and 2011.

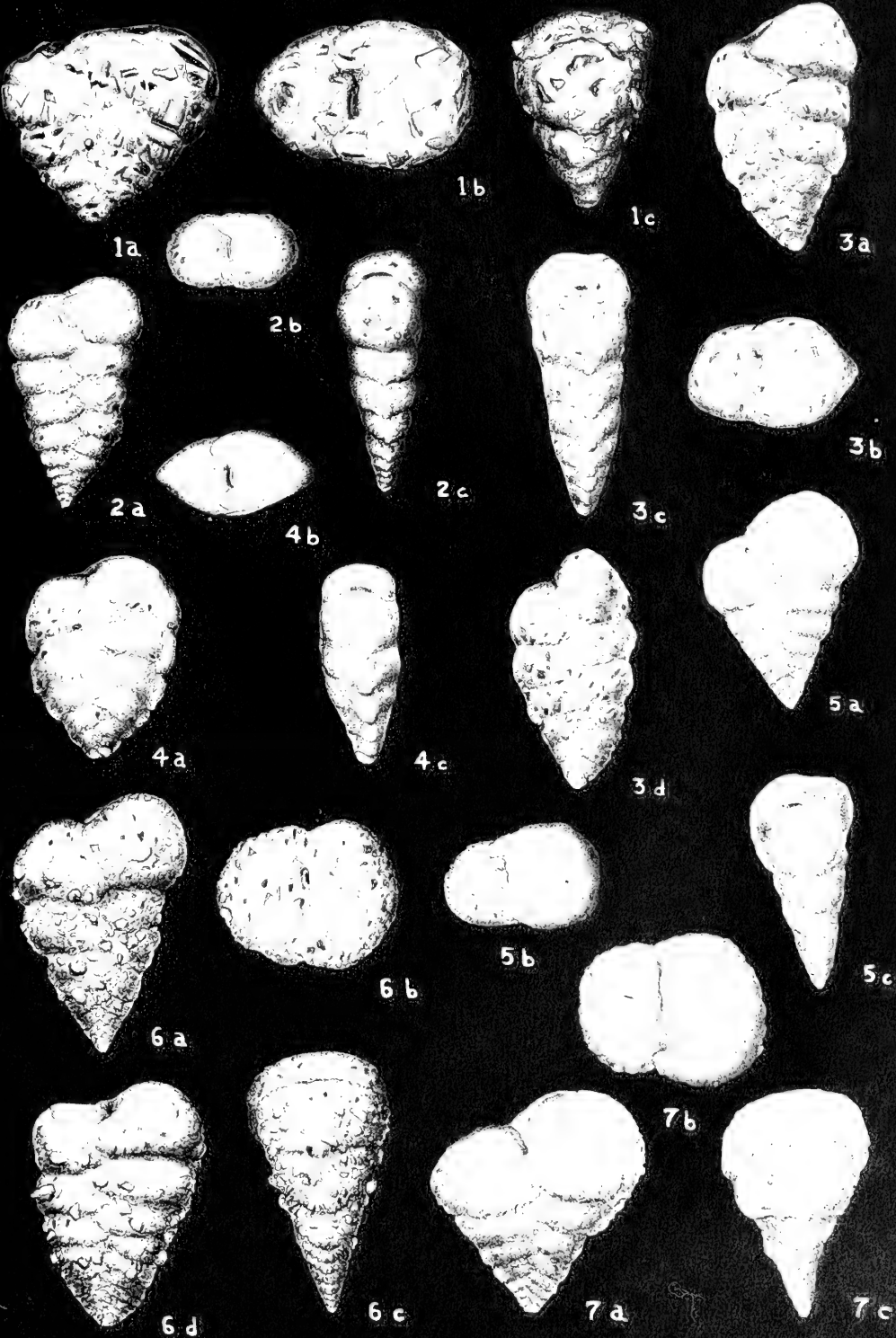
*Distribution.*—In the Gulf of California, off Catalina, southward to Peru with a depth range of 3 to 32 fms.

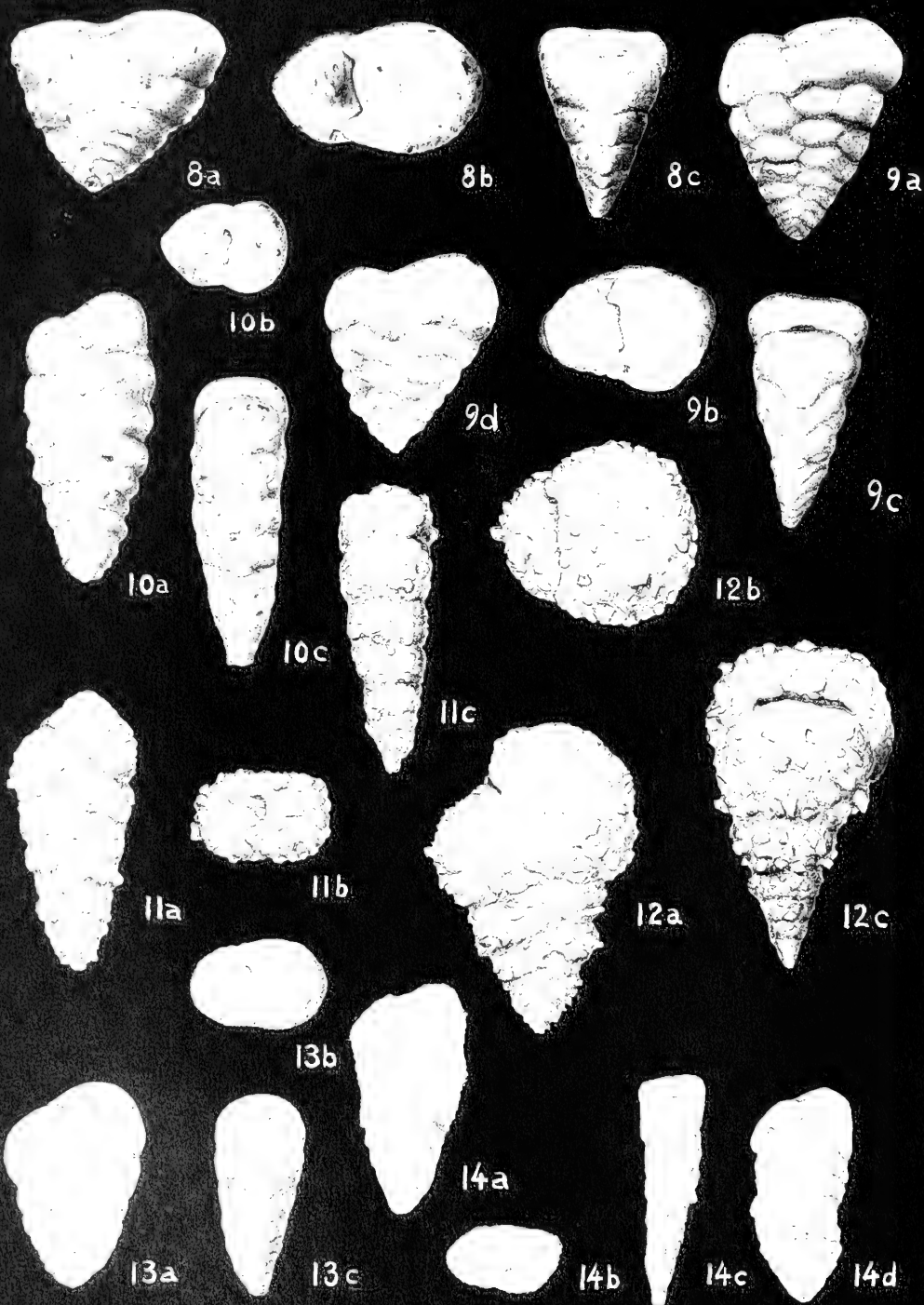
## EXPLANATION OF PLATE 13

## FIGS.

1. *Textularia abbreviata* d'Orbigny. x 40. *a*, front view; *b*, apertural view; *c*, side view. Station 1042.
2. *Textularia agglutinans* d'Orbigny. x 70. *a*, front view; *b*, apertural view; *c*, side view. Station 472.
3. *Textularia articulata* d'Orbigny. x 50. *a*, front view; *b*, apertural view; *c*, side view. Station 215. *d*, front view. Station 83.
4. *Textularia astutia* Lalicker and McCulloch, new species. Holotype. x 70. *a*, front view; *b*, apertural view; *c*, side view. Station 2013.
5. *Textularia aura* Lalicker and McCulloch, new species. Holotype. x 80. *a*, front view; *b*, apertural view; *c*, side view. Station 516.
6. *Textularia calva* Lalicker. Microspheric form. x 40. *a*, front view; *b*, apertural view; *c*, side view; *d*, megalospheric form, front view. Station 253.
7. *Textularia candeiana* d'Orbigny. x 65. *a*, front view; *b*, apertural view; *c*, side view. Station 421.

All illustrations were made by Miss Ann Shepard.







## EXPLANATION OF PLATE 14

## FIGS.

8. *Textularia conica* d'Orbigny. x 90. *a*, front view; *b*, apertural view; *c*, side view. Station 411.
9. *Textularia corrugata* Heron-Allen and Earland. x 70. *a*, front view; *b*, apertural view; *c*, side view; *d*, front view. Station 312.
10. *Textularia fistula* Cushman. x 40. *a*, front view; *b*, apertural view; *c*, side view. Station 2039.
11. *Textularia foliacea* Heron-Allen and Earland. x 40. *a*, front view; *b*, apertural view; *c*, side view. Station 239.
12. *Textularia foliacea* Heron-Allen and Earland, var. *oceanica* Cushman. x 40. *a*, front view; *b*, apertural view; *c*, side view. Station 293.
13. *Textularia gramen* d'Orbigny. x 60. *a*, front view; *b*, apertural view; *c*, side view. Station 3.
14. *Textularia lancea* Lalicker and McCulloch, new species. Holotype. x 70. *a*, front view; *b*, apertural view; *c*, side view; *d*, paratype, front view. Station 412.

**Textularia conica** d'OrbignyPlate 14, Figs. 8*a, b, c*

*Textularia conica* d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères," 1839, p. 143, pl. 1, figs. 19, 20; H. B. Brady, Rep. Voy. *Challenger*, Zool., vol. 9, 1884, p. 365, pl. 43, figs. 13, 14; pl. 113, fig. 1; Goës, Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 43; Cushman, Proc. U. S. Nat. Mus., vol. 59, 1921, p. 50, pl. 11, figs. 4-6; U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 123, pl. 25, figs. 2*a-c*; Carnegie Inst. Washington Publ. 311, 1922, p. 24, pl. 2, fig. 4; U. S. Nat. Mus. Bull. 104, pt. 3, 1922, p. 22, pl. 5, figs. 5-7; Carnegie Inst. Washington Publ. 342, 1924, p. 15, pl. 1, fig. 6; U. S. Nat. Mus. Bull. 161, 1932, p. 11, pl. 2, figs. 8-10; pl. 3, figs. 1, 3.

Test small, triangular in front view, usually wider than high, broadly oval in end view, somewhat compressed, peripheral margin subacute, initial end bluntly pointed; chambers comparatively few, low and broad, gradually increasing in height as added, slightly inflated; sutures distinct, slightly depressed, nearly horizontal but tending to curve downward near the peripheral margin; wall arenaceous, smooth or slightly roughened with a large proportion of calcareous cement; aperture a narrow slit at the base of the inner margin of the last-formed chamber. Length, up to 1.00 mm.; greatest width, up to 1.00 mm.; thickness, up to 0.50 mm.

*Textularia conica* d'Orbigny is widely distributed in the waters adjacent to the West Indies. It has been noted at a number of localities in the Tropical Pacific. It is present at the following Hancock Expedition stations: 58, 62, 227, 238, 275, 306, 320, 322, 329, 330, 401, 411, 412, 413, 414, 416, 421, 423, 457, 458, 460, 461, 462, 463, 464, 465, 466, 467, 468, 470, 473, 478, 481, 505, 540, 584, 1048, 2010, 2035, and 2074.

*Distribution*.—In Gulf of California, off Mexico, Central America, Colombia, and the Galapagos Islands, in 1 to 111 fms.

**Textularia corrugata** Heron-Allen and EarlandPlate 14, Figs. 9*a, b, c, d*

*Textularia conica* d'Orbigny, var. *corrugata* Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 629, pl. 47, figs. 24-27.

*Textularia corrugata* Cushman (not Costa), U. S. Nat. Mus. Bull. 161, pt. 1, 1932, p. 12, pl. 3, figs. 2, 4.

Test short and broad, triangular in front view, compressed, subovate in end view, peripheral margin subacute, thickest in central portion; chambers numerous, highly inflated at upper margin, depressed at lower margin, much broader than high; sutures very distinct, depressed, curving upward in the middle portion and downward near peripheral margin; wall distinctly arenaceous, composed of fine sand grains with considerable cement, giving it a smooth finish; aperture a low, broad opening at the base of the inner margin of the last-formed chamber, in a distinct re-entrant. Length and breadth, up to 1.00 mm.

This species has been reported from the Kerimba Archipelago and from various localities in the Tropical Pacific. It is present at the following Hancock Expedition stations: 62, 73, 203, 205, 206, 207, 209, 223, 224, 228, 229, 244, 249, 255, 256, 259, 260, 265, 271, 275, 283, 285, 286, 289, 292, 312, 317, 322, 328, 329, 413, 414, 416, 469, 500, 545, 554, 557, 585, 2005, 2009, 2010, 2011, 2013, 2015, 2019, 2020, 2021, 2023, 2024, 2027, 2029, 2033, 2049, 2051, 2057, 2060, 2062, 2063, 2064, 2065, and 2066.

*Distribution.*—Widely distributed in shallow waters in the Gulf of California, off Mexico, Central America, Colombia, Ecuador, and the Galapagos Islands.

### ***Textularia fistula* Cushman**

Plate 14, Figs. 10*a*, *b*, *c*

*Textularia agglutinans* d'Orbigny, var. *fistula* Cushman, U. S. Nat. Mus. Bull. 71, pt. 2, 1911, p. 10, fig. 11 (in text); U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 107.

Test large, elongate in front view, sides nearly parallel in adult specimens, initial end rounded, subovate in top view, somewhat compressed, periphery subacute; chambers numerous, wider than high, gradually increasing in height as added, slightly inflated, short spines being developed on the peripheral margin of the chambers in some specimens; sutures distinct, straight, horizontal, somewhat depressed; wall rather coarsely arenaceous, composed of arenaceous and calcareous fragments cemented with calcareous cement; aperture a broad, low slit at the inner margin of the last chamber. Length, up to 2.00 mm.

This species is common in the Oligocene deposits of Australia and New Zealand. It is present in Miocene sediments in Australia, Panama, and Europe. It has been reported from a number of localities in the Pa-

cific Ocean and has been noted at Hancock Expedition stations 2019 and 2039, where it is not common.

*Distribution.*—The station records indicated above place this species on the ocean side of the Gulf of California, in 8 and 9 fms.

***Textularia foliacea* Heron-Allen and Earland**

Plate 14, Figs. 11*a, b, c*

*Textularia foliacea* Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 628, pl. 47, figs. 17-20; Cushman, U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 117, pl. 19, figs. 7*a, b*; Carnegie Inst. Washington Publ. 342, 1924, p. 14, pl. 2, figs. 2-4; pl. 3, fig. 1; U. S. Nat. Mus. Bull. 161, pt. 1, 1932, p. 8, pl. 1, figs. 6-10.

Test subtriangular in front view, ovate in top view, compressed, increasing gradually in width from the initial end, periphery rounded; chambers numerous, somewhat wider than high, inflated; sutures depressed, usually strongly marked, but obscure in some specimens, oblique; wall roughly finished, composed of sand grains and calcareous fragments cemented with a calcareous cement; aperture a rather large, high opening at the base of the inner margin of the chamber, in a slight re-entrant. Length, up to 2.00 mm.

This species was first described by Heron-Allen and Earland from the Kerimba Archipelago. It was recorded by Cushman at a large number of stations in the shallow waters of the Tropical Pacific. It is present at numerous Hancock Expedition stations and is most common in water less than 50 fms. in depth. It was, however, noted at one station at a depth of 133 fms. It has been found at the following stations: 58, 77, 215, 217, 225, 237, 239, 252, 253, 254, 255, 257, 260, 265, 286, 290, 294, 296, 298, 299, 302, 318, 331, 540, 547, 584, 585, 2000, 2007, 2008, 2012, 2013, 2017, 2018, 2023, 2026, 2027, 2029, 2030, 2031, 2032, 2034, 2035, 2041, 2043, 2052, 2053, 2057, 2066, 2067, 2069, 2070, 2075, and 2077.

*Distribution.*—In the Gulf of California, off Mexico, Central America, and Colombia, in shallow waters.

***Textularia foliacea* Heron-Allen and Earland,**

var. ***oceanica* Cushman**

Plate 14, Figs. 12*a, b, c*

*Textularia foliacea* Heron-Allen and Earland, var. *oceanica* Cushman, U. S. Nat. Mus. Bull. 161, 1932, p. 8, pl. 1, figs. 11, 12.

This variety differs from the typical form in the thicker test, particularly at the apertural end, a broader aperture, a more rounded peripheral margin, and in being more roughly finished.

The variety occurs with the typical form in six of the eleven localities where it is found in the Hancock Collections. It has been noted by Cushman at several localities in the Tropical Pacific. It is present at the following stations of the Hancock Expeditions: 77, 264, 278, 292, 293, 298, 2012, 2017, 2025, 2026, 2030, and 2031.

*Distribution.*—The investigation so far records this species in the Gulf of California in depths ranging from 18 to 55 fms., with one additional record off Guadalupe Island, Mexico, in 11 fms.

### *Textularia gramen* d'Orbigny

Plate 14, Figs. 13a, b, c

*Textularia gramen* d'Orbigny, Foram. Fossiles Vienne, 1846, p. 248, pl. 15, figs. 4-6; Bagg, U. S. Geol. Surv. Bull. 88, 1898, p. 29; Bull. Amer. Pal., vol. 2, no. 10, 1898, p. 19; Maryland Geol. Surv., Eocene, p. 233, pl. 62, fig. 1; Cushman, U. S. Geol. Surv. Bull. 676, 1918, pp. 8, 45, pl. 9, fig. 5 (not 2, 3); Florida Geol. Surv. Bull. 4, 1930, p. 17, pl. 1, figs. 5a, b; Cushman and Ponton, Florida Geol. Surv. Bull. 9, 1932, p. 39; Cushman and Cahill, U. S. Geol. Surv. Prof. Paper 175-A, 1933, p. 7, pl. 1, figs. 9a, b.

*Textularia deltoidea* Reuss, Denkschr. k. Ak. Wiss. Wien, vol. 1, 1850, p. 381, pl. 49, figs. 4a-c.

*Textularia agglutinans* d'Orbigny, var. *abbreviata* Parker and Jones, Phil. Trans., 1865, p. 369, pl. 17, figs. 76a, b.

Test slightly longer than broad, somewhat compressed, periphery subacute, subovate in top view; chambers distinct, comparatively few, rather high, slightly inflated; sutures distinct, depressed, curving upward slightly, and somewhat oblique; wall distinctly arenaceous, smoothly finished, composed of fine arenaceous grains cemented with calcareous cement; aperture a rather broad, low opening at the inner margin of the chamber in a distinct re-entrant. Length of figured specimen, 0.66 mm.; width, 0.45 mm.; thickness, 0.28 mm.

This species was first described from Miocene deposits in Central Europe. It is present in the Miocene sediments of Florida and has been reported from a number of localities in the Atlantic Ocean and Mediter-

anean Sea. It has been found at the following Hancock Expedition stations: 3, 4, 101, 103, 503, 1020, 1024, and 2070.

*Distribution*.—Off San Pedro and the Channel Islands, California, in 11 to 45 fms.; off Guadalupe Island, Mexico, in 250 fms., and off La Libertad, Ecuador, in 19 fms.

***Textularia lancea* Lalicker and McCulloch, new species**

Plate 14, Figs. 14*a, b, c, d*

Test small, flattened, lancet shaped, periphery sharp to subacute; chambers numerous, low, about twice as wide as high, slightly inflated, the basal part of some chambers terminating in an indistinct spine at the peripheral margin; sutures distinct, slightly depressed, straight to slightly curved, meeting the vertical axis at an angle of about  $20^{\circ}$ - $25^{\circ}$ ; wall thin, typically finely arenaceous but usually with a few coarse grains scattered about the test, smoothly finished; aperture a low, broad opening at the base of the inner margin of the last-formed chamber, in a distinct re-entrant. Length of holotype, 0.50 mm.; greatest width, 0.24 mm.; thickness, 0.14 mm.

Holotype (AHF no. 24) from Hancock Expedition Station No. 412, latitude  $0^{\circ} 59' 15''$  S., longitude  $90^{\circ} 20' 30''$  W., near the Galapagos Islands, depth 111 fms.

This is a very distinctive species and has also been recorded from the following Hancock Expedition stations: 401, 409, 410, 411, 412, 413, 414, 415, 416, 417, 419, 423, 460, 461, 466, 467, 468, 472, 473, 475, 478, 481, 485, 487, 488, and 585.

*Distribution*.—Off Socorro Island, Mexico, in 13 fms.; numerous stations near the Galapagos Islands, with a depth range of 9 fms. at Tagus Cove to 400 fms. off Chatham Island.

***Textularia lauta* Lalicker and McCulloch, new species**

Plate 15, Figs. 15*a, b, c*

Test small, compressed, elongate and slender, peripheral margin acute and serrate, subovate in top view; chambers numerous, nearly as high as broad, slightly inflated; sutures very distinct, depressed, straight to slightly curved, nearly horizontal, although somewhat oblique in some specimens; wall finely arenaceous, composed of fine arenaceous grains cemented with calcareous cement; aperture a broad low slit, about one half as wide as the thickness of the test, located at the base of the inner margin

of the last chamber, in a slight re-entrant. Length of holotype, 0.74 mm.; maximum width, 0.40 mm.; thickness, 0.27 mm.

Holotype (AHF no. 25) from Hancock Expedition Station 418, Darwin Bay, Tower Island, Galapagos, depth 17 fms.

This species is more like *Textularia articulata* d'Orbigny than any other. It differs from that species in its much smaller size, more slender outline, and in the less oblique suture lines.

*Distribution.*—This species has not been noted at any other station, but is abundant at the type locality.

### *Textularia lythostrota* (Schwager)

Plate 15, Figs. 16a, b, c

*Plecanium lythostrota* Schwager, Novara-Exped., Geol. Theil, vol. 2, 1866, p. 194, pl. 4, figs. 4a-c.

*Textularia sagittula* DeFrance, var. *jugosa* Millett, Journ. Roy. Micr. Soc., 1899, p. 561, pl. 7, fig. 8.

*Textularia milletti* Cushman, U. S. Nat. Mus. Bull. 71, pt. 2, 1911, p. 13, figs. 18, 19 (in text); Heron-Allen and Earland, British Antarctic Exped., Zool., vol. 6, 1922, p. 118.

*Spiroplectammina milletti* Cushman, U. S. Nat. Mus. Bull. 161, 1932, p. 7, pl. 1, figs. 5a, b.

Test compressed, somewhat longer than broad, subrhomboidal in front view, subrectangular in top view, thickest in apertural chambers, periphery acute; chambers numerous, very low and broad, the upper margin of each one somewhat thickened and coarsely arenaceous, the lower portion concave and less roughened, so that the surface of the test is composed of an alternating series of raised ridges and smoother depressions; wall coarsely arenaceous, composed of calcareous fragments and much calcareous cement; aperture a low, narrow opening at the inner margin of the last-formed chamber, in a deep re-entrant.

The initial end of this species is rounded, making it appear much like a *Spiroplectammina*. However, a detailed examination with dilute acid of several specimens of this species from the Pliocene sediments of New Guinea and from the Pacific Ocean shows clearly that the initial portion is not planispiral.

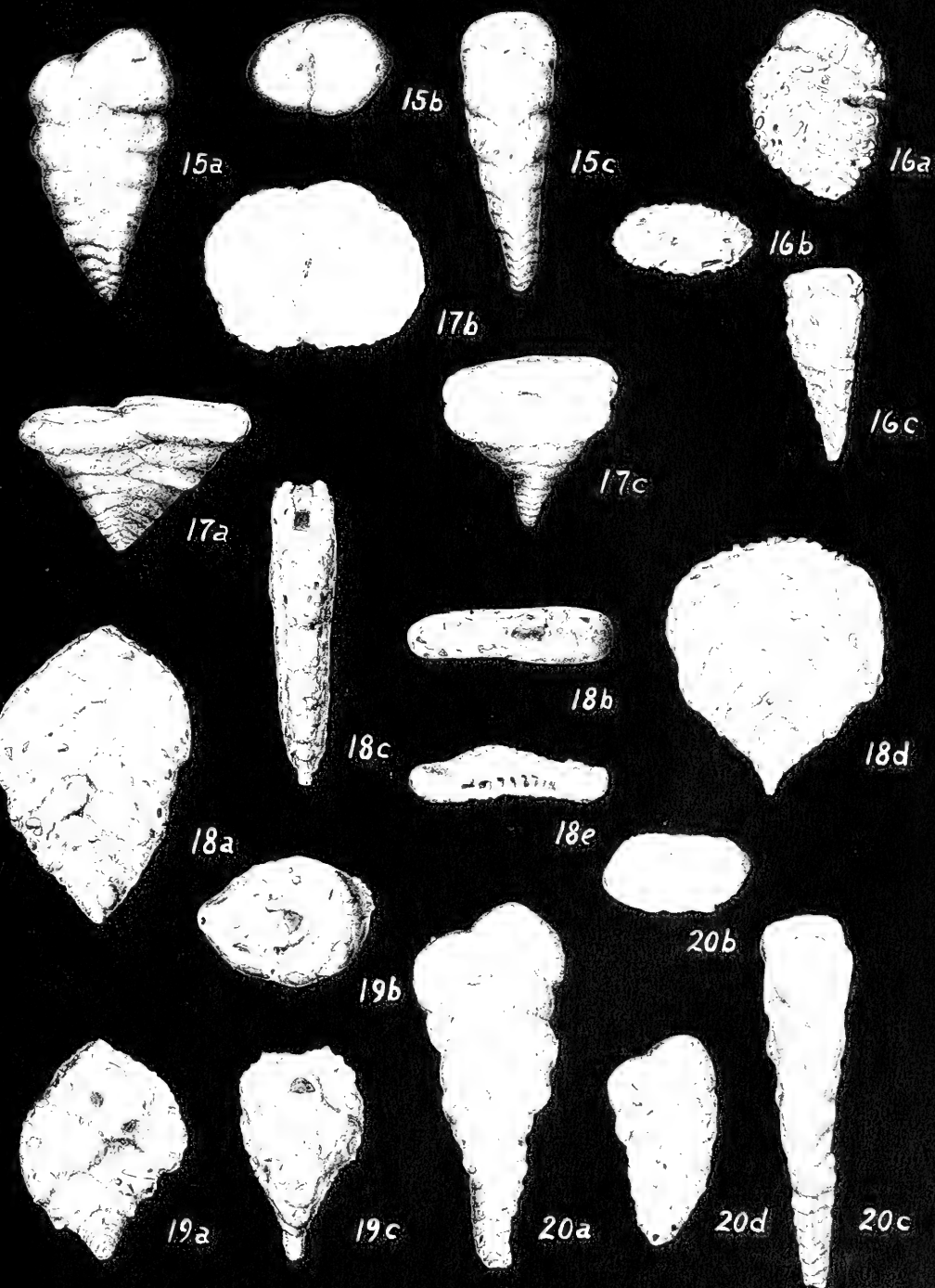
This species has been recorded from Pliocene sediments in Kar Nicobar and New Guinea. It has been noted at several localities in the Pacific Ocean and is present at the following Hancock Expedition stations: 482, 487; and the Manila locality.

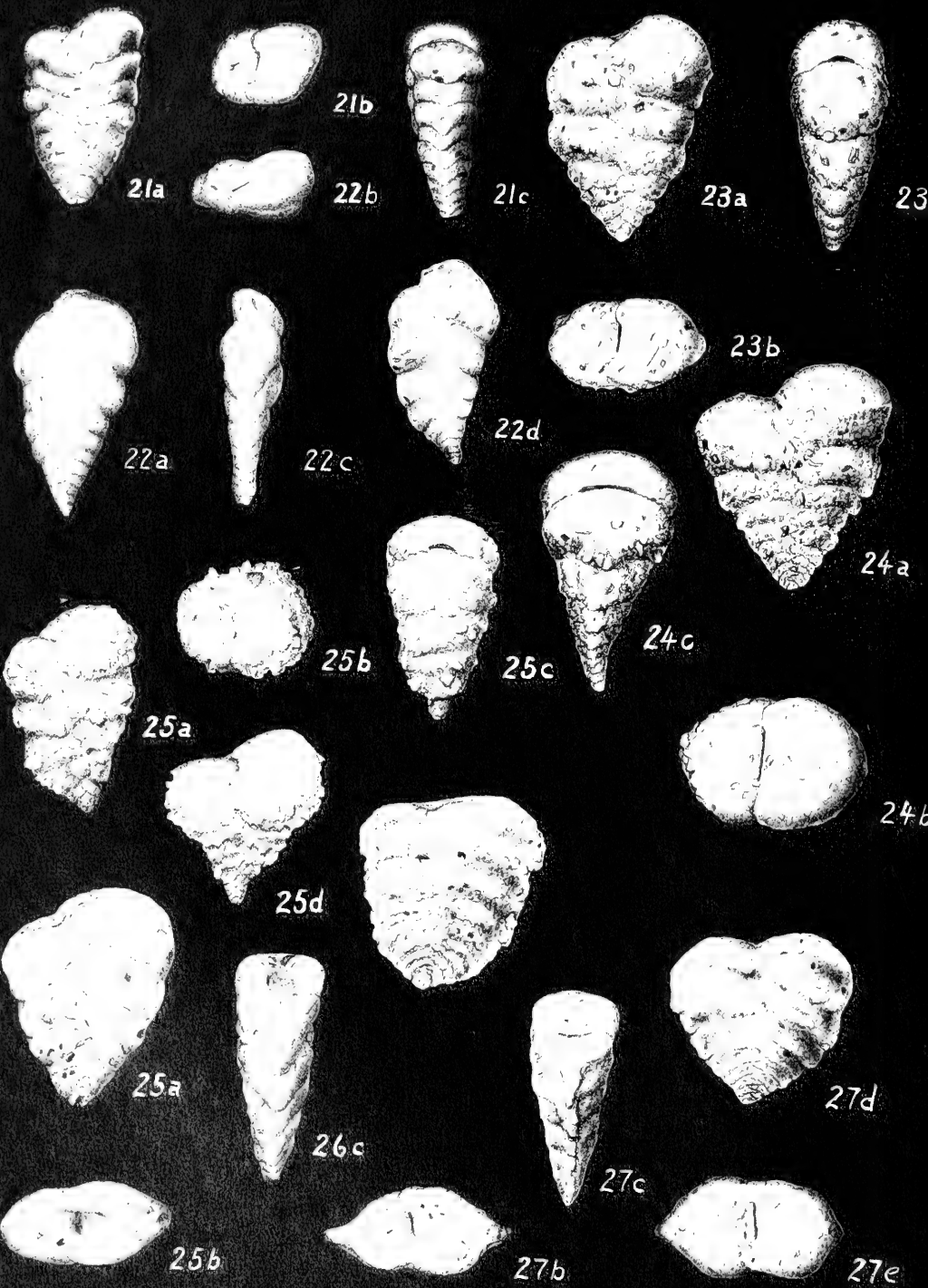
## EXPLANATION OF PLATE 15

## FIGS.

15. *Textularia lauta* Lalicker and McCulloch, new species. x 70. *a*, front view; *b*, apertural view; *c*, side view. Station 418.
16. *Textularia lythostrota* (Schwager). x 33. *a*, front view; *b*, apertural view; *c*, side view. Station 487.
17. *Textularia orbica* Lalicker and McCulloch, new species. Holotype. x 90. *a*, front view; *b*, apertural view; *c*, side view. Station 412.
18. *Textularia panamensis* Cushman. x 18. *a*, front view; *b*, apertural view; *c*, side view. Station 509. *d*, front view; *e*, apertural view. Station 2060.
19. *Textularia plaga* Lalicker and McCulloch, new species. Holotype. x 80. *a*, front view; *b*, apertural view; *c*, side view. Station 583.
20. *Textularia ramosa* Lalicker and McCulloch, new species. Holotype, microspheric form. x 70. *a*, front view; *b*, apertural view; *c*, side view; *d*, paratype, megalospheric form, front view. Station 487.







21a

21b

21c

23a

23

22a

22b

22a

22c

22d

23b

24a

25a

25b

25c

24c

24b

25d

25a

26c

27d

25b

27b

27c

27e

## EXPLANATION OF PLATE 16

## FIGS.

21. *Textularia rugosa* (Reuss). x 33. *a*, front view; *b*, apertural view; *c*, side view. Station 209.
22. *Textularia saulcyana* d'Orbigny. x 50. *a*, front view; *b*, apertural view; *c*, side view. Station 401. *d*, front view. Station 409.
23. *Textularia schencki* Cushman and Valentine. x 80. *a*, front view; *b*, apertural view; *c*, side view. Station 410.
24. *Textularia secasensis* Lalicker and McCulloch, new species. Holotype. x 60. *a*, front view; *b*, apertural view; *c*, side view. Station 221.
25. *Textularia scrupula* Lalicker and McCulloch, new species. Holotype. x 50. *a*, front view; *b*, apertural view; *c*, edge view; *d*, paratype, dorsal view. Station 548.
26. *Textularia solita* (Schwager). x 40. *a*, front view; *b*, apertural view; *c*, edge view. Station 2009.
27. *Textularia vola* Lalicker and McCulloch, new species. Holotype. x 80. *a*, front view; *b*, apertural view; *c*, side view; *d*, paratype, front view; *e*, paratype, apertural view. Station 412.

*Distribution.*—Off Albemarle Island, Galapagos, in 250 fms.; off Chatham Island, Galapagos, in 400 fms. This species was also found in a bottom sample taken at low tide in the harbor at Manila.

***Textularia orbica* Lalicker and McCulloch, new species**

Plate 15, Figs. 17a, b, c

*Textularia trochus* H. B. Brady (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 366, pl. 43, figs. 15-19 (part).

Test small, triangular in front view, nearly circular in top view, early portion of test somewhat compressed, later portion broadly rounded; chambers numerous, low and broad, apertural chambers flattened, early chambers somewhat overlapped by later ones; sutures distinct, slightly depressed, nearly straight and horizontal; wall rather smooth, composed of very fine sand grains cemented with calcareous cement; aperture a low, broad opening at the base of the inner margin of the last-formed chamber in a slight re-entrant, and a faint lip on some specimens. Length of holotype, 0.35 mm.; maximum width, 0.49 mm.; maximum thickness, 0.36 mm.

Holotype (AHF no. 26) from Hancock Expedition Station 412, latitude  $0^{\circ} 59' 15''$  S., longitude  $90^{\circ} 20' 30''$  W., Galapagos Islands, depth 111 fms.

This species has been noted also at Hancock Expedition stations 414, 419, 478, and 481. It is abundant at the type locality, but is quite rare at the other stations. This is apparently the same species that H. B. Brady identified as *Textularia trochus* d'Orbigny, from the Admiralty Islands and New Guinea. *T. trochus* d'Orbigny has been definitely assigned to the genus *Marssonella*.

*Distribution.*—Off Tower Island, Darwin Bay, in 17 fms.; off Chatham Island, Wreck Bay, in 26 fms.; off Albemarle Island, Cartago Bay, in 12 fms.; off Bindloe Island, Galapagos, in 56 fms.

***Textularia panamensis* Cushman**

Plate 15, Figs. 18a, b, c, d, e

*Textularia panamensis* Cushman, U. S. Nat. Mus. Bull. 103, 1918, p. 53, pl. 20, figs. 1a, b.

*Textularia espersoni* Applin, Bull. Amer. Assoc. Pet. Geol., vol. 9, no. 1, 1925, p. 97, pl. 3, fig. 2.

Test rhomboidal in front view, very much compressed, thickest in central portion, with a raised ridge commonly developed at the initial end, extending along the central part of the test nearly to the apertural end in some specimens, in others only a short distance above the initial end; chambers numerous, low and broad, slightly inflated; sutures distinct, depressed, curving downward sharply near the peripheral margin of test, in adult specimens chambers overlapping somewhat like uniserial chambers at the apertural end; wall arenaceous, smoothly finished, composed of fine sand grains and rather large sand and magnetite grains in some specimens; aperture normally developed as a long slit at the base of the inner margin of the last-formed chamber with the slit parallel to the flattened sides, in adult specimens sometimes a multiple aperture with as many as fifteen openings being developed on the end of the last-formed chamber above the inner margin of the chamber, apparently formed by bridgelike structures growing across the narrow slitlike aperture. Length, up to 3.00 mm.; width, up to 2.00 mm.; thickness, 0.50 mm.

This species was originally described by Cushman from the Miocene of the Panama Canal Zone. It is very abundant in the Miocene of Mexico, Texas, and Louisiana and has been noted at the following Hancock Expedition stations: 202, 203, 215, 317, 318, 325, 327, 329, 331, 332, 502, 503, 504, 509, 556, 558, 577, 578, 579, 2026, 2027, 2038, 2041, 2046, 2048, 2054, 2055, 2056, 2059, 2060, 2061, 2062, 2073, 2075, and 2078.

A large number of specimens from the Esperson well, Cameron Co., Texas, have been examined by the senior author. They are very similar to specimens of *Textularia panamensis* Cushman from the Miocene of Mexico and the Panama Canal Zone and should be assigned to that species.

*Distribution.*—Numerous stations in the Gulf of California with a depth range of 2-32 fms., southward off Central America, Ecuador, and Peru, in 9 to 47 fms.

### ***Textularia plaga* Lalicker and McCulloch, new species**

Plate 15, Figs. 19a, b, c

Test small, short and broad, initial end pointed, expanding very rapidly to the apertural chambers, thickest in central portion and at apertural end, peripheral margin compressed, acute; chambers few, low in early portion and very high in adult portion, highest at the center of the test, rapidly decreasing in height toward the periphery; sutures indistinct,

slightly depressed, very oblique; wall coarsely arenaceous, somewhat roughened, composed of coarse arenaceous grains with little cement, making the test very fragile; aperture a narrow, highly arched opening at the inner margin of the last chamber, in a re-entrant. Length of holotype, 0.52 mm.; maximum width, 0.41 mm.; maximum thickness, 0.30 mm.

Holotype (AHF no. 27) from Hancock Expedition Station 583, San Francisco Bay, Ecuador, in 10 fms.

*Distribution.*—It has not been noted at any other station, but is quite common at the type locality, latitude  $0^{\circ} 45' 30''$  S., longitude  $80^{\circ} 11'$  W.

### **Textularia ramosa** Lalicker and McCulloch, new species

Plate 15, Figs. 20*a, b, c, d*

Test very elongate, slender, usually slightly curved or twisted, early portion very slender, subrhomboidal in end view, periphery acute, serrate; chambers very numerous, low and broad, somewhat inflated, especially at the upper margin, depressed at the lower margin; sutures distinct, depressed, straight, oblique, making an angle of about  $25^{\circ}$  with the transverse axis in the microspheric form; wall finely arenaceous and smoothly finished, composed of a large proportion of calcareous fragments and some arenaceous grains, cemented with calcareous cement; aperture a broad, low slit at the inner margin of the last chamber, in a slight re-entrant. Length of holotype, 1.00 mm.; maximum width, 0.43 mm.; maximum thickness, 0.23 mm.

Holotype (AHF no. 28) from Hancock Expedition Station 487, Galapagos Islands, latitude  $1^{\circ} 01'$  S., longitude  $89^{\circ} 30'$  W., depth 400 fms.

*Distribution.*—It has not been noted from any other stations.

### **Textularia rugosa** (Reuss)

Plate 16, Figs. 21*a, b, c*

*Plecanium rugosum* Reuss, Sitz. k. Ak. Wiss. Wien, vol. 59, Abth. 1, 1869, p. 453, pl. 1, figs. 3*a, b*.

*Textularia rugosa* H. B. Brady, Rep. Voy. *Challenger*, Zool., vol. 9, 1884, p. 363, pl. 42, figs. 23, 24; Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, p. 185; l. c., vol. 30, 1907, p. 27, pl. 3, fig. 57; Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 625, pl. 47, figs. 7-9; Cushman, Carnegie Instit. Washington Publ. No. 213, 1918, p. 289; U. S. Nat. Mus. Bull. 100, vol. 4, 1921, p. 114, pl. 23, figs. 3, 4;

Carnegie Instit. Washington Publ. 342, 1924, p. 14, pl. 3, fig. 2; Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1924, p. 136; Cushman, Bernice P. Bishop Museum Bull. No. 27, 1925 (1926), p. 124.

*Textularia agglutinans* d'Orbigny, forma *jugosa* Goës, Kongl. Sv. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 35, pl. 7, figs. 297-299.

Test large, robust, early portion expanding rapidly, sides nearly parallel in later portion, somewhat compressed, peripheral margin subacute, lobulate; chambers numerous, about twice as wide as high, lower portion of each chamber excavated, and the upper portion inflated, giving each chamber an overhanging appearance; sutures distinct, depressed, somewhat curving in an anterior direction; wall rather coarsely arenaceous but smoothly finished, composed of fine and coarse arenaceous grains cemented with calcareous cement; aperture a very low, broad opening at the inner margin of the chamber, in a distinct re-entrant. Length, up to 1.75 mm.

This species is widely distributed in deposits ranging in age from Oligocene to Recent. It is present at the following Hancock Expedition stations: 209, 278, and 2049.

*Distribution.*—Near Bonito Island, Mexico, and in the Gulf of California, 12 to 55 fms.

### *Textularia saulcyana* d'Orbigny

Plate 16, Figs. 22a, b, c, d

*Textularia saulcyana* d'Orbigny, in De la Sagra, Hist. Fis. Pol. Nat. Cuba, "Foraminifères," 1839, p. 146, pl. 1, figs. 21, 22.

*Textularia concava* (Karrer), var. *heterostoma* Heron-Allen and Earland, Trans. Linn. Soc. London, vol. 11, ser. 2, 1916, p. 229, pl. 40, figs. 22, 23; Cushman, U. S. Nat. Mus. Bull. 104, pt. 3, 1922, p. 15, pl. 2, figs. 7, 8; Lacroix, Bull. Institut. Oceanogr. No. 622, 1933, p. 8, figs. 5-10 (in text).

Test elongate, somewhat subrhomboidal in outline, typically slightly twisted on the elongate axis, peripheral margin rounded; chambers numerous, low and broad, increasing in height as added, typically rounded and slightly inflated, upper surface somewhat flattened in some specimens; sutures distinct, depressed, sloping at an angle of about 25° from a horizontal line, straight to slightly curved; wall finely arenaceous, composed of fine sand grains and a large proportion of calcareous cement; aperture a narrow slit developed on the last-formed chamber just above

the inner margin, the slit being nearly parallel to the flattened sides of the form instead of at right angles to them as in typical species of *Textularia*.

This is a very common species in the Pacific Ocean as well as the Atlantic Ocean and the Caribbean Sea. It has been noted at the following Hancock Expedition stations: 103, 209, 252, 253, 260, 265, 266, 267, 268, 271, 275, 285, 286, 290, 292, 296, 333, 401, 403, 409, 410, 411, 413, 416, 418, 421, 423, 447, 454, 456, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 473, 478, 481, 482, 539, 540, 573, 2008, 2010, 2012, 2018, 2020, 2023, 2024, 2029, 2031, 2033, 2034, 2035, 2037, 2051, 2063, 2065, 2066.

*Distribution*.—The numerous stations recorded above give a range from California southward into the Gulf of California, off Central America and Peru, with the greatest abundance in the region of the Galapagos Islands.

### ***Textularia schencki* Cushman and Valentine**

Plate 16, Figs. 23a, b, c

*Textularia* cf. *abbreviata* Cushman, Bull. Scripps Inst. Oceanography, Tech. Ser., vol. 1, 1927, p. 136.

*Textularia schencki* Cushman and Valentine, Contr. Dept. Geol. Stanford Univ., vol. 1, no. 1, 1930, p. 8, pl. 1, figs. 3a, b.

Test short and broad, compressed, especially in the early portion, increasing rapidly in width from the pointed initial end, giving the test a broadly triangular form in front view, periphery subacute, except in the last pair of chambers in the adult, which have a rounded periphery, apertural end flat; chambers few, somewhat flattened except the last pairs in the adult, which are inflated; sutures distinct, only slightly depressed, straight; wall distinctly arenaceous, composed of fine and coarse arenaceous grains cemented with calcareous cement, smoothly finished; aperture a narrow slit at the inner margin of the last chamber. Length, up to 1.00 mm.

This species has been noted at the following Hancock Expedition stations: 50, 101, 201, 292, 306, 314, 328, 409, 410, and 459.

*Distribution*.—This investigation extends the range from the type locality off La Jolla, California, southward into the Gulf of California, off Central America, and off the Galapagos Islands.



**Textularia secasensis** Lalicker and McCulloch, new species

Plate 16, Figs. 24a, b, c

Test subtriangular in front view, sides of upper portion nearly parallel in elongate specimens, ovate in top view, early portion compressed, peripheral margin subacute; chambers numerous, much broader than high, inflated evenly; sutures very distinct, depressed, curving upward only slightly in the middle and downward near the peripheral margin; wall rather coarsely arenaceous, roughly finished, composed of arenaceous and calcareous grains cemented with calcareous cement; aperture a broad, low opening at the base of the inner margin of the last-formed chamber, in a slight re-entrant. Length of holotype, 0.75 mm.; maximum width, 0.61 mm.; maximum thickness, 0.43 mm.

Holotype (AHF no. 29) from Hancock Expedition Station 221, off Cape Rule, Socorro Isle, Mexico, located approximately at latitude 18° 20' N., longitude 114° 44' W., depth 20 fms.

This species is very common in the shallow waters off the coasts of Lower California and Western Mexico. It is somewhat like *Textularia corrugata* Heron-Allen and Earland, but is more elongate, has chambers that are evenly inflated, rounded apertural face, and nearly parallel sides in adult megalospheric specimens. It is also similar to *T. agglutinans* d'Orbigny, but differs in being larger and more compressed and in having a subacute peripheral margin. It has been noted at the following Hancock Expedition stations: 5, 203, 215, 216, 221, 222, 239, 265, 292, 300, 301, 307, 311, 313, 315, 316, 317, 320, 323, 333, 410, 422, 423, 425, 436, 460, 505, 546, 555, 2013, and 2021.

*Distribution.*—In the Gulf of California, off Mexico, Central America, Colombia, and Galapagos Islands, in 2 to 140 fms.

**Textularia scrupula** Lalicker and McCulloch, new species

Plate 16, Figs. 25a, b, c, d

Test small, triangular in front view, subcircular in top view, peripheral margin broadly rounded, initial end compressed and pointed, adult portion nearly circular; chambers numerous, inflated, width and height nearly equal; sutures somewhat indistinct, depressed, straight; wall coarsely arenaceous, roughly finished except on apertural face, which is smoothly finished, composed of sand grains and calcareous fragments cemented with calcareous cement; aperture a low arched opening at the

base of the inner margin of the last-formed chamber, in a slight re-entrant. Length of holotype, 0.82 mm.; width, 0.52 mm.; thickness, 0.44 mm.

Holotype (AHF no. 30) from Hancock Expedition Station 548, Cupica Bay, Colombia, depth 12 fms.

This species is quite distinctive and has been noted only along the west coast of Panama and Colombia. It has been found at the following Hancock Expedition stations: 304, 506, 514, 548, 553, and 556.

*Distribution.*—At the present time this species has been recorded in the region of Panama and off the coast of Colombia, in 12 to 50 fms.

### ***Textularia solita* (Schwager)**

Plate 16, Figs. 26*a, b, c*

*Plecanium solita* Schwager, Novara-Exped., Geol. Theil, vol. 2, 1866, p. 195, pl. 4, figs. 6*a-c*.

*Textularia solita* Cushman, Bernice P. Bishop Museum Bull. 119, 1934, p. 104, pl. 10, figs. 2*a, b*.

Test subtriangular in outline, much compressed, biconvex in top view, periphery acute, somewhat lobulate; chambers numerous, somewhat wider than high, the upper margin raised slightly and the lower margin depressed; sutures distinct, depressed, gently curved upward; wall thin, especially in the later chambers which are often broken, finely arenaceous, smoothly finished, composed of very fine arenaceous grains with considerable calcareous cement; aperture a large opening in a pronounced re-entrant at the inner margin of the last chamber. Length of figured specimen, 1.07 mm.; greatest width, 0.82 mm.; thickness, 0.42 mm.

This species was first described from the Pliocene sediments of Kar Nicobar Island. It was reported from marl beds in Fiji by Cushman. It has been found at stations 2009, 2016, 2022, 2034, and 2072 of the Hancock Expeditions.

*Distribution.*—In the Gulf of California with a depth range of 15 to 112 fms. At the Inner Gorda Bank off Mexico the records show a depth of 112 and 163 fms.

### ***Textularia vola* Lalicker and McCulloch, new species**

Plate 16, Figs. 27*a, b, c, d, e*

Test small, compressed, subrectangular in front view, subrhomboidal in top view, peripheral margin constricted, subacute, and serrate in some

specimens; chambers numerous, low and broad, the upper margin of each chamber typically raised above the general level of the test, especially in the central part of each series of chambers; sutures somewhat indistinct, straight in central portion of test and curving down sharply near the peripheral margin; wall finely arenaceous, smoothly finished, composed of very small, clear sand grains cemented with calcareous cement; aperture a very low, broad slit, located at the base of the inner margin of the last-formed chamber, in a slight re-entrant. Length of holotype, 0.50 mm.; greatest width, 0.46 mm.; thickness, 0.21 mm.

Holotype (AHF no. 31) from Hancock Expedition Station 412, latitude  $0^{\circ} 59' 15''$  S., longitude  $90^{\circ} 20' 30''$  W., near the Galapagos Islands, depth 111 fms.

This species has also been noted at the following Hancock Expedition stations: 410, 411, 412, 414, 415, 432, 461, 473, 481, 482, 485, and 585. This species appears to be more abundant in the vicinity of the Galapagos Islands.

*Distribution.*—Station records in the region of the Galapagos Islands show a depth range of 9 to 111 fms. One record off Gorgona Island, Colombia, is 20 fms.



508.3  
.L87

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 3

SOME NONIONIDAE IN THE COLLECTIONS  
OF THE ALLAN HANCOCK FOUNDATION

(PLATES 17-20)

BY

JOSEPH A. CUSHMAN and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

1940



REPORTS OF THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA,  
AND GALAPAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935,  
IN 1936, IN 1937, IN 1938, IN 1939, AND IN 1940.

SOME NONIONIDAE IN THE COLLECTIONS  
OF THE ALLAN HANCOCK FOUNDATION

(PLATES 17-20)

*By* JOSEPH A. CUSHMAN and IRENE McCULLOCH

THE UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS  
ALLAN HANCOCK PACIFIC EXPEDITIONS  
VOLUME 6, NUMBER 3  
ISSUED DECEMBER 23, 1940

---

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA



SOME NONIONIDAE IN THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION

(PLATES 17-20)

JOSEPH A. CUSHMAN and IRENE McCULLOCH

This is the third of a series of papers presenting the results of studies being made on the foraminiferal collections of the Allan Hancock Foundation, The University of Southern California.

In the first of these reports the localities for bottom samples were organized into definite tables (See pp. 3-30). The bottom samples collected since 1939, together with a special collection of earlier bottom samples procured by Miss Louise Hathaway, a student of The University of Southern California, are organized into tables in this report as continuations of those on pp. 3-30. Owing to the increasing number of mud samples from scattered areas under the heading of "Miscellaneous," these are now numbered as the "6" series.

Family **Nonionidae**

Genus **NONION** Montfort, 1808

**Nonion depressulum** (Walker and Jacob), var. **matagordanum**

Kornfeld

Plate 17, Fig. 1

*Nonion depressulum* (Walker and Jacob), var. *matagordanum* Kornfeld, Stanford Univ., Dept. Geology, Contr., vol. 1, 1931, p. 87, pl. 13, figs. 2a, b.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 21, pl. 5, fig. 26.

Test nearly circular in side view, much compressed, periphery broadly rounded; chambers 8 to 10 in the adult coil, of uniform shape and very gradually increasing in size as added, broadly triangular in side view, very slightly inflated; sutures distinct, only slightly depressed, gently curved; wall smooth, distinctly but finely perforate, the umbilical region filled in with secondary shell material, projecting slightly between the sutures, and very slightly papillate; aperture a low opening at the base of the last-formed chamber.

Diameter 0.25-0.30 mm; thickness 0.11-0.14 mm.

Stations: C-12, 1007.

*Distribution.*—This variety occurs in rather typical form at Station C-12, Morro Bay, California, in 2 fms.; at Station 1007, off Santa Barbara Island, in 54 fms. The types are from the Gulf of Mexico off the coast of Texas.

TABLE 6 — MISCELLANEOUS (CONTINUED FROM P. 11)

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
600	Low #1, Upper part of Gulf of California				1930
601	Funchal, Madeira				July 12, 1934
602	Naples, Italy			5	20, 1934
603	Algiers, Algeria			6	19, 1934
604	Genoa, Italy			5	24, 1934
605	Civita Vecchia			20	23, 1934
606	Monaco			30	27, 1934
607	Leish			10	Aug. 3, 1934
608	Gudvangen			4	9, 1934
609	Balestrand			8	9, 1934
610	Oslo			8	7, 1934
611	Göteborg			8	5, 1934
612	Copenhagen			6	4, 1934
613	Rotterdam			7	14, 1934
614	Boulogne			6½	18, 1934
615	Southampton			8	18, 1934
616	West Nole Island, Whit Sunday Passage, east coast of Australia			low tide	July, 1935
617	Kobe, Japan				April 9, 1939
618	3 miles out of Manila				17, 1939
619	Colombo				May 2, 1939
620	Gatun Lake				June 24, 1939
621	Off Staten Island				16, 1939
622	Suez, Asiatic end of Suez Canal				May 16, 1939
623	Colombo				Aug. 21, 1939

TABLE 6 — CONTINUED

Station	Locality	Bearings			Date
		Latitude	Longitude	Fathoms	
624	Balboa				Feb. 6, 1940
625	Cristobal				6, 1940
626	Hong Kong				November 24, 1940
627	Kobe				19, 1940
628	Manila				26, 1939
629	Singapore				Dec. 5, 1939
630	Penang				7, 1939
631	Bombay, India				15, 1939
632	Colombo				11, 1939
633	Alexandria				27, 1939
634	Port Said				26, 1939
635	Suez				25, 1939
636	Naples				30, 1939
637	Kobe			7	March 15, 1940
638	Shanghai			8	20, 1940
639	Manila			6	27, 1940
640	Singapore			6	April 1, 1940
641	Penang			6	4, 1940
642	Colombo			37	10, 1940
643	Bombay			30	14, 1940
644	Suez			8	25, 1940
645	Port Said			8	26, 1940
646	Alexandria			6	28, 1940
647	Genoa			10	May 5, 1940

TABLE 6 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
648	Gibraltar			90	May 9, 1940
649	Cristobal			11	June 7, 1940
650	Penang			6	April 4, 1940
651	Colombo			38	15, 1940

(Material from stations 637-649 collected by Mariano Banagan)

TABLE 7 — OFF SOUTHERN CALIFORNIA (CONTINUED FROM P. 13)

1054	San Clemente Island, Pyramid Cove	32 47 10	118 23 10	78-110	Feb. 19, 1939
1055	San Clemente Island, Pyramid Cove	32 46 30	118 21 15	214	19, 1939
1056	San Clemente Island, Pyramid Cove			75	19, 1939
1057	San Clemente Island, Pyramid Cove			70	19, 1939
1058	San Clemente Island, Pyramid Cove	32 48 55	118 23 20	29	19, 1939
1059	San Clemente Island, Pyramid Cove	33 00 30	118 33 20	60-85	19, 1939
1060	San Clemente Island, Pyramid Cove	33 29 30	118 31 50	135	19, 1939
1061	North of Santa Barbara Island			15-20	May 28, 1939
1062	East of Gull Island off Santa Barbara Island			21-28	28, 1939
1063	West of Gull Island off Santa Barbara Island			38-41	28, 1939
1064	Off Santa Barbara Island	33 30 01	119 02 20	27	29, 1939
1065	5 miles northwest of Santa Barbara Island	33 34 40	119 00 15	76	29, 1939
1066		33 43 30	119 09 45	83	29, 1939
1067		33 22 30	119 03 45	55	30, 1939
1068	San Miguel Passage	33 59 15	120 17 30	39	Aug. 4, 1939
1069	Off Santa Rosa Island	33 56	119 42	230	10, 1939
1070	Off Santa Cruz Island	33 58 30	119 54 45	127	10, 1939

TABLE 7 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1071	Prisoner's Harbor, Santa Cruz			35-45	12, 1939
1072	Off Catalina			90-101	13, 1939
1073	Off Catalina			50	13, 1939
1074	North of Santa Rosa, Bechers Bay	34 01 15	120 00 30	14	18, 1939
1075	Off County Quarry			56	20, 1939
1076*	South of San Benito Islands, Mex.	28 16 17	115 32 54	52	Sept. 19, 1939
1077	South of San Benito Islands, Mex.	28 18 00	115 25 00	35	19, 1939
1078	South of San Benito Islands, Mex.	28 12 05	115 33 20	92-95	20, 1939
1079	San Clemente	33 04 40	118 42 00	300	Nov. 24, 1939
1080a	San Clemente	33 03 10	118 40 30	150	24, 1939
1080b	San Clemente	33 03 45	118 39 45	135	24, 1939
1081	San Clemente	32 46 45	118 22 30	170	25, 1939
1082	San Clemente	32 46 20	118 22 45	110	25, 1939
1083	3 miles southwest, Castle Rock	33 00 40	118 39 12		25, 1939
1084	5 miles southeast, Catalina	33 15 22	118 13 40	144	25, 1939
1085	2½ miles east, White Cove	33 23 50	118 19 10	121	25, 1939
1086	East side of San Nicolas	33 18 20	119 28 45	30	April 11, 1940
1087	East side of San Nicolas	33 18 25	119 28 25	97	12, 1940
1088	East side of San Nicolas	33 18 15	119 22 10	212	12, 1940
1089	Off Newport Beach	33 35 10	117 54 15	50	21, 1940
1090	Off Laguna Beach	33 32 10	117 48 15	54-57	21, 1940
1091	Off Redondo Beach	33 48 50	118 25 55	43-85	May 5, 1940

\* Stations 1076-78 were considered local stations when recorded. All three should have been given numbers in the "2" series with other material off Mexico.

TABLE 7 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1092	Off Redondo Beach	33 48 45	118 25 55	49-140	May 5, 1940
1093	Off Redondo Beach	33 49 20	118 24 50	16-32	5, 1940
1094	Off Redondo Beach	33 50 45	118 25 10	18-45	5, 1940
1095	Off Redondo Beach	33 47 45	118 29 50	70-240	5, 1940
1096	Off Redondo Beach	33 49 55	118 25 45	96-120	5, 1940
1097	Off Redondo Beach			13-22	6, 1940
1098	Off El Segundo Beach	33 50 15	118 28 35	28-30	6, 1940
1099	Off Point Vicente lighthouse	33 40 45	118 24 15	17-41	6, 1940

TABLE 8 — OFF MEXICO (CONTINUED FROM P. 21)

2080	Clarion Island, Mex.	18 20 50	114 44 33	20	Mar. 16, 1939
2081	Clarion Island, Mex.	18 20 15	114 04 58	28-43	16, 1939
2082	Socorro Island, Mex.	18 42	111 56	16	18, 1939
2083	Braithwaite Bay, Socorro Island, Mex.			10-20	18, 1939
2084	Socorro Island, Mex.	18 41 52	110 55 20	17-46	18, 1939
2085	Chachagua Bay, Mex.			10	20, 1939
2086	Tenacatita Bay, Mex.			8-15	May 8, 1939
2087	Rompiente Point, L. Calif., Mex.	27 41 00	115 03 45	45	Jan. 18, 1940
2088	Same as 2087, but farther south a few minutes drift.				18, 1940
2089	Off Turtle Bay, L. Calif., Mex.			26-31	18, 1940
2090	Santa Maria Bay, L. Calif., Mex.	24 44 05	112 18 45	50	19, 1940
2091	Santa Maria Bay, L. Calif., Mex.	24 43 12	112 15 24	36	19, 1940
2092	Santa Maria Bay, L. Calif., Mex.	24 43 15	112 14 30	26	19, 1940
2093	Off Magdalena Bay, L. Calif., Mex.	24 29 12	112 12	85	19, 1940

TABLE 8 — CONTINUED

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2094	Off Magdalena Bay, L. Calif., Mex.	24 27 14	112 10 12	82	19, 1940
2095	Off Magdalena Bay, L. Calif., Mex.	24 21 00	112 12 02	150	19, 1940
2096	Santa Maria Bay, L. Calif., Mex.			18-25	19, 1940
2097	Inner Gorda Bank, Mex.	23 02 00	109 30 15	70-78	20, 1940
2098	Outer Gorda Bank, Mex.	23 00 54	109 29 22	59-95	20, 1940
2099	Outer Gorda Bank, Mex.	23 01 00	109 28 45	58	20, 1940
2100		23 38 07	109 30 00	54	21, 1940
2101		23 38 00	109 28 13	150	21, 1940
2102	Guaymas Bay, Sonora, Mex. Inner harbor channel			2-6	22, 1940
2103	Guaymas Bay, Sonora, Mex. In outer harbor beyond lighthouse			2-6	22, 1940
2104	Outside of Guaymas Bay, Mex. Beyond Pajoritas Island			6-10	23, 1940
2105	Outside of Guaymas Bay. Harpo Point Light. North of main channel			9	23, 1940
2106	Puerto Refugio, Angel de La Guardia Island, Gulf of Calif.			18	29, 1940
2107	Puerto Refugio, Angel de La Guardia Island, Gulf of Calif.			78-90	28, 1940
2108	Puerto Refugio, Angel de La Guardia Island, Gulf of Calif.			11-22	26, 1940
2109	South side of Puerto Refugio			6	27, 1940
2110	Mejia Island Channel, Angel de La Guardia, Gulf of Calif.			6-11	28, 1940
2111	In Gonzaga Bay, east of Anchorage			16	30, 1940
2112	Outside of Gonzaga Bay, L. Calif., Mex.			40	30, 1940
2113	Outside of Granite Island, Gulf of Calif.			57	28, 1940
2114	Anchorage, Gonzaga Bay, L. Calif., Mex.			16	29, 1940
2115	Gulf of Calif., Mex.	29 48	114 23	14	29, 1940
2116	Outside Granite Island, Gulf of Calif.			51-56	29, 1940
2117	Off Consag Rock, Gulf of Calif.	25 00	114 29	12	31, 1940

TABLE 8 — CONTINUED

Station	Locality	Bearings			Date
		Latitude	Longitude	Fathoms	
2118	North of Consag Rock, Gulf of Calif.			40-48	Jan. 31, 1940
2119	South of Consag Rock, Gulf of Calif.			30	Feb. 1, 1940
2120	East of Consag Rock, Gulf of Calif.			22	1, 1940
2121	Rocky Point Bay, Mexico Mainland			11	2, 1940
2122	Off Rocky Point, Mex.	31 18	113 36 30	10	2, 1940
2123	San Felipe Bay, L. Calif.			3	2, 1940
2124	San Felipe Anchorage, L. Calif., Mex.	34 02 00	114 49 00	5	2, 1940
2125	Rocky Point, Mex.			11	3, 1940
2126	Rocky Point, Mex.			3-10	3, 1940
2127	Rocky Point, Mex.			11	3, 1940
2128	Georges Islands, Mex., Anchorage			11	3, 1940
2129	Tepoca Bay, Sonora, Mex.			12	4, 1940
2130	Off Pond Island, Mex.			62-85	5, 1940
2131	North of Isla Partida, Mex.			46-75	5, 1940
2132	Gulf of California, Mex.	27 49 57	110 54 15	40	7, 1940
2133	Gulf of California, Mex.	27 50 15	110 57 55	51	7, 1940
2134	Gulf of California, Mex.	27 40 13	110 58 34	112	7, 1940
2135	Gulf of California, Mex.	27 56 15	111 03 02	15	7, 1940
2136	Gulf of California, Mex.	27 54 50	111 04	30	7, 1940
2137	Gulf of California, Mex.	27 55 30	111 54	21	7, 1940
2138	Off Ensenada de San Francisco, Sonora, Mex.			15-18	7, 1940
2139	Ensenada de San Francisco, Sonora, Mex.			2-6	7, 1940
2140	Gulf of California, Mex.	25 49 40	111 15 28	123	10, 1940
2141	Puerto Escondido, L. Calif., Mex.			18-21	11, 1940



**Nonion grateloupi** (d'Orbigny)

Plate 17, Fig. 2

*Nonionina grateloupi* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 294, no. 19; in de la Sagra, Hist. Fis. Pol. Nat. Cuba, Foraminifères, 1839, p. 46, pl. 6, figs. 6, 7.—Fornasini, Mem. Accad. Sci. Inst. Bologna, ser. 6, vol. 1, 1904, p. 12, pl. 3, fig. 5.—Cushman, Publ. 291, Carnegie Inst., Washington, 1919, p. 48; Proc. U.S. Nat. Mus., vol. 59, 1921, p. 61, pl. 14, figs. 9-11; Publ. 311, Carnegie Inst., Washington, 1922, p. 55, pl. 9, figs. 7, 8; Publ. 344, 1926, p. 79.

*Nonion grateloupi* Cushman, Bull. 104, U.S. Nat. Mus., pt. 7, 1930, p. 10, pl. 3, figs. 9-11; pl. 4, figs. 1-4; Bull. 4, Florida Geol. Survey, 1930, p. 36, pl. 6, figs. 1-3.—Cushman and Valentine, Stanford Univ., Dept. Geology, Contr., vol. 1, 1930, p. 20, pl. 5, figs. 9a, b.—Cushman and Parker, Proc. U.S. Nat. Mus., vol. 80, art. 3, 1931, p. 10, pl. 2, figs. 6a, b.—Cole, Bull. 6, Florida Geol. Survey, 1931, p. 32, pl. 7, figs. 7, 8.—Cushman and Ponton, Bull. 9, l. c., 1932, p. 68.—Heron-Allen and Earland, *Discovery* Rep'ts, vol. 4, 1932, p. 437, pl. 16, figs. 9, 10.—Earland, l. c., vol. 7, 1933, p. 131.—Cushman, Bull. 161, U.S. Nat. Mus., pt. 2, 1933, p. 43, pl. 10, figs. 8a-c.—Cushman and Cahill, Prof. Paper 175-A, U.S. Geol. Survey, 1933, p. 20, pl. 7, figs. 1a, b. —Bermudez, Mem. Soc. Cubana Nat. Hist., vol. 9, 1935, p. 185.—Hadley, Journ. Elisha Mitchell Sci. Soc., vol. 52, 1936, p. 35.—Asano, Journ. Geol. Soc. Japan, vol. 45, no. 538, 1938, p. 594, pl. 15 (4), fig. 14.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 21, pl. 6, figs. 1-7.

*Nonionina punctulata* d'Orbigny, Voy. Amér. Mérid., vol. 5, 1839, p. 28, pl. 5, figs. 21, 22.

Test planispiral, bilaterally symmetrical, mostly involute, in peripheral view with the sides nearly parallel, periphery rounded; chambers numerous, usually 10-12, sometimes 15, in the last-formed coil in adults, chambers increasing rapidly in length, especially in the last few chambers; sutures distinct, slightly depressed; wall smooth, finely perforate; aperture small, at the base of the last-formed chamber, narrow.

Length up to 0.60 mm; breadth 0.35 mm; thickness 0.22 mm.

The numerous stations listed for this species are: A-2, C-10, 3, 25, 28, 39, 61, 63, 71, 76, 77, 81, 83, 103, 106, 109, 110, 111, 112, 113, 127, 128, 132, 133, 144, 1003, 1017, 1041, 1051, 1052, 1058, 1059, 1062, 1063, 202, 206, 208, 209, 213, 215, 225, 227, 229, 231, 255, 263, 2002, 2012, 2017, 2032, 2061, 2069, 337, 339, 403, 409, 437, 469, 501, 502, 510, 539.

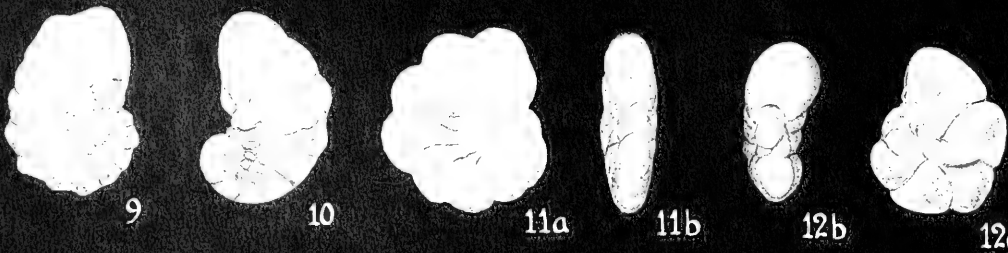
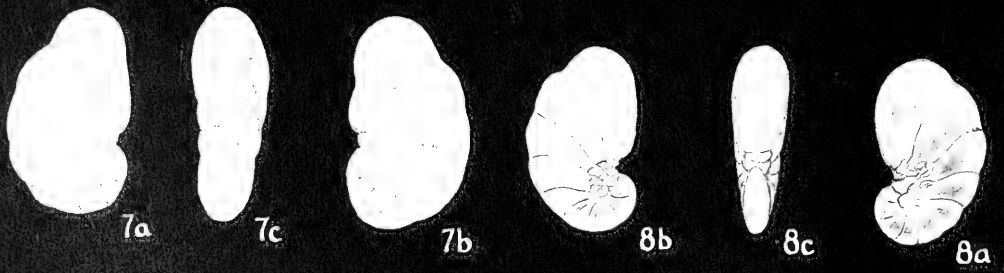
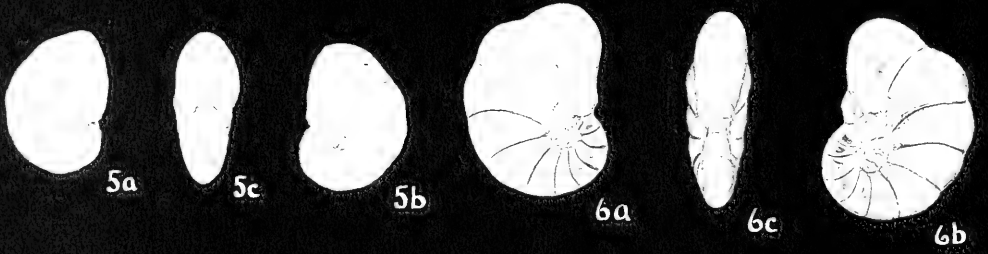
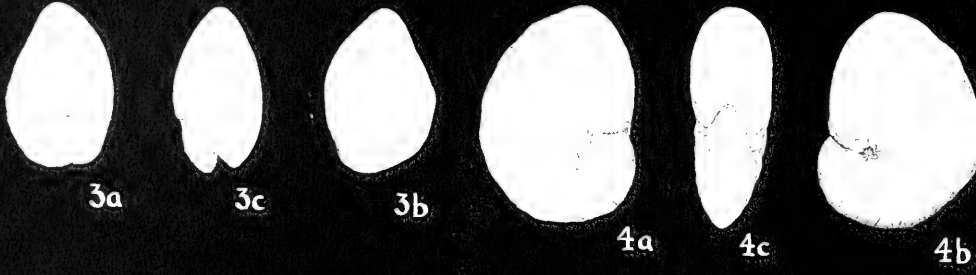
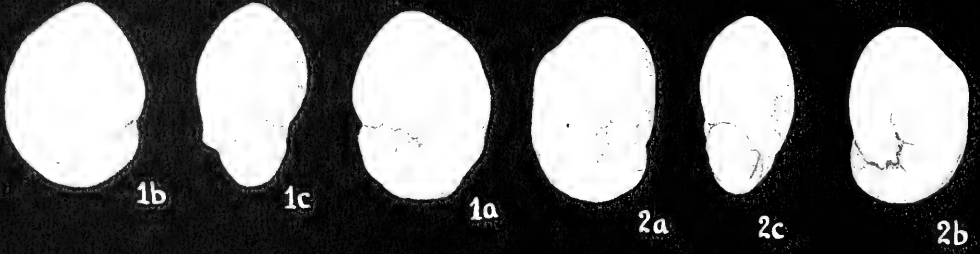
All illustrations were made by Miss Ann Shepard.

EXPLANATION OF PLATE 17

FIGS.

1. *Nonion depressulum* (Walker and Jacob), var. *matagordanum* Kornfeld. X 80. *a*, side view; *b*, apertural view.
2. *Nonion grateloupi* (d'Orbigny). X 60. *a*, side view; *b*, apertural view.
3. *Nonion incisum* (Cushman). X 90. *a*, *b*, opposite sides; *c*, apertural view.
- 4, 5. *Nonion hancocki* Cushman and McCulloch, new species. X 35. 4, Holotype. *a*, side view; *b*, apertural view. 5, Paratype.
- 6, 7. *Nonionella auricula* Heron-Allen and Earland. 6, X 60; 7, X 40. *aa*, *bb*, opposite sides; *cc*, apertural views.
- 8, 9. *Nonion pizarrense* W. Berry, var. *basispinatum* Cushman and Moyer. 8, X 60; 9, X 45. *aa*, *bb*, opposite sides; *cc*, apertural views.
10. *Nonionella japonica* (Asano), var. *mexicana* Cushman and McCulloch, new variety. X 80. *a*, *b*, opposite sides; *c*, apertural view.
- 11, 12. *Nonionella decora* Cushman and McCulloch, new species. 11, X 60. Paratype. 12, X 45. Holotype. *aa*, *bb*, opposite sides; *cc*, apertural views.





## EXPLANATION OF PLATE 13

## FIGS.

1. *Nonionella miocenica* Cushman. X 85. *a, b*, opposite sides; *c*, apertural view.
2. *Nonionella miocenica* Cushman, var. *stella* Cushman and Moyer. X 60. *a, b*, opposite sides; *c*, apertural view.
3. *Nonionella basiloba* Cushman and McCulloch, new species. X 80. *a, b*, opposite sides; *c*, apertural view.
- 4, 5. *Nonion pizarrense* W. Berry, var. *basispinatum* Cushman and Moyer. X 35. *aa, bb*, opposite sides; *cc*, apertural views.
- 6-10. *Cushmanella primitiva* Cushman and McCulloch, new species. 6, Holotype. X 60; 7, X 85; 8, 10, X 60; 9, X 40. *aaa, bbb*, opposite sides; *ccc*, apertural views.
11. *Astrononion stellatum* Cushman and Edwards. X 60. *a*, side view; *b*, apertural view.
12. *Astrononion viragoense* Cushman and Edwards. X 60. *a*, side view; *b*, apertural view.

*Distribution.*—This species is widely distributed and is the most common one of the genus in our material. Off Alaska in 2 fms., southward off Ecuador in 20 fms., including several stations in the shallow waters of the Gulf of California.

**Nonion pizarrense** W. Berry, var. **basispinatum**  
Cushman and Moyer

Plate 17, Figs. 8, 9; Plate 18, Figs. 4, 5

*Nonion pizarrense* W. Berry, var. *basispinata* Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 54, pl. 7, figs. 18*a*, *b*.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 25, pl. 6, fig. 28.

Variety differing from the typical form in the later chambers, which on the outer margin toward the base have a fringe of small, spinose processes, often very conspicuous also along the sutures.

Stations: A-2, 3, 28, 35, 37, 64, 106, 112, 253, 254, 298, 2038, 433, 503, 514, 524, 526, 531, 548, 556, 559, 600.

*Distribution.*—This variety was described first from material off San Pedro, 35-50 fms. The analysis indicates a range from Alaska southward to Ecuador, including the Gulf of California, in shallow waters. In Tagus Cove, off Albemarle Island, Galapagos, the recorded depth is 80 fms.

**Nonion incisum** (Cushman)

Plate 17, Fig. 3

*Nonionina incisa* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 90, pl. 13, figs. 13*a-c*; vol. 2, pt. 3, 1926, p. 65.

*Nonion incisa* Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 60.—Cushman and Laiming, Journ. Pal., vol. 5, 1931, p. 104, pl. 11, figs. 10*a*, *b*.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 7, pl. 1, figs. 26*a*, *b*.—Cushman and Cahill, U.S. Geol. Survey Prof. Paper 175-A, 1933, p. 20, pl. 7, figs. 4*a*, *b*.—Cushman and LeRoy, Journ. Pal., vol. 12, 1938, p. 125, pl. 22, figs. 8*a*, *b*.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 15, pl. 4, fig. 6.

Test longer than broad, periphery acute, somewhat compressed, umbilical regions depressed, apertural face heart shaped or broadly triangular, slightly convex; chambers distinct, later ones very slightly inflated, rather uniform in size and shape, increasing slightly in size in the adult,

about 15 in the final coil; sutures distinct, slightly depressed, strongly curved; wall smooth, very finely perforate; aperture a low, curved opening at the base of the apertural face.

Length 0.60-0.70 mm; breadth 0.45-0.50 mm; thickness 0.30-0.35 mm.

Stations: 503, 509, 511, 516, 538, 543.

*Distribution*.—Most of the previous records for this species are from the Miocene of California. The living specimens seem to be identical with the fossil ones. The depth range is from 18 to 55 fms.; off Colombia, in 19 fms. at La Libertad, and in 50 fms. at Port Utria.

### **Nonion hancocki** Cushman and McCulloch, new species

Plate 17, Figs. 4, 5

Test nearly circular in side view, very much compressed, umbilical region slightly depressed, periphery subacute; chambers distinct, numerous, 15 to 18 in the adult coil, very low and broad, of uniform shape, increasing gradually in breadth as added, height changing very slightly, not inflated; sutures very distinct, curved, strongly limbate; wall smooth, finely perforate; aperture a narrow, low opening at the base of the apertural face.

Length 0.70-0.80 mm; breadth 0.52-0.65 mm; thickness 0.20 mm.

Holotype (AHF no. 32) from locality 561.

This species differs from *Nonion pizarrense* W. Berry, in the larger number and lower chambers and the very strongly limbate sutures.

*Distribution*.—The type locality, Station 561, is San Juan Bay, Peru, in 30-40 fms.

### Genus **NONIONELLA** Cushman, 1926

#### **Nonionella auricula** Heron-Allen and Earland

Plate 17, Figs. 6, 7

*Nonionella auricula* Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 192, pl. 5, figs. 68-70.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 33, pl. 9, figs. 7-9.

Test longer than broad, strongly compressed, periphery rounded, ventrally umbilicate and involute, dorsally with the earlier coils visible; chambers distinct, about 9 in the adult whorl, somewhat inflated, increasing rapidly in size and height in the adult whorl; sutures distinct, de-

pressed in the later portion, slightly curved; wall thin, hyaline, smooth; aperture at the base of the apertural face extending over slightly onto the ventral side.

Length 0.18-0.25 mm; breadth 0.14-0.16 mm; thickness 0.12 mm.

Stations: 4, 39, 64, 76, 105, 2056, 2067, 334, 342, 345, 502, 506, 509, 535, 558.

*Distribution.*—The types of this species are from off Plymouth, England. It is somewhat surprising to find this species in our material, but others are known to have a distribution somewhat similar in cold water.

The smoother form figured (Fig. 7) may also be included within the limits of variation of this species, at least pending the finding of additional material. These localities record a range beginning with the Channel Islands, off San Pedro, to Peru, with a depth variation between 4 and 45 fms.

*Nonionella japonica* (Asano), var. *mexicana* Cushman and McCulloch, new variety  
Plate 17, Fig. 10

Variety differing from the typical in the smaller size, rounded periphery, and the parallel sides of the apertural face.

Length 0.30 mm; breadth 0.20 mm; thickness 0.05 mm.

Holotype of variety (AHF no. 33) from locality 223.

This is very close in most of its characters to the species described and figured by Asano from the late Tertiary of Japan.

Stations: 109, 112, 113, 222, 223, 409, 466, 468.

*Distribution.*—The type locality for this new variety is Sulphur Bay, Clarion Island, Mexico, in 53 fms. The other localities ranging from the Channel Islands off California to the Galapagos Islands record a depth range from 10 to 34 fms.

*Nonionella decora* Cushman and McCulloch, new species  
Plate 17, Figs. 11, 12

Test asymmetrical, somewhat trochoid, spire slightly if at all raised, periphery subacute; chambers numerous, 12-16 in the adult whorl, distinct, of rather uniform shape, increasing gradually in size as added, slightly if at all inflated; sutures very distinct, raised and limbate, thickened toward the umbilical end, curved; wall smooth except for the raised sutures and the umbilical area which is slightly papillate, the papillae occasionally extending out slightly along the sutures; aperture at the base



of the apertural face, extending over slightly onto the ventral side, with a slightly toothed lip.

Length 0.45-0.60 mm; breadth 0.30-0.45 mm; thickness 0.15-0.20 mm.

Holotype (AHF no. 34) from locality 472. Paratype figured from locality 532.

This species differs from *Nonionella auricula* Heron-Allen and Earland in the raised and limbate sutures, swollen at the inner end; the distinct apertural lip, which is toothed; and the larger number of chambers.

Stations: 1003, 1041, 201, 2086, 409, 436, 457, 458, 471, 472, 531, 532.

*Distribution.*—The type locality is Hood Island, Gardner Bay, Galapagos. Locality 532 is off East Beach, Independencia Bay, Peru, in 5 fms. This species is recorded also from Monterey Bay, California, in 25 fms.; off Mexico in 8-15 fms.; in shallow waters off Galapagos; and off Peru.

### *Nonionella miocenica* Cushman

Plate 18, Fig. 1

*Nonionella miocenica* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 3, 1926, p. 64; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 149.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 61, pl. 8, figs. 6a-c.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 8.—Cushman Special Publ. 5, l. c., 1933, pl. 23, figs. 3a-c.—Barbat and Johnson, Journ. Pal., vol. 8, 1934, p. 11, pl. 1, figs. 1-4.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 31, pl. 8, fig. 9.

*Nonionina auris* Cushman (not d'Orbigny), Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 91, pl. 13, figs. 4a-c.

Test subtrochoid, small, periphery broadly rounded; chambers distinct, slightly inflated, 8-10 in the adult whorl, on the ventral side with the last chambers developing a distinct rounded lobe covering the umbilical region; sutures distinct, slightly curved, very slightly depressed; wall smooth, finely perforate; aperture low, elongate, at the base of the apertural face and extending over onto the ventral side beneath the lobe of the last-formed chamber.

Length 0.30-0.45 mm; breadth 0.25-0.35 mm; thickness 0.20-0.25 mm.

Stations: A-2, Or-1, C-10, 7, 24, 35, 311.

*Distribution.*—This is typically a Miocene form but has previously been recorded as a living species off the coast of Mexico. The stations record a range from Wrangell, Alaska, in 2 fms. to Port Culebra, Costa Rica, in 3-10 fms.

***Nonionella miocenica* Cushman, var. *stella* Cushman and Moyer**

Plate 18, Fig. 2

*Nonionella miocenica* Cushman, var. *stella* Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 56, pl. 7, figs. 17a-c.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 34, pl. 9, fig. 10.

Variety differing from the typical form in the stellate character of the lobate ventral end of the last-formed chamber which develops short fingerlike processes over the previous sutures.

Stations: A-1, A-2, A-4, C-10, 24, 39, 58, 73, 1052.

*Distribution.*—The types of this variety came from off San Pedro, California, at depths of 35-50 fms. These localities range from shallow waters off Cordova, Alaska, in 2 fms. to the area off Guadalupe Island, Mexico, in 50 fms.

***Nonionella basiloba* Cushman and McCulloch, new species**

Plate 18, Fig. 3

Test small, dorsal side flattened, ventral side in the adult very convex, periphery rounded to subacute; chambers about 10 in the adult whorl, increasing rather rapidly in size as added, all visible on the dorsal side, on the ventral side with the later chambers developing a very large basal lobe which is inflated and comprises a large part of the test in ventral view, extending down to the periphery and in peripheral view forming a distinct portion offset from the earlier whorls; sutures distinct, not depressed, somewhat curved; wall smooth, finely perforate; aperture at the periphery, low, extending under the basal lobe on both sides.

Length 0.25-0.30 mm; breadth 0.18 mm; thickness 0.15 mm.

Holotype (AHF no. 35) from locality 136.

This species has a great development of the later chambers on the ventral side, resembling *Nonionella jacksonensis* Cushman, of the Eocene but differs from that species in the more acute periphery, more rhomboid form, and greater development of the ventral lobe.

Stations: 136, 343, 516, 517.

*Distribution*.—Type locality, Station 136, is off San Clemente Island, California, in 50 fms. Other records extend the range southward, at Bahia Honda, Panama, in 32 fms. and off the coast of Colombia, in 55 to 116 fms.

Genus **CUSHMANELLA** Palmer and Bermudez, 1936

**Cushmanella primitiva** Cushman and McCulloch, new species

Plate 18, Figs. 6-8, 10

Test bilaterally symmetrical, compressed, periphery rounded, height often twice the breadth, early portion with the chambers in a single series, later with supplementary ones, smaller and alternating with the larger primary ones, the test tending slightly to uncoil in final stages; chambers distinct, the primary ones increasing rapidly in size as added, slightly inflated in the adult, supplementary chambers small and irregular in size, developed slightly more on one side than on the other; sutures very distinct, slightly limbate, curved, becoming slightly sigmoid in the later portion in some specimens; wall thin, translucent, smooth, very finely perforate; aperture at the base of the chamber, low, and occasionally a supplementary one slightly above the base of the apertural face, rarely higher up and apparently connecting with an internal tube.

Length 0.30-0.45 mm; breadth 0.20-0.30 mm; thickness 0.12-0.15 mm.

Holotype (AHF no. 36) from locality 418.

This species differs from *Cushmanella brownii* (d'Orbigny) in the more compressed and smaller test, larger number of chambers, and more primitive apertural characters.

While the aperture in the middle of the apertural face is rarely seen in this species, its other characters show its relationship to the Atlantic species. It is evidently more primitive. There is a distinct tendency toward uncoiling in the later stages, particularly of the megalospheric form. Another species from the Pacific, *Nonionella translucens* Cushman, found in the Indo-Pacific region seems possibly an intermediate form between *Nonionella* and the species described here. Fig. 9 shows a peculiar form possibly related to *C. primitiva*.

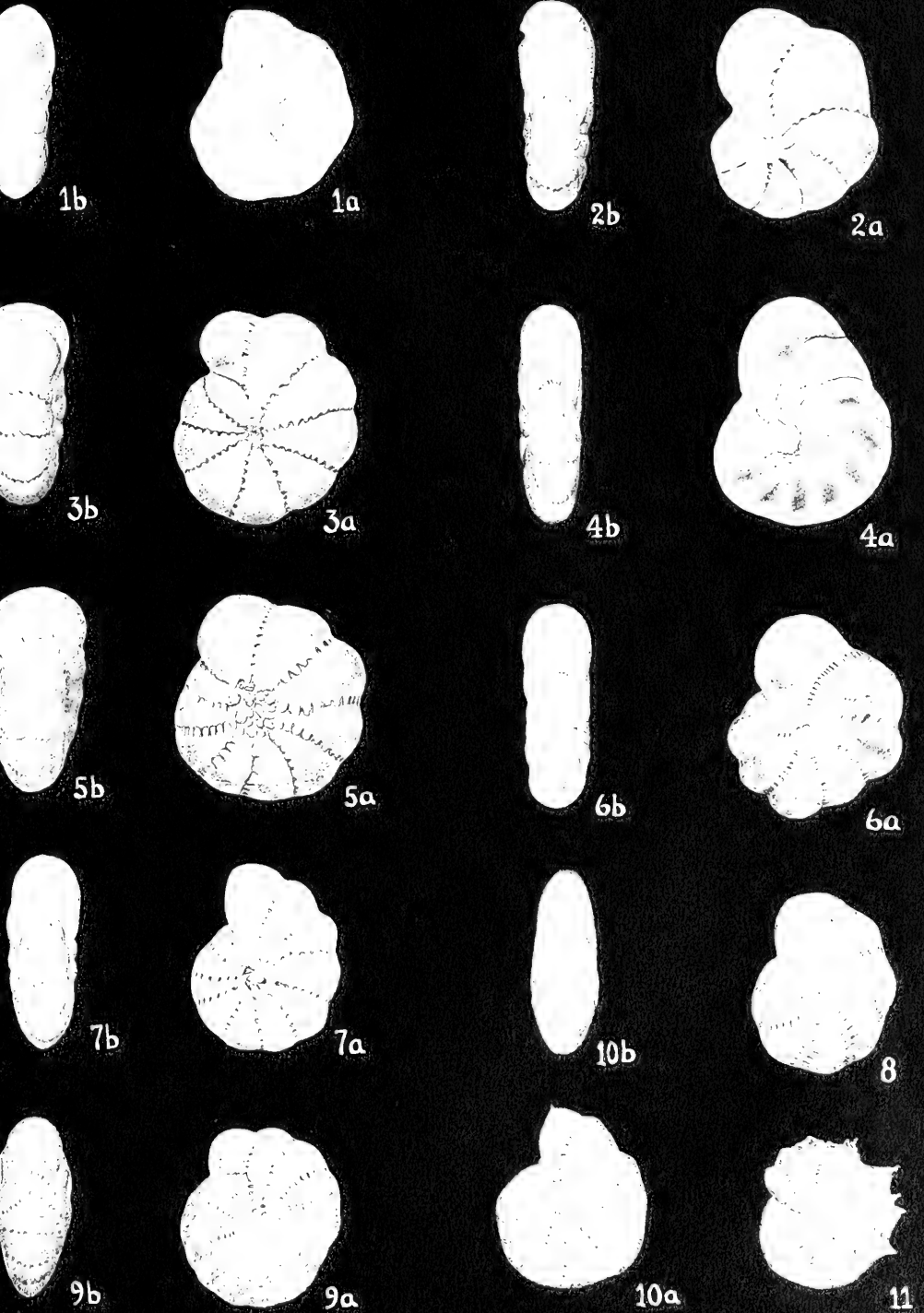
Stations: 222, 223, 2082, 339, 342, 343, 409, 418, 422, 423, 436, 460, 461, 463, 466, 468, 469, 470, 473, 500, 547, 556, 558.

*Distribution*.—Type locality, Station 418, is Darwin Bay, Tower Island, Galapagos, in 17 fms. The northward range is Braithwaite Bay,

## EXPLANATION OF PLATE 19

## FIGS.

1. *Elphidium simplex* Cushman. X 85. *a*, side view; *b*, apertural view.
- 2, 4. ? *Elphidium incertum* (Williamson), var. *lene* Cushman and McCulloch, new variety. 2, Holotype. X 85. 4, X 85.
- 3, 5. *Elphidium tumidum* Natland. X 45. *aa*, side views; *bb*, apertural views.
- 6, 8. *Elphidium frigidum* Cushman. 6, X 45. *a*, side view; *b*, apertural view. 8, X 28.
7. *Elphidium articulatum* (d'Orbigny). X 28. *a*, side view; *b*, apertural view.
9. *Elphidium translucens* Natland. X 35. *a*, side view; *b*, apertural view.
- 10, 11. *Elphidium spinatum* Cushman and Valentine. X 40. *a*, side view; *b*, apertural view.





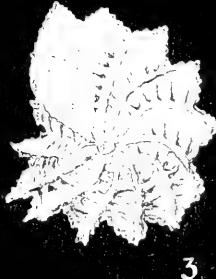
1



2b



2a



3



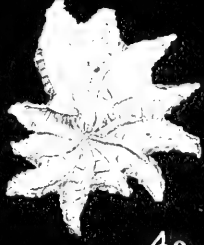
5a



5b



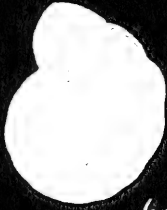
4b



4a



6b



6a



7b



7a



8b



8a



9b



9a



10b



10a



11a



11b

## EXPLANATION OF PLATE 20

## FIGS.

- 1, 2. *Elphidium spinatum* Cushman and Valentine, var. *magnificum* Cushman and McCulloch, new variety. X 60. 1, Paratype. 2, Holotype. *a*, side view; *b*, apertural view.
- 3, 4. *Elphidium stimulum* Cushman and McCulloch, new species. X 35. 3, Paratype. 4, Holotype. *a*, side view; *b*, apertural view.
5. *Elphidium crispum* (Linné). X 28. *a*, side view; *b*, apertural view.
6. *Elphidium crispum* (Linné), var. *subcrispum* Cushman and McCulloch, new variety. X 45. *a*, side view; *b*, apertural view.
- 7-10. *Elphidium pustulosum* Cushman and McCulloch, new species. X 28. 7, Holotype. 8-10, Paratypes. *aaaa*, side views; *bbbb*, apertural views.
11. *Elphidiella hannai* (Cushman and Grant). X 35. *a*, side view; *b*, apertural view.

Socorro Island, Mexico, in 4-10 fms., southward to Port Utria, Colombia, in 20 fms. The records between these points show a depth range from 4 to 80 fms.

Genus **ASTRONONION** Cushman and Edwards, 1937

**Astrononion stellatum** Cushman and Edwards

Plate 18, Fig. 11

*Astrononion stellatum* Cushman and Edwards, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 32, pl. 3, figs. 9-11.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 36, pl. 10, figs. 3-5.

Test somewhat compressed, umbilical region slightly depressed, periphery broadly rounded, lobulate; chambers 7 or 8 in the adult coil, strongly inflated, of uniform shape, and increasing very gradually in size as added, supplementary chambers rhomboid, the outer end in the adult very tapering; sutures depressed, curved; wall smooth, distinctly but finely perforate; aperture a low, arched slit at the base of the last-formed chamber, sometimes slightly subdivided, in the supplementary chambers a long, low opening at the posterior peripheral margin.

Diameter 0.40-0.60 mm; thickness 0.15-0.18 mm.

The types of this species are from off Iceland, but it is well distributed in the colder part of the North Atlantic. Our Pacific specimens are usually smaller and slightly more compressed than the Atlantic ones but otherwise seem to be identical.

Stations: 82, 1007, 1050, 226.

*Distribution*.—The records place this species near the Channel Islands, off California, and close to Guadalupe Island, Mexico, in 34 to 147 fms.

**Astrononion viragoense** Cushman and Edwards

Plate 18, Fig. 12

*Astrononion viragoense* Cushman and Edwards, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 32, pl. 3, figs. 12a, b.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 36, pl. 10, fig. 6.

Test somewhat compressed, strongly umbilicate, periphery very broadly rounded, lobulate; chambers about 7 in the adult, increasing rather rapidly in size as added, strongly inflated, supplementary chambers broadly rhomboid, somewhat fused; sutures depressed, curved, more strongly so in the earlier stages; wall smooth, finely perforate; aperture



at the base of the apertural face, subdivided into numerous small openings, those of the supplementary chambers low, at the posterior peripheral side.

Diameter 0.35-0.60 mm; thickness 0.20-0.30 mm.

The types of this species are from Virago Sound, British Columbia. Our material extends the known range considerably southward.

Stations: 1005, 1007, 2070, 412.

*Distribution.*—The range has been extended now from the type locality to the regions of the Channel Islands off California, in 49-54 fms.; Guadalupe Island, Mexico, in 250 fms.; and to the north side of Duncan Island, Galapagos, in 111 fms.

### Genus **ELPHIDIUM** Montfort, 1808

#### **Elphidium simplex** Cushman

Plate 19, Fig. 1

*Elphidium simplex* Cushman, Bull. 161, U.S. Nat. Mus., pt. 2, 1933, p. 52, pl. 12, figs. 8, 9; U.S. Geol. Survey Prof. Paper 191, 1939, p. 62, pl. 17, fig. 10.

Test nearly circular in side view, periphery rounded, becoming very slightly lobulate in the later portion, umbilical region with a large flat boss; chambers numerous, distinct, 8 to 12 in the last-formed coil, of rather uniform shape, increasing gradually in size as added, later ones slightly inflated; sutures distinct, depressed, rather strongly curved, particularly in the earlier stages, retral processes often indistinct but usually visible, especially in the later chambers; aperture consisting of one or more openings at the base of the apertural face.

Length 0.30-0.55 mm; breadth 0.28-0.45 mm; thickness 0.12-0.15 mm.

This is a characteristic Indo-Pacific species.

Stations: C-11, C-12, 4, 14, 111, 133, 144, 1018, 1062, 263, 322, 436, 469, 472.

*Distribution.*—This Indo-Pacific species is now recorded off California, at Gaviota Pier, in 8 fms.; Morro Bay, in 2 fms.; off the Channel Islands, in 2 to 45 fms.; in the Gulf of California, in 8 fms.; off Central America and Galapagos, in 2 to 15 fms.

**Elphidium incertum** (Williamson), var. **lene** Cushman and  
McCulloch, new variety

Plate 19, Fig. 2

Variety differing from the typical in the broader chambers, more compressed test, and higher apertural face.

Holotype of variety (AHF no. 37) from locality C-11.

This variety from the available material seems to be related to *E. incertum* (Williamson).

The peculiar form (Plate 19, Fig. 4) may be also related to this variety, but material is not in sufficient quantity to give a complete series to show the full amount of possible variation.

Stations: A-1, A-2, A-15, V-3, C-13, 56, 1017, 501.

*Distribution*.—Type locality, Station C-11, Gaviota Pier, 8 fms. Additional localities indicate a range from Wrangell, Alaska, southward to La Libertad, Ecuador, in shallow waters.

**Elphidium tumidum** Natland

Plate 19, Figs. 3, 5

*Elphidium tumidum* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, 1938, p. 144, pl. 5, figs. 5, 6.

*Elphidium hughesi* Natland (not Cushman and Grant), l. c., vol. 3, 1933, line 5 (table).

Test nearly circular in side view, somewhat depressed, periphery broadly rounded, lobulate, umbilical region depressed, roughened with minute papillae; chambers distinct, inflated, 10 or 11 in the adult coil, of uniform shape, broadly triangular in side view, increasing very gradually in size as added; sutures very distinct, depressed, slightly curved, retral processes short but numerous; wall finely arenaceous, smooth except in the umbilical region where the surface is papillate; aperture at the base of the last-formed chamber, usually composed of several small openings.

Diameter 0.50-0.60 mm; thickness 0.22-0.30 mm.

This species was described from off the coast of California and is recorded from the Pleistocene and Pliocene of southern California.

Stations: A-3, A-5, A-8, A-20, A-22, A-23, V-3, C-1, C-5, 61, 64, 81, 102, 103, 109, 110, 111, 113, 114, 127, 132, 133, 136, 2056, 313, 501.

*Distribution*.—These localities indicate a continuous distribution from the region of Cordova, Alaska, southward to La Libertad, Ecuador, in shallow waters.

**Elphidium frigidum** Cushman

Plate 19, Figs. 6, 8

*Elphidium frigidum* Cushman, Smithsonian Misc. Coll., vol. 89, no. 4, 1933, p. 5, pl. 1, figs. 8a, b; U.S. Geol. Survey Prof. Paper 191, 1939, p. 64, pl. 18, fig. 8.

Test usually completely involute, compressed, periphery rounded, lobulate, umbilical region depressed; chambers distinct, inflated, especially in the later portion, the final chambers often enlarged and projecting beyond the general contour of the test; sutures distinct, depressed, with numerous, short retral processes; wall thin, very distinctly perforate, the last-formed chambers often having distinct elongate markings; aperture consisting of numerous fine pores at the base of the apertural face of the last-formed chamber.

Length 0.60-1.00 mm; breadth 0.50-0.75 mm; thickness 0.20-0.30 mm.

Stations: A-1, A-8, A-13, A-23, V-1, W-1, W-3, W-5, C-9, C-10, 67, 1003.

*Distribution.*—This is typically an Arctic species but extends southward in cold water. The few records from our material are from northern localities with four exceptions. Localities C-9, C-10, and 1003 are off southern California with a depth range of 1 to 13 fms. Locality 67 is Santa Maria Bay, Mexico, in 7 fms. The list of stations places this species in shallow waters off the coast, from Cordova, Alaska, to Santa Maria Bay, Mexico.

**Elphidium articulatum** (d'Orbigny)

Plate 19, Fig. 7

*Polystomella articulata* d'Orbigny, Voy. Amér. Mérid., vol. 5, pt. 5, Foraminifères, 1839, p. 30, pl. 3, figs. 9, 10.

*Elphidium articulatum* Cushman, Bull. 104, U.S. Nat. Mus., pt. 7, 1930, p. 26, pl. 10, figs. 6-8.—Cushman and Valentine, Stanford Univ., Dept. Geology, Contr., vol. 1, no. 1, 1930, p. 21, pl. 5, figs. 10a, b.—Cushman and Parker, Proc. U.S. Nat. Mus., vol. 80, art. 3, 1931, p. 10.—Heron-Allen and Earland, *Discovery* Rep'ts, vol. 4, 1932, p. 439.—Earland, l. c., vol. 7, 1933, p. 132.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 188.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 53, pl. 14, figs. 17-19.

*Elphidium incertum* Heron-Allen and Earland (not Williamson), *Discovery Rep'ts*, vol. 4, 1932, p. 439, pl. 16, figs. 20, 21.

Test nearly circular in side view, compressed, periphery rounded, slightly lobulate in side view, umbilical region slightly depressed; chambers usually about 10 in the adult coil, slightly inflated, of uniform shape, increasing very gradually in size as added; sutures distinct, slightly depressed, especially in the later portion, retral processes usually short and broad, averaging about 10 in number; aperture composed of several, small rounded openings at the base of the apertural face.

Length 0.50-0.60 mm; breadth 0.45-0.50 mm; thickness 0.22-0.25 mm.

Stations: A-1, A-2, A-4, W-3, C-9, 3, 4, 39, 83, 112, 120, 1062, 1063, 209, 225, 227, 2019, 2070, 312, 344, 501, 506.

*Distribution*.—This species was described from off the Falkland Islands but extends northward to Cuba in the Atlantic and to Cordova, Alaska, in the Pacific. These localities show a depth range from 2 to 250 fms., with the greatest depth off Guadalupe Island, Mexico.

### ***Elphidium translucens* Natland**

Plate 19, Fig. 9

*Elphidium translucens* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, 1938, p. 144, pl. 5, figs. 3, 4.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 65, pl. 20, figs. 7a, b.

*Elphidium granulatum* Natland (not Galloway and Wissler), Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 3, 1933, line 28 (table).

Test nearly circular in side view, compressed but umbonate at the center, periphery broadly rounded, later portion slightly lobulate, umbilical region raised, with a translucent umbo, often showing the early chambers through the clear shell material; chambers 12 to 14 in the adult coil, increasing very gradually in size as added, in the later portion with the sides not extending back to the umbo, not inflated; sutures distinct, slightly if at all depressed, very slightly curved, with short, distinct, retral processes, 10-12 in number; wall translucent, distinctly perforate; aperture composed of numerous small openings at the base of the apertural face of the last-formed chamber.

Diameter 0.60-0.80 mm; thickness 0.22-0.35 mm.

Stations: C-10, 35, 37, 63, 77, 115, 116, 1017, 1018, 1041, 1058, 204, 222, 225, 226, 227, 231, 232, 253, 254, 255, 2019, 2034, 2069, 2081, 2082, 424, 461, 536, 540, 557.

*Distribution.*—This species was described from off California. It is often difficult to distinguish it from *E. spinatum* Cushman and Valentine in the same region. There seem to be nearly all graduations between the two species. The records indicate that this species has been recorded now as far southward as Peru, in very shallow waters with the exception of Station 227, off Guadalupe Island, Mexico, in 200 fms.

***Elphidium spinatum* Cushman and Valentine**

Plate 19, Figs. 10, 11

*Elphidium spinatum* Cushman and Valentine, Stanford Univ., Dept. Geology, Contr., vol. 1, no. 1, 1930, p. 21, pl. 6, figs. 1, 2.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 56.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 63, pl. 18, figs. 3, 4.

Test compressed, completely involute, periphery in the adult rounded and set with short spines, especially on the later chambers, extending forward obliquely from the anterior margin of the periphery of the chamber in a somewhat tangential direction; chambers numerous, 11-13 in the adult coil, distinct, only slightly inflated in the last half coil; sutures slightly if at all depressed, marked by the retral processes, usually 7 or 8 in number, short; wall very finely perforate; aperture very small, at the base of the apertural face.

Diameter 0.55-0.80 mm; thickness 0.22-0.25 mm.

Stations: 1, 77, 112, 204, 221, 502, 539, 548, 556.

*Distribution.*—This species has been known only from the coast of California heretofore. These new records place this species in shallow waters as far south as Ecuador.

***Elphidium spinatum* Cushman and Valentine, var. *magnificum***

Cushman and McCulloch, new variety

Plate 20, Figs. 1, 2

Variety differing from the typical in the much greater development of the spines, of which there are often more than one to a chamber and on the middle portion of the periphery of the chamber instead of confined to the peripheral angle.

Holotype of variety (AHF no. 38) from locality 548.

This variety represents a very high degree of spinose ornamentation for this genus.

Stations: 76, 77, 210, 2046, 2054, 2061, 548.

*Distribution*.—Type locality, Station 548, is Cupica Bay, Colombia, in 12 fms. Additional station records extend the range northward to Guadalupe Island and into the Gulf of California, Mexico, with a depth range of 11 to 32 fms.

***Elphidium stimulum* Cushman and McCulloch, new species**

Plate 20, Figs. 3, 4

Test much compressed, rowel shaped, the periphery deeply notched on account of the extensions of the chambers into pointed projections, umbilical region slightly depressed; chambers very distinct, increasing gradually in size as added, the edge of the apertural face raised into a definite ridge, the periphery extended out into pointed projections which are often serrate; sutures obscured by the retral processes which are elongate, extending nearly across the chamber, thickened at the base and tapering to a point, 8 to 10 in number in the adult; wall coarsely perforate, sometimes papillate or slightly spinose at the outer part of the chambers; aperture composed of several openings at the base of the apertural face of the last-formed chamber.

Length 0.85-1.00 mm; breadth 0.75-0.80 mm; thickness 0.20 mm.

Holotype (AHF no. 39) from locality 409.

This species differs from *E. spinatum* Cushman and Valentine in the ridges of the edges of the apertural face, the very long and raised retral processes, and the extensions of the chambers.

Stations: 409, 460.

*Distribution*.—Type locality, Station 409, is James Bay, James Island, Galapagos, in 15 fms. Stations 409 and 460 are both at the same locality. The *Velero III* dredged in James Bay, James Island, in both 1933 and 1934.

***Elphidium crispum* (Linné)**

Plate 20, Fig. 5

"Cornu Hammonis orbiculatum" Plancus (Bianchi), *Conchyliologia mineralogica*, 1739, p. 10, pl. 1, fig. 2.

"*Nautilus minimus*" Gualtieri, *Index Test. Conch.*, 1742, pl. 19, figs. A.D.

*Nautilus crispus* Linné, *Syst. Nat.* ed. 10, 1758, p. 709; ed. 13 (Gmelin's) 1788, p. 3370.—Fichtel and Moll, *Test. Micr.*, 1798, p. 40, pl. 4, figs. d-f.

*Polystomella crispa* Lamarck, Hist. Anim. sans Vert., vol. 7, 1822, p. 625.—d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 283, no. 1: Modèles no. 45; Foram. Foss. Bass. Tert. Vienne, 1846, p. 125, pl. 6, figs. 9-14.—Parker, Jones and H. B. Brady, Ann. Mag. Nat. Hist., ser. 3, vol. 16, 1865, p. 26, pl. 3, fig. 96.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 736, pl. 110, figs. 6, 7.

*Elphidium crispum* Cushman and Grant, Trans. San Diego Soc. Nat. Hist., vol. 5, no. 6, 1927, p. 73, pl. 7, figs. 3a, b.—Cushman and Leavitt, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 20, pl. 4, figs. 3, 4.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 7, 1930, p. 20.—Cushman and Valentine, Stanford Univ., Dept. Geology, Contr., vol. 1, no. 1, 1930, p. 21, pl. 5, figs. 12a, b.—Dolgopolskaja and Pauli, Sta. Biol. Karadagh Travaux, vol. 4, 1931, p. 34, pl. 3, figs. 13a-c, text figs. 1-3.—Hada, Tohoku Imp. Univ. Sci. Rep'ts, ser. 4, Biol., vol. VI, 1931, p. 123.—Bogdanowicz and Fedorov, On some representatives of the Genus *Elphidium* of the Sarmatian deposits of the lower Kuban River course, 1932, pp. 12, 48, pl. 1, fig. 3, text figs. 11, 12.—Macfadyen, Geol. Mag., vol. 69, 1932, pl. 35, figs. 18a, b.—Cushman, Bull. 161, U.S. Nat. Mus., pt. 2, 1933, p. 47, pl. 11, figs. 4a, b.—Tolmachoff, Ann. Carnegie Mus., vol. 23, 1934, p. 304, pl. 40, figs. 26, 27.—Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 50, pl. 13, figs. 17-21.

*Thameon rigatus* Montfort, Conch. Syst., vol. 1, 1808, p. 203, 51<sup>o</sup> genre.

Test of large size for the genus, about  $2\frac{1}{2}$  times longer than wide in peripheral view, lenticular, completely involute, the umbilical regions with a medium-sized, slightly projecting, rounded boss of clear shell material, the surface of which is set with 10 to 12 small, shallow, rounded pits, periphery sharply angular but not sharply keeled, sometimes becoming slightly lobulate and blunter in the last portion of the adult coil; chambers very numerous, 20 to 40, long and narrow, the last few often inflated, forward part slightly raised, giving a radially ribbed appearance; sutures somewhat sigmoid, the middle portion of each nearly radial, often partially obscured by the retral processes, set with pores, those of the earlier ones indistinct but later ones with large and deep pores; wall finely perforate, with about 12 relatively long retral processes extending well up onto the side of the next added chamber, appearing as fairly widely spaced, low elevations of the wall in the earlier chambers but as thicker and more rodlike structures in the later chambers; aperture a row of small openings at the base of the apertural face, which is low, sagittate, the sides often slightly concave, the ends pointed.

Diameter up to 3 mm; thickness 0.40-1.00 mm.

Stations: C-10, 60, 61, 67, 76, 136, 1007, 1023, 1050, 1061, 1062, 1064, 204, 211, 230, 258, 278, 280, 284, 285, 292, 2011, 2020, 2021, 2023, 2024, 2033, 2048, 2082, 2083, 2084, 322, 422, 423, 500.

*Distribution.*—This species is recorded as very widely distributed. The specimens from the Eastern Pacific, while apparently typical in most characters, average much smaller than from more tropical waters. An analysis of these station localities shows a geographical range from Ecuador into the Gulf of California and northward to points off the coast of California. The depth range is from 2 to 130 fms.

***Elphidium crispum* (Linné), var. *subcrispum* Cushman and McCulloch, new variety**

Plate 20, Fig. 6

Variety differing from the typical in the smaller size, fewer and higher chambers, shorter and fewer retral processes, and the less distinct, usually imperforate umbo.

Holotype of variety (AHF no. 40) from locality 421.

This variety, although occurring with the typical, is simpler in all respects.

Stations: 111, 222, 311, 317, 322, 406, 409, 411, 421, 452, 460, 463, 466, 467, 468, 472, 500, 616.

*Distribution.*—Type locality, Station 421, is Anchorage, South Seymour Island, Galapagos, in 13 fms. An analysis of station localities indicates that two records are off the coast of California in shallow waters; one off Socorro Island, Mexico, in 4-10 fms.; three off Costa Rica in 1-10 fms.; numerous stations off the Galapagos Islands in 13-65 fms.; one off La Plata Island, Ecuador, in 10 fms. This species was also found in a bottom sample, 616, from West Hole Island, Whit Sunday Passage, East Coast of Australia, at low tide.

***Elphidium pustulosum* Cushman and McCulloch, new species**

Plate 20, Figs. 7-10

Test nearly circular in side view, amount of compression variable, periphery acute, keeled, often slightly lobulate, denticulate, umbonal region slightly depressed; chambers distinct, numerous, 12 to 15 in the adult coil, of uniform shape and increasing very gradually in size as added, the edges of the apertural face strongly raised into a conspicuous ridge; sutures strongly curved, retral processes very distinct, usually extending



entirely across the chamber, 10 to 12 in number; wall reticulate on account of the raised ridges and retral processes, the umbilical region often with papillae and in some specimens the early portion of the whorl covered with fine papillae; aperture composed of several small openings at the base of the apertural face of the last-formed chamber.

Length 0.90-1.15 mm; breadth 0.65-0.90 mm; thickness 0.30-0.50 mm.

Holotype (AHF no. 41) from locality 447.

This species differs from *E. crispum* (Linné) in the absence of an umbonal boss, fewer chambers and very roughened surface. It is common in our collections and distinctive in appearance.

Stations: 401, 409, 423, 435, 437, 438, 441, 442, 447, 456, 458, 459, 460, 461, 463, 464, 465, 467, 469, 470, 471, 472, 478, 479.

*Distribution.*—All of the localities listed with the exception of 423 are off the Galapagos Islands, with a depth range from 9 to 80 fms. Stations 422, 423, and 425 (p. 23) are bottom samples from Socorro Island, Mexico, made by the *Velero III*, on the 1934 Expedition, to the Galapagos. The inclusion of bottom samples from off Mexico with those of Galapagos was not discovered soon enough to justify the changes necessary to correct the station numbers. This species is recorded at Station 423 in 13 fms.

### Genus *ELPHIDIELLA* Cushman, 1936

#### *Elphidiella hannai* (Cushman and Grant)

Plate 20, Fig. 11

*Elphidium hannai* Cushman and Grant, Trans. San Diego Soc. Nat. Hist., vol. 5, no. 6, 1927, p. 77, pl. 8, figs. 1, 2.—Cushman, Stewart and Stewart, l. c., vol. 6, 1930, p. 62, pl. 3, figs. 16, 17.

*Elphidiella hannai* Cushman, U.S. Geol. Survey Prof. Paper 191, 1939, p. 66, pl. 19, figs. 1, 2.

Test of medium size, the diameter about twice the thickness, periphery rounded but not broad, umbilical region flattened or very slightly concave, rarely slightly convex; chambers distinct, 12 to 15 in the last-formed coil, not inflated; sutures very distinct, limbate, flush with the surface, with a line of very fine pores, sometimes irregularly doubled, continued to the center of the umbilical region, the sutures appearing as darker curved lines on the lighter mass of the thick but very finely perforate wall; aperture consisting of a series of very fine pores along the base of the apertural

face and occasionally others scattered irregularly over the apertural face.

Diameter 0.80-1.00 mm; thickness 0.40-0.50 mm.

This is the only species of the genus known from the West Coast of America, but is fairly common as a living species and is recorded from the Pleistocene and Pliocene of California.

Stations: A-1, A-2, A-3, A-4, A-6, A-15, A-20, A-22, A-23, V-3, Silex, Oregon, C-1, C-9, 225, Penang.

*Distribution.*—These localities indicate a continuous range from off the coast at Cordova, Alaska, southward to the east side of Cedros Island, Mexico, in shallow waters. The bottom sample from Penang, low tide, also contained a few specimens which have been placed with those from this edge of the Pacific Ocean.

8.3  
87

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 4

SOME VIRGULININAE  
IN THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION  
(PLATES 21-28)

BY

JOSEPH A. CUSHMAN and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA  
1942



REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA, AND GALA-  
PAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, IN 1938,  
IN 1939, IN 1940, AND IN 1941.

SOME VIRGULININAE  
IN THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION

(PLATES 21-28)

*By* JOSEPH A. CUSHMAN and IRENE McCULLOCH

THE UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS  
ALLAN HANCOCK PACIFIC EXPEDITIONS  
VOLUME 6, NUMBER 4  
ISSUED JANUARY 19, 1942

---

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

SOME VIRGULININAE IN THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION

(PLATES 21-28)

Joseph A. Cushman and Irene McCulloch

In this fourth paper presenting the results of studies being made on the foraminiferal collections of the Allan Hancock Foundation, The University of Southern California, the third list of station tables is included. These three tables are continuations of Table 6 (see pp. 9-11, 146-148); of Table 7 (see pp. 11-13, 148-150) and Table 8 (see pp. 13-21, 150-152). With new material coming in constantly it has been impossible to complete the study of any one family or genus.

The foraminifera included in this paper mostly belong to the genus *Bolivina* and show a very considerable amount of variation. Figures on the plates show this variation to some extent and also the striking differences in the megalospheric and microspheric forms of the same species. As in other foraminifera, the adult characters are taken on much earlier in the megalospheric form, and it is in the comparison of these adult chambers that the relationships between the two forms become apparent.

TABLE 6 — MISCELLANEOUS (continued from page 148)

<i>Station</i>	<i>Locality</i>	<i>Fathoms</i>	<i>Date</i>
652	Kobe, Japan	22	July 12, 1940
653	Kobe, Japan	45	13, 1940
654	Entrance to Shanghai River	60	17, 1940
655	Shanghai	90	19, 1940
656	Outside of Breakwater, Manila	38	25, 1940
657	Penang	38	Aug. 1940
658	Bombay Bay, India	75	16, 1940
659	Capetown		31, 1940
660	Trinidad Bay, Port of Spain	45	Sept. 17, 1940
661	Cristobal	45	Oct. 10, 1940
662	Panama Lakes	38	10, 1940
663	Manila, P. I., outside Breakwater	30	Nov. 18, 1940
664	Colombo Bay	45	Dec. 13, 1940
665	Bombay Bay, India	38	16, 1940
666	Bombay Bay, India	45	19, 1940
667	Port of Spain	45	Jan. 20, 1941

TABLE 7 — OFF SOUTHERN CALIFORNIA (continued from p. 150)

<i>Station</i>	<i>Locality</i>	<i>Bearings</i>		<i>Fathoms</i>	<i>Date</i>
		<i>Latitude</i>	<i>Longitude</i>		
1100	W. end of Catalina Island	33 27 50	118 37 45	69	July 1, 1940
1101	W. end of Catalina Island	33 29 20	118 36 10	126	1, 1940
1102	E. of Long Point, Catalina Island			46	5, 1940
1103	3½ miles E. Long Point, Catalina Island	33 24 15	118 18 15	285	7, 1940



TABLE 7—OFF SOUTHERN CALIFORNIA (continued)

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1104	11½ miles S.E. Long Beach	33 36 15	118 06 45	52	July 22, 1940
1105	13½ miles S. of Seal Beach	33 30 32	118 06 35	225	23, 1940
1106	9½ miles S. of Seal Beach	33 34 55	118 06 00	58	23, 1940
1107	7 miles E. Long Point, Catalina Island	33 24 35	118 13 20	340	Aug. 8, 1940
1108	3½ miles off Newport Beach	33 34 15	117 58 35	37	9, 1940
1109	3¼ miles W. Huntington Beach	33 37 45	118 03 50	18	9, 1940
1110	4 miles S. E. end of Catalina Island	33 16 45	118 14 15	117	20, 1940
1111	San Pedro Channel, middle	33 24 15	118 00 20	67	20, 1940
1112	W. of Santa Barbara Island	33 29 40	119 07 00	150	Sept. 9, 1940
1113	N. of Santa Barbara Island	33 30 58	119 00 50	40	9, 1940
1114	N. of Catalina, off Eagle Bank	33 30 45	118 30 40	40	10, 1940
1115	Isthmus Cove	33 26 50	118 29 30	14	10, 1940
1116	N. of Catalina, Howland's Landing	33 30 20	118 32 28	47	10, 1940
1117	N. of Catalina, Howland's Landing	33 30 58	118 31 58	160	10, 1940
1118	N. of Catalina, Howland's Landing	33 29 28	118 33 30	160	10, 1940
1119	W. end of Catalina Island	33 29 10	118 36 30	123	11, 1940
1120	N. end of Catalina Island	33 28 30	118 31 00	50	28, 1940
1121	W. end of Catalina Island	33 41 10	118 19 15	58	Nov. 16, 1940
1122	W. end of Catalina Island	33 40 30	118 19 45	208	16, 1940
1123	W. end of Catalina Island	33 40 45	118 19 25	142	16, 1940
1124	W. end of Catalina Island	33 31 00	118 33 50	285	16, 1940
1125	W. end of Catalina Island	33 30 15	118 34 35	132	16, 1940
1126	W. end of Catalina Island	33 29 20	118 35 15	64	16, 1940
1127	W. end of Catalina Island	33 29 40	118 37 15	126	16, 1940

TABLE 7 — OFF SOUTHERN CALIFORNIA (continued)

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1128	W. end of Catalina Island	33 30 10	118 37 25	134	Nov. 16, 1940
1129	Off Point Firmin	33 41 45	118 17 50	18	17, 1940
1130	10 miles S. San Pedro Breakwater	33 33 35	118 09 10	81	Jan. 26, 1941
1131	Off San Pedro Channel				26, 1941
1132	Off San Pedro Channel				26, 1941
1133	5 miles 152° from San Pedro Breakwater	33 38 15	118 12 15	19	Feb. 15, 1941
1134	3½ miles 238° off Huntington Beach	33 37 40	118 04 10	18	16, 1941
1135	6 miles S.W. Seal Beach	33 36 30	118 06 25	26	16, 1941
1136	Off Huntington Beach, 80 fm. bank	33 34 30	118 07 10	74	16, 1941
1137	Off Wilson Cove, San Clemente Island	33 00 29	118 33 15	14	22, 1941
1138	Off Wilson Cove, San Clemente	33 00 40	118 32 45	52	22, 1941
1139	9 miles off San Diego	32 34 50	117 22 05	78	23, 1941
1140	7½ miles S. of Point Loma	32 33 10	117 15 16	30	23, 1941
1141	San Diego Bay Anchorage	32 38 50	117 12 15	7	23, 1941
1142	2¾ miles off Point Loma	32 37 45	117 12 35	40	23, 1941
1143	3 miles N.W. Anacapa Island light	34 02 30	119 24 30	47	Mar. 16, 1941
1144	3 miles N.W. Anacapa Island light	34 03 00	119 23 50	51	16, 1941
1145	¾ miles S.E. Cat Rock, Anacapa Island	33 59 50	119 24 30	25	16, 1941
1146	6½ miles N. Anacapa Island lighthouse	34 07 20	119 23 15	125	23, 1941
1147	5 miles N.E. Anacapa Island lighthouse	34 05 10	119 18 00	125	23, 1941
1148	3½ miles S. Hueneme	34 05 30	119 12 40	30	23, 1941
1149	1½ miles S.E. Point Mugu	34 04 00	119 02 45	30	23, 1941
1150	10¾ miles W. Point Dume	34 00 20	119 01 20	47	23, 1941
1151	1 mile N.E. San Miguel Island	34 05 15	120 20 40	35	Apr. 10, 1941

TABLE 7 — OFF SOUTHERN CALIFORNIA (continued)

Station	Locality	Bearings			Date
		Latitude	Longitude	Fathoms	
1152	3 miles E. South Point, Santa Rosa Island	33 53 30	120 02 55	26	Apr. 10, 1941
1153	2½ miles E. South Point, Santa Rosa Island	33 53 20	120 03 50	23	10, 1941
1154	1 mile S. East Point, Santa Rosa Island	33 55 30	119 58 30	15	10, 1941
1155	3 miles S. Fraser Point	34 00 40	119 57 00	24	11, 1941
1156	3½ miles S. Fraser Point, Santa Cruz Island	34 00 00	119 56 40	28	11, 1941
1157	5 miles S. Fraser Point, Santa Cruz Island	33 58 20	119 55 00	74	11, 1941
1158	2.6 miles E. East Point, Santa Rosa Island	33 56 05	119 54 50	49	11, 1941
1159	4.2 miles S.E. East Point	33 53 10	119 55 00	51	11, 1941
1160	6 miles E. South Point, Santa Rosa Island	33 53 30	120 00 00	30	11, 1941
1161	3½ miles E. South Point	33 53 20	119 58 00	38	11, 1941
1162	S. E. Smugglers Cove	34 00 30	119 31 30	19	12, 1941
1163	1 mile N. San Pedro	34 03 20	119 30 40	46	12, 1941
1164	3 miles N.W. San Pedro	34 05 00	119 32 35	80	12, 1941
1165	1½ miles N.W. Cavern Point	34 04 35	119 34 15	56	12, 1941
1166	0.3 miles N.W. Pelican Bay	34 02 10	119 41 50	39	12, 1941
1167	½ mile N.E. Platt Harbor	34 03 25	119 43 30	31	12, 1941
1168	3 miles N. Arch Rock, Santa Cruz Island	34 06 25	119 48 40	60	12, 1941
1169	7 miles E. Long Point, Catalina Island	33 24 40	118 13 35	267	May 3, 1941
1170	2.8 miles W.N.W. Long Point, Catalina Island	33 26 00	118 24 40	88	3, 1941
1171	3.5 miles W.N.W. Long Point, Catalina Island	33 26 20	118 25 20	51	3, 1941
1172	3.5 miles W.N.W. Long Point, Catalina Island	33 26 00	118 25 35	40	3, 1941
1173	1½ miles S.E. West End, Catalina Island	33 27 20	118 35 35	50	4, 1941
1174	½ mile S.W. Ribbon Rock, Catalina Island	33 26 05	118 34 50	56	4, 1941
1175	1¾ miles W. Catalina, Catalina Island	33 25 40	118 32 30	51	4, 1941
1176	1¾ miles S. Catalina Island	33 23 40	118 30 45	104	4, 1941

TABLE 8 — OFF MEXICO (continued from p. 152)

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
2142	Agua Verde Bay, L. Calif., Mex.			20	Feb. 12, 1940
2143	Agua Verde Bay, L. Calif., Mex.			10	12, 1940
2144	4 miles S.E. of Marcial Pt., L. Calif., Mex.			113-127	13, 1940
2145	N.W. of San Gabriel Island, L. Calif., Mex.			29-35	13, 1940
2146	L. Calif., Mex.	24 56 40	110 42 10	130	13, 1940
2147	Gulf of Calif.	24 37 30	110 31 30	208	13, 1940
2148	Gulf of Calif.	24 47 40	110 38 03	44	13, 1940
2149	Gulf of Calif.	25 27 20	110 58	125	13, 1940
2150	Gulf of Calif.	24 34 37	110 21 28	100	15, 1940
2151	Gulf of Calif.	24 35 23	110 21 33	160	15, 1940
2152	Gulf of Calif.	24 32 23	110 20 27	58	15, 1940
2153	East of Espiritu Santo Island			52-58	15, 1940
2154	San Jose Del Cabo Bay			51-55	16, 1940
2155	San Jose Del Cabo Bay			17-25	16, 1940
2156	Inner Gorda Bank			59	17, 1940
2157	4 miles off Todos Santos Island, Mex.	31 53 20	116 48 15	41	24, 1941
2158	N. end Ranger Bank off Cedros Island, Mex.	28 33 44	115 30 00	81	25, 1941
2159	1 mile S. San Benito Islands, Mex.	28 17 55	115 33 55	34	26, 1941
2160	1 mile S. San Benito Islands, Mex.	28 17 15	115 35 40	44	26, 1941
2161	5½ miles S. San Benito Islands, Mex.	28 13 00	115 33 30	81	26, 1941
2162	8½ miles S. San Benito Islands, Mex.	28 10 25	115 34 15	71	26, 1941
2163	8 miles S.W. Cedros Island, Mex.	28 00 17	115 28 43	63	26, 1941
2164	8½ miles S. Cedros Island, Mex.	27 55 20	115 21 32	55	27, 1941
2165	3 miles N.W. Natividad Island, Mex.	27 55 53	115 15 58	30	27, 1941
2166	8½ miles S. Dewey Channel, Mex.	27 42 00	115 05 15	49	27, 1941
2167	Dewey Channel, San Eugene Pt., Mex.	27 49 50	115 06 05	23	27, 1941
2168	4 miles N. of Dewey Channel	27 54 15	115 06 40	24	27, 1941
2169	2 miles S.E. Cedros Island, Light	28 20 35	115 10 10	55	28, 1941

Family **Buliminidae**Subfamily *Virgulininae*Genus **VIRGULINA** d'Orbigny, 1826**Virgulina seminuda** Natland

Plate 21, Fig. 1

*Virgulina seminuda* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, 1938, p. 145, pl. 5, fig. 12.

"Test elongate, slender, oval in cross section, broadest near the middle tapering to an acute initial end usually with a short spine; apertural end subacute; chambers rapidly increasing in height, four pairs usually making up the biserial stage, triserial stage very short; sutures distinct; walls with a band of clear shell material surrounding a finely perforate and relatively opaque area, clear shell area iridescent; aperture subterminal, loop shaped. Length 0.50 mm.; breadth 0.12 mm.; thickness 0.10 mm."

This species described from the coast of California occurred at Station 231 in typical form.

*Distribution.*—The station record of 231, listed with the stations off Mexico, is off California, Smuggler's Cove, Santa Cruz, 10 fms. This record is one of several which deviate from the general plan of labeling bottom samples at the Foundation.

Genus **BOLIVINA** d'Orbigny, 1839

**Bolivina acerosa** Cushman, var. **pacifica** Cushman and McCulloch,  
new variety

Plate 21, Figs. 2, 3

Variety differing from the typical in the somewhat larger size, lack of ornamentation of the early portion, and the distinct clear areas at the upper and inner portion of each chamber.

Holotype of variety (AHF no. 42) from Station 60.

The typical form of the species is from the Miocene of Haiti.

The varietal form shows very little variation, although specimens are numerous at some of the stations. It has a wide range along the coast of the eastern Pacific.

Stations: A-2, A-15, 55, 60, 79, 80, 144, 468, 508, 516, 1006, 1009, 1015, 1068, 1095, 1096, 1097, 1100, 1101, 2000, 2093, 2107, 2113, 2116, 2134, 2140, 2149.

*Type locality*.—Ensenada de Los Muertos, Gulf of California, Mexico, in 10 fms.

*Distribution*.—The above records range from Wrangell, Alaska, in 2 fms.; the Gulf of California in 56 to 125 fms.; to Galapagos in 20 fms. and to Colombia in 55 fms.

### ***Bolivina advena* Cushman**

Plate 21, Figs. 4-6

*Bolivina advena* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 29, pl. 5, figs. 1a, b; vol. 2, pt. 3, 1926, p. 54.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 67.—Cushman and Ponton, Bull. 9, Florida State Geol. Survey, 1932, p. 83, pl. 12, fig. 3.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 95, pl. 10, fig. 16.—Cushman and McGlamery, Prof. Paper 189D, U.S. Geol. Survey, 1938, p. 107, pl. 25, fig. 12.—Kleinpell, Miocene Stratigraphy of California, 1938, p. 264, pl. 7, fig. 6; pl. 9, fig. 7 (?).

Test elongate,  $2\frac{1}{2}$  to 3 times as long as broad, somewhat fusiform, greatest breadth toward the apertural end, periphery of the early portion acute, becoming rounded in the later portion, early portion strongly compressed, later portion somewhat more thickened; chambers distinct, those of the early portion very low and broad, later increasing in relative height as added, so that toward the apertural end the last-formed chamber may be nearly as high as broad, slightly inflated, particularly in the later portion; sutures slightly limbate, particularly in the early portion, later somewhat depressed, somewhat curved, in the early portion forming an angle of about  $30^\circ$  with the horizontal; wall smooth, but distinctly perforate; aperture narrow, elongate, opening on the base of the inner margin of the last-formed chamber. Length 0.45-0.50 mm.; breadth 0.20-0.22 mm.; thickness 0.10-0.12 mm.

The records for this species are all from the Miocene. Rare specimens occurred at stations 469, 1015, and 1069, but they may possibly be reworked fossils.

*Distribution*.—Station 1015 is off Tyler Bay, Santa Cruz Island, in 32 fms.; Station 1069 is off Santa Rosa Island in 230 fms.; Station 469 is off Charles Island, Galapagos, in 10 fms. These bottom samples gave no evidence of reworked fossils.

***Bolivina advena* Cushman, var. *striatella* Cushman**

Plate 21, Figs. 7-11

*Bolivina advena* Cushman, var. *striatella* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 30, pl. 5, figs. 3a, b; vol. 2, pt. 3, 1926, p. 54.—Cushman and Moyer, l. c., vol. 6, 1930, p. 58, pl. 8, fig. 6.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 68.—Cushman and Laiming, Journ. Pal., vol. 5, 1931, p. 110, pl. 12, fig. 5.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 9.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 98, pl. 10, fig. 22; pl. 16, figs. 15-17.—Kleinpell, Miocene Stratigraphy of California, 1938, p. 266, pl. 15, fig. 1.

Variety differing from the typical in the longer, more tapering form, the initial end subacute, about 9 chambers making up the last half of the test; sutures somewhat distinct, very slightly depressed; wall finely perforate, surface of the early portion ornamented with very fine, numerous longitudinal costae, the later portion smooth.

This variety was described from the Miocene of California, but specimens that are very similar have been recorded from dredgings off the California coast. There is considerable variation in the development of the costae and in the amount of compression of the test.

Stations: 55, 81, 109, 110, 113, 114, 115, 138, 213, 217, 225, 226, 255, 256, 261, 264, 296, 321, 338, 422, 503, 526, 529, 558, 627, 629, 1011, 1015, 1017, 1063, 1068, 1076, 1099, 2087, 2090, 2092, 2093, 2100, 2106, 2107, 2109, 2110, 2113, 2116, 2129, 2132, 2133, 2136, 2137, 2140, 2153, 2154.

*Distribution*.—These numerous records off California and Mexico range from a depth of 14 to 123 fms. Additional records are off Costa Rica, Ecuador, Kobe, Japan, and Singapore with a depth range from 10 to 19 fms.

***Bolivina aenariensis* (Costa) (?)**

Plate 21, Fig. 12

There are a number of specimens similar to that here figured which may be referred with some question to Costa's species. They are all very similar and show little variation.

Stations: 136, 422, 512, 583.

*Distribution*.—Station 136 is in shallow waters off San Pedro; Station 422 is off Socorro Island, Mexico. The other two records are off Colombia in 48 fms. and off Ecuador in 10 fms.

***Bolivina albatrossi* Cushman**

Plate 21, Figs. 13-15; Plate 22, Fig. 1

*Bolivina albatrossi* Cushman, Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 31, pl. 6, fig. 4.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 153, pl. 18, figs. 22-24.

*Bolivina textularioides* Heron-Allen and Earland (not Reuss), Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 238, pl. 41, figs. 10-14 (?).

Test from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  times as long as broad, small, rather thick, periphery broadly rounded; chambers fairly distinct, slightly if at all inflated, much broader than high throughout, increasing gradually in size as added, the basal edge at the inner margin in the adult often developing a definite lobe and re-entrant; sutures distinct except in the early portion, somewhat limbate, not depressed, strongly oblique, somewhat more so in the adult portion; wall finely perforate, with coarse surface ornamentation, which, in the early portion, consists of a rather coarse network, the edges of which are considerably raised above the surface, becoming finer and less raised toward the apertural end, the last pair of chambers often fairly smooth; aperture elongate, narrow. Length up to 0.50 mm.; diameter 0.18-0.20 mm.

The types are from *Albatross* D2677, 478 fms., off the Carolina coast.

This species somewhat resembles *B. compacta* Sidebottom, but the sutures are different, and the ornamentation, particularly of the early portion, is much more pronounced. The shape of the two forms is also quite different.

The Pacific specimens so far as our material shows are somewhat broader than the Atlantic ones, although there are intermediate specimens and the ornamentation and other characters are very similar.

Stations: 403, 411, 412, 414, 461, 466, 472, 627, 629.

*Distribution*.—The series of records from the regions of the Galapagos give a range of 15, 60, 111 fms. At both Kobe, Japan, and Singapore the bottom samples were collected from anchors.

***Bolivina argentea* Cushman**

Plate 22, Figs. 2-6

*Bolivina argentea* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 42, pl. 6, fig. 5; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 155, pl. 3, fig. 5.—Cushman and Moyer,



Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 57, pl. 8, fig. 3.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 140, pl. 19, figs. 7-11.

Test elongate,  $2\frac{1}{2}$  to 3 times as long as broad, very much compressed, periphery subacute, usually not keeled, the width after the first few chambers increasing slowly; chambers very distinct, narrow in the young, in the adult about  $2\frac{1}{2}$  times as long as broad; sutures oblique and curved, early ones limbate, later ones thin and somewhat depressed; wall very finely perforate, smooth except for the very base, which occasionally has a trace of one or more costae on the proloculum, and one or two following chambers; color of test light silvery gray, polished. Length up to 0.80 mm.; breadth 0.40 mm.

The types are from *Lydonia* station 30, Lat.  $7^{\circ} 01' N.$ , Long.  $81^{\circ} 48' W.$ , in 428 fms. It also occurs northward along the west coast of America at least as far as Oregon, and may possibly have been recorded as *B. aenariensis* from farther north. It occurs in the upper Pliocene of California in typical form, and has the same silvery gray test in well-preserved specimens. It is one of the characteristic and abundant species of the western coast of America.

In our material this species has occurred at but few stations, but it is often difficult to separate it from *Bolivina interjuncta* Cushman, var. *bicostata* Cushman, which may account for the many records of the former.

Stations: 82, 260, 261, 473, 629, 634, 1069, 1070, 1077, 1083, 1095, 1096, 1097, 1099.

*Distribution.*—Most of the above records are for the regions off the Channel Islands and range in depth from 17 to 230 fms. In the Gulf of California the record is for 52 fms.; off the San Benito Islands it is 16-42 fms. A single record for Galapagos, Hood Island, is for 73 fms. The records for Port Said and Singapore are for less than 10 fms.

### ***Bolivina bramlettei* Kleinpell**

Plate 22, Figs. 7-13

*Bolivina bramlettei* Kleinpell, Miocene Stratigraphy of California, 1938, p. 267, pl. 21, figs. 9-11.

“Test compressed, fusiform in outline, broadest somewhat above the middle, periphery acute, serrate; chambers distinct, somewhat inflated, about 10 or 11 pairs, earlier 7 or 8 pairs low and making up about half the test, last 3 pairs more overlapping and becoming successively higher,

base of each chamber somewhat extended outward and downward to a point at the periphery, last pair of chambers showing a low and blunt but distinct peripheral keel; sutures distinct, depressed, strongly curved to meet periphery obliquely; wall smooth, punctate; aperture terminal, elongately oval, with lip. Length up to 0.9 mm.; thickness 0.16 mm."

The types of this species are from the Miocene of Palos Verdes Hills, California. It has not previously been recorded as a living species, but there are numerous specimens in our collections that seem to belong here. It is a more fusiform, somewhat thicker species than *B. pseudo-beyrichi* Cushman.

Stations: 59, 60, 200, 217, 299, 336, 412, 512, 516, 540, 543, 585, 1007, 1076, 2023, 2087, 2090, 2097, 2098, 2101, 2106, 2107, 2110, 2113, 2140, 2149, 2151, 2152, 2153, 2154, 2156.

Some of the more elongate specimens are close to *Bolivina bradyi* Asano and may possibly belong there.

*Distribution.*—Numerous records for the Gulf of California give a depth range from 6 to 160 fms. In Parker Bay, Costa Rica, the depth is 15 fms.; in the area north of Duncan Island, Galapagos, the depth is 111 fms.; for three stations off Colombia the depth range is 48 to 50 fms.

### ***Bolivina compacta* Sidebottom**

Plate 23, Fig. 4

*Bolivina robusta* H. B. Brady, var. *compacta* Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 49, no. 5, 1905, p. 15, pl. 3, fig. 7.

*Bolivina compacta* Cushman, Bull. 71, U.S. Nat. Mus., pt. 2, 1911, p. 36, text fig. 58; Bull. 100, vol. 4, 1921, p. 137, pl. 26, fig. 7; Publ. 311, Carnegie Instit. Washington, 1922, p. 26, pl. 1, fig. 10; Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 45; Publ. 342, Carnegie Instit. Washington, 1924, p. 18, pl. 5, fig. 1.—Heron-Allen and Earland, *Discovery Rep'ts*, vol. IV, 1932, p. 354.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 135, pl. 17, figs. 22-24; Smithsonian Misc. Coll., vol. 99, no. 9, 1941, p. 10.

Test elongate, tapering,  $2\frac{1}{2}$  to 3 times as long as broad, periphery rounded, initial end bluntly pointed, apertural end obliquely rounded; chambers numerous, somewhat inflated; sutures very slightly depressed, not very distinct; wall ornamented by a series of large, coarse punctae somewhat irregularly arranged, those of the last-formed chambers finer and more numerous; aperture elongate, extending from the base of the

inner margin of the last-formed chamber to the highest point of the chamber. Length up to 0.75 mm.; breadth 0.25-0.30 mm.; thickness 0.12-0.15 mm.

This species is widely distributed in the Pacific and elsewhere and is somewhat variable in shape.

Stations: C-13, 53, 61, 62, 73, 80, 208, 228, 416, 423, 457, 460, 461, 466, 468, 469, 470, 472, 500, 534, 535, 539, 574, 1003, 1013, 1017, 1041.

*Distribution.*—An analysis of the stations shows a record for Monterey Bay, California, 25 fms.; near Catalina and San Clemente for 10 to 25 fms.; off Mexico in 17 to 50 fms.; a series of records off Ecuador and Peru in 10 to 100 fms.; and a series of records off the Galapagos Islands in 7 to 80 fms.

### ***Bolivina costata* d'Orbigny**

Plate 23, Figs. 1-3

*Bolivina costata* d'Orbigny, Voy. Amer. Merid., vol. 5, 1839, p. 62, pl. 8, figs. 8, 9; Foram. Foss. Bass. Tert. Vienne, 1846, p. 239, pl. 21, figs. 44, 45.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 41, pl. 6, figs. 2a, b; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 155, pl. 3, fig. 8.—Cushman and Kellett, Proc. U.S. Nat. Mus., vol. 75, art. 25, 1929, p. 8, pl. 3, figs. 9a-c.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 122, pl. 15, figs. 4, 5.

Test small, tapering, about twice as long as broad, broadest toward the apertural end in both front and side views, periphery broadly rounded; chambers numerous, earlier ones low and broad, later ones becoming gradually higher, until, in the last-formed ones, the height is often nearly equal to the breadth, slightly inflated; sutures somewhat indistinct, but appearing as irregular, angular lines between the sutures, pointing toward the aperture, since the suture line extends out onto the costae and backward at the same time; wall very coarsely perforate, with a few, sharp, raised, longitudinal costae, continuous over the sutures, usually 5 or 6 costae on a side, last-formed chambers of each series usually smooth on the outer face; aperture narrow, elliptical, extending in from the base nearly in the median line. Maximum length 0.40 mm.; breadth 0.15 mm.; thickness 0.12 mm.

This species was described by d'Orbigny from off the west coast of South America. It is abundant off the coast of Peru, and it is interesting to note that all of the stations which have this species are in this same region.

Because later authors have placed other forms under this name, there has been some confusion in regard to it, but the species as d'Orbigny described it is very distinctive and limited in its distribution.

Stations: 323, 522, 529, 533, 534, 536, 537, 573, 574.

*Distribution.*—The above records place this species in Salinas Bay, Costa Rica, in 8 fms. and off the coast of Peru with a depth range from 6 to 100 fms.

### ***Bolivina doniezi* Cushman and Wickenden**

Plate 23, Fig. 5

*Bolivina doniezi* Cushman and Wickenden, Proc. U.S. Nat. Mus., vol. 75, art. 9, 1929, p. 9, pl. 4, figs. 3*a*, *b*.—Cushman and Kellett, l.c., art. 25, 1929, p. 8, pl. 3, figs. 8*a*, *b*.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 140, pl. 19, fig. 6.

Test small, depressed, broadest near the apertural end; chambers comparatively few, consisting of 8 or 10 pairs; wall very coarsely perforate, the earlier chambers with a few coarse perforations near the basal margin, the adult chambers with the coarse perforations scattered over the general surface; chambers fairly narrow, but becoming higher toward the apertural end; sutures distinct, depressed, strongly oblique; aperture elongate, arched, in the median line, at the base of the last-formed chamber. Length 0.36 mm.; breadth 0.15 mm.; thickness 0.10 mm.

The types of this species are from off Juan Fernandez. A few specimens in our collections seem to belong to this species.

Stations: 61, 100, 313, 464, 469, 472, 502.

*Distribution.*—These records indicate a range beginning off San Francisco Island, Mexico, in 17 fms.; Secas Islands, Panama, in 25 fms.; three stations off Charles and Hood islands, Galapagos, in 10-15 fms.; and off La Libertad, Ecuador, in 15 fms.

### ***Bolivina goudkoffi* Rankin**

Plate 23, Figs. 6, 7

*Bolivina goudkoffi* Rankin MS., in Cushman and Kleinpell, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 22, pl. 4, figs. 4, 5.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 101, pl. 11, figs. 11, 12.

Test elongate, about 3 times as long as broad, broadly elliptical in transverse section, periphery broadly rounded, sides nearly parallel or

very slightly tapering, somewhat contracted toward the apertural end, which distinctly projects; chambers distinct, slightly inflated, high, strongly overlapping, except the last three chambers; sutures distinct, slightly limbate, very slightly depressed, somewhat sigmoid, forming a slight angle with the horizontal, the inner margin with a distinct lobe; wall finely but distinctly perforate, with a tendency for the upper portion of the chamber to become clear; aperture large, broad, with a distinct, raised lip. Length 0.70-0.80 mm.; breadth 0.25-0.28 mm.; thickness 0.15-0.18 mm.

The types are from the Miocene, 2,040 feet stratigraphically above base of Modelo formation as exposed along road from Girard to Mohn Spring, Santa Monica Mountains, California.

Numerous specimens from restricted areas off the coast of Mexico seem to be identical with the types of this species.

Stations: 57, 59, 60, 62, 67, 2100.

In some specimens there is a tendency toward a lobing of the sutures similar to that seen in *Bolivina sinuata* Galloway and Wissler, but the early stages are not the same. This is shown in our figured specimen.

*Distribution.*—All of these station records are off the tip of Lower California, Mexico, beginning with the Santa Maria Bay on the Pacific side, in 7 fms., and around Cape San Lucas to the region of Espiritu Santo in 150 fms.

### ***Bolivina imbricata* Cushman**

Plate 23, Fig. 8

*Bolivina imbricata* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 31, pl. 5, figs. 7a, b; vol. 2, pt. 3, 1926, p. 54.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 68, pl. 8, fig. 3.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 99, pl. 10, fig. 23.

Test elongate, about  $2\frac{1}{2}$  times as long as broad, very strongly compressed, periphery acute and keeled throughout; chambers distinct, early ones much broader than high, gradually increasing in relative height in the adult portion, strongly overlapping; sutures distinct, strongly limbate, much curved; wall thin, finely perforate, the surface ornamented with strong longitudinal costae, 8 to 10 on each side, the central one strongest and often continuing nearly to the apertural end of the test, the others less prominent, and usually limited to the first third of the test; aperture

broadly elliptical, with a slight lip. Length up to 0.75 mm.; breadth 0.30 mm.; thickness 0.10 mm.

The types of this species are from the Miocene.

The specimen here figured from Station 1062 seems to be a recent one. There are two specimens from Station C-11 that are probably washed out from fossil beds as is indicated by the peculiar appearance of the wall and the broken edges. Abundant specimens from Station 1003 may also be fossils.

*Distribution.*—These records are off the coast of southern California in shallow water.

### ***Bolivina interjuncta* Cushman**

Plate 23, Fig. 12

*Bolivina costata* d'Orbigny, var. *interjuncta* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 41, pl. 6, fig. 3.—Cushman and Moyer, l.c., vol. 6, 1930, p. 57.

*Bolivina interjuncta* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 70, pl. 11, figs. 10-13.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 120, pl. 15, figs. 1-3.—Adams, Amer. Journ. Sci., vol. 237, 1939, p. 509.

Test elongate, 2 to 2½ times as long as broad, much compressed, periphery sharp and keeled, gradually tapering, greatest breadth toward the apertural end; chambers distinct, the earliest ones low and broad particularly in the microspheric form, gradually increasing in relative height as added, the later ones very slightly if at all inflated; sutures fairly distinct, oblique, forming an angle of about 35° with the horizontal, strongly limbate; wall finely perforate, ornamented by several, very strongly raised, longitudinal costae, running nearly the entire length of the test, connected in the later portion by numerous, irregularly anastomosing, shorter costae of about the same strength; aperture elongate, narrow. Length up to 1.00 mm.; breadth 0.35-0.40 mm.; thickness 0.08-0.10 mm.

The types are from the Pleistocene, Lomita Quarry, Palos Verdes Hills, California.

As a living species this is rare, much more so than the following variety. A fairly typical specimen is figured.

Stations: 230, 1077, 1078, 2093, 2094, 2140, 2144, 2146, 2149, 2151, 2152, 2153.

*Distribution*.—Beginning at the region of San Benito Islands, Mexico, in 35 fms. and continuing on around into the Gulf of California with a depth range of 58 to 160 fms.

***Bolivina interjuncta* Cushman, var. *bicostata* Cushman**

Plate 23, Figs. 9-11, 13-16

*Bolivina costata* d'Orbigny, var. *bicostata* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 42.—Cushman and Moyer, l.c., vol. 6, 1930, p. 57.—*Bolivina interjuncta* Cushman, var. *bicostata* Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 116, pl. 22, fig. 23.

Variety differing from the typical in having the 2 costae nearest the middle most strongly developed, and continued for most of the length of the test, but no anastomosing costae present.

Some of the Pacific material that has been referred to "*Bolivina aenariensis* Costa" may belong to this variety.

There is considerable variation from forms such as Plate 23, Fig. 15, where but 2 costae are present, to the ones with additional lateral costae. The costae in the variety do not anastomose as in the typical form of the species.

Stations: 55, 82, 200, 215, 217, 230, 251, 261, 409, 422, 506, 516, 517, 543, 583, 1078, 2097, 2100, 2101, 2134, 2156.

*Distribution*.—The records indicate a range beginning off Catalina in 147 fms., continuing southward along Mexico, into the Gulf of California, the region of the Galapagos Islands, and off Colombia in 10 to 225 fms.

***Bolivina laevigata* (Williamson)**

Plate 24, Fig. 1

*Textularia variabilis* Williamson, var. *laevigata* Williamson, Rec. Foram. Gt. Britain, 1858, p. 77, pl. 6, fig. 168.

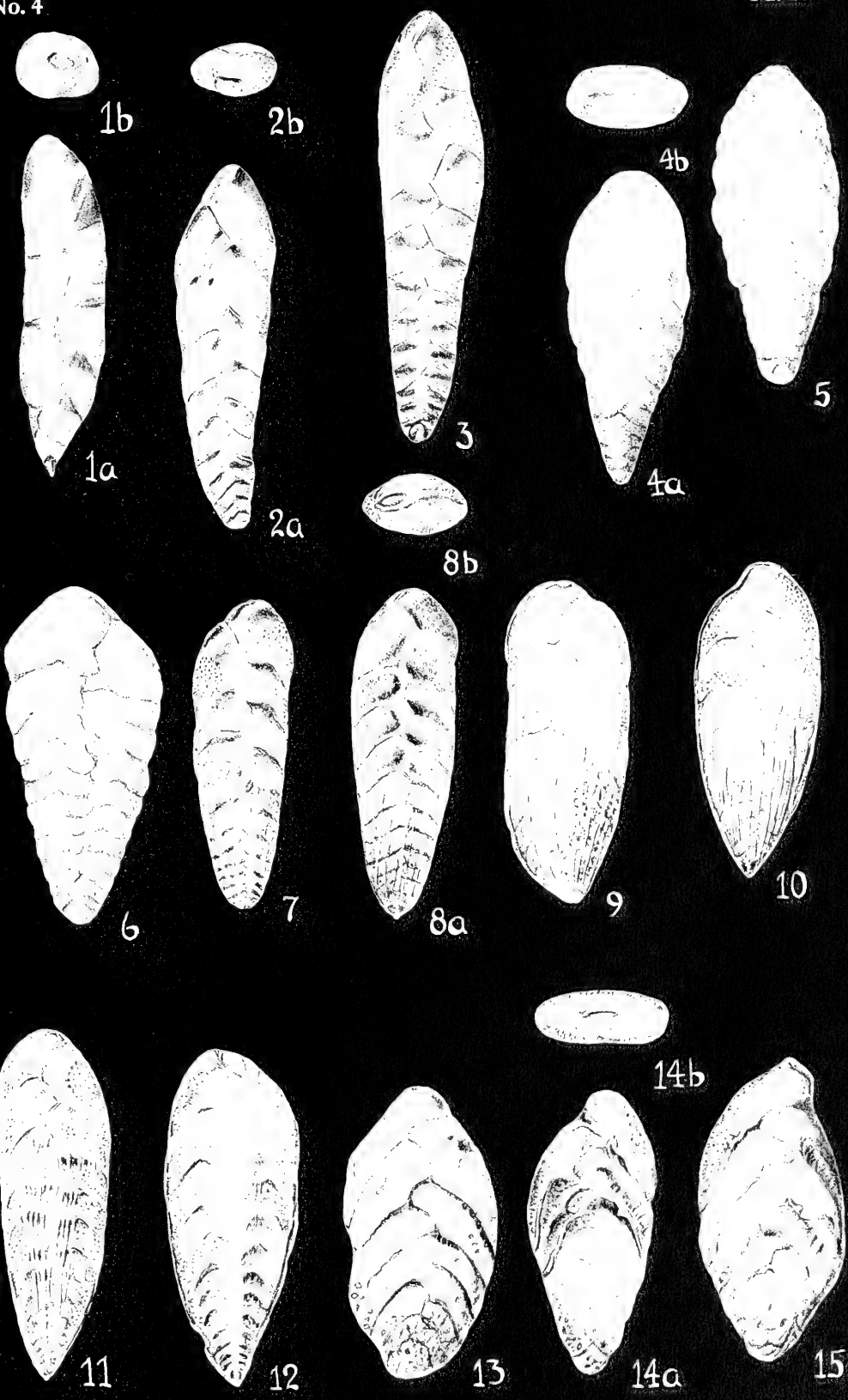
*Bolivina laevigata* H. B. Brady, Journ. Roy. Micr. Soc., 1887, p. 900.—Halkyard, Trans. Manchester Micr. Soc., 1889, pp. 11, 65.—Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1889-1891 (1891), p. 474.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890-1891 (1892), p. 59.—Halkyard, Trans. Manchester Micr. Soc., 1891 (1892), p. 7 (list).—Wright, Irish Nat., vol. 9, 1900, p. 53 (list); Proc. Liverpool Geol. Soc., 1901-1902 (1902), p. 183 (list); Journ. Isle of Man Nat. Hist. Ant.

## EXPLANATION OF PLATE 21

## FIGS.

1. *Virgulina seminuda* Natland. x 130.
- 2, 3. *Bolivina acerosa* Cushman, var. *pacifica* Cushman and McCulloch, new variety. x 130. 2. Holotype, *a*, front view; *b*, apertural view. 3. Paratype.
- 4-6. *Bolivina advena* Cushman. x 90. *a*, front view; *b*, apertural view.
- 7-11. *Bolivina advena* Cushman, var. *striatella* Cushman. x 120. *a*, front view; *b*, apertural view.
12. *Bolivina aenariensis* (Costa) (?) x 130.
- 13-15. *Bolivina albatrossi* Cushman. x 120. *a*, front view; *b*, apertural view.







1



2b



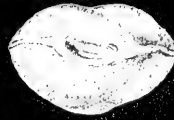
2a



3



4



7b



8b



5



6



7a



8a



9b



11b



9a



10



11a



12



13

## EXPLANATION OF PLATE 22

## FIGS.

1. *Bolivina albatrossi* Cushman. x 120.
- 2-6. *Bolivina argentea* Cushman. x 50. *a*, front view; *b*, apertural view.
- 7-13. *Bolivina bramlettei* Kleinpell. 7, 9, 10, 12, 13, x 70. 8, x 90. 11, x 60. *aaaa*, front views; *bbbb*, apertural views.

Soc., vol. 3, 1902, p. 2 (list).—Reade, Proc. Liverpool Geol. Soc., 1903-1904 (1904), pp. 5, 7 (lists).—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 208.—Millett, Rec. Foram. Galway, 1908, p. 5.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1909, p. 335; l.c., 1910, p. 409; Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 65; Journ. Roy. Micr. Soc., 1916, p. 43; Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 238.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 36, pl. 4, fig. 2.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 79.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 159, pl. 16, figs. 1-5.

Test elongate, about 3 times as long as broad, somewhat compressed, rapidly tapering at the initial end, then with the sides nearly parallel, periphery broadly rounded; chambers distinct, comparatively few, height and breadth about equal, of rather uniform shape throughout, increasing in size as added, those of the adult portion about equal; sutures distinct, very slightly depressed, nearly horizontal or very slightly oblique; wall smooth, very finely perforate; aperture broadly oval, often with distinct tooth. Length 0.50 mm.; breadth 0.20 mm.; thickness 0.10-0.15 mm.

This species is known mostly from about the British Isles. The Pacific specimens are somewhat less compressed, but when compared with the Atlantic specimens seem to be close enough to be included in the same species. Specimens are very rare in our material.

Stations: 209, 329, 534, 1062.

*Distribution.*—The four records show a range from east of Gull Island off Santa Barbara Island in 21 fms.; the region of San Benito Islands in 13 fms.; Cocos Island in 40 fms.; off Peru in 18 fms.

***Bolivina marginata* Cushman, var. *adelaidana* Cushman and Kleinpell**

Plate 24, Figs. 2, 3

*Bolivina marginata* Cushman, var. *adelaidana* Cushman and Kleinpell, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 10, pl. 2, figs. 1, 2.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 87, pl. 10, figs. 11-14.

Variety differing from the typical in the strongly raised and limbate sutures and the tendency of the chambers to become somewhat spinose at the basal angle.

The type is from the Miocene, 1,100 feet N. and 200 feet W. of S.E. corner of Sec. 7, T. 26 S., R. 10 E., Adelaida Quadrangle, California.

The living specimens show a considerable range of variation as will be seen from our figures. Some of the specimens are very close indeed to the fossils as a comparison with the types shows. From these there is a tendency for the chambers to be lower and more in the test as a whole. The spinosity of the margin also is variable.

Stations: 200, 509, 1049, 1080, 1082.

*Distribution.*—Off Santa Barbara and San Clemente islands in 110 to 160 fms.; off Tangola Tangola, Mexico; off Colombia in 18 fms.

### ***Bolivina minuta* Natland**

Plate 24, Figs. 4-7

*Bolivina minuta* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, 1938, p. 146, pl. 5, fig. 10.

“Test very compressed, sides nearly parallel, periphery angled, flattened, forming a slightly concave side; eight to ten pairs of chambers, rapidly expanding from a subacute initial end; sutures distinct, curved, quite oblique; walls thin, very finely perforate; aperture a loop-shaped opening in the top of the last chamber.” Length 0.22-0.30 mm.; breadth 0.15-0.17 mm.; thickness 0.04 mm.

This small species is recorded from off Panama and off the coast of California. In our material it occurs at several stations off Peru and off Mexico. Our figures show some of the variations in the form and number of the chambers in the microspheric and megalospheric forms.

Stations: 536, 537, 569, 573, 2070, 2097, 2153.

*Distribution.*—Off Guadalupe Island in 250 fms., southward into the Gulf of California in 58 fms., and off the coast of Peru in 12-45 fms.

### ***Bolivina pisciformis* Galloway and Morrey**

Plate 24, Fig. 8

*Bolivina pisciformis* Galloway and Morrey, Bull. Amer. Pal., vol. 15, 1929, p. 36, pl. 5, fig. 10.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 93, pl. 13, fig. 26.—Palmer and Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 10, No. 5, 1936, p. 289.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 92, pl. 11, figs. 20, 21.—Kleinpell, Miocene Stratigraphy of California, 1938, p. 279, pl. 4, fig. 10.

Test about twice as long as broad, very strongly compressed, keeled, the basal angle of each chamber marked by a backwardly pointing projection from the outer edge of the keel, giving it a dentate appearance, tapering throughout, greatest breadth formed by the last pair of chambers; chambers very distinct, slightly if at all inflated, earlier ones very low and broad, increasing slightly in relative height as added, but in the adult much broader than high, not inflated; sutures distinct, strongly limbate, increasing in the amount of obliquity toward the apertural end, and becoming also slightly curved, not depressed; wall smooth, finely perforate; aperture narrow, elongate, its base opening at the inner margin of the last-formed chamber. Length 0.50 mm.; breadth 0.25 mm.

The types of this species are from the Miocene exposures along the coast of Ecuador, but it had a wide distribution in the Miocene of America. Specimens seemingly identical were found at Station 1007.

*Distribution.*—Station 1007 is two miles west of Santa Barbara Island, in 54 fms.

### ***Bolivina paula* Cushman and Cahill**

Plate 24, Figs. 9-12

*Bolivina paula* Cushman and Cahill MS., Cushman and Ponton, Bull. 9, Florida State Geol. Survey, 1932, p. 84, pl. 12, figs. 6a, b.—Cushman and Cahill, Prof. Paper 175A, U.S. Geol. Survey, 1933, p. 26, pl. 8, figs. 14a, b.—Cushman, Special Publ. 9, 1937, p. 91, pl. 11, fig. 9.—Cushman and McGlamery, Prof. Paper 189D, U.S. Geol. Survey, 1938, p. 107, pl. 25, figs. 14, 18, 19.

Test minute, about 3 times as long as broad, much compressed, periphery subacute, sides for the most part nearly parallel, initial end tapering; chambers numerous, often 12 or more pairs in the adult test, increasing somewhat in height as added, some of the earliest ones being very low; sutures distinct, very slightly if at all depressed, slightly limbate, rather strongly curved backward; wall smooth, finely perforate; aperture an elongate, somewhat comma-shaped opening in the median line of the apertural face. Length 0.30-0.35 mm.; breadth 0.15 mm.; thickness 0.06-0.08 mm.

The types of this species are from the Miocene, and it has been recorded from the Oligocene. Very similar specimens occur in the eastern Pacific. It is a small species and easily overlooked.

Stations: A-1, 64, 126, 223, 298, 409, 410, 460, 464, 516, 573, 636, 2139.

*Distribution.*—These stations from Ketchikan, Alaska, in 8 fms., southward along Mexico, in the Gulf of California in 2 to 53 fms.; off the Galapagos Islands in 9-16 fms.; and off Colombia and Peru in 15 to 116 fms. Another record of interest is Station 636, material from an anchor in the Bay of Naples, Italy.

### ***Bolivina plicata* d'Orbigny**

Plate 24, Figs. 13-15

*Bolivina plicata* d'Orbigny, Voy. Amer. Merid., vol. 5, 1839, p. 62, pl. 8, figs. 4-7.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 39; Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 40, pl. 6, figs. 1a, b; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 154, pl. 3, figs. 11, 12; Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 123, pl. 15, figs. 6-8.

Test small, thick, elongate, very slightly tapering, the periphery broadly rounded, initial end broadly rounded; chambers distinct, inflated; sutures distinct, somewhat depressed, nearly straight, at right angles to the elongate axis; wall ornamented with one or two costae on each side, usually running the entire length of the test except for the last-formed chamber, the costae rounded at the surface and broad, the surface and sides very finely plicated with alternating grooves and ridges, somewhat oblique, but nearly parallel to the costae themselves; wall finely perforate; aperture elongate, extending somewhat above the outline of the chamber, owing to the definite lip that is developed. Length up to 0.50 mm.; breadth 0.15-0.20 mm.; thickness 0.08-0.10 mm.

This species described by d'Orbigny from off Chile is rare in our collections, occurring in small numbers at Stations 55, 57, 59, 251, 339, 517, 1077, 1095, 2097, 2098, 2100, 2101, 2103, 2104, 2134, 2146, 2149, 2151, 2152, 2156.

*Distribution.*—The northward record is off Redondo, California, in 70-240 fms.; southward off Mexico, and in the Gulf of California in 2-225 fms.; off Central and South America in 12-116 fms.

### ***Bolivina pseudobeyrichi* Cushman**

Plate 25, Figs. 1-3

*Bolivina pseudobeyrichi* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 45; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 156, pl. 3, fig. 7.—Cushman and Moyer, Contr.

Cushman Lab. Foram. Res., vol. 6, 1930, p. 58, pl. 8, fig. 5.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 139, pl. 19, figs. 4, 5.

*Bolivina beyrichi* Reuss, var. *alata* Cushman (not Seguenza), Bull. 71, U.S. Nat. Mus., pt. 2, 1911, p. 35, text figs. 57a, b.

Test short,  $1\frac{1}{2}$  to 2 times as long as broad, strongly compressed, rapidly increasing in breadth, greatest at the last 2 chambers, periphery keeled except about the first few chambers, not spinose at the initial end; chambers distinct, somewhat inflated, increasing rapidly in size and relative height as added, usually without strongly pointed peripheral angles; sutures distinct, depressed, strongly oblique in the early stages, less strongly so later, not limbate; wall distinctly and coarsely perforate, otherwise smooth; aperture elongate, elliptical or oval, with raised lip. Length 0.50-0.60 mm.; breadth 0.30-0.35 mm.; thickness 0.10-0.12 mm.

This species is apparently confined to the eastern Pacific in rather cold water at depths of 55 to 500 fms.

Stations: 56, 57, 69, 516.

*Distribution*.—From Los Frailes Point, Mexico, in 160 fms.; in the Gulf of California in 150 fms.; and off Colombia in 55 fms.

### ***Bolivina pseudoplicata* Heron-Allen and Earland (?)**

Plate 25, Figs. 4-7

There are numerous specimens in the collection which seem related to *B. subexcavata* Cushman and Wickenden but which develop, as our figures show, a distinct reticulation, particularly on the basal portion. These show a wide range of variation, but the Atlantic forms show fully as wide a range, and it may be that they are the same.

Stations: C-13, 76, 106, 109, 110, 136, 144, 227, 503, 1004, 1006, 1009, 1010, 1011, 1014, 1017, 1042, 1062, 1099, 2135, 2139, 2153.

*Distribution*.—Numerous records off the Channel Islands with a depth range of 4 to 63 fms.; four records off Mexico and in the Gulf of California in 2 to 58 fms.; near La Libertad, Ecuador, in 19 fms.

### ***Bolivina pygmaea* H. B. Brady**

Plate 25, Figs. 8-12

*Bolivina pygmaea* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 27; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 421, pl. 53, figs. 5, 6.—Jones and Chapman, Monograph of Christmas Island, 1900,



p. 231.—Jensen, Proc. Linn. Soc. New South Wales, vol. 29, 1904, p. 812.—Goddard, Rec. Austr. Mus., vol. 6, 1905-1908 (1908), p. 307 (list).—Chapman, Rep't Foram. Subantarctic Islands of New Zealand, 1909, p. 331, pl. 14, fig. 11; Zool. Res. *Endeavour*, pt. 3, 1912, p. 310; Biol. Res. *Endeavour*, vol. 3, pt. 1, 1915, p. 20.—Cushman, Bull. 100, U.S. Nat. Mus., vol. 4, 1921, p. 136.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 57, pl. 8, fig. 4.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 124, pl. 15, figs. 18, 19.

Test usually less than twice as long as broad, much compressed, greatest breadth formed by the last pair of chambers, periphery serrate or spinose; chambers distinct, numerous, inflated, much broader than high, very slightly overlapping, increasing rather regularly in size as added, the lower peripheral angle in the adult ending in a distinct spine; sutures distinct, depressed, nearly straight, strongly oblique, forming an angle of about  $45^\circ$  with the horizontal; wall smooth, finely perforate; aperture narrow, elongate. Length 0.25 mm.; breadth 0.20 mm.; thickness 0.08-0.10 mm.

Specimens of this species are rather rare in these collections. There seems to be considerable variation, and the specimens on Plate 25, Figs. 11, 12, have traces of spines and occur with typically spinose specimens. They are referred here with some question, although they seem definitely related to one another.

Stations: 55, 59, 315, 517, 1077, 1095, 2029, 2071, 2134, 2140, 2149, 2151, 2152.

*Distribution*.—Beginning with one record off Redondo, California, in 70 to 240 fms., the series of stations places this species as far southward as Colombia with a depth range from 45 to 116 fms.

### ***Bolivina quadrata* Cushman and McCulloch, new species**

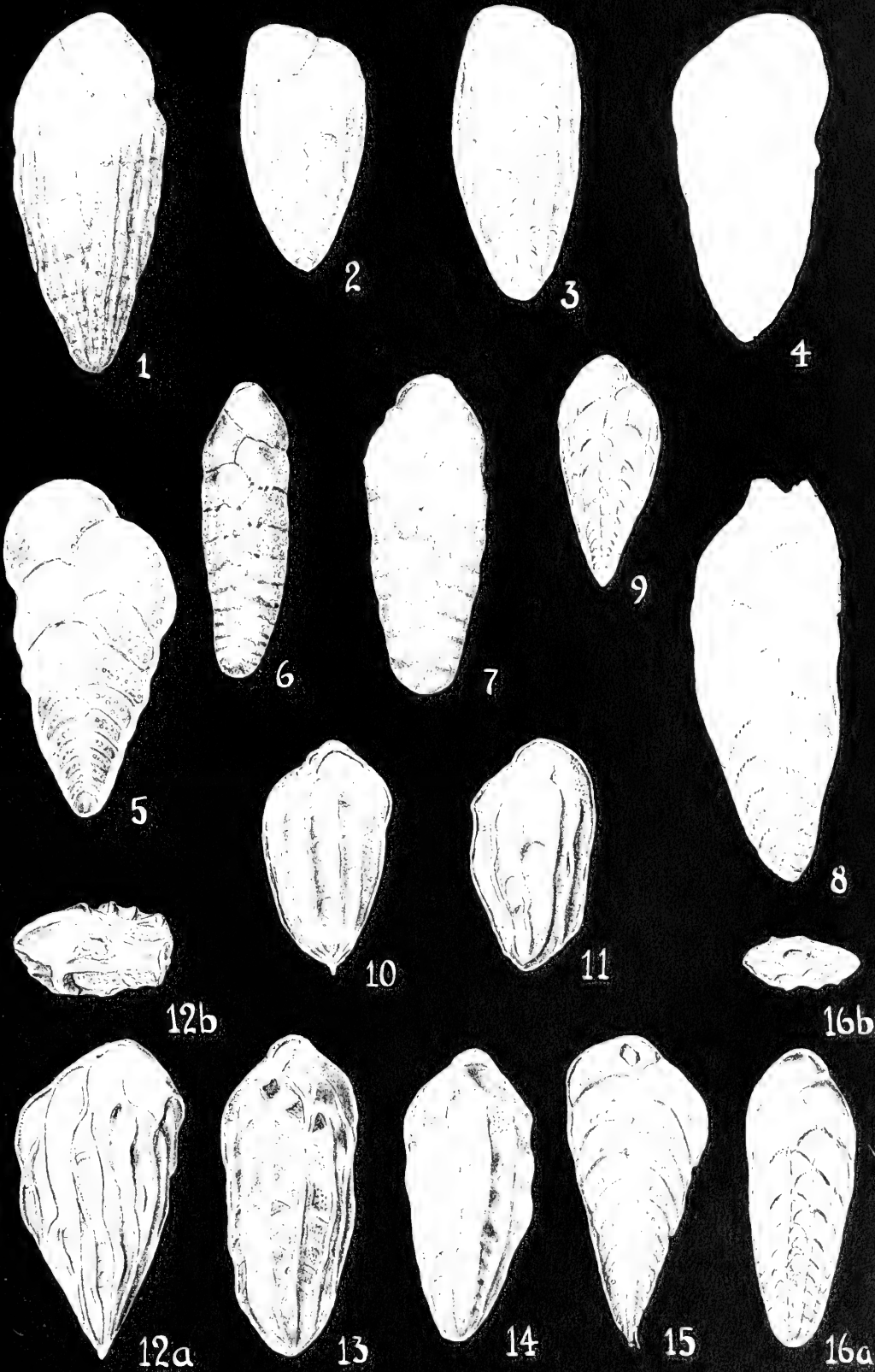
Plate 25, Fig. 13

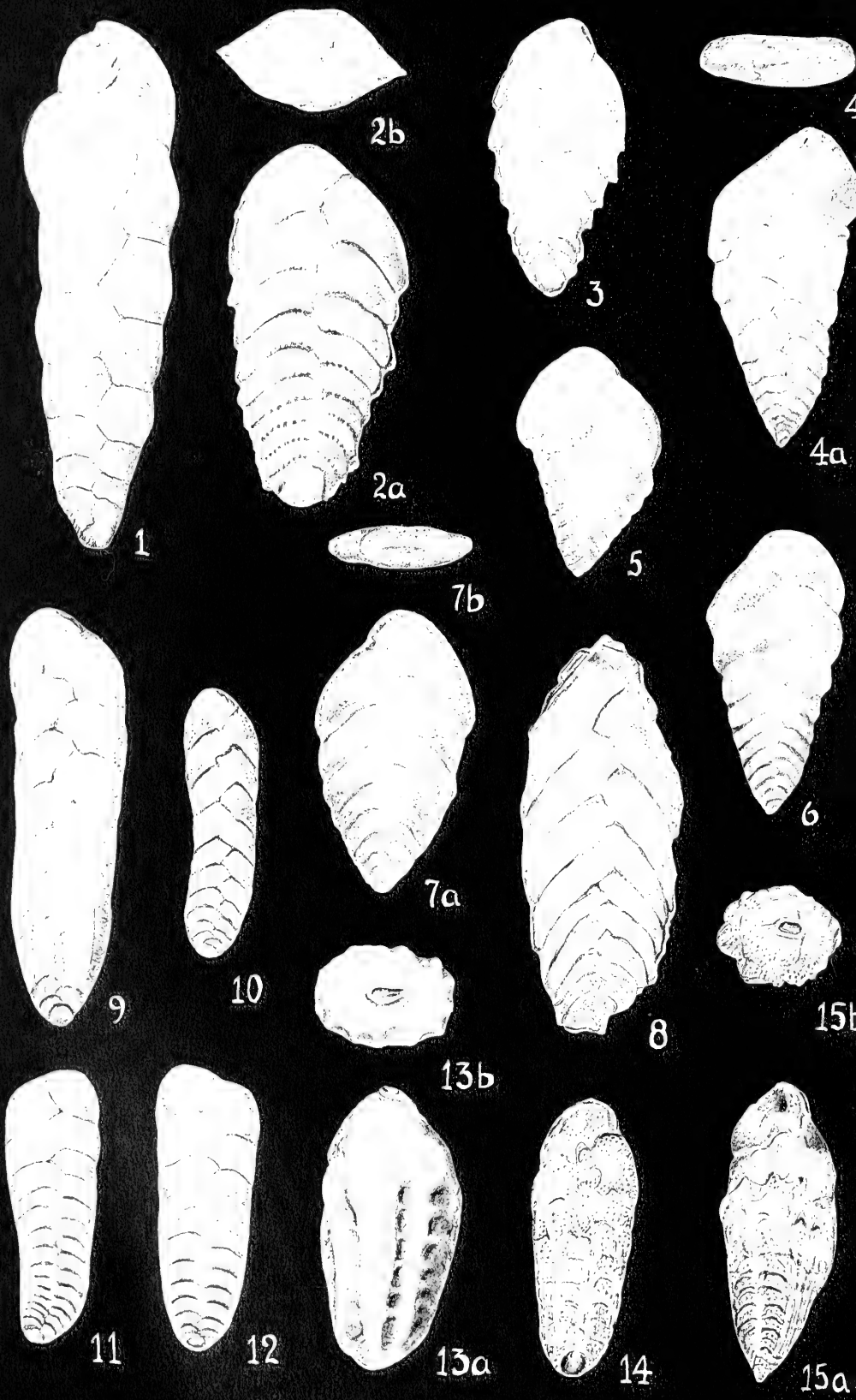
Test small, early portion gradually tapering, adult portion with the sides nearly parallel, only slightly compressed; chambers numerous, distinct, not inflated, very low in the early portion, about as high as broad in the adult; sutures distinct, little if at all depressed, at nearly right angles to the elongate axis; wall smooth, finely perforate; aperture elongate oval, extending from the base of the last-formed chamber to the middle of the outer apertural end. Length 0.30-0.35 mm.; breadth 0.12 mm.; thickness 0.08 mm.

## EXPLANATION OF PLATE 23

## FIGS.

- 1-3. *Bolivina costata* d'Orbigny. x 130.
4. *Bolivina compacta* Sidebottom. x 130.
5. *Bolivina doniezi* Cushman and Wickenden. x 160.
- 6, 7. *Bolivina goudkoffi* Rankin. 6, x 70. 7, x 90.
8. *Bolivina imbricata* Cushman. x 120.
- 9-11, 13-16. *Bolivina interjuncta* Cushman, var. *bicostata* Cushman. 9-11, 15, 16, x 70. 13, 14, x 90. *a*, front view; *b*, apertural view.
12. *Bolivina interjuncta* Cushman. x 90. *a*, front view; *b*, apertural view.





## EXPLANATION OF PLATE 24

## FIGS.

1. *Bolivina laevigata* (Williamson). x 120.
- 2, 3. *Bolivina marginata* Cushman, var. *adelaidana* Cushman and Kleinpell. 2, x 120, 3, x 70. *a*, front view; *b*, apertural view.
- 4-7. *Bolivina minuta* Natland. 4, 5, x 145. 6, 7, x 130. *aa*, front views; *bb*, apertural views.
8. *Bolivina pisciformis* Galloway and Morrey. x 120.
- 9-12. *Bolivina paula* Cushman and Cahill. 9, 10, x 120. 11, 12, x 180.
- 13-15. *Bolivina plicata* d'Orbigny. x 70. *a*, front view; *b*, apertural view.

Holotype (AHF no. 43) from Station 208.

This species is a small one but keeps its characters with little variation. It differs from *Bolivina paula* Cushman and Cahill in the much less compressed test, sutures at nearly right angles to the elongate axis and broadly rounded periphery.

Stations: 73, 80, 106, 110, 144, 208, 209, 226, 227, 271, 1005, 1018, 1076, 1081, 2107, 2110, 2112, 2113, 2114, 2116, 2156.

*Type locality*.—Melpomene Cove, south end of Guadalupe Island, in 18 fms.

*Distribution*.—Off the Channel Islands in 8 to 180 fms.; southward along Mexico and into the Gulf of California in 13 to 225 fms.

### ***Bolivina seminuda* Cushman**

Plate 25, Fig. 14

*Bolivina seminuda* Cushman, Bull. 71, U.S. Nat. Mus., pt. 2, 1911, p. 34, text fig. 55; Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 43; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 157, pl. 3, fig. 6.—Hada, Trans. Sapporo Nat. Hist. Soc., vol. 11, 1929, p. 11.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 57.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. 6, 1931, p. 132, text fig. 89.—Cushman, Special Publ. 9, 1937, p. 142, pl. 18, figs. 13-15.

Test elongate, 3 to 4 times as long as broad, subcylindrical, very slightly compressed, increasing slightly in width, periphery very broadly rounded; chambers numerous, distinct, very slightly inflated, the earlier ones broader than high, but in the adult becoming higher than broad; sutures distinct, depressed, forming an angle of less than  $45^\circ$  with the horizontal; wall of the upper portion of each chamber clear and hyaline, the lower half with rather coarse foramina, giving a whitish appearance to the lower half of the test in contrast to the clear upper portion; aperture elongate, oval. Length up to 1.00 mm.; breadth 0.30-0.35 mm.; thickness 0.20-0.25 mm.

The types are from *Albatross* D4775, Bowers Bank, Bering Sea, 584 fms. The species ranges southward along the Pacific Coast as far at least as Panama, and westward across the Pacific to Japan, where it is recorded by Hada from shallow water of Hokkaido and Mutsu Bay. It has been found at three *Albatross* stations in the eastern Pacific. It occurs in the Pliocene of California.

The only occurrence of the typical form in these collections is from Station 59.

*Distribution.*—Station 59 is in the Gulf of California, Mexico, at Ensenada de los Muertos in 150 fms.

**Bolivina seminuda** Cushman, var. **humilis** Cushman and McCulloch,  
new variety  
Plate 26, Figs. 1-6

Variety differing from the typical in the lower chambers, more limbate sutures, and the disappearance of the clear portion of the wall in the adult chambers.

Holotype of variety (AHF no. 44) from locality 56.

The varietal form is much more common in these collections than is the typical form. It is distinct from var. *foraminata* R. E. and K. C. Stewart.

Stations: 55, 56, 60, 62, 514, 525, 526, 531, 533, 552, 569, 574, 2000, 2098.

*Type locality.*—Los Frailes Point, Mexico, in 160 fms.

*Distribution.*—The station records indicated here are for the area off Mexico near the type locality and off Colombia and Peru in 5 to 100 fms.

### **Bolivina spissa** Cushman

Plate 26, Figs. 7-11

*Bolivina subadvena* Cushman, var. *spissa* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, pt. 2, 1926, p. 45, pl. 6, figs. 8a, b; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 157, pl. 3, fig. 10.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 67, pl. 5, fig. 7.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 58.

*Bolivina spissa* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 72, pl. 11, figs. 14-16.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 118, pl. 14, figs. 12-15.—Adams, Amer. Journ. Sci., vol. 237, 1939, p. 507.

Test  $2\frac{1}{2}$  to 3 times as long as broad, gradually tapering, much compressed, thickened along the median portion, periphery acute or even slightly carinate, initial end occasionally with a very slight apical spine; chambers numerous, distinct, slightly if at all inflated, much broader than high throughout, increasing only slightly in relative height toward

the apertural end; sutures distinct, often strongly limbate, strongly oblique, forming an angle of nearly  $45^\circ$  with the horizontal; wall coarsely perforate, the earliest portion, especially in the megalospheric form, with a few prominent costae; aperture narrow, elongate, the inner end slightly expanded. Length up to 0.75 mm.; breadth 0.25-0.30 mm.; thickness 0.08-0.10 mm.

The types are from the Pliocene of Timms Point, San Pedro, California. It is common in the Pliocene and Pleistocene of southern California, and occurs in the Pliocene, Humboldt County, California. It occurs off the coast of California at various depths.

The species is somewhat variable, on one hand tending toward the roughened, thick-walled condition of *B. subadvena* Cushman, and on the other hand tending to become smooth, and related to *B. argentea* Cushman.

This has proved to be a rare species in our material except at one station, 82, off Long Point, Catalina Island, in 147 fathoms, where it was abundant.

Stations: 80, 82, 227, 634, 1070, 1077, 1079, 1080, 1083.

*Distribution.*—Additional records for this species place it off the Channel Islands in 127 to 300 fms.; near Guadalupe Island, Mexico, in 200 fms. At Port Said the bottom sample came from the anchor.

### *Bolivina striatula* Cushman

Plate 26, Figs. 12, 13

*Bolivina striatula* Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 27, pl. 3, fig. 10; Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 43.—Cushman and Parker, Proc. U.S. Nat. Mus., vol. 80, art. 3, 1931, p. 16, pl. 3, figs. 21a, b.—Cole, Bull. 6, Florida State Geol. Survey, 1931, p. 41, pl. 2, fig. 9.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 154, pl. 18, figs. 30, 31.—Asano, Journ. Geol. Soc. Japan, vol. 45, 1938, p. 604, pl. 16 (5), fig. 18.—Cushman, Smithsonian Misc. Coll., vol. 99, no. 9, 1941, p. 10.

Test elongate, about 3 times as long as broad, much compressed, microspheric form tapering throughout, megalospheric form often with the adult portion of the test with the sides nearly parallel, periphery rounded; chambers numerous, distinct, very slightly inflated, earlier ones much broader than high, relative height increasing toward the apertural end, where height and breadth are often about equal; sutures distinct, slightly limbate, obliquely curved, forming an angle of about  $30-40^\circ$  with the



horizontal, slightly depressed in the adult portion; wall finely perforate, smooth, except for the early portion, which has numerous, fine, longitudinal costae, sometimes running up halfway of the length of the test; aperture elongate, narrow at the base, and somewhat expanded at the upper end. Length 0.35-0.40 mm.; breadth 0.10-0.12 mm.; thickness 0.03-0.04 mm.

The types are from the Atlantic off Florida, and most of the records are from the Atlantic. Recently it has been recorded by Asano from off Japan.

Stations: 118, 222, 226, 473, 535, 536, 573, 579, 1010, 1041, 2070.

*Distribution*.—In Monterey Bay, California, in 25 fms.; off Socorro and Guadalupe islands, Mexico, in 4 to 250 fms.; off Hood Island, Galapagos, in 75 fms.; off Peru in 12 to 22 fms.

### *Bolivina subadvena* Cushman, var. *serrata* Natland

Plate 26, Fig. 14; Plate 27, Figs. 1, 2

*Bolivina subadvena* Cushman, var. *serrata* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 4, 1938, p. 145, pl. 5, figs. 8, 9.

"Test elongate, compressed; periphery acute, serrate, with spines formed by the pointed ends of the chambers extended in a downward direction beyond the previous chambers; initial end of the microspheric form pointed, and rounded in the megalospheric; apertural end broadly rounded; chambers slightly keeled, distinct, usually ten to eleven pairs; sutures curved, limbate; walls smooth with rather large perforations for the size of the test; aperture elongate, loop-shaped, terminal." Length 0.40-0.45 mm.; breadth 0.20-0.24 mm.; thickness 0.10-0.12 mm.

The types are from off the coast of southern California. In our collections this variety has been found to be common at some of the many stations and to keep its characters rather well. There is a tendency in some specimens toward *Bolivina marginata* Cushman, var. *adelaidana* Cushman and Kleinpell.

Stations: 55, 59, 60, 79, 80, 83, 136, 144, 215, 230, 271, 422, 512, 513, 516, 517, 543, 1010, 1011, 1047, 1068, 1070, 1071, 1075, 1076, 1077, 1078, 1096, 1097, 1100, 1101, 2087, 2093, 2100, 2107, 2113, 2116, 2134, 2136, 2140, 2149, 2152, 2153.

*Distribution*.—The numerous station records extend from off Santa Cruz and Santa Barbara islands, California, in 14 to 127 fms.; southward off Mexico and in the Gulf of California, Mexico, in 10 to 183 fms.

***Bolivina subexcavata* Cushman and Wickenden**

Plate 27, Figs. 3, 4

*Bolivina subexcavata* Cushman and Wickenden, Proc. U.S. Nat. Mus., vol. 75, art. 9, 1929, p. 9, pl. 4, figs. 4a, b.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 138, pl. 18, fig. 33.

Test small, broadest near the apertural end, from which it rapidly tapers to the initial end, periphery rounded; chambers few, consisting of 6 or 8 pairs, the earlier ones broad and low, the later ones increasing in height toward the apertural end; sutures distinct, depressed, slightly oblique; wall very coarsely perforate with 2 regions, one at either side of the central area, which are excavated; aperture an arched indentation at the base of the last-formed chamber in the median line. Length 0.32 mm.; breadth 0.18 mm.; thickness 0.12 mm.

The types are from off Juan Fernandez. It is a peculiar small form, marked by the coarse perforations, and the 2 distinct ridges close to the median line. It is similar to *B. pseudoplicata* Heron-Allen and Earland, from off the British Isles, and also resembles *B. plicatella* Cushman, but has a much less developed sculpture than either. Similar specimens occur widely distributed in the Tropical Pacific.

In our material the species occurs at numerous stations and seems to grade into the form here referred to *B. pseudoplicata*.

Stations: 61, 76, 136, 213, 232, 233, 323, 413, 466, 469, 472, 500, 502, 503, 539, 1009, 1041, 1062, 2066.

*Distribution*.—In shallow waters from Monterey, California, in 25 fms., southward off the Channel Islands in 20 to 52 fms.; off Mexico and in the Gulf of California in 9 to 22 fms.; off Galapagos in 10 to 35 fms.; and off Ecuador in 10 to 19 fms.

***Bolivina tongi* Cushman, var. *filacostata* Cushman and McCulloch,  
new variety**

Plate 27, Figs. 7-11

Variety differing from the typical in the more highly ornamented test which in the later portion particularly consists of many fine, threadlike costae.

Holotype of variety (AHF no. 45) from Station 461.

When compared with the types of *B. tongi* Cushman from the Miocene, the similarity is very striking; but the living form, which in some

specimens has the ornamentation largely confined to the sides of the test, is usually more highly ornamented on the later chambers with very delicate threadlike costae. It occurs at many stations and is often found in considerable numbers.

Stations: 39, 55, 80, 136, 226, 227, 241, 256, 258, 259, 260, 264, 299, 329, 343, 409, 410, 412, 413, 414, 417, 461, 466, 468, 472, 473, 474, 478, 504, 512, 514, 573, 1008, 1011, 1068, 1072, 1075, 1076, 1100, 2087, 2097, 2098, 2100, 2113, 2116, 2133, 2134, 2136, 2137, 2140, 2149, 2152, 2153, 2154, 2156.

*Type locality*.—Off Tagus Cove, Albemarle Island, Galapagos, in 80 fms.

*Distribution*.—These stations record this species at numerous places in the Gulf of California in 8 to 200 fms.; off Catalina in 180 fms. and southward off Central America in 5 to 46 fms.; off the Galapagos Islands in 9 to 175 fms.

### ***Bolivina torqueata* Cushman and McCulloch, new species**

Plate 27, Figs. 5, 6

Test small, twisted, often strongly so, early portion compressed, later irregularly rhomboid in section, sides slightly concave, periphery in the adult broad and truncate; chambers distinct, numerous, increasing rather regularly in size as added, little if at all inflated; sutures distinct, oblique, somewhat limbate, little if at all depressed; wall coarsely perforate; aperture an oblong opening in the median line of the apertural face of the last-formed chamber with a distinctly thickened rim.

Length 0.40-0.50 mm.; breadth 0.20-0.25 mm.; thickness 0.12-0.16 mm.

Holotype (AHF no. 46) from Station 470.

This species differs from *Bolivina rhomboidalis* Millett in the very much twisted test, the early compressed portion, and the strongly limbate sutures.

The species occurs in considerable numbers at numerous stations and shows much variation in the amount of twisting of the test. The coarse perforations give a very rough appearance to the surface of the test.

Stations: 208, 222, 227, 228, 418, 457, 466, 469, 470, 472, 473, 503, 1003, 1008, 1013, 1017, 1052, 2153.

*Type locality*.—Off Charles Island, ½ mile north of Black Beach, in 9 fms.

## EXPLANATION OF PLATE 25

## FIGS.

- 1-3. *Bolivina pseudobeyrichi* Cushman. 1, 2, x 120. 3, x 70. *a*, front view; *b*, apertural view.
- 4-7. *Bolivina pseudoplicata* Heron-Allen and Earland. (?) 4, 5, x 120. 6, x 145. 7, x 130. *a*, front view; *b*, apertural view.
- 8-12. *Bolivina pygmaea* H. B. Brady. 8, 9, 12, x 130. 10, 11, x 70. *aa*, front views; *bb*, apertural views.
13. *Bolivina quadrata* Cushman and McCulloch, new species. x 130. *a*, front view; *b*, apertural view. Holotype.
14. *Bolivina seminuda* Cushman. x 70.



1b

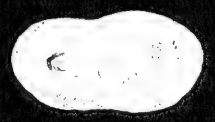
1a



2



3



4b



4a



6



7



9b



5



8



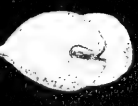
12



13b



9a



10b



11



13a



10a



14



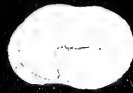
1b



2



3



4b



5



1a



4a



7



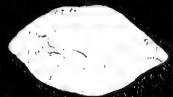
8



9



6



14b



10



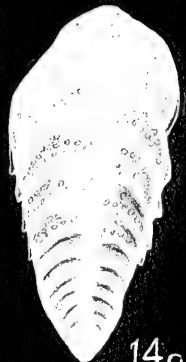
11



12



13



14a

## EXPLANATION OF PLATE 26

## FIGS.

- 1-6. *Bolivina seminuda* Cushman, var. *humilis* Cushman and McCulloch, new variety. 1-3, x 120. 4, 5, x 90. 6, x 130. 1. Holotype. 2, 3. Paratypes. *aa*, front views; *bb*, apertural views.
- 7-11. *Bolivina spissa* Cushman. 7-9, x 70. 10, 11, x 80. *a*, front view; *b*, apertural view.
- 12, 13. *Bolivina striatula* Cushman. x 90.
14. *Bolivina subadvena* Cushman, var. *serrata* Natland. x 120. *a*, front view; *b*, apertural view.

*Distribution.*—This species has been collected off Santa Barbara, California, in 33 fms.; off the Channel Islands in 13 fms.; off Mexico in 17 to 200 fms.; and at a series of stations in the Galapagos with a depth range of 9 to 23 fms.

### ***Bolivina tortuosa* H. B. Brady**

Plate 27, Fig. 12

*Bolivina tortuosa* H. B. Brady, Quart. Journ. Micr. Soc., vol. 21, 1881, p. 57; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 420, pl. 52, figs. 31, 32 (not 33, 34).—Egger, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 298, pl. 8, figs. 43, 44 (part).—Millett, Journ. Roy. Micr. Soc., 1900, p. 543.—Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900, p. 187; 1902, p. 382.—Sidebottom, Journ. Roy. Micr. Soc., 1918, p. 127.—Cushman, Publ. 342, Carnegie Inst. Washington, 1924, p. 18, pl. 5, figs. 4, 5.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1924, p. 145; Journ. Linn. Soc. Zool., vol. 35, 1924, p. 621.—Yabe and Hanzawa, Jap. Journ. Geol. Pal., vol. 4, 1925 (1926), p. 50.—Hanzawa, Lc., 1925 (1926), p. 40 (table).—Macfadyen, Geol. Survey Egypt, 1930 (1931), p. 57.—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 16, pl. 3, figs. 22a, b.—Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 195.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 133, pl. 17, figs. 11-19.—Cushman and McGlamery, Prof. Paper 189D, U.S. Geol. Survey, 1938, p. 107, pl. 25, figs. 13, 21.

Test short and broad, slightly longer than broad, much compressed, periphery acute but not carinate, early portion with the axis much twisted; chambers few, distinct, comparatively high, periphery not lobulate; sutures distinct, not depressed; wall with numerous coarse punctae; aperture tending to become terminal, elongate, elliptical. Length up to 0.35 mm.; breadth up to 0.35 mm.

Most of the records for this species are from the Pacific, especially from among the islands of the Tropical Pacific. The species is rather rare in our material, mostly single specimens.

Stations: 62, 208, 457, 458, 469, 470, 472, 500.

*Distribution.*—Off Guadalupe Island in 18 fms.; in San Gabriel Bay, Mexico, in 10 fms.; off Indefatigable, Charles, and Hood islands, Galapagos, in 9 to 15 fms.; and off La Plata Island, Ecuador, in 10 fms.



Genus **LOXOSTOMA** Ehrenberg, 1854**Loxostoma convallarium** (Millett)

Plate 27, Figs. 13, 14

*Bolivina convallaria* Millett, Journ. Roy. Micr. Soc., 1900, p. 544, pl. 4, figs. 6a, b.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 647.

*Loxostoma convallarium* Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 191, pl. 22, figs. 11-13.

Test very elongate, slender, about 4 times as long as broad, periphery serrate in front view, rounded in end view; chambers distinct, inflated, as high as broad throughout, early ones smooth except for a spine at the peripheral angle, later ones very deeply excavated on the lower side and crenulate at the border, tending to become somewhat uniserial in the adult; sutures distinct, depressed, very strongly so in the adult, oblique; wall of early portion smooth, later portion smooth except for the crenulate border; aperture elongate, oval, with a distinct lip, tending to become terminal.

The records for this species are from the Malay Archipelago and from the Kerimba Archipelago off the east coast of Africa. Our specimens have a tendency to be slightly more spinose than the types and in this respect resemble somewhat *Bifarina elongata* Millett.

Station: 616.

*Distribution.*—The material from which these specimens were obtained was collected at low tide on West Nole Island, Whitsunday Passage, east coast of Australia, by Miss Archie McLean, while visiting the Great Barrier Reef in Australia.

**Loxostoma instabile** Cushman and McCulloch, new species

Plate 27, Figs. 15-17; Plate 28, Figs. 1-7

Test elongate, slender, especially in the earlier stages and in the microspheric form, cylindrical in the young, later becoming much compressed, periphery in the adult acute and keeled; chambers distinct, in the microspheric form very gradually increasing in size as added in the early portion, later becoming rapidly larger and inflated in the median portion, compressed and keeled at the periphery, the posterior angles extending backward into distinct spines, later chambers becoming irregularly uniserial; sutures distinct, in the later portion depressed, more strongly curved; wall mostly smooth, rather coarsely perforate, the perforations

often in longitudinal rows; aperture in the adult terminal, oval or elliptical, with a marginal lip and a tubular internal structure connecting the aperture with the opening into the previous chamber. Length 0.65-1.10 mm.; breadth 0.25-0.30 mm.; thickness 0.10 mm.

Holotype (AHF no. 47) from Station 2070.

This species differs from *L. mayori* (Cushman) in the much compressed adult portion, the keeled and spinose adult chambers, and the more conical early stage.

There is a great amount of variation in this species as will be seen by our figures, the microspheric form often having the spinose and compressed chambers at the very end, while the megalospheric form has them reaching nearly to the base. From the localities this seems to have a rather restricted distribution.

Stations: 56, 76, 82, 144, 215, 226, 227, 540, 1010, 1078, 2070.

*Type locality*.—Off Guadalupe Island, latitude  $29^{\circ} 8'$ ; longitude  $115^{\circ} 10'$ , in 250 fms.

*Distribution*.—Off San Nicolas and Catalina islands in 147 fms.; off Guadalupe Island in 12 to 250 fms.; off Gorgona Island, Ecuador, in 20 fms.

### *Loxostoma limbatum* (H. B. Brady)

Plate 28, Fig. 8

*Bolivina limbata* H. B. Brady, Quart. Journ. Micr. Sci., vol. 21, 1881, p. 27; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 419, pl. 52, figs. 26-28; Quart. Journ. Geol. Soc., vol. 44, 1888, p. 8 (table).—Howchin, Trans. Proc. Roy. Soc. So. Australia, vol. 12, 1889, p. 8.—Chapman, Proc. Zool. Soc. London, 1895, p. 23.—Millett, Journ. Roy. Micr. Soc., 1900, p. 543.—Chapman, Journ. Linn. Soc. Zool., vol. 28, 1900-1902, pp. 187, 382.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 48, pt. 2, 1904, p. 15; l.c., vol. 49, no. 5, 1905, p. 15.—Dakin, Rep't Ceylon Pearl Oyster Fish., vol. 5, 1906, p. 234.—Chapman, Journ. Linn. Soc. Zool., vol. 30, 1907, p. 32, pl. 4, fig. 83.—Bagg, Proc. U.S. Nat. Mus., vol. 34, 1908, p. 138.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, pt. 3, 1910, p. 13.—Chapman, Journ. Linn. Soc. Zool., vol. 30, 1910, p. 404; Proc. Roy. Soc. Victoria, vol. 22, 1910, p. 275.—Cushman, Bull. 71, U.S. Nat. Mus., pt. 2, 1911, p. 47, text fig. 78; Publ. 291, Carnegie Instit. Washington, 1919, p. 33; Bull. 100, U.S. Nat. Mus., vol. 4, 1921, p. 135, pl. 19, fig. 5.—Heron-Allen and Earland, British Antarctic Exped., Zoology, vol. 6, 1922, p. 137.—Cushman,

Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 36, pl. 7, fig. 3.—Heron-Allen and Earland, Journ. Linn. Soc. Zool., vol. 35, 1924, p. 622; Journ. Roy. Micr. Soc., 1924, p. 145.—Cushman, Bernice P. Bishop Museum Bull. No. 27, 1925 (1926), p. 125.—Chapman, New Zealand Geol. Survey Pal. Bull. No. 11, 1926, p. 40, pl. 9, fig. 6; Rep'ts of Great Barrier Reef Comm., vol. 3, 1931, pp. 38, 39 (lists).

*Loxostoma limbatum* Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 186, pl. 21, figs. 26-29.

Test elongate, 3 or 4 times as long as broad, much compressed, tapering at the ends, middle portion with the sides nearly parallel, thickest along the median line thence thinning toward the subacute lateral margins, whole test usually somewhat twisted; chambers rapidly increasing in height as added, in the adult as high as wide, slightly inflated; sutures very distinct, strongly limbate, strongly curved backward; wall calcareous, smooth, coarsely perforate; aperture elongate, oval, terminal in the adult. Length up to about 1.00 mm.; breadth 0.35-0.40 mm.; thickness 0.20-0.25 mm.

The types of this species are from off the Hawaiian Islands. There are many records for it, almost entirely in warm, fairly shallow water.

Stations: 221, 222, 311, 312, 314, 319, 421, 422, 423, 427, 460, 463, 466, 469, 470, 500, 545, 557, 2015, 2081.

*Distribution*.—Off Clarion and Socorro islands in 4 to 28 fms.; off Costa Rica and Panama in 3 to 15 fms.; off Clipperton, James, South Seymour, and Charles islands, Galapagos, in 10 to 16 fms.; off Colombia and Ecuador in 10 to 12 fms.

***Loxostoma limbatum* (H. B. Brady), var. *costulatum* (Cushman)**

Plate 28, Figs. 9, 10

*Bolivina limbata* H. B. Brady, var. *costulata* Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 26, pl. 3, fig. 8; Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 37; Publ. 342, Carnegie Instit. Washington, 1924, p. 19, pl. 5, figs. 2, 3, 6; Publ. 344, 1926, p. 76; Bernice P. Bishop Museum Bull. No. 27, 1925 (1926), p. 125.

*Loxostoma limbata* (Brady), var. *costulata* Palmer and Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 248.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 187, pl. 21, figs. 30, 31.

*Bolivina limbata* Chapman, Journ. Linn. Soc. Zool., vol. 28, 1901, p. 409, pl. 36, fig. 12.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 646, pl. 50, figs. 1-4.

*Loxostoma mayori* Cushman and Parker (not Cushman), Proc. U.S. Nat. Mus., vol. 80, art. 3, 1931, p. 16, pl. 3, fig. 24.

Variety differing from the typical form of the species mainly in the addition of longitudinal costae, usually few in number, and mostly near the base of the test. Length up to 2.00 mm.; breadth 0.40 mm.; thickness 0.20 mm.

This variety sometimes merges with the typical form, but the two seem rarely to occur together.

Stations: 424, 500, 501, 503, 504, 2084.

*Distribution.*—An analysis of the station records places this species off Socorro Island, Mexico, in 17 to 46 fms. and off La Libertad, Ecuador, in 4 to 25 fms.

### **Loxostoma mayori** (Cushman)

Plate 28, Figs. 11, 12

*Bolivina mayori* Cushman, Publ. 311, Carnegie Instit. Washington, 1922, p. 27, pl. 3, figs. 5, 6; Bull. 104, U.S. Nat. Mus., pt. 3, 1922, p. 40; Publ. 342, Carnegie Instit. Washington, 1924, p. 19, pl. 6, figs. 3, 4; Publ. 344, 1926, p. 76.

*Loxostomum mayori* Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 197.—Cushman, Special Publ. 9, Cushman Lab. Foram. Res., 1937, p. 195, pl. 22, figs. 16-21; Smithsonian Misc. Coll., vol. 99, no. 9, 1941, p. 11.

Test elongate, slender, often arcuate or somewhat twisted, somewhat compressed, periphery rounded, the early portion somewhat tapering, later with the sides nearly parallel throughout their length; chambers numerous, distinct, becoming gradually higher as added until, in the later development, the height becomes greater than the breadth, and the last-formed chambers uniserial but usually with oblique sutures, and somewhat more rounded in form than the early portion; sutures distinct, limbate, slightly depressed, more so in the later portion, in the early portion oblique and nearly straight, later becoming sigmoid as the chambers tend to become uniserial; wall coarsely perforate, the perforations often in longitudinal lines, and surface with a few, short, weakly developed costae; aperture in the adult terminal, narrowly elliptical, often with a slight rounded lip. Length up to 2.00 mm.; breadth 0.30 mm.; thickness 0.20 mm.

This is a widely distributed species in rather shallow tropical and subtropical regions. The specimens recorded here are somewhat variable

and less well developed than is usual. The specimens included from Australia may not belong here but have many similar characters.

Stations: 76, 244, 295, 461, 466, 501, 616.

*Distribution*.—Off Guadalupe Island in 12 fms.; in the Gulf of California, Mexico, in 5 to 10 fms.; at Tagus Cove, Albemarle Island, in 80 fms.; off Charles Island in 23 fms.; off La Libertad, Ecuador, in 4 fms.; and off the east coast of Australia at low tide.

### Genus **BIFARINA** Parker and Jones, 1872

#### **Bifarina hancocki** Cushman and McCulloch, new species

Plate 28, Figs. 13-19

Test in the early stages compressed, biserial, in the adult uniserial and broadly elliptical in end view, periphery broadly rounded; chambers distinct, slightly inflated in the early stages, in the adult uniserial portion strongly inflated; sutures distinct, in the early biserial portion strongly limbate and raised, in the earliest portion strongly oblique, less so as growth progresses, in the adult uniserial portion, depressed; wall distinctly perforate, in the early portion and in some specimens somewhat spinose throughout; aperture in the adult terminal, elliptical, with a distinct lip. Length 0.50-0.65 mm.; breadth 0.15-0.20 mm.; thickness 0.10-0.15 mm.

Holotype (AHF no. 48) from Station 503.

This species differs from *B. zanzibarensis* Cushman in the strongly raised and limbate sutures, more slender test, and spinose surface.

There is considerable variation as shown in our figures. The surface is finely to coarsely spinose or in some specimens nearly smooth in the last-formed chambers. In the large series, however, these variations seem to merge and the whole represent a single species.

Stations: 61, 256, 321, 331, 503, 514, 540, 543, 558, 583.

*Type locality*.—La Libertad, Ecuador, in 19 fms.

*Distribution*.—In shallow waters of the Gulf of California in 17 to 38 fms.; off Costa Rica in 9 fms.; off Panama in 15 fms.; off Colombia and Ecuador in 10 to 19 fms.

#### **Bifarina pacifica** Cushman and McCulloch, new species

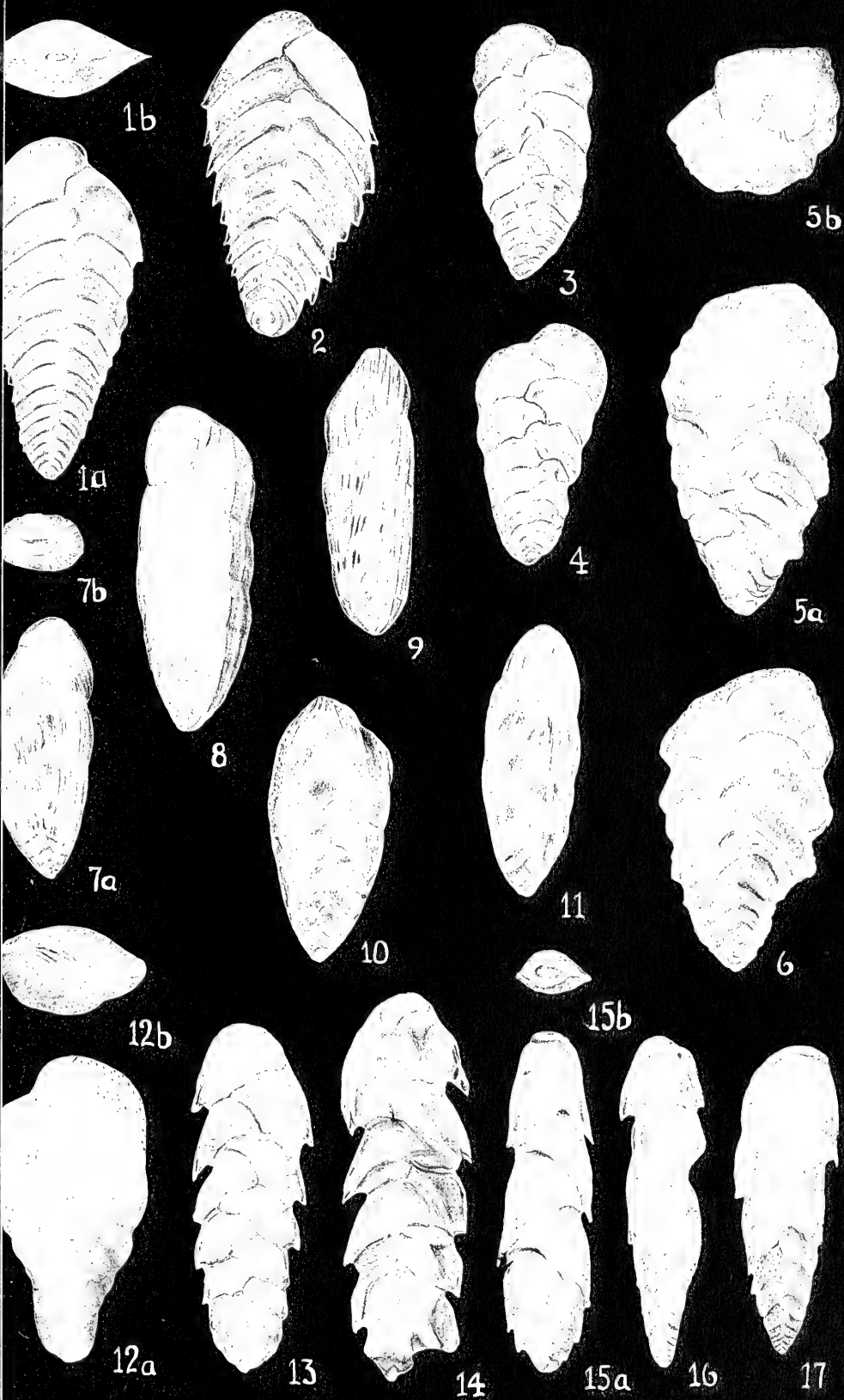
Plate 28, Fig. 20

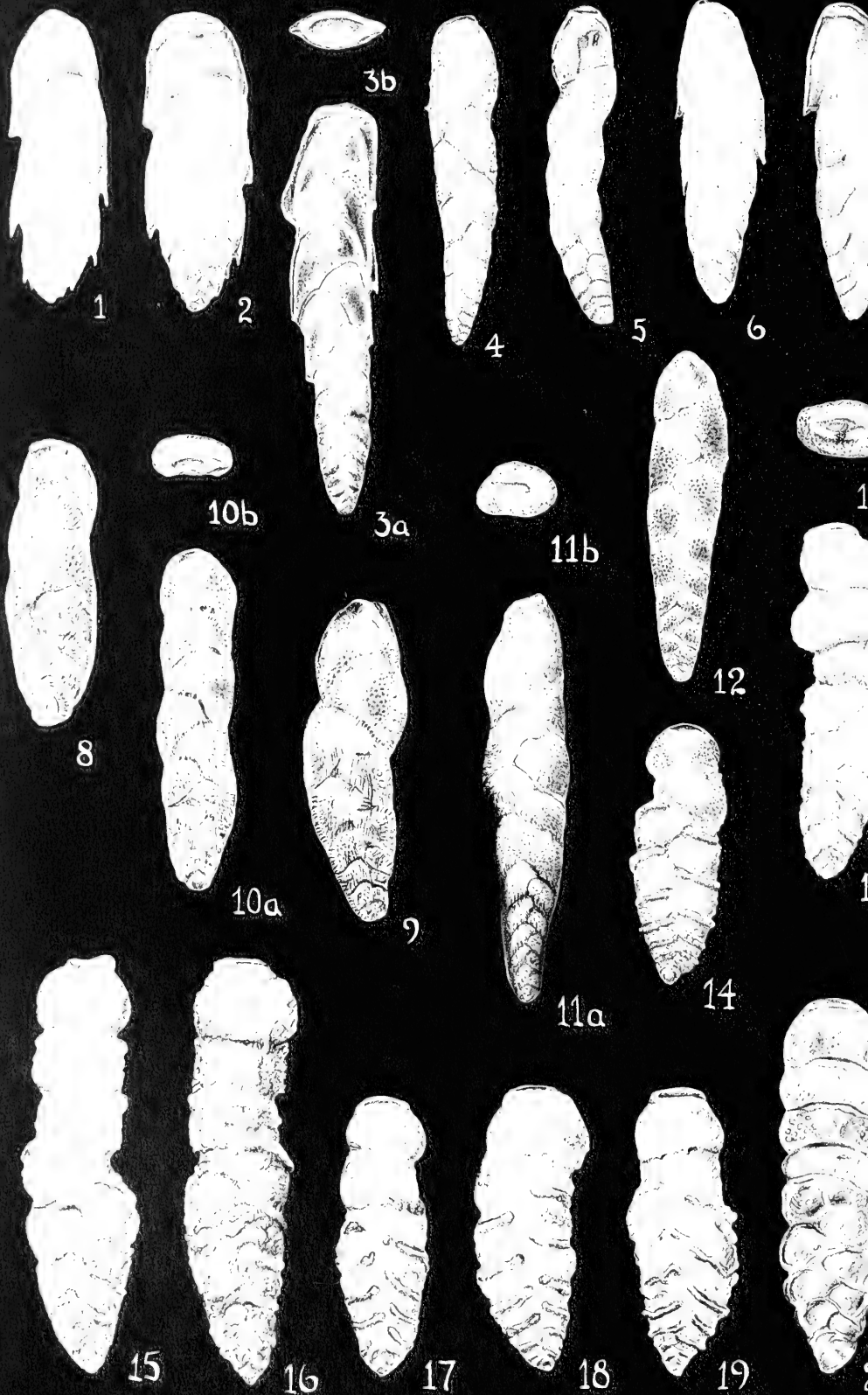
Test elongate, compressed throughout, slender, early portion biserial, tapering, adult with the sides nearly parallel, uniserial, periphery rounded, lobulate; chambers distinct, slightly inflated, in the adult uniserial portion much wider than high; sutures distinct, somewhat limbate,

## EXPLANATION OF PLATE 27

## FIGS.

- 1, 2. *Bolivina subadvena* Cushman, var. *serrata* Natland. x 120. *a*, front view; *b*, apertural view.
- 3, 4. *Bolivina subexcavata* Cushman and Wickenden. x 145.
- 5, 6. *Bolivina torqueata* Cushman and McCulloch, new species. x 120. 5. Holotype. 6. Paratype. *a*, front view; *b*, apertural view.
- 7-11. *Bolivina tongi* Cushman, var. *filacostata* Cushman and McCulloch, new variety. 7-9, 11, x 120. 10, x 145. 7. Holotype. 9, 11. Paratypes. *a*, front view; *b*, apertural view.
12. *Bolivina tortuosa* H. B. Brady. x 145. *a*, front view; *b*, apertural view.
- 13, 14. *Loxostoma convallarium* (Millett). x 145.
- 15-17. *Loxostoma instabile* Cushman and McCulloch, new species. x 70. 15. Holotype. 16, 17. Paratypes. *a*, front view; *b*, apertural view.







## EXPLANATION OF PLATE 28

## FIGS.

- 1-7. *Loxostoma instabile* Cushman and McCulloch, new species. 1, 2, 4-7, x 70. 3, x 60. 1, 2. Paratypes. *a*, front view; *b*, apertural view; 1. Holotype.
8. *Loxostoma limbatum* (H. B. Brady). x 60.
- 9, 10. *Loxostoma limbatum* (H. B. Brady), var. *costulatum* (Cushman). x 60. *a*, front view; *b*, apertural view.
- 11, 12. *Loxostoma mayori* (Cushman). x 70. *a*, front view; *b*, apertural view.
- 13-19. *Bifarina hancocki* Cushman and McCulloch, new species. 13, 14, 17-19, x 90. 15, 16, x 120. 13. Holotype. 14. Paratype. *a*, front view; *b*, apertural view.
20. *Bifarina pacifica* Cushman and McCulloch, new species. x 120. Holotype.

depressed throughout; wall distinctly and coarsely perforate, the early biserial portion frequently with short costae giving a roughened appearance; aperture narrowly elliptical, terminal. Length 0.40-0.45 mm.; breadth 0.15-0.18 mm.; thickness 0.04-0.07 mm.

Holotype (AHF no. 49) from Station 319.

This species differs from *B. zanzibarensis* Cushman in the more compressed test, very different ornamentation, and more elongate, slender form.

There is considerable variation in the early biserial portion of the test which ranges from almost smooth to distinctly costate.

Stations: 61, 62, 69, 215, 256, 313, 314, 316, 319, 321, 543, 558.

*Type locality*.—Port Parker, Costa Rica, in 5 fms.

*Distribution*.—In the Gulf of California, Mexico, in 10 to 110 fms.; off Costa Rica in 5 to 14 fms.; off Panama in 12 to 25 fms.; and off Colombia in 50 fms.

8.3  
87

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 5

THE SPECIES OF *BULIMINA* AND  
RELATED GENERA IN THE COLLECTIONS  
OF THE ALLAN HANCOCK FOUNDATION

(PLATES 29-32)

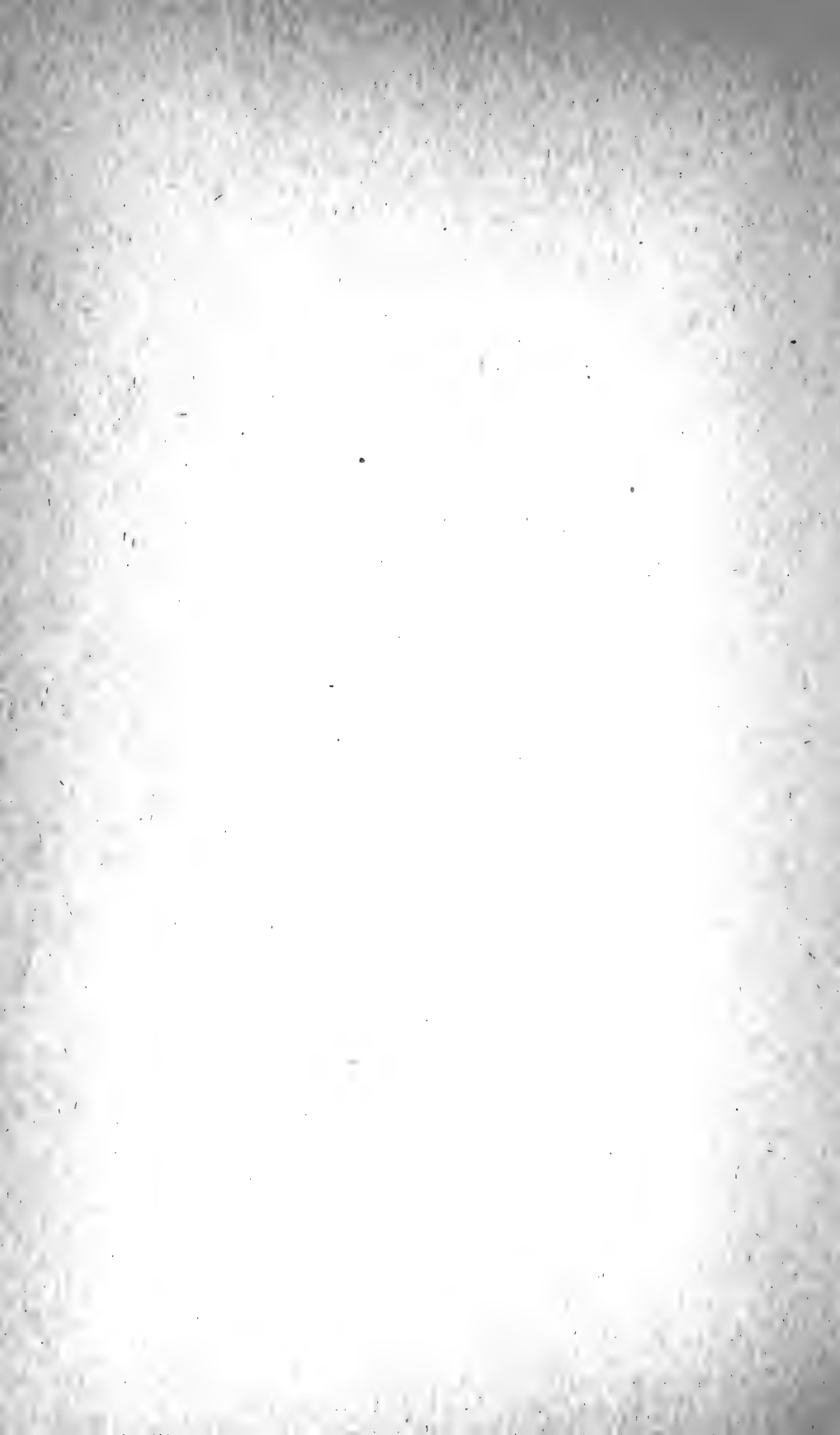
BY

JOSEPH A. CUSHMAN and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

1948



Los Angeles, University of Southern  
California, Allan Hancock

REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA, AND GALA-  
PAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, IN 1938,  
IN 1939, IN 1940, AND IN 1941.

THE SPECIES OF *BULIMINA* AND  
RELATED GENERA IN THE COLLECTIONS  
OF THE ALLAN HANCOCK FOUNDATION

(PLATES 29-32)

By JOSEPH A. CUSHMAN and IRENE McCULLOCH

THE UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS  
ALLAN HANCOCK PACIFIC EXPEDITIONS  
VOLUME 6, NUMBER 5  
ISSUED MARCH 8, 1948

---

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA



THE SPECIES OF *BULIMINA* AND RELATED GENERA IN  
THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION

(PLATES 29-36)

JOSEPH A. CUSHMAN AND IRENE McCULLOCH

In this fifth paper presenting the results of studies being made on the foraminiferal collections of the Allan Hancock Foundation, The University of Southern California, a fourth list of station tables is included. The station list of this paper covers additional records off southern California and is therefore a continuation of Table 7 (see pp. 11-13, 148-150, 180-183). Attention is called again to some inconsistencies in the Tables of this volume i.e., Stations 422-427 (see pp. 23-24) are not off the Galapagos Islands but off Mexico. The type locality and station number of holotype no. 53 in this paper emphasize this inconsistency.

TABLE 7—OFF SOUTHERN CALIFORNIA (continued from p. 183)

Station	Locality	Bearings		Fathoms	Date
		Latitude	Longitude		
1177	1 mile SW Ben Weston Point, Catalina Island	33 20 55	118 30 25	45	May 17, 1941
1178	3.2 miles S Ben Weston Point, Catalina Island	33 18 05	118 29 30	175	17, 1941
1179	4½ miles W Church Rock, Catalina Island	33 18 00	118 25 00	50	18, 1941
1180	3½ miles E Church Rock, Catalina Island	33 18 00	118 15 20	103	18, 1941
1181	2 miles W Church Rock, Catalina Island	33 17 40	118 21 55	45	18, 1941
1182	3 miles SE Church Rock, Catalina Island	33 16 00	118 16 40	100	18, 1941
1183	2½ miles SE Church Rock, Catalina Island	33 17 00	118 16 40	61	18, 1941
1184	1 mile NE Castle Rock, San Clemente Island	33 03 15	118 36 20	46	June 8, 1941
1185	½ mile W Castle Rock, San Clemente Island	33 02 00	118 37 20	37	8, 1941
1186	1 mile SW Castle Rock, San Clemente Island	33 01 40	118 37 40	46	8, 1941
1187	2 miles SW Castle Rock, San Clemente Island	33 01 00	118 38 45	107	8, 1941
1188	4 miles NE buoy Cortes Bank	32 29 45	119 05 00	60	9, 1941
1189	3 miles E buoy, Cortes Bank	32 26 30	119 03 30	51	9, 1941
1190	4¾ miles SE buoy, Cortes Bank	32 24 00	119 02 30	131	9, 1941
1191	1 mile SW buoy, Cortes Bank	32 25 50	119 07 30	32	9, 1941
1192	Wilson Cove, San Clemente	33 00 30	118 33 30	25	10, 1941
1193	Tanner Bank, off Channel Islands	32 41 00	119 06 30	38	10, 1941
1194	4½ miles NNW buoy, Cortes Bank	32 30 45	119 09 30	60	10, 1941
1195	9½ miles NW buoy, Cortes Bank	32 33 15	119 15 15	50	June 10, 1941
1196	9½ miles NNW buoy, Cortes Bank	32 35 00	119 11 45	110	10, 1941
1197	4 miles W Tanner Bank	32 40 00	119 16 30	86	11, 1941
1198	5 miles SE Church Rock, Catalina Island	33 16 00	118 13 30	118	12, 1941
1199	6 miles E Church Rock, Catalina Island	33 16 45	118 12 20	192	12, 1941
1200	4 miles E Church Rock, Catalina Island	33 17 20	118 14 00	116	12, 1941
1201	2½ miles SE Church Rock, Catalina Island	33 16 40	118 17 10	80	12, 1941



Station	Locality	Bearings			Fathoms	Date
		Latitude	Longitude			
1202	4 miles E Church Rock, Catalina Island	33 18 30	118 15 00	110	June 12, 1941	
1203	½ mile E Abalone Point, Catalina Island	33 20 20	118 18 30	46	12, 1941	
1204	1 mile E White Cove	33 23 30	118 20 50	38	13, 1941	
1205	1¼ mile E White Cove	33 23 40	118 20 00	108	13, 1941	
1206	2½ miles E Long Point, Catalina Island	33 24 25	118 19 15	225	13, 1941	
1207	3½ miles S Church Rock, Catalina Island	33 15 00	118 20 00	600	12, 1941	
1208	3 miles E Avalon Bay, Catalina Island	33 20 20	118 15 30	120	12, 1941	
1209	2½ miles E Long Point, Catalina Island	33 24 40	118 19 00	250	13, 1941	
1210a	2¼ miles NE Long Point, Catalina Island	33 26 10	118 20 00	300	13, 1941	
1210b	Same (core sample)	33 26 10	118 20 00	300	13, 1941	
1211a	4¾ miles N NE Long Point, Catalina Island	33 29 00	118 20 30	489	June 13, 1941	
1211b	Same as above (core sample)	33 29 00	118 20 30	489	13, 1941	
1212a	8 miles N Long Point, Catalina Island	33 32 10	118 20 00	490	13, 1941	
1212b	Same as above (core sample)	33 32 10	118 20 00	490	13, 1941	
1213a	7 miles S Point Fermin	33 35 20	118 19 05	380	13, 1941	
1213b	Same as above (core sample)	33 35 20	118 19 05	380	13, 1941	
1214a	5¾ miles SW Point Fermin	33 38 00	118 22 00	448	13, 1941	
1214b	Same as above, (core sample)	33 38 00	118 22 00	448	13, 1941	
1215	Off Willow Cove, Catalina Island			35	July 11, 1941	
1216	Off Goat Harbor, Catalina Island			30	13, 1941	
1217	South Side of San Nicolas Island	33 12 40	119 29 30	34	Nov. 24, 1940	
1218	1 mile E Long Point, Catalina Island	33 24 25	118 21 00	107	July 18, 1941	
1219	1¼ mile NW Long Point, Catalina Island	33 25 40	118 22 55	77	20, 1941	
1220	¾ mile E Empire Landing, Catalina Island	33 25 50	118 24 50	57	20, 1941	
1221	Off White Cove, Catalina Island	33 25 55	118 21 15	105	Aug. 2, 1941	

Station	Locality	Bearings		Longitude	Fathoms	Date
		Latitude	Longitude			
1222	Off Avalon, Catalina Island	33 24 01	118 21 10	83	August 3, 1941	
1223	Off Avalon, Catalina Island	33 21 01	118 18 50	55	3, 1941	
1224	Catalina Channel	33 33 00	118 10 00	95	4, 1941	
1225	Catalina Channel	33 33 00	118 09 05	126	4, 1941	
1226	Catalina Channel	33 28 45	118 07 40	212	4, 1941	
1227	16½ miles S E of East Point, Santa Rosa Island	33 41 00	119 52 58	75	Aug. 25, 1941	
1228	7 miles SE East Point, Santa Rosa Island	33 51 00	119 54 20	104	25, 1941	
1229	4½ miles SE East Point, Santa Rosa Island	33 54 05	119 54 30	52	25, 1941	
1230	3.6 miles off East Point, Santa Rosa Island	33 54 30	119 54 25	55	25, 1941	
1231	4.5 miles SWx½W of East Point, Santa Rosa Island	33 51 30	120 05 00	45	26, 1941	
1232	6.5 miles SE of South Point, Santa Rosa Island	33 49 10	120 55 00	57	26, 1941	
1233	10 miles SEx½E of South Point, Santa Rosa Island	33 46 30	119 58 30	125	26, 1941	
1234	2.5 miles SE of Point Bennet, San Miguel Island	33 59 10	120 25 10	57	27, 1941	
1235	16.5 miles SE of South Point Station, Santa Rosa Island	33 38 40	119 58 30	72	27, 1941	
1236	8 miles E of Long Point, Catalina Island	33 24 45	118 13 30	300	Sept. 14, 1941	
1237	1 mile off east side, Santa Barbara Island	33 28 40	119 00 30	40	15, 1941	
1238	1 mile S of Point Bennet, San Miguel Island	34 00 50	120 27 20	48	16, 1941	
1239	1½ miles S of Crook Point, San Miguel Island	33 59 20	120 22 20	41	16, 1941	
1240	2 miles SW of Cardwell Point, San Miguel Island	34 59 55	120 19 15	35	16, 1941	
1241	1 mile S Cardwell Point, San Miguel Island	34 00 20	120 17 25	15	16, 1941	
1242	1½ miles N of light Anacapa Island	34 02 30	119 21 10	77	17, 1941	
1243	7¼ miles E of Long Point, Catalina Island	33 24 55	118 13 25	228	28, 1941	
1244	2½ miles SE of Seal Rocks, Catalina Island	33 17 20	118 15 35	91	Oct. 25, 1941	
1245	1½ miles SxW Gull Island, off Santa Cruz	33 56 00	119 50 55	48	Nov. 8, 1941	
1246	2¾ miles N of West Point, Santa Cruz	34 07 00	119 56 05	55	9, 1941	

Subfamily *Turrilininae*Genus **BULIMINELLA** Cushman, 1911**Buliminella curta** Cushman

Plate 29, Fig. 1

*Buliminella curta* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 33, pl. 5, fig. 13.—Cushman and Laiming (part), Journ. Pal., vol. 5, 1931, p. 106, pl. 11, fig. 16 (not fig. 15).—Cushman and Ponton, Bull. 9, Florida Geol. Survey, 1932, p. 75.—Cushman and LeRoy, Journ. Pal., vol. 12, 1938, p. 125, pl. 22, fig. 17.—Kleinpell, Miocene Stratig. Calif., 1938, p. 248, pl. 7, fig. 3; pl. 15, fig. 4; pl. 16, fig. 8.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 24, 1940, pp. 439, 444 (lists), pl. 4, fig. 4.—Weaver, Washington Univ. (Seattle), Publ. Geol., vol. 6, 1944, p. 23 (list).—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 64, pl. 16, fig. 22.

Test tapering, broadest part formed by the last-formed whorl, initial end pointed, apertural end broadly rounded, consisting of about five whorls in the adult; chambers distinct, inflated, about four to the whorl; sutures distinct, depressed; wall smooth; aperture small, in a semicircular depression of the apertural face, extending partially down the side of the test. Length 0.45-0.50 mm; breadth 0.25 mm.

The types of this species are from the Miocene, Monterey shale of California. It is also recorded from other members of the Miocene of California, Alabama and Florida. It occurs at a number of stations in the present collections.

Stations: C-11, C-13, 55, 216, 250, 1003, 1005, 1010, 1231, 1234, 2095.

*Distribution*.—These localities range from the coast of southern California southward along the coast of Mexico.

**Buliminella brevior** Cushman

Plate 29, Fig. 2

*Buliminella brevior* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 33, pl. 5, fig. 14.—Kleinpell, Miocene Stratig. Calif., 1938, p. 247, pl. 12, fig. 10.—Hanna and Hertlein, State of Calif., Div. of Mines Bull. 118, 1941, p. 180, fig. 67 (plate), fig. 22.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 65, pl. 16, fig. 24.

Test short and broad, fusiform, the last-formed whorl making up about three-fourths of the test; chambers distinct, inflated, about five to the whorl; sutures distinct, depressed; wall smooth; aperture in a narrow depression of the apertural face and extends down the side of the test. Length up to 0.50 mm; breadth 0.30 mm.

The types are from the Miocene, Monterey shale of California and it is also recorded from the upper Zemorrian to the lower Delmontian in the California Miocene.

Recent specimens in the present collections seem typical.

Stations: C-11, 55, 67, 2151, 2153.

*Distribution.*—These stations range from the coast of California north of Los Angeles southward along the coast of Mexico.

### ***Buliminella bassendorfensis* Cushman and Parker**

Plate 29, Fig. 3

*Buliminella bassendorfensis* Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, pp. 40, 53, pl. 4, fig. 13; U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 66, pl. 17, fig. 6.

Test elongate, somewhat fusiform, the greatest diameter toward the apertural end,  $2\frac{1}{2}$  to 3 times as long as broad, consisting of about five whorls; chambers distinct, somewhat inflated, about four to a whorl; sutures distinct, depressed; wall smooth, sometimes with very fine spines near the base of the test; aperture a rounded, loop-shaped opening near the top of the very short and narrow apertural face. Length 0.70 mm; breadth 0.20 mm.

The types of this species are from the Miocene, south side of Alsea Bay, Lincoln Co., Oregon, and it has not been recorded elsewhere.

Our Recent specimens have been compared with the types and seem identical.

Stations: C-11, 55, 339, 1068, 1243, 2014.

*Distribution.*—These stations range from the coast of California southward along the coast of Mexico.

### ***Buliminella elegantissima* (d'Orbigny)**

Plate 29, Fig. 4

*Bulimina elegantissima* d'Orbigny, Voy. Amér. Mérid., vol. 5, pt. 5, "Foraminifères," 1839, p. 51, pl. 7, figs. 13, 14.—Williamson, Rec. Foram. Gt. Britain, 1858, p. 64, pl. 5, figs. 134, 135.—Schlumberger, Feuille Jeunes Nat., vol. 12, 1881, pl. 1, fig. 14.—H. B. Brady, Rep.

Voy. *Challenger*, Zoology, vol. 9, 1884, p. 402, pl. 50, figs. 20-22.—Reade, Geol. Mag., dec. 4, vol. 7, 1900, pp. 100, 101 (lists), pl. 5, fig. 6.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 49, no. 5, 1905, p. 11, pl. 2, fig. 6.—Bagg, U. S. Geol. Survey Bull. 513, 1912, p. 38, pl. 9, fig. 8.—Heron-Allen and Earland, *Discovery* Repts., vol. 4, 1932, p. 351, pl. 8, figs. 35-37.

*Buliminella elegantissima* Cushman, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 606; *idem*, Bull. 100, vol. 4, 1921, p. 168; Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 40, pl. 6, fig. 5.—Cushman and Wickenden, Proc. U. S. Nat. Mus., vol. 75, art. 9, 1929, p. 8, pl. 3, fig. 12.—Cushman and Kellett, *idem*, vol. 75, art. 25, 1929, p. 6, pl. 3, figs. 1-3.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 64, pl. 4, fig. 7.—Cushman, Florida Geol. Survey Bull. 4, 1930, p. 42, pl. 8, figs. 2, 3.—Cole, *idem*, Bull. 6, 1931, p. 39, pl. 2, fig. 8.—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 13, pl. 3, figs. 12, 13.—Howe and Wallace, Louisiana Dept. Cons., Geol. Bull. 2, 1932, p. 61, pl. 11, fig. 3, 1932.—Cushman and Ponton, Florida Geol. Survey, Bull. 9, 1932, p. 75.—Cushman, Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 3; Special Publ. 5, 1933, pl. 27, fig. 4.—Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175-A, 1933, p. 23, pl. 7, figs. 13, 14.—Barbat and Johnson, Journ. Pal., vol. 8, 1934, p. 12, pl. 1, figs. 12, 13.—Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 193.—Cushman, Bull. Geol. Soc. Amer., vol. 47, 1936, p. 431.—Chapman and Parr, Australasian Antarctic Exped., ser. C., vol. 1, pt. 2, 1937, p. 39.—Kleinpell, Miocene Stratig. Calif., 1938, p. 249, pl. 16, fig. 10.—Cushman and Henbest, U. S. Geol. Survey, Prof. Paper 196-A, 1940, pl. 9, fig. 20.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 21.—Hanna and Hertlein, State of Calif., Div. of Mines, Bull. 118, 1941, p. 178, fig. 67 (plate), figs. 5-7.—Macfadyen, Geol. Mag., vol. 79, 1942, p. 135.—Cushman, Special Publ. 12, Cushman Lab. Foram. Res., 1944, p. 27, pl. 3, figs. 43, 44; *idem*, Contr., vol. 21, 1945, p. 7, pl. 2, fig. 6.—Cushman and Gray, *idem*, Special Publ. 19, 1946, p. 28.—Cushman and Todd, *idem*, Special Publ. 21, 1947, p. 15, pl. 3, fig. 1.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 66, pl. 17, figs. 10-12.

*Buliminella* cf. *B. elegantissima* Cushman and Ponton, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 67, pl. 8, figs. 20, 21.—Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189-D, p. 107, pl. 25, fig. 15.—Palmer, Mem. Soc. Cubana Hist. Nat., vol. 14, 1940, p. 294.

Test small, fusiform, composed of two to three whorls, initial end in the megalospheric form subacute to rounded, in the microspheric form more acute; chambers distinct, slightly inflated, seven to ten in the final whorl; sutures distinct, slightly depressed, slightly curved; wall smooth; aperture narrowly elongate, near the upper end of the apertural face which is narrow and depressed. Length 0.25-0.40 mm; breadth 0.13-0.18 mm.

d'Orbigny's original specimens were from the Pacific, off Peru, Bolivia, and Chile. The species has been recorded from very wide areas of the present oceans and as a fossil throughout most of the Tertiary.

Stations: A-1, A-2, A-4, Or. 7, Or. 8, Or. 9, Or. 10, 5, 14, 39, 54, 58, 60, 76, 118, 204, 213, 264, 315, 502, 564, 626, 629, 659, 1005, 1014, 1041, 1061, 1092, 1096, 1097, 1122, 1159, 1161, 1231, 1232, 2004, 2093, 2135.

*Distribution.*—The above stations represent a range of this species from Alaska southward to Peru.

### ***Buliminella elegantissima* (d'Orbigny), var. *limbosa***

Cushman and McCulloch, new variety

Plate 29, Fig. 5

Variety differing from the typical in having coarser, strongly limbate and slightly raised sutures; fewer chambers to a whorl; the aperture more nearly terminal and more rounded.

Holotype of variety (AHF no. 50) from Station 535, in 22 fathoms, off Lobos de Afuera Island, Peru.

This variety seems to be quite distinct from the typical form and not occurring with it.

Stations: C-2, C-11, C-13, 64, 529, 534, 535, 550, 577, 579.

*Distribution.*—The variety from the material of the above stations ranges from the coast of southern California southward to the coast of Peru.

### ***Buliminella elegantissima* (d'Orbigny), var. *tenuis***

Cushman and McCulloch, new variety

Plate 29, Fig. 6

Variety differing from the typical in the very elongate, slender form with the aperture subterminal, small and rounded.

Holotype of variety (AHF no. 51) from Station 1019, in 20 fathoms, off Cuyler Harbor, San Miguel Island, California.

Stations: 22, 24, 258, 1014, 1015, 1018, 1019, 1089, 1129, 1161, 2103.

*Distribution*.—So far as is known the range of this variety seems to be from the coast of southern California southward along the coast of Mexico.

### ***Buliminella parallela* Cushman and Parker**

Plate 29, Fig. 7

*Buliminella parallela* Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 13, pl. 3, fig. 15; U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 69, pl. 17, fig. 22.

Test elongate, rounded at both ends, the sides nearly parallel, nearly circular in transverse section, consisting of three or more whorls; chambers distinct, only slightly inflated if at all, five or more to the whorl; sutures distinct, not depressed, slightly limbate, the spiral suture irregularly crenulate; wall smooth; aperture rounded, in a depressed area of the apertural face with slightly raised costae radiating from the upper border. Length 0.25 mm; breadth 0.08-0.10 mm.

The types of this species are from off Ilha Paqueta, Rio de Janeiro Harbor, Brazil. It occurs at several stations in the western Atlantic, off the Falklands, and possibly in the Indo-Pacific.

Stations: 52, 64, 311, 466, 472, 500, 2152.

*Distribution*.—In our material the species ranges from the Gulf of California southward to the coast of Ecuador.

### Genus **BULIMINOIDES** Cushman, 1911

#### ***Buliminoides williamsoniana* (H. B. Brady)**

Plate 29, Fig. 8

*Bulimina williamsoniana* H. B. Brady, Quart. Journ. Micr. Soc., vol. 21, 1881, p. 56; Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 408, pl. 51, figs. 16, 17.—Millett, Journ. Roy. Micr. Soc., 1900, p. 279, pl. 2, fig. 8.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 136.—Heron-Allen and Earland, Trans. Zool. Soc. London, vol. 20, 1915, p. 641; British Antarctic Exped., Zoology, vol. 6, 1922, p. 130.

*Buliminoides williamsoniana* Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 90, text fig. 144; Publ. 311, Carnegie Instit. Washington, 1922, p. 31, pl. 3, fig. 7; Bull. 104, U. S. Nat. Mus., pt. 3, 1922, p. 113;

Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 5; Special Publ. No. 5, 1933, pl. 27, figs. 6, 7.—Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 194.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 22.—Cushman, Bull. 161, U.S. Nat. Mus., pt. 3, 1942, p. 8, pl. 3, figs. 7-9.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 70, pl. 17, figs. 23, 24.

Test elongate, subcylindrical, sides nearly parallel, ends broadly rounded; chambers obscured by the surface ornamentation, not inflated; sutures largely obscured; wall ornamented with longitudinal costae, somewhat irregularly spiral, running the entire length of the test to the aperture in a radiate pattern; aperture small, circular, in the center of the depressed apertural face. Length up to 0.50 mm; breadth 0.18-0.22 mm.

This species is widely distributed in the warmer waters of the present oceans.

Stations: Aus-2, 222, 252, 2067, 2084, 2149.

*Distribution.*—There are a few specimens from the Eastern Pacific, from the coast of lower California, along the coast of Mexico with a single record from the Australian region.

### Genus **ROBERTINA** d'Orbigny, 1846

#### **Robertina austriaca** Reuss

Plate 29, Fig. 9

*Robertina austriaca* Reuss, Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 375, pl. 47, fig. 15.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 94, pl. 16, figs. 2, 3; U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 73, pl. 18, figs. 8, 22.

Test conical, only slightly longer than broad, little if at all compressed, expanding very slightly toward the apertural end, bluntly pointed or rounded at the initial end; chambers only slightly inflated, about five pairs making up the final whorl; sutures distinct, slightly depressed; wall smooth; aperture elongate, slightly curved, oblique at the base of the apertural face with a secondary aperture consisting of a narrow slit at the basal margin. Length 0.36-0.40 mm; breadth 0.20-0.23 mm.

The only previous records for this species are from the Miocene of the Vienna Basin.

There are two specimens very close to and apparently identical with this species from off Gibraltar, Station 648.



**Robertina californica** Cushman and Parker

Plate 29, Fig. 10

*Robertina californica* Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 12, 1936, p. 97, pl. 16, fig. 14.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 28, pl. 5, figs. 7-9.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 74, pl. 18, fig. 11.

Test nearly twice as long as broad, initial end subacute, tapering, apertural end broadly rounded; chambers very slightly inflated, increasing gradually and regularly in size as added, about eight or nine pairs composing the final whorl; sutures little if at all depressed, strongly limbate; wall smooth; aperture very narrow, elongate, running more than half way up the apertural face, nearly straight, secondary aperture low, elongate. Length 0.28 mm; breadth 0.13 mm.

This species is known only from the Pliocene of southern California. Rare specimens were found at Stations 73 and 80 which seem to belong to this species. They are from off the coasts of southern California and Mexico.

**Robertina charlottensis** (Cushman)

Plate 30, Figs. 1, 2

*Cassidulina charlottensis* Cushman, Contr. Cushman Lab. Foram. Res., vol. 1, pt. 2, 1925, p. 41, pl. 6, figs. 6, 7; vol. 1, pt. 3, 1925, p. 53, pl. 8, figs. 17, 18.

*Robertina charlottensis* Cushman, *idem*, Special Publ. No. 5, 1933, pl. 27, fig. 9.—Cushman and Parker, *idem*, Contr., vol. 12, 1936, p. 97, pl. 16, fig. 12.—Cushman and Todd, *idem*, Special Publ. No. 21, 1947, p. 18, pl. 3, fig. 2.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 74, pl. 18, fig. 14.

Test about twice as long as broad, strongly spiral, greatest breadth at about the middle, in front view one side nearly straight, the other strongly convex, initial end subacute, rapidly tapering, apertural end obliquely rounded, truncate; chambers slightly if at all inflated, increasing gradually and regularly in size as added, nine or more pairs making up the final whorl; sutures distinct, strongly limbate; wall smooth; aperture elongate, somewhat open, running half way up the apertural face, slightly curved, secondary aperture elongate, low. Length up to 1 mm; breadth up to 0.55 mm.

The types are from Queen Charlotte Sound.

Stations: A-2, A-15, 5, 58, 78, 102, 113, 114, 136, 207, 226, 1004, 1005, 1006, 1008, 1011, 1014, 1017, 1050, 1059, 1063, 1064, 1070, 1072, 1075, 1076, 1086, 1093, 1099, 1100, 1101, 1112, 1113, 1114, 1116, 1134, 1150, 1151, 1152, 1153, 1155, 1156, 1157, 1158, 1159, 1160, 1161, 1162, 1165, 1167, 1168, 1171, 1172, 1173, 1175, 1176, 1177, 1179, 1184, 1185, 1186, 1188, 1189, 1190, 1192, 1193, 1194, 1195, 1203, 1215, 1216, 1221, 1228, 1229, 1231, 1234, 1238, 1239, 1241, 1246, 2070, 2160, 2162, 2164, 2168, 2169.

*Distribution.*—Specimens are abundant along the eastern coast of the Pacific, Alaska to Mexico, especially abundant in the southern portion.

### Subfamily *Bulimininae*

Genus **BULIMINA** d'Orbigny, 1826

#### ***Bulimina elongata*** d'Orbigny, var. ***subulata*** Cushman and Parker

Plate 30, Fig. 3

*Bulimina elongata* d'Orbigny, var. *subulata* Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 13, 1937, p. 51, pl. 7, figs. 6, 7; Bull. 161, U. S. Nat. Mus., pt. 3, 1942, p. 11, pl. 3, fig. 13.—LeRoy, Colorado School Mines Quart., vol. 36, no. 1, 1941, p. 32, pl. 3, figs. 72, 73.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 109, pl. 26, figs. 1, 2.

*Bulimina* aff. *elongata* d'Orbigny, var. *subulata* LeRoy, *idem*, vol. 39, no. 3, 1944, p. 84, pl. 2, fig. 4.

*Bulimina aculeata* Reuss (not d'Orbigny), Denkschr. Akad. Wiss. Wien, vol. 1, 1850, p. 374, pl. 47, fig. 13.—Egger, Jahresber. 16, Nat. Ver. Passau, 1895, p. 17, pl. 3, figs. 8, 10, 13, 14.—Macfadyen, Geol. Survey Egypt, 1930 (1931), p. 55, pl. 1, fig. 19.—Hofker (part), Pub. Sta. Zool. Napoli, vol. 12, pt. 1, 1932, p. 121, figs. 33-35.

*Bulimina spinosa* Seguenza, Atti Accad. Gioenia Sci. Nat., ser. 2, vol. 18, 1862, p. 23, pl. 1, figs. 8, 8a.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 62.

*Bulimina ovata* Parker and Jones (not d'Orbigny), Phil. Trans., vol. 155, 1865, p. 374, pl. 17, fig. 67.

*Bulimina elongata* H. B. Brady (not d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 401, pl. 51, figs. 1, 2.

*Bulimina elegans* Egger (not d'Orbigny), Abhandl. k. bay. Akad. Wiss., Cl. II, vol. 18, 1893, p. 284, pl. 8, figs. 66, 67; Jahresber. 16, Nat. Ver. Passau, 1895, p. 16, pl. 3, fig. 9.

Variety differing from the typical form in having well-developed spines at the base of the test, varying in length and number.

The types of this variety are from the Miocene of Austria and it is recorded widely from the Miocene and Pliocene, and from the present oceans.

Stations: 83, 114, 118, 213, 253, 254, 271, 290, 506, 514, 558, 634, 1008, 1017, 1102, 1148, 2012, 2013, 2055, 2087, 2090, 2096, 2103, 2104, 2105, 2108, 2111, 2112, 2115, 2117, 2120, 2130, 2136, 2137, 2138, 2143, 2154, 2155, 2167.

*Distribution.*—This variety occurs at many stations, most of them along the coasts of Mexico and California.

### ***Bulimina pseudotorta* Cushman**

Plate 30, Fig. 4

*Bulimina pseudotorta* Cushman, Contr. Cushman Lab. Foram. Res., vol. 2, 1926, p. 55, pl. 7, fig. 3.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 66.—Kleinpell, Miocene Stratig. Calif., 1938, p. 258.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 111, pl. 26, fig. 13.

Test of medium size, rapidly tapering, initial end narrow, rounded, apertural end broadly rounded or somewhat truncate; chambers few, slightly inflated, angular in shape; sutures distinct, depressed; wall smooth; aperture elongate, comma-shaped. Length 0.50-0.75 mm; breadth 0.34-0.40 mm.

The types of this species are from the Miocene of California recorded from numerous localities.

At Station 1003, in 13 fathoms, North West Harbor, off California, 33° 02' 10" N.; 118° 35' 00" W.; there are numerous specimens that seem identical with this species known previously only from the Miocene of this same region.

### ***Bulimina acanthia* Costa**

Plate 30, Fig. 5

*Bulimina acanthia* Costa, Atti Accad. Pont., vol. 8, pt. 2, 1856, p. 335, pl. 13, figs. 35, 36.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 61; U.S. Geol. Survey Prof. Paper, 210-D, 1947, p. 115, pl. 26, figs. 25-27; pl. 27, fig. 1.

*Bulimina etnea* Seguenza, Atti Accad. Gioenia Sci. Nat., ser. 2, vol. 18, 1862, p. 24, pl. 1, fig. 9.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 59, pl. 10, figs. 6-9.

*Bulimina marginata* Terrigi (not d'Orbigny), Atti Pont. Accad. Sci. Nuovi Lincei, vol. 33, 1880, p. 72, pl. 2, figs. 35, 36.

*Bulimina pulchella* Cushman and Moyer (not d'Orbigny), Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 56, pl. 7, fig. 19.

Test of medium size, tapering, about twice as long as broad, composed of four to seven whorls, initial end usually with one or more small spines; chambers distinct, those of the last-formed whorl inflated, in the adult microspheric form with a distinct overhang of the chambers in the last one or two whorls and sometimes throughout the test in the megalospheric form; sutures distinct, depressed; wall smooth, except in the overhanging chambers which are slightly scalloped along the edge and occasionally with small spines; aperture broad, loop-shaped, with a distinct lip. Length up to 0.90 mm; breadth up to 0.50 mm.

The types of this species are from the Pliocene of Italy. Specimens recorded as *Bulimina pulchella* in the reference above from off San Pedro, California, seem to be the same and specimens from numerous localities in the present collections seem identical.

Stations: Or. 9, 3, 4, 39, 58, 73, 79, 80, 83, 106, 107, 109, 110, 111, 113, 114, 115, 132, 133, 136, 144, 213, 225, 259, 290, 293, 298, 343, 409, 425, 503, 517, 543, 583, 1008, 1011, 1015, 1016, 1017, 1019, 1062, 1063, 1068, 1071, 1074, 1075, 1092, 1093, 1095, 1096, 1097, 1098, 1099, 1101, 1102, 1106, 1108, 1116, 1119, 1121, 1123, 1125, 1126, 1127, 1128, 1129, 1130, 1132, 1134, 1135, 1136, 1137, 1139, 1140, 1141, 1143, 1147, 1148, 1150, 1152, 1153, 1157, 1158, 1159, 1160, 1162, 1166, 1167, 1168, 1171, 1173, 1174, 1175, 1176, 1178, 1179, 1181, 1184, 1215, 1216, 1218, 1220, 1221, 1223, 1224, 1225, 1229, 1231, 1234, 1239, 1246, 2070, 2092, 2136, 2141, 2142, 2149, 2154, 2164, 2168, 2169.

*Distribution.*—The numerous stations from which specimens referred to this species were obtained range from the coast of Oregon southward to Ecuador with most of the records from off the coasts of California and Mexico and off the Galapagos Islands.

### ***Bulimina pagoda* Cushman, var. *hebespinata***

R. E. and K. C. Stewart

Plate 30, Fig. 6

*Bulimina pagoda* Cushman, var. *hebespinata* R. E. and K. C. Stewart, Journ. Pal., vol. 4, 1930, p. 63, pl. 8, fig. 3.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 55, pl. 9, figs. 6, 7; U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 117, pl. 27, figs. 9, 10.

Variety differing from the typical in having much heavier, blunter spines that are the continuation of rather indistinct, short costae not projecting as far as in the typical form.

The types are from the Pliocene of California.

Specimens from Station 1150 in 47 fathoms, 34° 00' 20" N.; 119° 01' 20" W., 10¾ miles west of Point Dume, southern California, seem identical.

### ***Bulimina denudata* Cushman and Parker**

Plate 30, Fig. 7

*Bulimina pagoda* Cushman, var. *denudata* Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 14, 1938, p. 57, pl. 10, figs. 1, 2.

*Bulimina denudata* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 29, pl. 5, figs. 13-15.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 117, pl. 27, figs. 13, 14.

*Bulimina marginata* Galloway and Wissler (not d'Orbigny), Journ. Pal., vol. 1, 1927, p. 73, pl. 11, fig. 17.

*Bulimina pulchella* Cushman (not d'Orbigny), Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 152, pl. 2, fig. 13.

Test two or more times as long as broad, made up of as many as seven whorls, megalospheric form fusiform, microspheric form tapering from the broadest part near the apertural end, initial end occasionally with a small basal spine; chambers distinct, earlier ones not inflated, becoming somewhat inflated in the later ones, undercut at the margins; sutures distinct, slightly depressed in the later portion; wall mostly smooth except the margins of the undercut chambers which are slightly and irregularly toothed; aperture loop-shaped, near the apex of the test. Length 0.35-0.55 mm; breadth 0.18-0.28 mm.

The types are from the Pliocene of California and it is recorded also from the Pleistocene of Lomita Quarry, Palos Verdes Hills, Los Angeles Co., California, and in the present ocean off La Jolla, California. It is not surprising therefore to find this to be common in our material.

Stations: 1, 73, 80, 82, 109, 200, 201, 203, 215, 217, 225, 250, 264, 336, 343, 423, 503, 504, 506, 509, 1010, 1017, 1077, 1089, 1117, 1118, 1122, 1146, 1156, 1164, 1165, 1177, 1182, 1198, 1200, 1225, 2066, 2090, 2093, 2112, 2134, 2140, 2145, 2146, 2149, 2151, 2152, 2166.

*Distribution.*—The stations range from the coast of California south to Ecuador with the majority of them along the coast of Mexico.

**Bulimina marginata** d'Orbigny

Plate 30, Fig. 8

*Bulimina marginata* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 269, pl. 12, figs. 10-12.—Parker and Jones (part), Ann. Mag. Nat. Hist., ser. 2, vol. 19, 1857, p. 296, pl. 11, figs. 39, 40 (not figs. 35-38).—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 405, pl. 51, figs. 3-5.—H. B. Brady, Parker and Jones, Trans. Zool. Soc. London, vol. 12, 1888, p. 220, pl. 43, figs. 7, 10.—Egger, Abhandl. K. Bayer. Akad. Wiss., Cl. II, vol. 18, 1893, p. 287, pl. 8, figs. 69, 70.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, no. 9, 1894, p. 46, pl. 9, figs. 439-444.—Jones, Foram. Crag. pt. 2, 1895, p. 165, pl. 3, figs. 5, 6.—Reade, Geol. Mag., dec. 4, vol. 7, 1900, pp. 100, 101 (lists), pl. 5, fig. 4.—Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 9, 1901, p. 372; vol. 10, 1902, p. 15.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 83, text fig. 136.—Applin, Ellisor, and Knicker, Bull. Amer. Assoc. Petr. Geol., vol. 9, 1925, p. 98, pl. 3, fig. 4.—Ikari, Suisangaku Zasshi, no. 30, 1927, p. 3, pl. 1, fig. 7.—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, art. 3, 1931, p. 14.—Cushman and Ponton, Florida Geol. Survey Bull. 9, 1932, p. 77, pl. 11, fig. 12.—Macfadyen, Geol. Mag., vol. 69, 1932, p. 34, fig. 5.—Cushman, Special Publ. no. 5, 1933, pl. 27, fig. 11.—Cushman and Parker, *idem*, Contr., vol. 14, 1938, p. 91, pl. 16, figs. 5, 6; vol. 16, p. 9, pl. 2, figs. 8, 9.—Phleger, Bull. Geol. Soc. Amer., vol. 50, 1939, p. 1403, pl. 3, fig. 23.—Coryell and Rivero, Journ. Pal., vol. 14, 1940, p. 341.—Macfadyen, Geol. Mag., vol. 79, 1942, p. 135 (list).—Cushman, Special Publ. No. 12, Cushman Lab. Foram. Res., 1944, p. 27, pl. 3, figs. 45, 46.—Palmer, Bull. Amer. Pal., vol. 29, no. 115, 1945, p. 46.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 119, pl. 28, figs. 5, 6.

*Bulimina pulchella* d'Orbigny, Voy. Amér. Mérid., vol. 5, pt. 5, "Foraminifères," 1839, p. 50, pl. 1, figs. 6, 7.

*Bulimina serrata* Bailey, Smithsonian Contr., vol. 2, 1851, p. 12, pl., figs. 32-34.

*Bulimina pupoides* d'Orbigny, var. *marginata* Williamson, Rec. Foram. Gt. Britain, 1858, p. 62, pl. 5, figs. 126, 127.

*Bulimina presli* Reuss, var. *marginata* Parker and Jones, Phil. Trans., vol. 155, 1865, p. 372, pl. 15, fig. 10; pl. 17, fig. 70.

*Bulimina elegans* d'Orbigny, var. *marginata* Fornasini, Mem. Accad. Sci. Istit. Bologna, ser. 5, vol. 9, 1901, p. 376, pl. 0, figs. 7, 14, 33, 39.

*Bulimina fusiformis* Williamson, var. *marginata* Fornasini, *idem*, p. 378, pl. 0, figs. 24, 25.

*Bulimina gibba* Fornasini, var. *marginata* Fornasini, *idem*, p. 379, pl. 0, figs. 15, 19, 22, 26, 35, 42.

*Bulimina patagonica* Cushman and Wickenden (not d'Orbigny), Proc. U. S. Nat. Mus., vol. 75, art. 9, 1929, p. 8, pl. 3, fig. 11.—Cushman and Kellett, *idem*, vol. 75, art. 25, 1929, p. 7, pl. 3, fig. 4.

Test of medium size, widest toward the apertural end, thence tapering to the subacute initial end, composed of about five whorls; chambers distinct, somewhat inflated, undercut at the basal margin; sutures distinct, depressed; wall smooth except for the basal margins of the chambers which have short, tooth-like spines; aperture loop-shaped, near the apex of the test, with a distinct lip. Length 0.45-0.60 mm; breadth 0.20-0.28 mm.

The types of this species are from shore sands of Rimini, Italy. The species is a variable one. It is recorded from the Miocene to Recent and from the various oceans including the Pacific coast of South America.

Stations: Or. 4, 58, 83, 113, 114, 119, 225, 253, 255, 256, 293, 304, 412, 503, 509, 540, 542, 600, 1005, 1016, 1017, 1076, 1096, 1102, 1136, 1148, 1220, 2012, 2016, 2034, 2111, 2115, 2129, 2135, 2136, 2139, 2141, 2153, 2154, 2168, 2169.

*Distribution.*—The range of these stations is from southern California southward to Ecuador and also in the Galapagos Islands. The records from the California coast are very few with most of the stations off the coast of Mexico and South America.

### ***Bulimina patagonica* d'Orbigny, var. *glabra***

Cushman and Wickenden

Plate 31, Fig. 1

*Bulimina patagonica* d'Orbigny, var. *glabra* Cushman and Wickenden, Proc. U. S. Nat. Mus., vol. 75, art. 9, 1929, p. 9, pl. 4, fig. 1.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 17, pl. 3, figs. 13, 14.—Cushman and Gray, *idem*, Special Publ. No. 19, 1946, p. 28, pl. 5, fig. 10.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 122, pl. 28, figs. 18, 19.

Variety differing from the typical form in the lack of spines on the basal portion of the test.

The types are from material dredged in Cumberland Bay, Juan Fernandez Island, Chile, and has not been recorded elsewhere.

Stations: 58, 118, 135, 1007, 1015, 1226.

*Distribution.*—These stations are mostly from the coast of southern California, with one from the coast of Mexico.

***Bulimina exilis* H. B. Brady, var. *tenuata* (Cushman)**

Plate 31, Fig. 2

*Buliminella subfusiformis* Cushman, var. *tenuata* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 149, pl. 2, fig. 9.

*Bulimina exilis* H. B. Brady, var. *tenuata* Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 124, pl. 28, fig. 29.

*Bulimina elegans* Cushman (not d'Orbigny), Bull. 71, U. S. Nat. Mus., pt. 2, 1911, p. 82, text fig. 134; Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 7.

*Buliminella subfusiformis* Cushman and Moyer (not Cushman 1925), Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 56, pl. 7, fig. 20.

Variety differing from the typical form in having the initial end rounded and in lacking a basal spine.

The types are from Recent material from *Guide* Station 13, Lat. 33° 17' N.; Long. 117° 55' W., in 396 fathoms.

Stations: 3, 55, 258, 466, 583, 1124, 1150, 1207, 1210, 1211.

*Distribution.*—This variety seems to be limited to the Eastern Pacific, ranging from the coast of California southward to Ecuador, and also from off the Galapagos Islands.

***Bulimina barbata* Cushman**

Plate 31, Fig. 3

*Bulimina barbata* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, no. 10, 1927, p. 151, pl. 2, fig. 11.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 16, pl. 3, fig. 10; U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 126, pl. 29, fig. 8.

Test of medium size, broadly oval, greatest breadth at or below the middle, last-formed whorl forming more than half the test; chambers distinct, slightly inflated; sutures distinct, slightly depressed; wall smooth in the last-formed whorl but the earlier portion and lower margin of the last whorl covered with fine acicular spines; aperture narrow, loop-shaped, near the apex of the test. Length 0.50-0.58 mm; breadth 0.25-0.30 mm.



The types of this species were from Recent material in 1,121 fathoms off the west coast of North America, Lat.  $36^{\circ} 40' N.$ ; Long.  $122^{\circ} 26' W.$  It has been found at other localities in this area.

Stations: 1124, 1212.

*Distribution.*—A few specimens occurred at these stations off southern California and seem very typical.

### ***Bulimina (Desinobulimina) auriculata* Bailey**

Plate 31, Fig. 4

*Bulimina auriculata* Bailey, Smithsonian Contr., vol. 2, 1851, p. 12, pl., figs. 25-27.

*Bulimina (Desinobulimina) auriculata* Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 16, 1940, p. 20, pl. 3, figs. 19-21.—Cushman, *idem*, Special Publ. No. 12, 1944, p. 28, pl. 3, fig. 48.—Cushman and Todd, *idem*, Special Publ. No. 15, 1945, p. 40, pl. 6, fig. 14.—Cushman and Gray, *idem*, Special Publ. No. 19, 1946, p. 29.—Cushman and Todd, *idem*, Special Publ. No. 21, 1947, p. 18, pl. 3, fig. 3.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 129, pl. 29, figs. 22-24.

*Bulimina pyrula* Flint (not d'Orbigny), Ann. Rept. U. S. Nat. Mus., 1897 (1899), p. 290, pl. 36, figs. 4, 5.

Test elongate, fusiform, composed of about three whorls, involute, the last-formed whorl forming three-fourths of the test or more, initial end acute or slightly rounded; chambers distinct, inflated; sutures distinct, slightly if at all depressed; wall thin, smooth; aperture terminal, with a large, curved tooth, the connecting internal trough easily visible through the wall of the test. Length up to 1.00 mm; breadth up to 0.45 mm.

The types of this species are from the western Atlantic southeast of Montauk Point, Long Island, in 51 fathoms. It is a common species in the western Atlantic and occurs in the late Tertiary and in the Eastern Pacific.

Stations: Or. 10, Or. 16, 1, 114, 136, 144, 339, 653, 1052, 1068, 1073, 1090, 1096, 1097, 1101, 1104, 1105, 1106, 1108, 1114, 1116, 1119, 1121, 1122, 1131, 1135, 1136, 1143, 1144, 1146, 1150, 1157, 1158, 1159, 1161, 1165, 1166, 1167, 1169, 1173, 1174, 1175, 1179, 1180, 1181, 1184, 1203, 1210, 1215, 1220, 1229, 1230, 1231, 1234, 1238, 1239, 1242, 1245, 2169.

*Distribution.*—These stations are nearly all from the coast of southern California and the species is often abundant in some of the samples.

Genus **GLOBOBULIMINA** Cushman, 1927  
**Globobulimina pacifica** Cushman

Plate 31, Fig. 5

*Globobulimina pacifica* Cushman, Contr. Cushman Lab. Foram. Res., vol. 3, 1927, p. 67, pl. 14, fig. 12; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, 1927, p. 153, pl. 3, fig. 1.—Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 74, pl. 11, fig. 18.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 57.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 66, pl. 5, fig. 4.—Cushman and Ponton, Florida Geol. Survey, Bull. 9, 1932, p. 79, pl. 12, fig. 2.—Cushman, Special Publ. No. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 22; *idem*, Special Publ. No. 5, 1933, pl. 27, fig. 16; Bernice P. Bishop Mus. Bull. 119, 1934, p. 123, pl. 15, fig. 1.—Campbell, Journ. Entom. and Zool., vol. 27, no. 3, 1935, p. 41, text fig. 1.—Palmer, Mem. Soc. Cubana Hist. Nat., vol. 14, 1940, p. 296.—LeRoy, Colorado School Mines Quart., vol. 36, no. 1, 1941, p. 33, pl. 3, figs. 70, 71.—Schenck and Childs, Stanford Univ. Publ., Univ. Ser., Geol. Sci., vol. 3, no. 2, 1942, p. 27 (list).—Beck, Journ. Pal., vol. 17, 1943, p. 606, pl. 107, fig. 16.—Franklin, *idem*, vol. 18, 1944, p. 314, pl. 46, fig. 19.—LeRoy, Colorado School Mines Quart., vol. 39, no. 3, 1944, p. 27, pl. 5, fig. 12.—Weaver, Washington Univ. (Seattle), Publ. in Geol., vol. 6, no. 1, 1944, p. 24 (list).—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 29.—Cushman and Parker, U.S. Geol. Survey Prof. Paper 210-D, 1947, p. 134, pl. 29, fig. 37.

Test oval, broadest near the base and gradually narrowing toward the apertural end; chambers distinct, somewhat inflated, the first formed chamber of the last whorl, from the exterior, narrow, usually surrounded on both sides by the last two chambers in front view, only two chambers visible in rear view; sutures distinct, slightly depressed; wall thin, smooth; aperture loop-shaped with a slight lip and a broad apertural tooth. Length up to 1.75 mm; breadth to 1.00 mm.

The types of this species are from the Eastern Pacific. It has been widely recorded from Eocene to Recent but these records need to be checked.

Stations: Or. 10, 55, 57, 59, 82, 200, 251, 516, 542, 1060, 1077, 1080, 1083, 1095, 1098, 1103, 1105, 1106, 1117, 1118, 1123, 1124, 1125, 1128, 1150, 1157, 1168, 1212, 1226, 1243, 2000, 2008, 2016, 2151, 2154, 2162.

*Distribution.*—In this material the species is common off the coast of southern California, ranging northward to the coast of Oregon and southward along the coast of Mexico and Colombia.

Subfamily *Reussellinae*Genus **REUSSELLA** Galloway, 1933**Reussella pacifica** Cushman and McCulloch, new species

Plate 31, Fig. 6

Test increasing gradually in diameter from the spinose initial end to near the apertural end where in the adult it tends to narrow slightly, triangular in transverse section, the sides somewhat concave, periphery acute with a distinct, somewhat blunt spine at the basal angle of each chamber projecting outward and somewhat backward, of clear shell material and a continuation of the anterior edge of the chamber which is slightly carinate; chambers distinct, not inflated, increasing gradually and rather evenly in size as added; sutures distinct, nearly straight, slightly limbate; wall translucent, distinctly perforate; aperture a small, rounded opening at the inner margin of the last formed chamber. Maximum length 0.70 mm; diameter 0.35 mm.

Holotype (AHF no. 52) from Station 410.

This species differs from *R. aculeata* Cushman in the more concave sides, more elongate form, and the peripheral spines broader and less acute.

Stations: 244, 255, 311, 409, 410, 418, 421, 459, 460, 462, 468, 469, 471, 472, 539, 542, 600, 627, 646, 2007, 2028, 2066, 2125, 2127, 2129.

*Type locality*.—Tagus Cove, Albemarle Island, Galapagos Islands, in 9 fathoms.

*Distribution*.—These station records place this species in the Gulf of California, Mexico, off Central America, Ecuador, Galapagos Islands, Alexandria, Egypt and at Kobe, Japan in shallow waters from 3 to 80 fathoms.

**Reussella aequa** Cushman and McCulloch, new species

Plate 31, Fig. 7

*Reussia spinulosa* Cushman and Kellett (not Reuss), Proc. U. S. Nat. Mus., vol. 75, art. 25, 1929, p. 9, pl. 3, fig. 10.

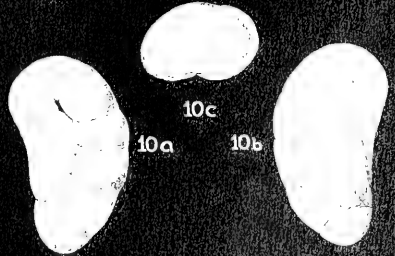
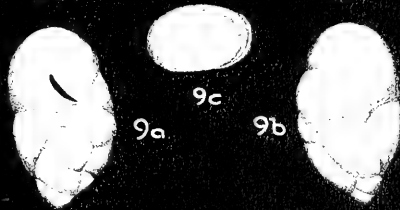
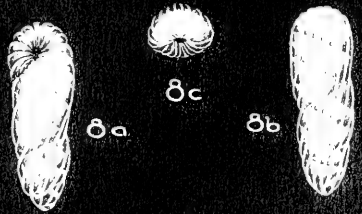
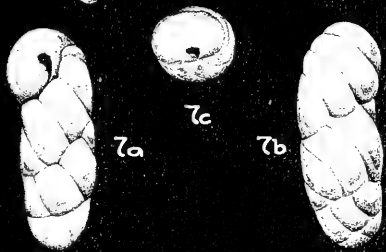
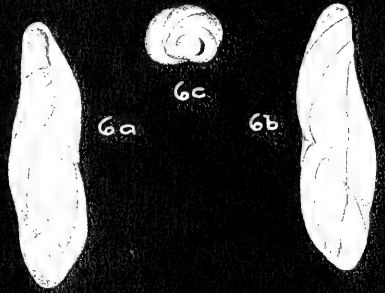
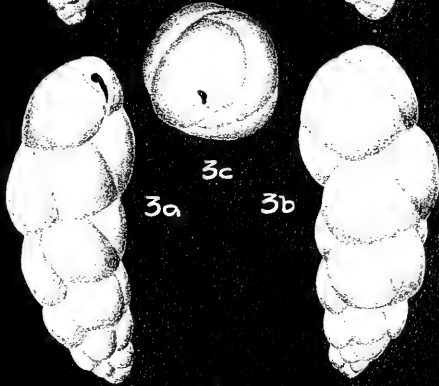
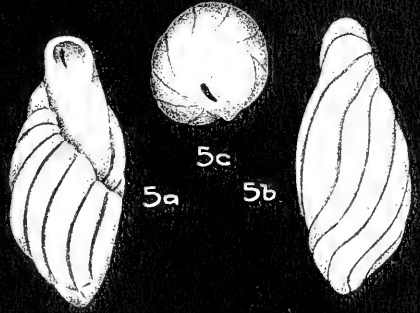
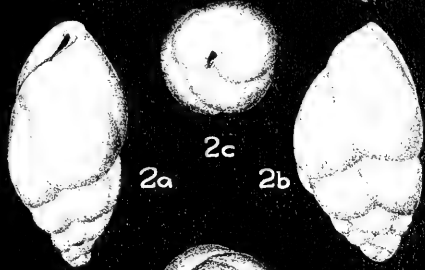
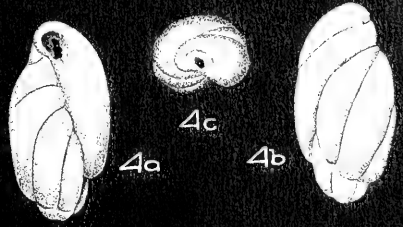
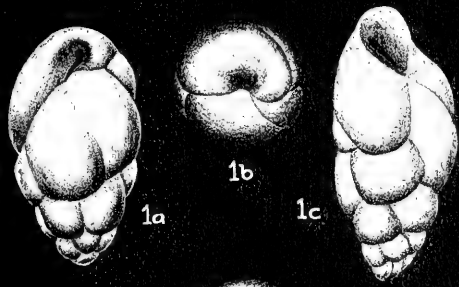
Test triserial, with the early portion increasing rapidly in diameter, the adult usually with the sides nearly parallel, sides flattened or very slightly concave, periphery acute but not distinctly keeled, usually entire but occasionally with a slight projection at the outer edge of the base of the chamber but not spinose; chambers distinct, not inflated, increasing very gradually in height as added in the adult portion; sutures distinct,

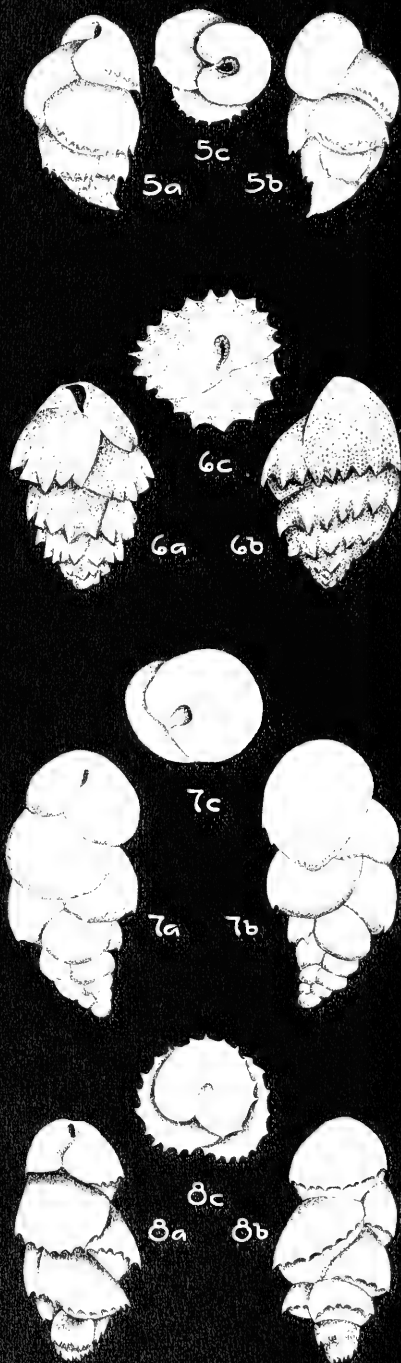
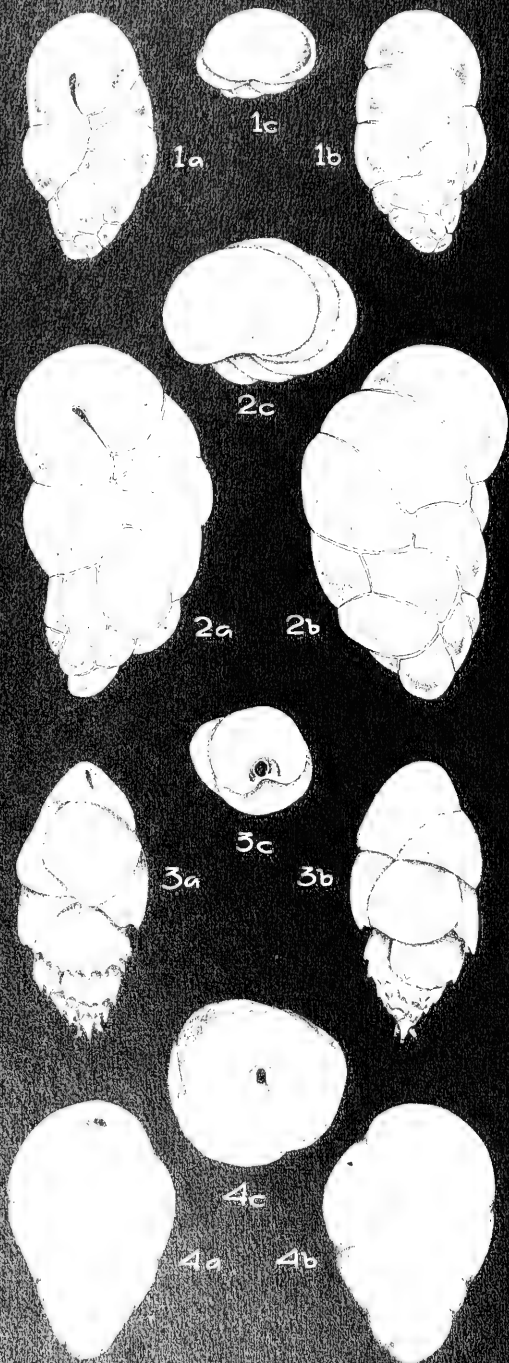
All illustrations were made by Miss Mary E. Taylor.

EXPLANATION OF PLATE 29

FIGS.

1. *Buliminella curta* Cushman. x65. *a*, ventral view; *b*, apertural view; *c*, ventral view of another specimen.
2. *Buliminella brevior* Cushman. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
3. *Buliminella bassendorfensis* Cushman and Parker. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
4. *Buliminella elegantissima* (d'Orbigny). x85. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
5. *Buliminella elegantissima* (d'Orbigny) var. *limbosa* Cushman and McCulloch, new variety. x100. Holotype. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
6. *Buliminella elegantissima* (d'Orbigny) var. *tenuis* Cushman and McCulloch, new variety. x85. Holotype. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
7. *Buliminella parallela* Cushman and Parker. x95. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
8. *Buliminoides williamsoniana* (H. B. Brady). x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
9. *Robertina austriaca* Reuss. x65. *a*, ventral view; *b*, dorsal view; *c*, end view.
10. *Robertina californica* Cushman and Parker. x90. *a*, ventral view; *b*, dorsal view; *c*, end view.





## EXPLANATION OF PLATE 30

## FIGS.

1. *Robertina charlottensis* (Cushman). x80. *a*, ventral view; *b*, dorsal view; *c*, end view.
2. *Robertina charlottensis* (Cushman). x75. *a*, ventral view; *b*, dorsal view; *c*, end view.
3. *Bulimina elongata* d'Orbigny var. *subulata* Cushman and Parker. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
4. *Bulimina pseudotoria* Cushman. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
5. *Bulimina acanthia* Costa. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
6. *Bulimina pagoda* Cushman var. *hebespinata* R. E. and K. C. Stewart. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
7. *Bulimina denudata* Cushman and Parker, x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
8. *Bulimina marginata* d'Orbigny. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.

not depressed, oblique but straight; wall ornamented by a single line of coarse pores along the border of the chamber, the middle portion translucent and mostly without pores; aperture small, rounded, at the base of the last-formed chamber. Maximum length 0.55 mm; maximum breadth 0.30 mm.

Holotype (AHF no. 53) from Station 422.

The species differs from *R. aculeata* Cushman in the nearly straight sides, with little or no dentation, the initial end without a spine and the pores of the wall limited almost entirely to the border of the chamber.

Stations: 63, 76, 221, 222, 244, 311, 422, 436, 457, 458, 470, 500, 504, 1026, 2004, 2011, 2015, 2019, 2020, 2039, 2067, 2081, 2082, 2084, 2116, 2126, 2139, 2153.

*Type locality*.—Socorro Island, Mexico in 16 fathoms.

*Distribution*.—These station records indicate a range from the Gulf of California, Mexico, southward to Ecuador with a number of localities in the Galapagos Islands. The depth range is from 3 to 80 fathoms.

### Genus **CHRYSALIDINELLA** Schubert, 1907

#### **Chrysalidinella spectabilis** Cushman and McCulloch, new species

Plate 32, Figs. 1-7

Test elongate, early portion triserial and triangular in section, very soon becoming uniserial, the adult portion either triangular, quadrangular or in some specimens compressed; chambers distinct, increasing gradually in breadth but very little in height in the adult uniserial portion; sutures distinct, slightly depressed in the adult; wall ornamented by longitudinal costae, those of each chamber distinct, the angles of the test in the adult often with very thin, transparent keels, the initial end sometimes slightly spinose; apertures terminal, numerous, rounded, with thin, raised borders.

Length up to 1.25 mm; diameter of triangular forms up to 0.55 mm; of broader compressed forms up to 0.65 mm.

Holotype (AHF no. 54) from Station 2065.

This species differs from *C. dimorpha* (H. B. Brady) in the ornamented surface, more tapering test, and tendency toward a quadrangular or compressed shape.

Our series of figures shows the range of variation in the adult stages of this species which is unique in this respect.



Stations: 207, 221, 222, 223, 226, 228, 229, 238, 242, 249, 253, 254, 258, 263, 265, 266, 268, 286, 296, 298, 299, 422, 542, 1076, 2011, 2012, 2013, 2015, 2023, 2033, 2034, 2052, 2063, 2065, 2066, 2070, 2090, 2104, 2105, 2106, 2107, 2108.

*Type locality*.—Outer Gorda Bank, Lower California, Lat. 23° 01' N.; Long. 109° 28' W., in 50 fathoms.

*Distribution*.—With the exception of Station 542 which is off the coast of Ecuador in 65-80 fathoms, all other records of the above list indicate a wide distribution within the Gulf of California and off the coast of Mexico. The depth range is from 8 to 250 fathoms off Guadalupe Island.

### Subfamily *Uvigerininae*<sup>1</sup>

The foraminifera included in this subfamily belong in the genera *Uvigerina*, *Hopkinsina*, *Angulogerina*, and *Trifarina*. The large series of specimens available for study has made more apparent than ever the close relationships between certain species and varieties, and the actual gradation of one species into another. Consequently, it must be recognized that the concepts of the species here presented may be a matter of convenience. More study of many more specimens may be expected to result in further clarification of this problem. The study of these large series of specimens also shows the wide range of ornamentation present, the variations in type of ornamentation and in degree, and the rudimentary ornamentation sometimes present on a normally unornamented form. In some cases several specimens are figured illustrating these variations. In most species and varieties both microspheric and megalospheric forms have been recognized and in some cases figured to illustrate the great differences between them. A few species show gerontic characteristics, becoming smaller and more attenuated as growth proceeds.

Genus **UVIGERINA** d'Orbigny, 1826

***Uvigerina cushmani*** Todd, new species<sup>1</sup>

Plate 33, Fig. 1

*Uvigerina cushmani* Todd, Ms, in Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 23, 1947, p. 66, pl. 16, figs. 4, 5.

Test of medium size for the genus, elongate, of nearly equal diameter

<sup>1</sup> The senior author of this report turned over all of the mounted material of the genera *Uvigerina*, *Hopkinsina*, *Trifarina* and of *Angulogerina* to Miss Ruth Todd, Research Associate, Cushman Laboratory for Foraminiferal Research. Miss Todd has been responsible for the synonymy, description of new species, and the discussion in connection with the species of these genera.

throughout, initial end bluntly pointed, slightly lobulated; chambers slightly inflated, of about equal size except the first-formed ones; sutures distinct, deeply incised, curved; wall thin, finely hispid, ornamented with numerous, low, narrow, rather widely spaced costae, and very fine spines, usually both being present, but sometimes only spines; aperture circular, at the end of a short neck, surrounded by a narrow, phialine lip.

Length 0.60-0.80 mm; diameter 0.22-0.28 mm.

Holotype (AHF no. 55) from Station 82, where it occurs abundantly.

This species differs from *U. senticosa* Cushman in its slenderer form and the greater development of costae. It closely resembles *U. juncea* Cushman and Todd from the Pliocene of Timms Point, Calif., but differs in its larger, stouter test and more strongly developed ornamentation. It also resembles *U. pigmea* d'Orbigny from the Pliocene of Italy but differs in its much less prominent costae. Specimens have been recorded from Pliocene? material from the Aleutian Islands.

Specimens were found rarely to abundantly at numerous stations in the Hancock collections as follows: 73, 80, 82, 144, 517, 1041, 1068, 1070, 1071, 1082, 1096, 1101, 1110, 1118, 1122, 1125, 1127, 1129, 1135, 1143, 1144, 1146, 1147, 1148, 1157, 1158, 1159, 1162, 1163, 1164, 1165, 1168, 1174, 1176, 1179, 1180, 1181, 1182, 1184, 1186, 1190, 1196, 1198, 1199, 1200, 1201, 1203, 1204, 1205, 1218, 1219, 1223, 1224, 1225, 1226, 1227, 1228, 1229, 1230, 1233, 1234, 1238, 1239, 1242, 1244, 1245, 1246, 2014, 2087, 2107, 2110, 2154, 2162, 2169.

*Distribution.*—The type locality, Station 82, is off Long Point, Catalina, in 147 fms. The stations listed thus far occur, on the whole, off the Channel Islands and in the Gulf of California at depths ranging from 10 to 212 fms.

### ***Uvigerina excellens* Todd, new species**

Plate 33, Fig. 2

*Uvigerina* sp. Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 37, pl. 6, fig. 15.

Test large, elongate, compact, greatest breadth about middle of test, periphery lobulated; chambers distinct, inflated, rapidly increasing in size; sutures deeply incised, curved; wall thin, translucent, ornamented by numerous, low, regular, sharp, longitudinal costae, about 30 on the circumference of the test, not continuous across the sutures, occasionally

becoming obsolete and spinous on the last-formed chamber; aperture large, at the end of a short, broad neck, surrounded by a narrow, flaring lip.

Length 0.85-1.25 mm; diameter 0.35-0.50 mm.

Holotype (AHF no. 56) from Station 55, where it occurs very abundantly.

The unnamed species referred to in the reference above is from the Pliocene of Timms Point, California, and appears to be the same as this.

This species differs from *U. peregrina* Cushman, var. *curticosta* (Cushman) and var. *dirupta*, n. var. in its lower, more regular, and much more numerous costae, and its more elongate shape.

A very few specimens show a marked rugosity in addition to the costae, and may represent a varietal form, but they are not separated here.

A single specimen from Station 1106, questionably referred here, is interesting as it possesses two complete apertures from the last-formed chamber. Such a freak development in this group of the foraminifera has been noted previously. (See *Uvigerina canariensis* d'Orbigny, var. *distoma* de Amicis [Atti Soc. Toscana Sci. Nat., vol. 14, 1894, p. 14, pl. 2, fig. 5] from the Pliocene of Sicily and *Uvigerina angulosa* Williamson of Heron-Allen and Earland, [*Discovery Reports*, vol. 4, 1932, p. 397, pl. 12, fig. 38] from Recent material from off the Falkland Islands.) In these cases the apertures were from two different chambers while in this case they are from the single, last-formed chamber.

It is also found at the following stations: 56, 57, 58, 60, 64, 67, 230, 251, 299, 552, 1069, 1077, 1080, 1083, 1103, 1117, 1173, 1194, 1198, 2000, 2014, 2070, 2100, 2101, 2144, 2151, 2162.

*Distribution*.—The type locality, Station 55, is Los Islets, North Isla Partida, Mexico, bearing west, in 183 fms. An analysis of the other station records shows a range off the Channel Islands, in the Gulf of California southward to Callao, Peru, in 210 fms.

### ***Uvigerina hootsi* Rankin**

Plate 33, Fig. 3

*Uvigerina hootsi* Rankin, in Cushman and Kleinpell, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 22, pl. 3, figs. 8, 9.—Woodring, Bramlette, and Kleinpell, Bull. Amer. Assoc. Petr. Geol., vol. 20, 1936, pp. 141, 144, 147 (lists).—Kleinpell, Miocene Stratig. Calif., 1938, p. 295, pl. 22, fig. 6.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 46, pl. 13, figs. 16, 17.

Test of medium size, stout, compact, greatest diameter across the last whorl of chambers; chambers distinct, large, inflated, rapidly attaining adult size; sutures distinct, depressed; wall smooth, dull; aperture rather large, at the end of a very short neck, surrounded by a thick phialine rim.

Length 0.50-1.00 mm; diameter 0.35-0.50 mm.

This species, described from the Miocene of California, occurs at the following stations, usually rather rarely: 2, 39, 55, 1095, 1103, 1107, 1129, 1133. The specimens vary considerably in size and some are much larger than the types of *U. hootsi*, but they maintain their stout, inflated shape quite constantly.

*Distribution*.—According to these records, the shallow water localities suggest a redeposition. Other stations show a depth range from 183 to 340 fms.

### ***Uvigerina incilis* Todd, new species**

Plate 33, Fig. 4

Test small for the genus, slender, fusiform, initial end sharply pointed, the greatest diameter a little above the middle, periphery markedly indented; chambers numerous, gradually increasing in size until the last one or two, then decreasing, the last-formed ones tending to become biserial; sutures very distinct, straight, deeply incised; wall thin, translucent, ornamented with numerous, sharp costae, not continuous across the sutures, usually regular, but sometimes serrate and spinous; aperture small, circular, at the end of a short neck, surrounded by a flaring lip.

Length 0.48-0.55 mm; diameter 0.20-0.25 mm.

Holotype (AHF no. 57) from Station 217.

This species differs from *U. subperegrina* Cushman and Kleinpell in its deeply incised sutures and its smaller, slenderer form.

This species occurs rarely to frequently at the following stations: 200, 201, 215, 217, 336, 343, 422, 503, 505, 509, 539, 542, 543, 558, 574, 583, 2016, 2087, 2090, 2093, 2094, 2113, 2132, 2134, 2136, 2137, 2140, 2146, 2149, 2152, 2153, 2154, 2164, 2165.

*Distribution*.—The type locality, Station 217, is Tenacatita Bay, Mexico, in 50 fms. Other records are off Mexico, off Central America, and off the coasts of Colombia and Ecuador in 6 to 138 fms.

**Uvigerina kernensis** Barbat and von Estorff?

Plate 33, Fig. 5

Test short and stout, greatest diameter toward apertural end; chambers inflated, rapidly increasing in size as added; sutures distinct, deeply depressed; wall ornamented by a few, low, somewhat irregular costae becoming obsolete toward the apertural end; aperture at the end of a short neck, without a lip so far as observed.

Length 0.45-0.90 mm; diameter 0.33-0.45 mm.

No types of *U. kernensis* Barbat and von Estorff (Journ. Pal., vol. 7, 1933, p. 172, pl. 23, fig. 13) which was described from the Miocene of California, have been available for comparison, and these specimens are referred here questionably. In general shape they resemble "*Uvigerina canariensis* d'Orbigny, var. *striata* Bagg" but the ornamentation is much stronger than on the type of that form, with which these have been compared. Specimens occur commonly at Station 1 and rarely at Stations 1236 and 2144.

*Distribution*.—An analysis of these three station records places this species off San Pedro in 12 fms, off Long Point, Catalina Island, California, in 300 fms, and in the Gulf of California in 113 to 117 fms.

**Uvigerina nodosa** d'Orbigny

Plate 33, Fig. 6

*Uvigerina nodosa* d'Orbigny, Ann. Sci. Nat., vol. 7, 1826, p. 269.—Parker, Jones, and H. B. Brady, Ann. Mag. Nat. Hist., ser. 4, vol. 8, 1871, p. 171, pl. 11, fig. 110.—Fornasini, Boll. Soc. Geol. Ital., vol. 19, 1900, p. 165, text fig. 7.

Test of medium size, elongate, compact, periphery only slightly indented; chambers large, early ones indistinct, not inflated, the last one or two chambers smaller than previous ones; sutures indistinct in the early part, deeply incised between later chambers, not curved; wall ornamented by numerous, low, sharp costae, about 20 on the circumference of the test, aligned across the sutures, although interrupted by the more deeply incised sutures, tending to disappear on the last-formed chamber; aperture circular, at the end of a short neck, surrounded by a thickened rim.

Length 0.60-0.65 mm; diameter 0.25-0.30 mm.

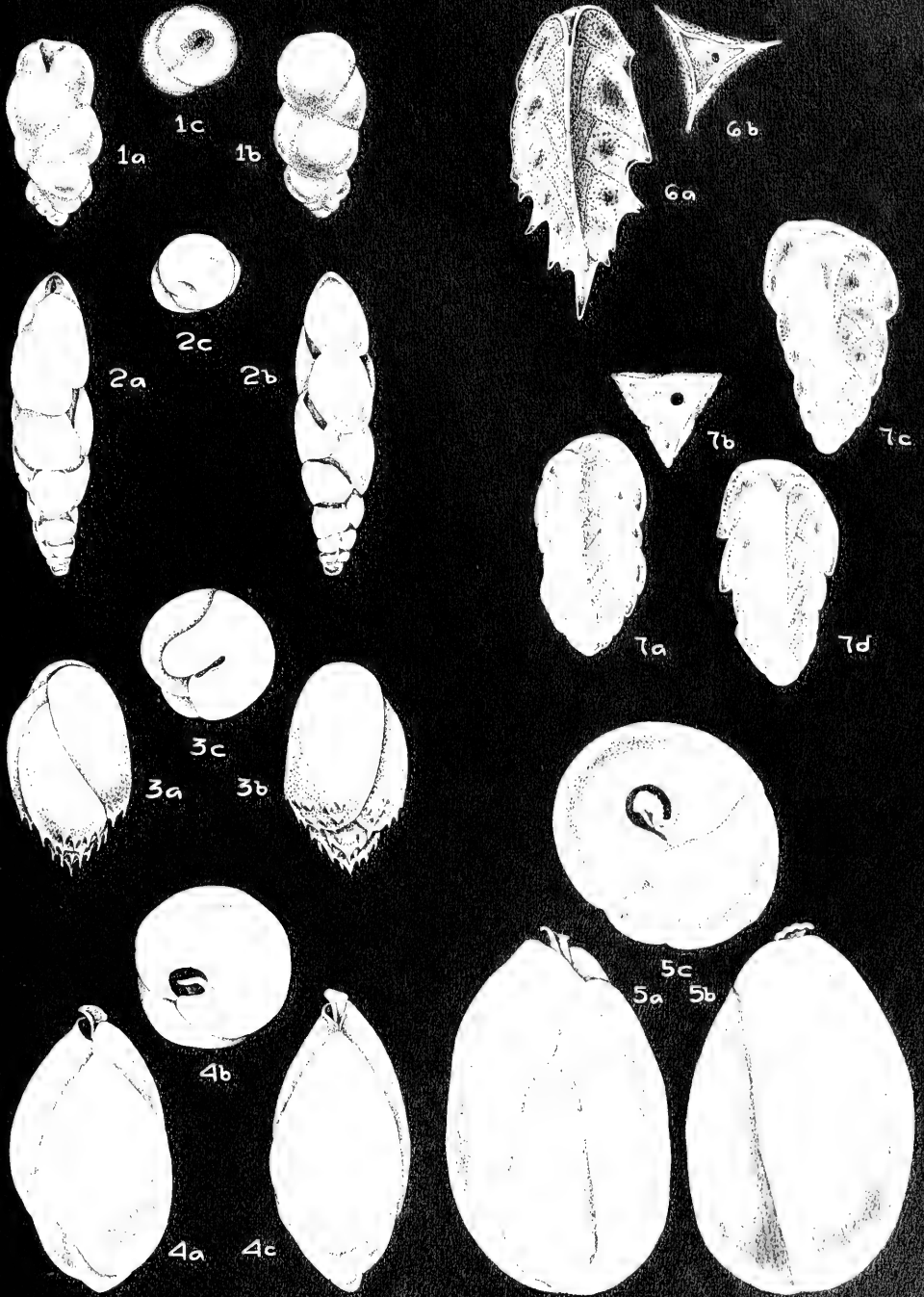
This species, based on Soldani's figures, was described from the Adriatic, and has not been recorded elsewhere.

*Distribution*.—A number of specimens which appear to belong here were found in the Hancock material from Gibraltar (Station 648) and a single specimen from Port Said (Station 634).

## EXPLANATION OF PLATE 31

## FIGS.

1. *Bulimina patagonica* d'Orbigny var. *glabra* Cushman and Wickenden. x70. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
2. *Bulimina exilis* H. B. Brady var. *tenuata* (Cushman). x70. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
3. *Bulimina barbata* Cushman. x65. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
4. *Bulimina (Desinobulimina) auriculata* Bailey. x60. *a*, ventral view; *b*, apertural view; *c*, ventral view of another specimen.
5. *Globobulina pacifica* Cushman. x30. *a*, ventral view; *b*, dorsal view; *c*, apertural view.
6. *Reussella pacifica* Cushman and McCulloch, new species. x60. Holotype. *a*, side view; *b*, apertural view.
7. *Reussella aequa* Cushman and McCulloch, new species. x60. Holotype. *a*, side view; *b*, apertural view. Paratypes. *c*, side view; *d*, side view.







## EXPLANATION OF PLATE 32

## FIGS.

- 1-6. *Chrysalidinella spectabilis* Cushman and McCulloch, new species. x60. 1a-6a, side views; 1b-6b, apertural views.
7. *Chrysalidinella spectabilis* Cushman and McCulloch, new species. x60. Holotype. a, side view; b, apertural view.

**Uvigerina peregrina** Cushman, var. **bradyana** Cushman

Plate 34, Fig. 1

*Uvigerina peregrina* Cushman, var. *bradyana* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 168, pl. 42, fig. 12; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 158, pl. 4, fig. 2.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 69, pl. 5, fig. 12.—Cushman, Bull. Geol. Soc. Amer., vol. 47, 1936, p. 429, pl. 5, fig. 10.

Variety differing from the typical form in the smaller, slenderer form, the fewer and much lower costae, and the more finely punctate, translucent, wall.

Length 0.50-0.60 mm; diameter 0.25-0.30 mm.

This, as well as the other varieties, shows a considerable range of ornamentation with costae, serrate costae, and spines.

This variety was described from off the northeastern coast of the United States and has been recorded from late Tertiary core material off the Atlantic coast, from the Pliocene of California, and from the Pacific.

The specimens have been compared with typical specimens from the Atlantic and seem to be the same, although generally smaller. They are from stations: Or. 10, 82, 667, 1097, 1105, 1106, 1135, 1150, 1178.

*Distribution.*—The station records here include, off the coast of Oregon, off California and in the harbor of Port Said in 13 to 175 fms.

**Uvigerina peregrina** Cushman, var. **curticosta** (Cushman)

Plate 34, Fig. 2

*Uvigerina pigmea* d'Orbigny, var. *curticosta* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 157, pl. 4, fig. 1.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 60.

Variety differing from the typical form in the fewer costae, more irregularly spaced, not usually aligned from chamber to chamber, sometimes slightly oblique to the axis of the test, lacking any spinosity.

Length 0.50-1.00 mm; diameter 0.25-0.50 mm.

This form was described from 800 fathoms, off Panama (*Lydonia* Sta. 33), as a variety of *U. pigmea* d'Orbigny. It seems, however, to be much more closely related to *U. peregrina* Cushman from off the eastern United States and is here placed under that species. It has a great range in size but maintains its ornamentation of high, discontinuous, rather widely spaced costae.

This variety occurs widely and usually abundantly at the following stations: C-15, 1080, 1095, 1103, 1105, 1107, 1124, 1168, 1178, 1207, 1210, 1211, 1212, 1226, 1243, 2070.

*Distribution.*—With the exception of Station 2070, off Guadalupe Island in 250 fms, all other records here are off the coast of California, and off the Channel Islands from low tide to 600 fms.

### ***Uvigerina peregrina* Cushman, var. *dirupta* Todd, new variety**

Plate 34, Fig. 3

Variety differing from the typical form in the larger size and in the ornamentation, the costae becoming strongly serrate, and, toward the apertural end, breaking up into spines.

Length 0.85-1.15 mm; diameter 0.45-0.55 mm.

Holotype of variety (AHF no. 58) from Station 1212.

The ornamentation shows all degrees of spinosity from an almost lack of spines to a completely spinose form without any trace of alignment of spines. Where there is a combination of spines and costae the spines are best developed toward the apertural end.

Brady's reference to an unnamed *Uvigerina* from off Juan Fernandez (Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 74, fig. 26 [not figs. 24, 25]) may be this variety.

The variety is fairly common at Stations 1211 and 1212 and single specimens were found at 1095 and 1210.

*Distribution.*—The type locality, Station 1212, is 8 miles north of Long Point, Catalina Island in 490 fms. All other records are in the immediate region of this island with the exception of 1095, off Redondo Beach, California, in 240 fms.

### ***Uvigerina proboscidea* Schwager**

Plate 34, Fig. 4

*Uvigerina proboscidea* Schwager, *Novara-Exped.*, Geol. Theil, vol. 2, 1866, p. 250, pl. 7, fig. 96.—Karrer, in von Drasche, Frag. Geol. Insel Luzon, 1878, p. 94.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 94, pl. 42, fig. 2.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 69, pl. 5, fig. 10.—Cushman, Bull. 119, Bernice P. Bishop Mus., 1934, p. 126, pl. 15, fig. 10; Journ. Geol. Soc. Japan, vol. 46, No. 546, 1939, p. 151 (41), pl. 10 (6), fig. 13.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 73, pl. 17, fig. 9; pl. 19, figs. 3-9.—Cushman, Bull. 161, U. S. Nat. Mus.,

pt. 3, 1942, p. 49, pl. 14, figs. 1-4.—LeRoy, Colorado School Mines Quart., vol. 39, No. 3, pt. 2, 1944, p. 86, pl. 2, fig. 5.—Cushman and Todd, Special Publ. No. 15, Cushman Lab. Foram. Res., 1945, p. 50, pl. 7, fig. 28.—Valk, in Rutten and Hotz, Geol., Petrogr. and Paleont. Results Explor. Island of Ceram, 3rd ser., Geol., No. 1, 1945, p. 25.

Test stout, compact in early portion, later portion attenuated; chambers few, comparatively large, inflated; sutures indistinct, depressed, not curved; wall thickly covered with rather coarse spines, generally without any trace of alignment, an initial spine sometimes present; aperture at the end of a prominent neck, surrounded by a slight lip.

Length up to 0.85 mm; diameter 0.25-0.42 mm.

This species was described from the Pliocene of Kar Nicobar and is also known from other localities in the Indo-Pacific, fossil and Recent, and from the Pliocene of California and the Miocene of Buff Bay, Jamaica. This species was recorded at stations: 513, 1105, 1122, 1150. Specimens from the last station are larger than those from the first three.

*Distribution.*—These station records place this species off Catalina Island, off Seal Beach, California, in 47 to 225 fms, and off the coast of Colombia in 47 fms.

### ***Uvigerina proboscidea* Schwager, var. *vadescens* Cushman**

Plate 34, Fig. 5

*Uvigerina proboscidea* Schwager, var. *vadescens* Cushman, Contr. Cushman Lab. Foram. Res., vol. 9, 1933, p. 85, pl. 8, figs. 14, 15; Bull. 161, U. S. Nat. Mus., pt. 3, 1942, p. 50, pl. 14, figs. 5-9.—Palmer, Bull. Amer. Pal., vol. 29, No. 115, 1945, p. 51.—Cushman and Todd, Special Publ. 15, Cushman Lab. Foram. Res., 1945, p. 50, pl. 7, fig. 29.

Very rare, usually single, specimens from a few stations may be referred with some question to this variety which is distinguished from the typical form by its smaller size and slender form, and the elongate apertural neck. The present specimens, however, have more inflated and globose chambers and the neck is not as long as in the types. Also, the hispid wall shows an alignment, occasionally developing into faint longitudinal costae at the initial end.

The specimens are from the following stations: 82, 629, 637, 655, 664, 1182, 1184, 1218, 1229, 1243, 2164. The known distribution of this variety is Recent of the Tropical Pacific and Miocene of Jamaica.

*Distribution.*—These stations include records off Catalina, San Clemente, and Cedros Islands in 46 to 228 fms, and from the harbors of Singapore, of Kobe, Japan, and Colombo Bay in 7 to 90 fms.

**Uvigerina segundoensis** Cushman and Galliher

Plate 34, Fig. 6

*Uvigerina segundoensis* Cushman and Galliher, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 26, pl. 4, fig. 11.—Woodring, Bramlette, and Kleinpell, Bull. Amer. Assoc. Petr. Geol., vol. 20, 1936, pp. 141, 145, 147 (lists).—Kleinpell, Miocene Stratig. Calif., 1938, p. 297.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 51, pl. 14, fig. 18.

This species upon comparison with the type, seems very close to this species described and previously known only from the Miocene of California.

Three specimens were recorded from Station 1194.

*Distribution.*—The single record is  $4\frac{1}{2}$  miles NW of buoy, Cortes Bank in 110 fms.

**Uvigerina senticosa** Cushman

Plate 34, Fig. 7

*Uvigerina senticosa* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 159, pl. 3, fig. 14.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 58.—Cushman, Stewart and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 68, pl. 5, fig. 9.

“Test fusiform, broadest toward the apertural end, initial end rounded; chambers numerous, inflated; sutures distinct and depressed; wall in the early portion roughened with bristly points, very fine and numerous, not as conspicuous in later chambers except in the sutural regions; apertural end with a short cylindrical neck and slightly flaring lip. Length up to 0.85 mm.”

The bristly ornamentation occasionally develops into actual fine spines on the initial portion of the test and may be longitudinally aligned. Our specimens are generally smaller but some tend to be more robust than the types. Several are figured to illustrate the variations.

The original description is quoted above. This species was described from 1390 fathoms, off southern California (*Guide* Sta. 3). It occurs in typical form but never abundantly at a number of stations as follows: A-1, Or. 9, Or. 10, 1, 58, 80, 82, 136, 144, 230, 1074, 1078, 1079, 1100, 1101, 1116, 1117, 1119, 1120, 1125, 1132, 1135, 1139, 1143, 1157, 1161, 1165, 1168, 1173, 1174, 1175, 1177, 1178.

*Distribution.*—In addition to the numerous records off the Channel Islands in 2 to 300 fms, there is a northern record here off Ketchikan, Alaska, in 8 fms and one at Los Frailes, Mexico, in 160 fms.

***Uvigerina subperegrina* Cushman and Kleinpell**

Plate 34, Fig. 10

*Uvigerina subperegrina* Cushman and Kleinpell, Contr. Cushman Lab. Foram. Res., vol. 10, 1934, p. 12, pl. 2, figs. 9-11.—Woodring, Bramlette, and Kleinpell, Bull. Amer. Assoc. Petr. Geol., vol. 20, 1936, pp. 141, 145 (list).—Kleinpell, Miocene Stratig. Calif., 1938, p. 298.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 52, pl. 14, figs. 19-23.—Cushman and Gray, Special Publ. 19, Cushman Lab. Foram. Res., 1946, p. 36, pl. 6, fig. 14.

“Test small, fusiform, often slightly compressed; chambers distinct, inflated; sutures distinct, depressed, slightly oblique; wall ornamented by numerous fine costae, as many as ten to a chamber, those of each chamber independent of adjacent ones, last-formed chambers somewhat smooth; aperture terminal, small, with a short neck. Length 0.60-0.70 mm; diameter 0.30-0.40 mm.”

The original description is quoted above, of this species from the Miocene of California. A number of specimens from the following stations: 1, 2, 57, 227, 509, 1077, 1081, 1123, 1125, 1146, 1190, 1225, 1226, 2155, may be referred here, making the first Recent records for this species. These Recent specimens differ somewhat, chiefly in being proportionately slenderer.

*Distribution.*—The records here off San Pedro, and the Channel Islands, indicate a depth range of 12 to 170 fms; off Guadalupe and San Benito Islands, 35 to 200 fms; and 17 to 25 fms in San Jose Del Cabo Bay.

***Uvigerina uncinata* Mariani**

Plate 34, Fig. 11

*Uvigerina uncinata* Mariani, Atti Soc. Ital. Sci. Nat., vol. 31, 1888, p. 119, pl. 1, fig. 7.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 75, pl. 18, fig. 2.

Test small, compressed in the later portion, tending to become uniserial, greatest breadth usually at about the lower third; chambers distinct, slightly inflated, rather high, slightly overhanging earlier ones; sutures distinct, deeply incised, curved; wall thin, translucent, ornamented by numerous low, straight, narrow costae, about 8 or 10 to a chamber, not continuous across the sutures, ending in slight, backwardly-projecting spines; aperture at the end of a short, broad neck, surrounded by a narrow, phialine lip.

Length 0.40-0.50 mm; breadth 0.17-0.20 mm; thickness 0.12-0.15 mm.

This species, described from the Pliocene of Italy, is present at the following stations: 634, 636, 648, all in the Mediterranean Sea. The present specimens show the gradation of this form into *Siphogenerina*.

*Distribution*.—The bottom samples were collected at Port Said, Naples and Gibraltar in 7 to 90 fms.

### **Uvigerina sp. A**

Plate 34, Fig. 8

Test small, fusiform, greatest breadth a little above the middle; chambers distinct, inflated, rapidly increasing in size so that the last two whorls comprise most of test; sutures deeply incised, curved; wall smooth, polished, sometimes with faint traces of costae at the base of the later chambers; aperture at the end of a short, stout neck, surrounded by a phialine lip.

Length 0.40-0.47 mm; diameter 0.18-0.20 mm.

This species differs from *U. canariensis* d'Orbigny in the chambers less rapidly increasing in size so that the last whorl makes up proportionately much less of the test than it does in *U. canariensis*; in the faint costae; and in its smaller size.

Four specimens of this species were found at Station 200.

*Distribution*.—Tangola Tangola, Mexico.

### **Uvigerina sp. B**

Plate 34, Fig. 9

Test short and stout, chambers few, large, inflated; sutures deep; wall thin, translucent, ornamented by fine, sharp, rather widely spaced spines with the addition in some specimens of a few serrate costae on the early portion of the test; aperture at the end of a prominent neck with a narrow lip.

Length 0.50-0.55 mm; diameter 0.35-0.42 mm.

This species seems to be undescribed. It occurs at only two stations: 1150 and 1243, and with too few specimens available for adequate description.

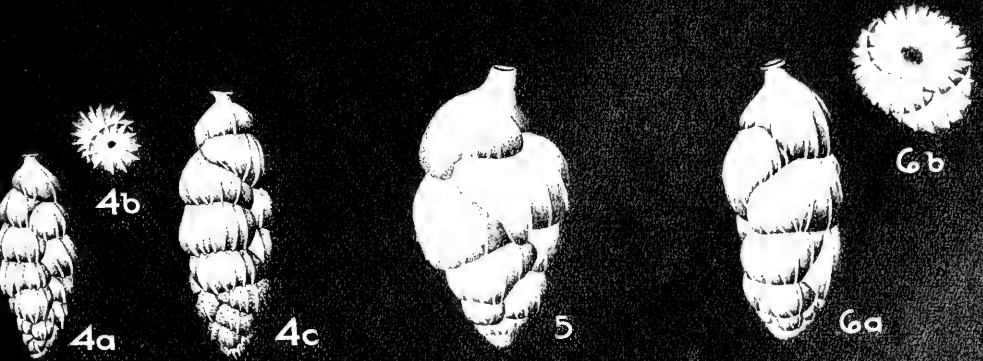
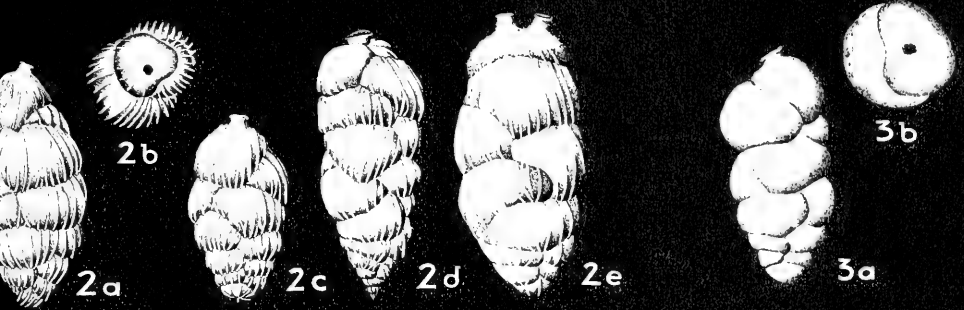
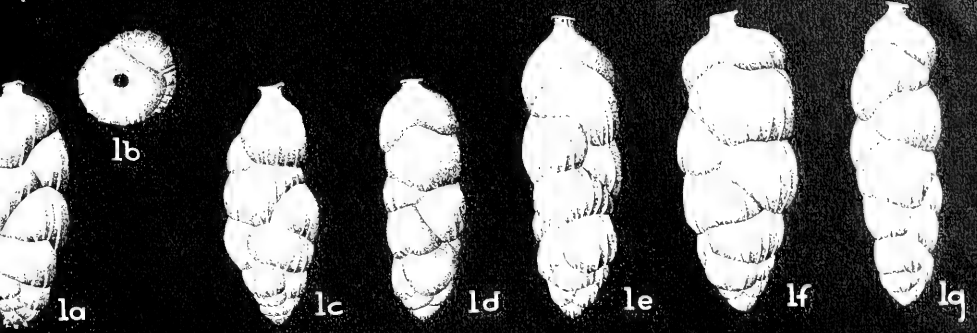
*Distribution*.—These stations are Point Dume in 47 fms and off Long Point, Catalina Island in 228 fms.

## EXPLANATION OF PLATE 33

## FIGS.

1. *Uvigerina cushmani* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view; *c*, microspheric form; *d*, *e*, variants; *f*, megalospheric form; *g*, microspheric form. *c-g*, paratypes.
2. *Uvigerina excellens* Todd, new species, x30. *a*, holotype, side view; *b*, apertural view; *c*, *d*, paratypes; *e*, abnormal form.
3. *Uvigerina hootsi* Rankin, x30. *a*, side view; *b*, apertural view.
4. *Uvigerina incilis* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view; *c*, paratype.
5. *Uvigerina kernensis* Barbat and von Estorff?, x55.
6. *Uvigerina nodosa* d'Orbigny, x55, *a*, side view; *b*, apertural view.







## EXPLANATION OF PLATE 34

## FIGS.

1. *Uvigerina peregrina* Cushman, var. *bradyana* Cushman, x55.
2. *Uvigerina peregrina* Cushman, var. *curticosta* (Cushman), x55. *a, b*, side and apertural views.
3. *Uvigerina peregrina* Cushman, var. *dirupta* Todd, new variety, x30. *a*, holotype, side view; *b*, apertural view; *c, d*, paratypes.
4. *Uvigerina proboscidea* Schwager, x55. *a*, side view; *b*, apertural view.
5. *Uvigerina proboscidea* Schwager, var. *vadescens* Cushman, x55.
6. *Uvigerina segundoensis* Cushman and Galliher, x55.
7. *Uvigerina senticosa* Cushman, x55. *a-c*, variants, side view.
8. *Uvigerina* species A, x55. *a, b*, side and apertural views.
9. *Uvigerina* species B, x55. *a, b*, side and apertural views.
10. *Uvigerina subperegrina* Cushman and Kleinpell, x55.
11. *Uvigerina uncinata* Mariani, x55. *a*, side view; *b*, apertural view.
12. *Trifarina bradyi* Cushman, x55. *a*, side view; *b*, apertural view.

Genus **HOPKINSINA** Howe and Wallace, 1933**Hopkinsina hancocki** Todd, new species

Plate 35, Fig. 1

Test small, delicate, attenuated, with periphery strongly indented, greatest diameter across last two chambers; chambers few, globose, separated from adjacent ones; sutures deeply depressed; wall thin, transparent in well preserved specimens, bearing 3 or 4 high, sharp, serrate costae per chamber, not continuous across sutures, sometimes obsolete toward the apertural end of the test, becoming spinous at the initial end of the test and obscuring the first-formed chambers; aperture at the flaring end of a long, prominent neck.

Length 0.37-0.52 mm; diameter (including costae) 0.20-0.27 mm.

Holotype (AHF no. 59) from Station 416, where it is common and beautifully preserved.

This species somewhat resembles *Uvigerina porrecta* H. B. Brady from the Indo-Pacific region but the chambers are globose rather than angular, and the costae are fewer and much higher and sharper. The species is placed in the genus *Hopkinsina* as it becomes biserial in the adult.

It also occurs less commonly and in less typical form at the following additional stations: Lowe 1, 200, 409, 511, 512, 513, 583, 1122.

*Distribution*.—The type locality, Station 416, is north of Duncan Island, Galapagos Islands, in 35 to 68 fms. With the exception of Station 1122, off Catalina Island, in 208 fms, the other records are off Central America, off the Galapagos Islands, and off the coast of Ecuador.

**Hopkinsina oceanica** Todd, new species

Plate 35, Fig. 2

Test fusiform, attenuated, initial end pointed, periphery lobulated; chambers distinct, strongly inflated, rapidly increasing in size as added until the last two or three, the last several pairs of chambers biserially arranged; sutures distinct, deep, not curved; wall thin, ornamented by a combination of high, sharp, serrate costae and coarse, sharp, thickly set spines; aperture circular, at the end of a prominent neck, surrounded by a fragile lip.

Length 0.42-0.52 mm; breadth 0.22-0.25 mm; thickness 0.17-0.20 mm.

Holotype (AHF no. 60) from Station 513.

This species differs from *H. hancocki*, new species, in having its last few chambers reduced in size and in its almost complete covering of ornamentation.

It is common here and shows its considerable range of variation in ornamentation. It occurs less frequently at the following additional stations: 112, 503, 505, 512, 540, 583, 1096.

*Distribution*.—The type locality is Station 513, off the coast of Colombia,  $0^{\circ} 39' 20''$  N.,  $80^{\circ} 15' 30''$  W. in 58 fms. Other records include the coast off Redondo Beach, Catalina Island, the coast of Colombia, and off the coast of Ecuador.

### Genus *ANGULOGERINA* Cushman, 1927

#### *Angulogerina albatrossi* Cushman

Plate 35, Fig. 3

*Angulogerina albatrossi* Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 45, pl. 6, figs. 11, 12.

Test elongate, subfusiform and irregularly triangular throughout in the microspheric form, subcylindrical and irregularly inflated in the megalospheric form, becoming loosely coiled toward the apertural end; chambers few, slightly inflated, those of the microspheric form and the last-formed ones of the megalospheric form triangular in section, sometimes with concave sides; sutures distinct, deeply depressed; wall coarsely punctate, generally smooth, although on the microspheric form the early part sometimes shows traces of low costae and the initial end may have very slight spinose projections; aperture large, at the end of a distinct neck, surrounded by a thickened phialine lip.

Length 0.90-1.25 mm; diameter 0.30-0.60 mm.

The megalospheric forms are identical with the types which were from *Albatross* H 1805, off the west coast of Mexico, Lat.  $18^{\circ} 33' 30''$  N., Long.  $114^{\circ} 44' 00''$  W., 1732 fms. Microspheric forms have not been figured previously and are quite different in shape, being much broader in the middle of the test, and having a pointed rather than rounded initial end. Three specimens are illustrated to show these variations. Only the microspheric forms, as would be expected, show faint traces of ornamentation and seem almost to grade into the var. *ornata*.

A few specimens from the following stations: 223, 420, 432, 438, 444, 461, 474, 1189, 2084, are placed in this species.

*Distribution*.—Analysis of these station records shows a range from Cortes Bank in 51 fms southward to Hood Island in 175 fms.

**Angulogerina albatrossi** Cushman, var. **hirsuta** Todd, new variety

Plate 35, Fig. 4

Variety differing from the typical form in the ornamentation, consisting of numerous high, sharp costae on the early part of the test, and prominent, thickly-set spines over the later two or three chambers and even the apertural neck, and in the proportionately stouter and more sharply triangular, but not carinate, section of the test.

Holotype (AHF no. 61) from Station 406, off the Galapagos Islands.

This variety exhibits great variation in size from one locality to another. The specimens from Station 406 are fairly uniform: 1.00-1.25 mm in length and 0.50-0.55 mm in breadth. Those from the other stations: 5, 403, 412, and 473, are much smaller: 0.60-0.80 mm in length and 0.25-0.40 mm in breadth. In addition, the proportion of costae and spines varies greatly, and sometimes the initial end also bears spines.

From the material available it seems related to *A. albatrossi*, especially the microspheric form of that species, but it may prove to be a distinct species.

*Distribution.*—The type locality is 1° 03' 30" S., 90° 17' 30" W. in 60 fms. Additional records include one off San Pedro in 38 fms, and four off the Galapagos Islands at depths from 9 to 111 fms.

**Angulogerina albatrossi** Cushman, var. **ornata** Cushman

Plate 35, Fig. 5

*Angulogerina albatrossi* Cushman, var. *ornata* Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 45, pl. 6, figs. 13, 14; U. S. Nat. Mus. Bull. 161, pt. 3, 1942, p. 57, pl. 15, figs. 10, 11.

Variety differing from the typical form in the ornamentation, consisting of very fine costae, low, yet sharp, slightly wavy in pattern, curving, branching, and intercalating, not continuous across the sutures, and usually faint or absent on the last-formed chamber. The strength of the ornamentation varies considerably, the costae being almost obliterated on some specimens, yet with the characteristic wavy pattern still visible.

This variety shows the same sort of variation in shape of test in the microspheric and megalospheric forms as that shown by the species. Two specimens are figured to illustrate this.

*A. albatrossi* var. *ornata* Cushman was described from the same station as the species off the west coast of Mexico, and has been recorded as rare from the Tropical Pacific. It occurs in few numbers with the typical form at two of its stations, 223 and 2084, and at the following additional

stations: 283, 403, 409, 411, 412, 414, 419, 423, 427, 460, 472, 473, 2081, 2086, 2129.

*Distribution.*—These records indicate a range from Sulphur Bay, Clarion Isle, in 53 fms southward to the Galapagos Islands in 9 to 111 fms.

### *Angulogerina angulosa* (Williamson)

Plate 35, Fig. 6

*Uvigerina angulosa* Williamson, Recent Foram. Gt. Britain, 1858, p. 67, pl. 5, fig. 140.—H. B. Brady, Trans. Linn. Soc. London, vol. 24, 1864, p. 473 (table); Nat. Hist. Trans. Northumberland and Durham, vol. 1, 1865 (1867), p. 99.—Berthelin, Ann. Soc. Acad. Nantes, ser. 5, vol. 8, 1878, p. 30.—Balkwill and Wright, Proc. Roy. Irish Acad., ser 2, vol. 3, 1882, p. 549 (list).—H. B. Brady (part), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 576, pl. 74, figs. 15, 16 (not 17, 18).—Balkwill and Wright, Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 347.—Siddall, First Rep. Fauna Liverpool Bay in Proc. Lit. Phil. Soc. Liverpool, 1886, p. 69 (list).—Brady, Journ. Roy. Micr. Soc., 1887, p. 915.—Halkyard, Trans. Manchester Micr. Soc., 1889, p. 68.—Wright, Ann. Mag. Nat. Hist., ser. 6, vol. 4, 1889, p. 449 (list).—Pearcey, Trans. Nat. Hist. Soc. Glasgow, vol. 2, 1890, p. 178.—Halkyard, Trans. Manchester Micr. Soc., 1891, p. 8.—Wright, Proc. Roy. Irish Acad., ser. 3, vol. 1, 1891, p. 487.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890-91 (1892), p. 64.—Robertson, Trans. Nat. Hist. Soc. Glasgow, vol. 3, pt. 3, 1889-92, p. 241 (list).—Goës, Kongl. Svensk. Vet.-Akad. Handl., vol. 25, No. 9, 1894, p. 51, pl. 9, figs. 502-509.—Jones, Foram. Crag, pt. 3, 1896, p. 277, pl. 7, fig. 26.—Flint, Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 320, pl. 68, fig. 3.—Wright, Irish Nat., vol. 9, 1900, p. 55 (list).—Kiaer, Rep't Norwegian Fish- and Marine-Investigations, vol. 1, No. 7, 1900, p. 42.—Earland, Journ. Quekett Micr. Club, ser. 2, vol. 9, 1905, p. 218.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 150.—Millett, Recent Foram. Galway, 1908, p. 6.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 52, 1908, p. 1, pl. 1, fig. 4.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., 1909, p. 436.—Sidebottom, Mem. Proc. Manchester Lit. Philos. Soc., vol. 54, 1910, p. 23.—Wright, Proc. Belfast Nat. Field Club, Appendix, 1910-11, p. 7.—Faure-Fremiet, Bull. Mus., Paris, 1911, p. 78.—Bagg, Bull. 513, U. S. Geol. Survey, 1912, p. 75, pl. 22, fig. 2.—Cushman, Bull. 71, U. S.

Nat. Mus., pt. 3, 1913, p. 98, pl. 44, fig. 4.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 104; Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 266; Journ. Roy. Micr. Soc., 1916, p. 49; Bull. Soc. Sci. Hist. Nat. Corse, 1922, p. 132.—Hofker, Flora en Fauna der Zuiderzee, Protozoa, 1922, p. 143, text fig. 34.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 170, pl. 41, figs. 17-20.—Hanna and Church, Journ. Pal., vol. 1, 1928, p. 201.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 177.—Macfadyen, Geol. Mag., vol. 79, 1942, p. 137 (list).

*Angulogerina angulosa* Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 60, pl. 8, fig. 7.—Thalman, Eclogae geol. Helvetiae, vol. 25, 1932, p. 306.—Cushman, Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 14; Special Publ. 5, 1933, pl. 28, figs. 13, 14.—Campbell, Journ. Entom. and Zool., vol. 27, No. 3, 1935, p. 45, text fig. 6.—Marie, Bull. Lab. Dinard, Fasc. 20, 1938, p. 77 (list).—Phleger, Bull. Geol. Soc. Amer., vol. 50, 1939, p. 1404, pl. 3, figs. 10, 11.—Cushman, Foraminifera, 3rd Ed., 1940, pl. 22, fig. 14; Key, pl. 28, figs. 13, 14; Special Publ. 12, Cushman Lab. Foram. Res., 1944, p. 30, pl. 4, fig. 9.

Test fusiform, triangular in section throughout, initial and apertural ends about equally pointed, periphery slightly lobulated; chambers indistinct, two of the three sides very slightly inflated, the third side slightly concave, the angles acute but not carinate; sutures distinctly depressed, curved; wall thin, ornamented by a few low costae on the earlier chambers, not continuous across the sutures; aperture at the end of a very short, slightly flaring neck.

Length 0.35-0.48 mm; width 0.15-0.20 mm.

Rare to few specimens in the Hancock collections seem to belong to this species described from off the British Isles and widely recorded, both Recent and fossil. The specimens have been compared with typical material from off Ireland and seem very similar, although they average considerably smaller. They occur at stations: A-1, A-2, 82, 227, 1136, 1139, 1141, 1143, 1146, 1147, 1157, 1158, 1159, 1164, 1168, 1171, 1175, 1179, 1180, 1182, 1183, 1184, 1198, 1200, 1201, 1205, 1207, 1222, 1229, 1231, 1233, 1242, 1245, 1246.

*Distribution.*—These station records give a range from Alaska in 2 fms to Guadalupe Island in 200 fms, with numerous records off the Channel Islands in depths from 7 to 125 fms.



**Angulogerina baggi** (Galloway and Wissler)

Plate 35, Fig. 7

*Uvigerina baggi* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 75, pl. 11, fig. 19.

*Angulogerina baggi* Campbell, Journ. Entom. Zool., vol. 27, No. 3, 1935, p. 46, text fig. 8.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 75, pl. 18, fig. 5; pl. 19, fig. 19.

“Test short, thick, fusiform, lower half conical, tapering abruptly from the short initial end, later half triangular, with slightly concave sides; chambers few, the last three composing one-half of the test, slightly inflated; sutures distinct, not depressed, of clear shell material; wall smooth, very finely perforate; aperture situated at the end of a fairly short neck with a phialine lip.

“Length of the type specimen, 0.45 mm; diameter, 0.28 mm.”

The original description of this species from the Pleistocene of California is quoted above. The species occurs rather rarely at numerous stations as follows: 1, 73, 134, 249, 1017, 1018, 1050, 1061, 1062, 1064, 1100, 1111, 1113, 1114, 1118, 1138, 1143, 1144, 1145, 1152, 1153, 1155, 1156, 1157, 1160, 1163, 1165, 1166, 1167, 1168, 1170, 1171, 1172, 1186, 1192, 1193, 1194, 1195, 2165, 2169.

*A. baggi* and *A. hughesi* occur usually together and seem to grade into one another. They may be merely stages or micro- and megalospheric forms of a single species; *A. baggi* being the early stage or the megalospheric form, and *A. hughesi* the adult stage or microspheric form. The separation between the two seems to be arbitrary and is based on shape of test (short, fusiform, and periphery not lobulated in *baggi*) and sutures (not depressed in *baggi*).

*Distribution*.—With the exception of one record off Isla Partida, Mexico, in 140 fms, the other localities are off the Channel Islands in 12 to 160 fms.

**Angulogerina carinata** Cushman

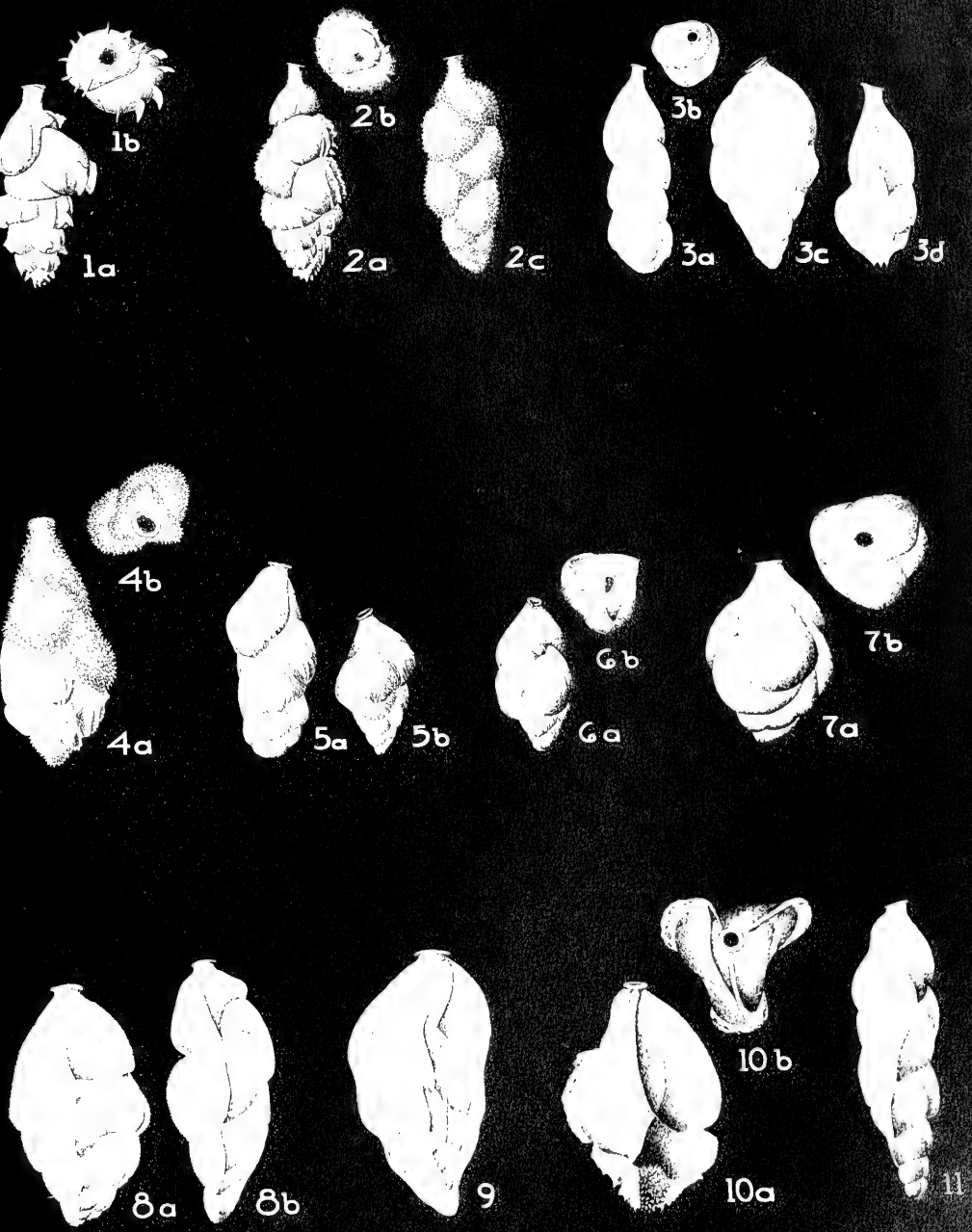
Plate 35, Figs. 8, 11

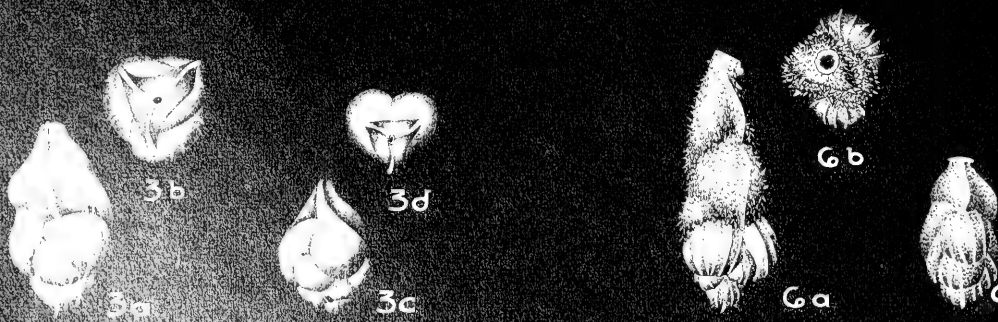
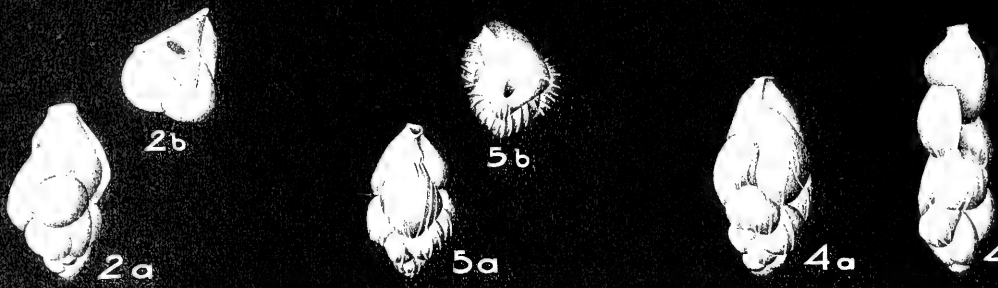
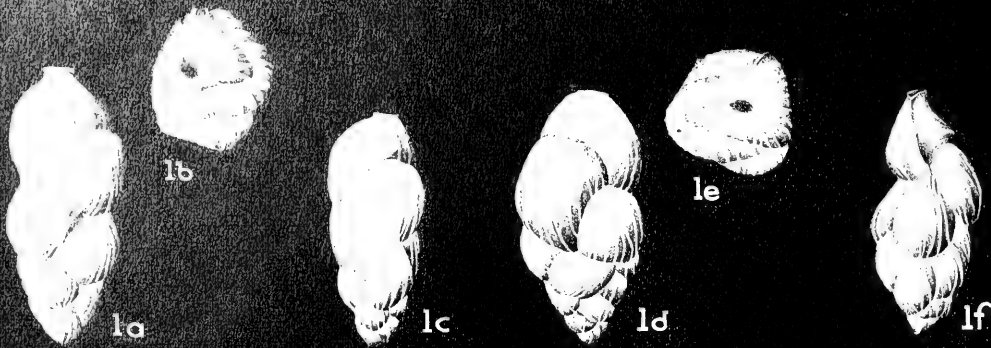
*Angulogerina carinata* Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 159, pl. 4, fig. 3; Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 44, pl. 6, figs. 7, 8.—Coryell and Mossman, Journ. Pal., vol. 16, 1942, p. 245, pl. 36, fig. 56.

## EXPLANATION OF PLATE 35

## FIGS.

1. *Hopkinsina hancocki* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view.
2. *Hopkinsina oceanica* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view; *c*, variant.
3. *Angulogerina albatrossi* Cushman, x30. *a*, megalospheric; *b*, apertural view of *a*; *c*, *d* microspheric forms.
4. *Angulogerina albatrossi* Cushman, var. *hirsuta* Todd, new variety, x30. *a*, holotype, side view; *b*, apertural view.
5. *Angulogerina albatrossi* Cushman, var. *ornata* Cushman, x30. *a*, megalospheric form; *b*, microspheric form.
6. *Angulogerina angulosa* (Williamson) x55. *a*, side view; *b*, apertural view.
7. *Angulogerina baggi* (Galloway and Wissler), x55, *a*, side view; *b*, apertural view.
8. *Angulogerina carinata* Cushman, x30. *a*, side view; *b*, apertural view.
9. *Angulogerina carinata* Cushman, var. *bradyana* Cushman, x30.
10. *Angulogerina carinata* Cushman, var. *vana* Todd, new variety, x30. *a*, holotype, side view; *b*, apertural view.
11. *Angulogerina carinata* Cushman, x30.





## EXPLANATION OF PLATE 36

## FIGS.

1. *Angulogerina fluens* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view; *c*, paratype, side view; *d-f*, variants, side and apertural views.
2. *Angulogerina hughesi* (Galloway and Wissler), x55. *a*, side view; *b*, apertural view.
3. *Angulogerina hughesi* (Galloway and Wissler), var. *picta* Todd, new variety, x55. *a*, holotype, side view; *b*, apertural view of holotype; *c, d*, paratype, side and apertural views.
4. *Angulogerina occidentalis* (Cushman), x55. *a, b*, lateral views.
5. *Angulogerina semitrigona* (Galloway and Wissler), x55. *a, b*, lateral and end views.
6. *Angulogerina agrestis* Todd, new species, x55. *a*, holotype, side view; *b*, apertural view; *c*, paratype, lateral view.

"Test generally triangular in section, initial end bluntly rounded, chambers few, distinct, the three sides flattened, the angles with sharp carinae often with fine radial tubules, sutures distinct, depressed; wall smooth, thick, opaque; aperture with a very short neck and distinct lip. Length up to 0.90 mm."

The original description of *A. carinata* Cushman, quoted above, accurately describes a large number of specimens from the following stations: 35, 55, 56, 57, 60, 64, 80, 82, 223, 230, 242, 250, 284, 299, 517, 1055, 1069, 1077, 1078, 1081, 1082, 1101, 1103, 1110, 1116, 1118, 1120, 1124, 1130, 1137, 1141, 1146, 1157, 1168, 1173, 1177, 1178, 1180, 1182, 1183, 1196, 1198, 1199, 1200, 1201, 1205, 1223, 1243, 1244, 2000, 2009, 2070, 2079, 2084, 2097, 2098, 2100, 2101, 2106, 2107, 2144, 2151, 2152, 2158, 2161, 2162, 2163. It occurs very abundantly at stations: 55, 56, 60, 64, 1147, 2101, 2158.

The species was described from *Guide* Station 12, Lat. 32° 28' N., Long. 118° 20' W., 429 fms, and has been recorded from other Pacific localities and from the Pliocene, Charco Azul formation, of Panama.

This species is very distinctive in the white, opaque shell well. The radial tubules in the carinae of the test are not always present. As noted in the original description, the species attains a large size. The largest observed in the present collection are 1.90 mm in length and 0.70 mm in breadth, from Station 2014.

In some specimens there is a tendency toward a few large, low costae on the early part of the test and sometimes the carinae are broken into projecting spines at the initial end of the test. In these characters the species approaches var. *vana*, n. var.

In the large collection available, another direction of variation has been noted: toward a more slender, somewhat twisted form with less prominent and blunt carinae. A specimen is figured but the available material is too meager to warrant description as a new variety, figure 11. Specimens occur at stations: 2000, 2009, 2014, 2100, 2101, 2151.

This species is easily distinguished from *A. albatrossi* Cushman, with which it occurs, by its carinae which are continuous from initial to apertural end, and by its much more regular form with nearly horizontal sutures.

*Distribution.*—These stations are off Catalina Island and southward to the coast of Colombia in 116 fms, including many localities in the Gulf of California. The depth range recorded here is 6 to 250 fms.

**Angulogerina carinata** Cushman, var. **bradyana** Cushman

Plate 35, Fig. 9

*Uvigerina angulosa* H. B. Brady (part) (not Williamson), Rep. Voy. Challenger, Zoology, vol. 9, 1884, pl. 74, figs. 17, 18 (not figs. 15, 16).

*Angulogerina carinata* Cushman and Wickenden (not Cushman), Proc. U. S. Nat. Mus., vol. 75, Art. 9, 1929, p. 11, pl. 4, fig. 7.

*Angulogerina carinata* Cushman, var. *bradyana* Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 45, pl. 6, figs. 9, 10.—Thalman, Eclogae geol. Helvetiae, vol. 25, 1932, p. 306.

Variety differing from the typical form in the ornamentation of the chambers consisting of numerous, low, longitudinal costae, not continuous across the sutures, and usually lacking on the last-formed chamber or two.

From the type specimens of this variety one would judge it to be a more slender, delicate, and thinner-walled form than the species. The present large collection available, however, shows it to be quite as robust and heavy as the unornamented species. But, like the species, it also exhibits considerable variation in size and shape of test as well as in degree of ornamentation.

This species was described from *Albatross* H 1805, off the west coast of Mexico, Lat. 18° 33' 30" N., Long. 114° 44' 00" W., 1732 fms. Typical specimens occur at the following stations: 242, 284, 299, 412, 517, 1078, 1110, 1112, 1147, 1186, 1190, 1194, 1198, 1207, 1221, 2005, 2009, 2010, 2063, 2064, 2065, 2097, 2100, 2102, 2140, 2145, 2149, 2158, 2163.

*Distribution*.—All of these stations are off the Channel Islands and in the Gulf of California in depths from 2 to 600 fms.

**Angulogerina carinata** Cushman, var. **vana** Todd, new variety

Plate 35, Fig. 10

Variety differing from the typical form in the ornamentation; the carinae being thin and broad, sharp, and undulating or spinose, and the walls of the early chambers covered by a few, heavy, short, irregular costae or more thickly covered by finer, higher costae, often with backwardly-projecting spines. In size and shape of test and opaque wall the variety closely resembles the typical form.

Holotype (AHF no. 63) from Station 1103. It also occurs at the following stations: 227, 230, 284, 1083, 1095, 1103, 1116, 1117, 1168, 1178, 1212, 1222, 1244, 2070, 2144, 2161.

*Distribution.*—The type locality is  $3\frac{1}{2}$  miles east of Long Point, Catalina Island, 285 fms. With the exception of one record in the Gulf of California, these localities are off Catalina, Guadalupe and San Benito Islands in depths ranging from 47 to 490 fms.

***Angulogerina agrestis* Todd, new species**

Plate 36, Fig. 16

Test very small for the genus, irregular, compactly coiled in the early part, becoming attenuated toward the apertural end, periphery indented, greatest width usually below the middle; chambers indistinct, overhanging, last chamber usually concave on its inner face; sutures deeply depressed; wall covered by numerous, high, serrated costae and spines giving a rugose appearance to the test; aperture large, at the end of a prominent neck, surrounded by a phialine lip.

Length 0.40-0.62 mm; breadth 0.20-0.25 mm.

This species differs from *A. albatrossi* Cushman, var. *hirsuta* n. var. in its much smaller size and slenderer and more attenuated shape. In type of ornamentation the two forms are quite similar.

Holotype (AHF no. 62) from Station 73, where it occurs abundantly. It occurs frequently to rarely at the following additional stations: 207, 223, 226, 628, 1062, 1064, 1072, 1113, 1120, 1138, 1140, 1151, 1183, 1184, 1186, 1188, 1189, 1192, 1193, 1194, 1195, 1225, 1228, 1242, 2070, 2081, 2084, 2098.

*Distribution.*—Type locality, Station 73, is off Guadalupe Island in 17 fms. Other localities are north of Santa Barbara Island in 40 fms; and southward to Socorro Island in 17 to 46 fms. There is also one record for Manila Harbor, Philippines.

***Angulogerina fluens* Todd, new species**

Plate 36, Fig. 1

*Angulogerina fluens* Todd, Ms, in Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 23, 1947, p. 67, pl. 16, figs. 6, 7.

Test elongate, slender, fusiform, triangular in section in the early part, later becoming irregularly inflated, and finally sometimes with flattened chamber walls and strongly indented periphery, greatest breadth about the middle of the test, periphery lobulated; chambers compact and indistinct in the early part, rapidly increasing in size, inflated in the later part, sometimes the last several chambers smaller and remotely placed, with flattened or concave walls; sutures distinct, depressed, strongly curved; wall ornamented by numerous, low costae, curving with the



curvature of the chambers, often confluent across the sutures; aperture terminal, elongate oval, without a neck or with only a short one, surrounded by a slightly thickened rim.

Length 0.45-0.65 mm; width 0.20-0.30 mm.

This species seems to be characterized by its curved costae, sometimes confluent across the sutures, and its compressed aperture. It may be distinguished from *A. angulosa* (Williamson) by its more heavily ornamented test and its later inflated and irregular chambers, whereas *A. angulosa* is triangular in section throughout. It may be mentioned, however, that rare specimens of *A. fluens* n. sp. are also triangular throughout, and these are believed to represent microspheric individuals. One of these is figured. The occasional development of the attenuated, flattened or concave, later chambers is believed to represent the gerontic stage of development of this species, and a specimen is figured illustrating this stage (See figs. 1*d*, *e* and *f*.)

Some of the specimens figured as "*Uvigerina angulosa* Williamson" by Heron-Allen and Earland (*Discovery Reports*, vol. 4, 1932, p. 397, pl. 12, figs. 33-36 [not 32, 37-39]) from off the Falkland Islands would appear to belong in this species. The species has been recorded from Pliocene? material from the Aleutian Islands.

Holotype (AHF no. 64) from Station A-2, at Wrangell, Alaska, where it occurs abundantly. It also occurs at the following stations: A-1, 67, 226, 228, 283, 285, 535, 1100, 1168, 1183, 1201, 1204, 2063, 2086, 2097, 2098, 2100, 2131, 2140, 2149, 2152, 2153, 2154, 2156, 2165, 2167. It is especially beautifully developed at Station 535, Lobos de Afuera Island, Peru, from which station a specimen is illustrated (figures 1*d*, *e*).

*Distribution*.—The type locality, Station A-2, is Wrangell, Alaska, in 2 fms. A further analysis of the localities places this species off Peru in 22 fms and in the Gulf of California in depths ranging from 8 to 160 fms.

### ***Angulogerina hughesi* (Galloway and Wissler)**

Plate 36, Fig. 2

*Uvigerina hughesi* Galloway and Wissler, *Journ. Pal.*, vol. 1, 1927, p. 76, pl. 12, fig. 5.

*Angulogerina hughesi* Cushman, Stewart and Stewart, *Trans. San Diego Soc. Nat. Hist.*, vol. 6, 1930, p. 70, pl. 5, fig. 16; Campbell, *Journ. Entom. and Zool.*, vol. 27, No. 3, 1935, p. 45, text fig. 7; Cushman and Todd, *Contr. Cushman Lab. Foram. Res.*, vol. 17, 1941, p. 76, pl. 18, fig. 4; pl. 19, fig. 17; *Special Publ. 21, Cushman Lab. Foram. Res.*, 1947, p. 19, pl. 3, fig. 8.

"Test fusiform, subtriangular in cross-section in the later portion, early portion conical; chambers numerous, early ones inflated, later ones flattened so as to produce a triangular outline; sutures distinct, depressed; wall smooth; the apical end in some specimens provided with a few obscure costae; aperture terminal, oval, with a thickened lip and very short neck.

"Length of the type specimen, 0.48 mm."

This species occurs usually with *A. baggi* and, as noted under that species, the two may be closely related. *A. hughesi* is distinguished by its deeply indented sutures and consequently lobulated periphery, and its generally longer test.

The original description of this species from the Pleistocene is quoted above. The species occurs commonly to rarely at numerous stations as follows: 227, 230, 284, 1083, 1095, 1113, 1116, 1117, 1168, 1178, 1212, 1222, 1244, 2070, 2144, 2161.

*Distribution*.—Two areas are represented in these station records, off San Pedro, San Benito, and Guadalupe Islands, and in the Gulf of California in depths of 17 to 490 fms.

### ***Angulogerina hughesi* (Galloway and Wissler), var. *picta***

Todd, new variety

Plate 36, Fig. 3

Variety differing from the typical form in the ornamentation consisting of costae and spines, the costae low, numerous, and faint, sometimes extending over nearly the entire test but more prominent toward the initial end, and the spines short and heavy and varying from covering the lower half of the test to almost none.

The ornamentation on this variety is a highly variable character but the spinosity is consistently toward the initial, not apertural, end. The sizes and shapes of the tests include forms that, lacking ornamentation, would be included in both *A. hughesi* and *A. baggi*, thus suggesting that these two species should be combined.

Holotype (AHF no. 65) from Station 1194. This variety is very widespread, more so than the typical form of the species. It is recorded from the following stations, often in considerable numbers: Or. 7, 73, 82, 126, 207, 232, 283, 542, 1018, 1050, 1061, 1062, 1063, 1064, 1066, 1077, 1082, 1086, 1100, 1101, 1112, 1113, 1114, 1133, 1138, 1151, 1152, 1153, 1155, 1156, 1158, 1160, 1161, 1163, 1165, 1168, 1170, 1172, 1175, 1177, 1183, 1186, 1187, 1188, 1189, 1190, 1191, 1192, 1193, 1194, 1195, 1196, 1198, 1201, 1228, 1229, 1230, 1238, 1241, 1242, 1246, 2057, 2063, 2097, 2098, 2100, 2130, 2133, 2157, 2165.

*Distribution.*—The type locality, Station 1194, is  $4\frac{1}{2}$  miles NNW buoy, Cortes Bank,  $32^{\circ} 30' 45''$  N.,  $119^{\circ} 09' 30''$  W. in 60 fms. Additional station records include one off Oregon in shallow waters, others off the Channel Islands, off Mexico, and in the Gulf of California with the depths ranging from 15 to 175 fms.

### ***Angulogerina occidentalis* (Cushman)**

Plate 36, Fig. 4

*Uvigerina angulosa* Cushman (not Williamson), Publ. 311, Carnegie Instit. Washington, 1922, p. 34, pl. 5, figs. 3, 4.

*Uvigerina occidentalis* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 169.

*Angulogerina occidentalis* Cushman, Bull. 4, Florida State Geol. Survey, 1930, p. 50, pl. 9, figs. 8, 9.—Cole, l. c., Bull. 6, 1931, p. 44, pl. 2, fig. 5.—Cushman and Laiming, Journ. Pal., vol. 5, 1931, p. 112, pl. 12, figs. 15, 16.—Cushman and Parker, Proc. U. S. Nat. Mus., vol. 80, Art. 3, 1931, p. 17.—Cushman and Ponton, Bull. 9, Florida State Geol. Survey, 1932, p. 86.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 46, pl. 6, figs. 15, 16.—Cushman and Cahill, U. S. Geol. Survey Prof. Paper 175-A, 1933, p. 28, pl. 9, fig. 8.—Palmer and Bermúdez, Mem. Soc. Cubana Hist. Nat., vol. 9, 1935, p. 249.—Campbell, Journ. Entom. and Zool., vol. 27, No. 3, 1935, p. 46, text fig. 10.—Hadley, Journ. Elisha Mitchell Sci. Soc., vol. 52, 1936, p. 35.—Kleinpell, Miocene Stratig. Calif., 1938, p. 306.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 3, 1942, p. 58, pl. 15, fig. 12; U. S. Geol. Survey Prof. Paper 210-A, 1946, p. 10.

Test elongate, slender, occurring in two forms: one compact, fusiform, and with the periphery nearly smooth, the other longer, attenuated, of about equal width throughout, and with greatly indented periphery; chambers compact and indistinct in the early part, slightly inflated, later becoming remote, with flat or concave faces, not increasing in size except the earliest ones; sutures distinct, strongly depressed; wall thin, ornamented with numerous, weak, low, longitudinal costae, usually absent over the later chambers, sometimes heavy and spinous at the initial end, not continuous across the sutures except over the earlier chambers; aperture relatively large, at the end of a very short neck, surrounded by a very narrow lip.

Length 0.40-0.75 mm; width 0.17-0.22 mm.

This species was described from the Dry Tortugas, off Florida, and has been very widely recorded, both Recent and fossil (Pliocene and Miocene). Our specimens have been compared with the types and some are considerably larger, but nevertheless would seem to belong here.

These specimens strongly resemble *A. byramensis* (Cushman) from the Oligocene of Mississippi, especially in showing the two forms, one smoothly fusiform and the other greatly indented. That species, however, is more heavily costate throughout.

They are from the following stations: Or. 7, Or. 10, 73, 76, 80, 82, 83, 101, 109, 113, 114, 133, 135, 144, 207, 222, 223, 225, 226, 227, 228, 241, 298, 313, 409, 410, 422, 423, 447, 458, 460, 465, 470, 472, 542, 653, 1017, 1063, 1066, 1068, 1073, 1083, 1086, 1095, 1096, 1097, 1099, 1101, 1102, 1105, 1106, 1110, 1112, 1114, 1116, 1118, 1119, 1121, 1126, 1127, 1132, 1135, 1136, 1137, 1138, 1143, 1150, 1157, 1158, 1159, 1160, 1167, 1168, 1173, 1175, 1182, 1186, 1190, 1192, 1195, 1196, 1199, 1201, 1203, 1205, 1206, 1218, 1219, 1220, 1221, 1223, 1224, 1225, 1226, 1228, 1229, 1230, 1232, 1234, 1236, 1245, 1246, 2066, 2070, 2081, 2082, 2084, 2086, 2087, 2098, 2130, 2139, 2141, 2142, 2145, 2153, 2154, 2155, 2156, 2157.

*Distribution.*—The localities are off Oregon, in the harbor of Kobe, Japan, numerous stations off California, in the Gulf of California, off the Galapagos Islands, and off Colombia in depths of 2 to 240 fms.

### ***Angulogerina semitrigona* (Galloway and Wissler)**

Plate 36, Fig. 5

*Uvigerina semitrigona* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 77, pl. 11, fig. 21.

*Angulogerina semitrigona* Campbell, Journ. Entom. and Zool., vol. 27, No. 3, 1935, p. 46, text fig. 9.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 17, 1941, p. 76, pl. 18, fig. 6; pl. 19, fig. 18.—Cushman and Gray, Special Publ. 19, Cushman Lab. Foram. Res., 1946, p. 37, pl. 6, fig. 16.—Cushman and Todd, Special Publ. 21, 1947, p. 19, pl. 3, fig. 7.

“Test short, thick, fusiform, lower half conical, tapering abruptly from the sharp initial point in the microspheric form, later half triangular; chambers few, the last three composing one-half of the test, very slightly inflated; sutures distinct, slightly depressed, of clear shell material; wall ornamented with about ten rows of low costae to a side, which are not continuous beyond the sutures, very finely perforate; aperture at the end of a very short neck with a phialine lip.

"Length of the type specimen, 0.43 mm; diameter, 0.25 mm."

The original description is quoted above. This species was described from the Pleistocene of California and has been recorded from the Pliocene and also from Recent material off California and Washington.

The specimens average a little smaller than the types and the strength of ornamentation varies considerably. Also, more elongate forms are included than the type figure would indicate, but this is known to be true from a study of typical specimens from the Pliocene of California.

This is one of the *baggi-hughesi-semitrigona* group and, again, the separation seems to be arbitrary; forms which are tricarinate toward the apertural end and more or less completely costate being placed here. The separation between *A. semitrigona* and *A. hughesi*, var. *picta*, n. var., is mainly on the basis of the ornamentation, that in var. *picta* being more strongly developed toward the initial end and including spines.

Numerous specimens from a large number of stations are referred to this species: Or. 8, 1, 60, 73, 76, 80, 82, 83, 106, 109, 111, 113, 114, 203, 222, 225, 232, 248, 249, 256, 271, 286, 299, 409, 412, 414, 417, 423, 466, 469, 471, 472, 652, 653, 666, 1017, 1062, 1063, 1068, 1070, 1072, 1073, 1075, 1096, 1097, 1098, 1102, 1104, 1111, 1112, 1114, 1116, 1118, 1119, 1120, 1127, 1132, 1136, 1138, 1139, 1140, 1143, 1144, 1145, 1146, 1147, 1151, 1153, 1157, 1158, 1159, 1160, 1161, 1163, 1165, 1166, 1167, 1168, 1170, 1171, 1172, 1175, 1177, 1179, 1182, 1183, 1184, 1186, 1187, 1190, 1193, 1196, 1198, 1201, 1203, 1205, 1216, 1218, 1219, 1220, 1221, 1222, 1223, 1229, 1230, 1231, 1232, 1238, 1241, 1242, 1245, 1246, 2063, 2065, 2087, 2097, 2130, 2131, 2152, 2157, 2164, 2165, 2168, 2169.

*Distribution.*—These records include Bombay, India; Kobe, Japan; off the Channel Islands; off Mexico; in the Gulf of California and off the Galapagos Islands with depths ranging from surface to 160 fms.

## Genus TRIFARINA Cushman, 1923

### *Trifarina bradyi* Cushman

Plate 34, Fig. 12

*Rhabdogonium tricarinatum* H. B. Brady (not *Vaginulina tricarinata* d'Orbigny), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 525, pl. 67, figs. 1-3.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc. London, vol. 12, 1888, p. 223, pl. 45, fig. 3.—Silvestri, Mem. Pont.

Accad. Nuovi Lincei, vol. 12, 1896, p. 194; l. c., vol. 15, 1899, pl. 6, fig. 8.—Jones, Foram. Crag, pt. 3, 1896, p. 232, pl. 7, fig. 16.—Bagg, Proc. U. S. Nat. Mus., vol. 34, 1908, p. 145.

*Triplasia tricarinata* Cushman (not *Vaginulina tricarinata* d'Orbigny), Bull. 1, U. S. Nat. Mus., pt. 3, 1913, p. 62, pl. 39, fig. 2; Bull. 100, vol. 4, 1921, p. 219.

*Trifarina bradyi* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 99, pl. 22, figs. 3-9; Publ. 342, Carnegie Instit. Washington, 1924, p. 27, pl. 7, fig. 5; Bull. 27, Bernice P. Bishop Mus., 1925 (1926), p. 127; Contr. Cushman Lab. Foram. Res., vol. 1, pt. 4, 1926, p. 86; l. c., vol. 5, 1929, p. 96, pl. 13, fig. 39.—Thalmann, Eclogae geol. Helvetiae, vol. 25, 1932, p. 305.—Cushman, Special Publ. 4, Cushman Lab. Foram. Res., 1933, pl. 22, fig. 15; Special Publ. 5, pl. 28, fig. 15; Bull. 119, Bernice P. Bishop Mus., 1934, p. 127, pl. 15, fig. 11; Foraminifera, 3rd Ed., 1940, pl. 22, fig. 15; Key, pl. 28, fig. 15.—LeRoy, Colorado School Mines Quart., vol. 36, No. 1, pt. 1, 1941, p. 38, pl. 2, figs. 114, 115; pt. 2, p. 82, pl. 2, fig. 24.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 3, 1942, p. 59, pl. 15, fig. 13.—Cushman and Stainforth, Special Publ. 14, Cushman Lab. Foram. Res., 1945, p. 50, pl. 8, fig. 4.—Cushman, U. S. Geol. Survey Prof. Paper 210-A, 1946, p. 10.

"Test elongate, slightly tapering toward either end, often somewhat twisted, triangular in transverse section, with carinae at three angles, thin and fairly high, running from the initial end to the aperture, even onto the neck itself; chambers distinct, those of the earlier portion at least irregularly spiral, later ones less distinctly so; sutures distinct but not depressed; wall thin, translucent, finely punctate, smooth; aperture terminal, central, at the end of a short tubular neck, usually with a phialine lip.

"Length up to 0.50 mm."

The original description is quoted above. This species was described from the Caribbean Sea and is very widely distributed in the Atlantic and Pacific as well as fossil. These specimens from stations 409, 410, 412, 461, 466, 468, 473, 648, 1023, have been compared with types and seem identical, although slightly smaller.

*Distribution.*—Most of these records are off the Galapagos Islands showing a depth range of 9 to 111 fms, with one record from Gibraltar in 90 fms and another off Santa Rosa Island in 16 fms.

508.3  
.L87

ALLAN HANCOCK PACIFIC EXPEDITIONS

VOLUME 6

NUMBER 6

SOME LAGENIDAE IN THE COLLECTIONS  
OF THE ALLAN HANCOCK FOUNDATION

(PLATES 37-48)

BY

JOSEPH A. CUSHMAN and IRENE McCULLOCH



THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
LOS ANGELES, CALIFORNIA

1950





Los Angeles. University of Southern  
California. Allan Hancock foundation for  
Scientific research.

REPORTS ON THE COLLECTIONS OBTAINED BY ALLAN HANCOCK PACIFIC EXPEDITIONS OF  
VELERO III OFF THE COAST OF MEXICO, CENTRAL AMERICA, SOUTH AMERICA AND  
GALAPAGOS ISLANDS IN 1932, IN 1933, IN 1934, IN 1935, IN 1936, IN 1937, IN 1938,  
IN 1939, IN 1940, IN 1941, AND VELERO IV IN 1949.

## SOME LAGENIDAE IN THE COLLECTIONS OF THE ALLAN HANCOCK FOUNDATION

(PLATES 37-48)

By JOSEPH A. CUSHMAN and IRENE McCULLOCH

**Joseph A. Cushman**  
1881 - 1949

The manuscript for this report was in press when word came of the death of Dr. Joseph A. Cushman, April 16, 1949, at Sharon, Massachusetts. Deep regret is expressed that his great and experienced ability was not available to aid in noting errors in the final stages of this work.

THE UNIVERSITY OF SOUTHERN CALIFORNIA PRESS  
ALLAN HANCOCK PACIFIC EXPEDITIONS  
VOLUME 6. NUMBER 6  
ISSUED FEBRUARY 23, 1950  
PRICE \$2.00

---

UNIVERSITY OF SOUTHERN CALIFORNIA PUBLICATIONS  
LOS ANGELES, CALIFORNIA



SOME LAGENIDAE IN THE COLLECTIONS OF THE  
ALLAN HANCOCK FOUNDATION

Joseph A. Cushman and Irene McCulloch

The foraminifera included in this paper belong in the family Lagenidae. This is one of the most difficult families in the foraminifera, in respect to applying specific names, as the amount of variation is very great. Also, it is difficult to try to give the synonymy for various species as so many authors have placed such a wide variety of forms under the same name and many of the records are without figures. We have tried to show some of the variations on our plates. Many of the forms previously referred to *Lagena* belong in the genus *Entosolenia* which will be taken up at a later time. For ease in finding the various species of *Lagena*, they have been arranged alphabetically.

Family **Lagenidae**

Subfamily **Nodosariinae**

Genus **ROBULUS** Montfort, 1808

**Robulus strongi** Church

Plate 37, Figs. 1, 2

*Robulus strongi* Church, Journ. Pal., vol. 3, 1929, p. 305, text fig. 3.  
—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 11, pl. 2, fig. 11.

This is a large species described from 30-40 fathoms, off White's Landing, Santa Catalina Island, California, and recorded from the Pleistocene of Timms Point, California. A few of the specimens have a tendency to a twisting of the axis as in *Darbyella*. The specimens very closely resemble *Robulus occidentalis* (Cushman), var. *novangliae* (Cushman) from the colder waters of the Atlantic Coast. Some of the Pacific Coast specimens are large, measuring up to 5 mm. in diameter.

Stations: 1042, 1070, 1078, 1082, 1096, 1101, 1103, 1104, 1116, 1120, 1130, 1135, 1136, 1138, 1139, 1144, 1158, 1159, 1161, 1165, 1167, 1168, 1178, 1181, 1182, 1184, 1190, 1195, 1219, 1224, 1229, 1230, 1238, 1242, 1244, 1246, 2157, 2161, 2163, 2164, 420, and 534.

*Distribution*.—Most of the records are off San Pedro and the Channel Islands in 46 to 285 fms. with an average depth range of only 72 fms. Station 420, Darwin Bay, Tower Island, in 100 fms. and Station 534 in 18 fms. extended the range to Peru. The greatest abundance of the species was recorded off San Diego in 75 fms.

**Robulus cf. cultratus** Montfort

Plate 37, Figs. 3, 4

Numerous specimens, two of which are drawn, seem to belong within the range of this very widely recorded species.

Stations: 56, 60, 67, 79, 80, 1006, 1009, 1077, 1078, 1082, 1083, 1100, 1101, 1110, 1112, 1116, 1117, 1120, 1128, 1135, 1139, 1170, 1171, 1178, 1180, 1182, 1183, 1184, 1186, 1187, 1190, 1194, 1195, 1198, 1200, 1201, 1218, 1219, 1244, 226, 227, 2016, 2023, 2070, 2140, 2144, 2156, 2158, 2161, 2163, 2165, 2166, 2169, 340, 406, 413, 415, 416, 417, 452, 461, and 467.

*Distribution.*—Stations 80 through 1244 off San Pedro and the Channel Islands place this species at a depth range of 26 to 230 fms. off Santa Rosa Island with an average of 68 fms. Stations off Mexico give a range of 7 to 250 fms. with an average of 90 fms. At Panama, the depth was 54 fms. In the Galapagos Islands, 28 to 68 fms. with an average of 64 fms. The hauls off Guadalupe and Duncan Islands showed the largest numbers.

**Robulus cf. cultratus** Montfort, var.

Plate 37, Figs. 5-8; Plate 38, Figs. 1-3

The figured specimens show a considerable amount of variation and would be placed under this species by numerous authors from a study of their figures. There are many intermediate forms which make this group a very confusing one.

Stations: 82, 1055, 1069, 1079, 1083, 1101, 1103, 1105, 1117, 1169, 1177, 1195, 1198, and 1212.

*Distribution.*—Off the Channel Islands with depth range of 45 to 285 fms. The average depth is 182 fms. Some of the best material was off Seal Beach in 225 fms.

**Robulus orbicularis** (d'Orbigny)

Plate 38, Figs. 4-7

Numerous forms have been referred to this species from widely separated areas. The series here figured seems to come within the range of variations of this species. As so many forms have been referred to this species, no attempt is made to give a synonymy here.

Stations: 1004, 1006, 1064, 1067, 1078, 1112, 1113, 1136, 1139, 1143, 1152, 1153, 1155, 1156, 1160, 1161, 1172, 1183, 1184, 1186, 1187, 1188, 1191, 1192, 1194, 1223, 1228, 1231, 1232, 1235, 1238, 1239, 1242, 207-2, 217, 223, 2023, 2029, 2033, 2063, 2064, 2065, 2098, 2100, 2131, 2137, 2142, 2156, 2157, 2160, 2162, 2164, 2166, 340, 406, 411, 413, 415, 416, 438, 450, 456, and 461.

*Distribution.*—Off the Channel Islands with a depth range of 25 to 107 fms., the average depth being 57 fms. Off Mexico and in the Gulf of California a range of 21 to 95 fms., the average being 50 fms. Off the Galapagos Islands, the range is 20 to 80 fms., the average is 44 fms. Numerous specimens were found at Clarion Island in 53 fms.

### ***Robulus limbosus* (Reuss)**

Plate 38, Fig. 8; Plate 39, Figs. 1-4

*Robulina limbosa* Reuss, Sitz. Akad. Wiss. Wien, vol. 48, pt. 1, 1863 (1864), p. 55, pl. 6, fig. 69.

*Robulus limbosus* Cushman, Bull. 161, U.S. Nat. Mus., pt. 2, 1933, p. 3, pl. 1, figs. 4-6; pl. 2, fig. 5.

Test close coiled or tending to be slightly uncoiled, slightly evolute, strongly biconvex in peripheral view, periphery strongly keeled; chambers usually 6 to 8 in the adult coil, those of the early portion often seen through the somewhat clear umbilical region, of rather uniform shape and increasing regularly in size as added, very slightly if at all inflated; sutures very distinctly limbate, slightly curved, and in general tangential in position in relation to the earlier central portion; wall smooth, finely perforate, translucent or in parts almost transparent; aperture radiate, at the peripheral angle, usually with the ventral slit characteristic of *Robulus* very distinctly developed. Diameter up to 2 mm.; thickness up to 0.60 mm.

From the records this species is variable as are most species of *Robulus*. Typical specimens are figured with others showing very considerable variation.

Stations: 225, 2016, 2144, 2164, 2169, 429, and 438.

*Distribution.*—Five of these stations are off Mexico and Cedros Island in 55 to 127 fms., the average being 100 fms. The two hauls off Wenman and Chatham Islands, Galapagos, were in 100 and 35 fms. respectively. The best record for numbers is off Cedros Island.

## EXPLANATION OF PLATE 37

Figs.

1, 2. *Robulus strongi* Church. X 14, p. 295.

3, 4. *Robulus* cf. *cultratus* Montfort. X 33, p. 296.

5-8. *Robulus* cf. *cultratus* Montfort, var. X 14, p. 296.

In all specimens, *a*, side view; *b*, apertural view.

All of the illustrations on Plates 37-48 were drawn by Russell D. Cangialosi and Alfred J. Van Auker.





1b



1a



2b



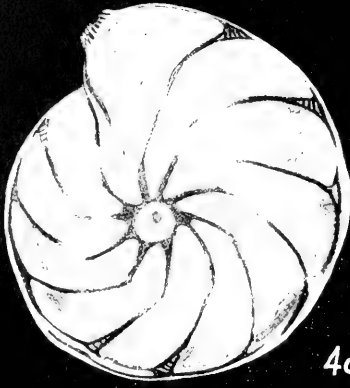
2a



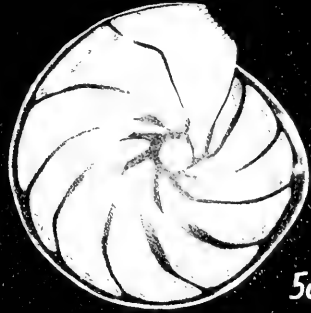
3b



4b



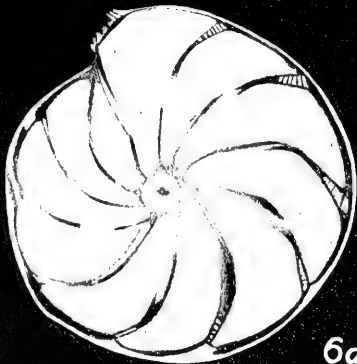
4a



5a



6b



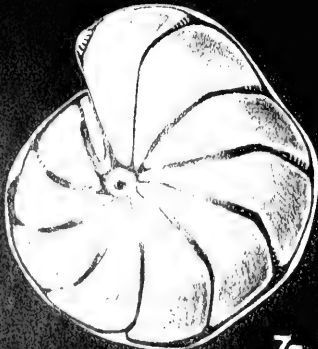
6a



5b



7b



7a



8a



## EXPLANATION OF PLATE 38

Figs.

- 1-3. *Robulus cf. cultratus* Montfort, var. X 14, p. 296.  
4-7. *Robulus orbicularis* (d'Orbigny). X 33, p. 296.  
8. *Robulus limbosus* (Reuss). X 33, p. 297.

In all specimens, *a*, side view; *b*, apertural view.

Genus **LENTICULINA** Lamarck, 1804  
**Lenticulina peregrina** (Schwager)

Plate 39, Fig. 5

*Cristellaria peregrina* Schwager, *Novara-Exped.*, Geol. Theil, vol. 2, 1866, p. 245, pl. 7, fig. 89.—Cushman, Bull. 104, U.S. Nat. Mus., pt. 4, 1923, p. 113, pl. 30, figs. 3, 4.—Asano, Sci. Rep't Tohoku Imp. Univ., ser. 2, Geol., vol. 19, 1938, p. 215 (37), pl. 29 (6), figs. 6, 7, 11.

*Lenticulina peregrina* Chapman and Parr, Australasian Antarctic Exped., ser. C, vol. 1, pt. 2, 1937, p. 58.—Coryell and Rivero, Journ. Pal., vol. 14, 1940, p. 328, pl. 43, figs. 13, 14.—Cushman and Todd, Special Publ. No. 15, Cushman Lab. Foram. Res., 1945, p. 17, pl. 2, fig. 18.

*Cristellaria variabilis* H. B. Brady (not Reuss), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 541, pl. 68, figs. 11-16.—H. B. Brady, Parker, and Jones, Trans. Zool. Soc. London, vol. 12, 1888, p. 224, pl. 44, fig. 12.—Egger, Abhandl. kön. bay. Akad. Wiss. München, Cl. II, vol. 18, 1893, p. 353, pl. 11, figs. 61, 62; pl. 12, figs. 16-18.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 62, pl. 10, figs. 593-595.—Flint, Ann. Rep. U. S. Nat. Mus. 1897 (1899), p. 316, pl. 63, fig. 1.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 70, pl. 36, figs. 1-3; Proc. U. S. Nat. Mus., vol. 56, 1919, p. 615; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 229.—Hofker (part), Publ. Sta. Zool. Napoli, vol. 12, pt. 1, 1932, p. 116, text figs. 30*c*, 30*d* (not 30*a*, 30*b*).

Test coiled, compressed, periphery slightly keeled; chambers few, 4 or 5 in the megalospheric form, increasing rather rapidly in size as added, last formed one in the adult becoming evolute, sutures distinct, slightly curved, little if at all depressed; wall smooth, thin and translucent; aperture in the adult terminal, radiate, slightly projecting. Length of figured specimen 0.80 mm., breadth 0.60 mm.

The only specimens in the Hancock collections are from 30 fms., off Monaco.

Station: 606.

*Distribution.*—As indicated above, this material came from Station 606, off Monaco. It was of interest to note that the material from this station was not abundant at a depth of 30 fms.

Genus **PLANULARIA** DeFrance, 1824  
**Planularia californica** (Galloway and Wissler)

Plate 39, Figs. 6-9

*Cristellaria reniformis* Bagg (not d'Orbigny), Bull. 513, U. S. Geol. Survey, 1912, p. 66, pl. 19, fig. 2.

*Astacolus californicus* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 46, pl. 8, fig. 4.

*Planularia californica* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 12, pl. 2, fig. 16.—Cushman and Todd, Contr. Cushman Lab. Foram. Res., vol. 23, 1947, p. 62, pl. 15, figs. 4-7.

Test somewhat longer than broad, much compressed, uncoiling in the adult portion, periphery rounded or flattened, with a raised costa on either side; chambers distinct, not inflated, increasing gradually in length but little if at all in height; sutures strongly curved, very distinct, tending to become transparent, not raised; wall usually smooth but occasionally with elongate costae generally parallel to the periphery; aperture terminal, radiate. Length up to 0.85 mm.; breadth up to 0.50 mm.

The types of this species are from the Pleistocene of Lomita Quarry, California, and it has been recorded from the Pleistocene of Timms Point, California, and of Alaska.

Stations: 1007, 1075, 1079, 1082, 1083, 1111, 1112, 1118, 1138, 1144, 1182, 1186, 1187, 1194, 1196, 1219, 1228, 1232, and 1238.

*Distribution*.—These stations are all off the Channel Islands and the depth range is 51 to 300 fms., with the average being 87 fms. Good material was found off San Pedro in 67 fms.

**Planularia planulata** (Galloway and Wissler)

Plate 40, Figs. 1-5

*Astacolus planulatus* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 46, pl. 8, fig. 5.

*Planularia planulata* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 12, pl. 2, fig. 18.

Test two or three times longer than broad, periphery broadly rounded, early portion close coiled, becoming somewhat uncoiled in the adult, initial end broadly rounded; chambers distinct, as many as 12 in the microspheric form, much less in the megalospheric form, increasing rather rapidly in size as added; sutures distinct, not depressed, curved, more strongly so toward the dorsal side; wall smooth, transparent, aperture terminal, radial. Length up to 0.70 mm.; breadth up to 0.30 mm.

## EXPLANATION OF PLATE 39

Figs.

- 1-4. *Robulus limbosus* (Reuss). X 33, p. 297.
5. *Lenticulina peregrina* (Schwager). X 37, p. 302.
- 6-9. *Planularia californica* (Galloway and Wissler). X 33, p. 303.

In all specimens, *a*, side view; *b*, apertural view.



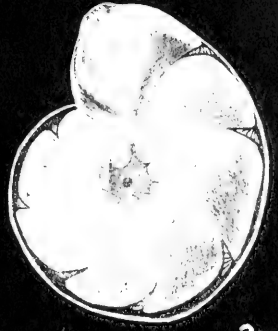
1b



1a



2b



2a



3a



3b



5



6



7



8



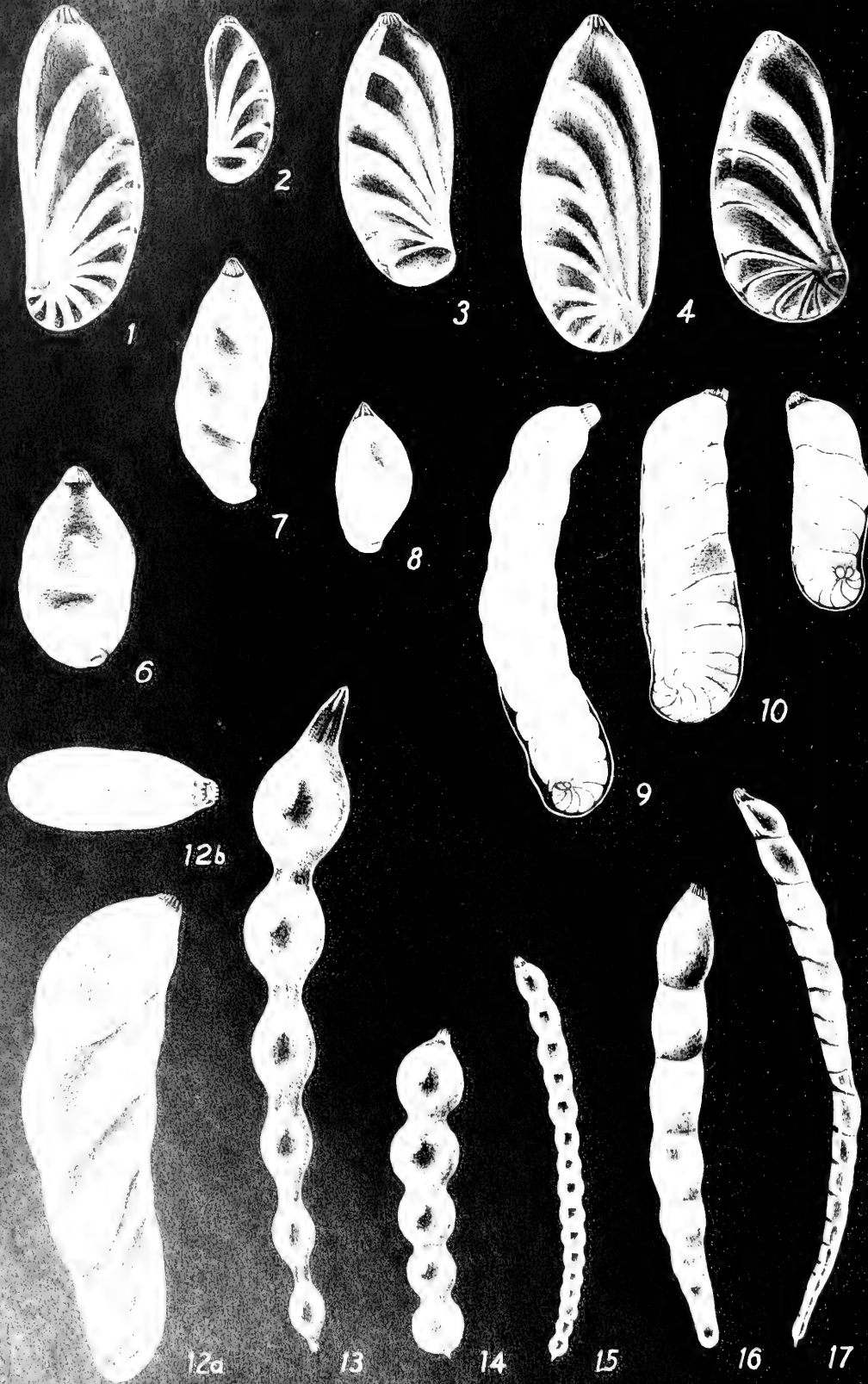
9



4a



4b



## EXPLANATION OF PLATE 40

Figs.

- 1-5. *Planularia planulata* (Galloway and Wissler). X 65, p. 303.
- 6-8. *Marginulina glabra* d'Orbigny. 6, X 37. 7, 8, X 33, p. 308.
- 9-11. *Marginulina hancocki* Cushman and McCulloch, n. sp. X 14. 9, Holotype. 10, 11, Paratypes, p. 309.
12. *Marginulina bacheii* Bailey. X 37. *a*, side view; *b*, apertural view, p. 309.
- 13-15. *Dentalina subsoluta* (Cushman). 13, 14, X 37. 15, X 9, p. 315.
16. *Dentalina consobrina* d'Orbigny, var. *emaciata* Reuss. X 14, p. 310.
17. *Dentalina filiformis* (d'Orbigny). X 14, p. 314.

The types are from the Pleistocene of Lomita Quarry, California, and it also occurs at Timms Point, California. The series of figures given shows the very considerable amount of variation in the microspheric and megalospheric forms.

Stations: 84, 1003, 1005, 1011, 1013, 1062, 1064, 1111, 1113, 1116, 1118, 1151, 1153, 1163, 1170, 1171, 1185, 1188, 1189, 1191, 1192, 1193, 1195, 1201, 1228, 1233, 1242, 1244, 223, 227, 2065, 2070, 2098, 2160, 573, and 607.

*Distribution.*—Stations 84 through 1244 are off the Channel Islands and give a depth range of 10 to 160 fms. The average depth is 51 fms. Stations 223 through 2160 are off Mexico in 53 to 250 fms. with an average of 115 fms. Station 573 is off Peru and Station 607 is at Leish in 15 and 10 fms. respectively. The most specimens of this species were found off San Clemente Island in 37 fms.

Genus **MARGINULINA** d'Orbigny, 1826

**Marginulina glabra** d'Orbigny

Plate 40, Figs. 6-8

Test longer than broad, variable in form, circular in transverse section, later chambers uniserial in varying degrees; chambers distinct, somewhat inflated, increasing rather rapidly in size as added; sutures distinct, slightly depressed, only slightly curved; wall smooth; aperture terminal, radiate.

So many forms have been referred to this species that it is impossible to give a definite synonymy. It shows a wide range of variation.

Stations: 1072, 1075, 1079, 1083, 1086, 1118, 1139, 1143, 1144, 1159, 1160, 1161, 1165, 1172, 1181, 1184, 1190, 1201, 1203, 1205, 1216, 1218, 1221, 1229, 1230, 1233, 1234, 1238, 1240, 1244, 1245, 257, 283, 2009, 2010, 2017, 2051, 2064, 2084, 2097, 2098, 2156, 2157, 2164, 460, 466, 467, 606, and 648.

*Distribution.*—Stations 1072 through 1245 are off the Channel Islands with a depth range of 30 to 160 fms., the average being 72 fms. Stations 257 through 2164 are off Mexico and in the Gulf of California. The depth range is 20 to 112 fms., the average is 76 fms. Stations 460 to 467 are in the waters of the Galapagos Islands in 16 to 28 fms. Stations 606 and 648 are in the Mediterranean waters in 30 to 90 fms. The best record for numbers of specimens thus far was at Outer Gorda Bank off Mexico in 59-95 fms.



**Marginulina hancocki** Cushman and McCulloch, new species

Plate 40, Figs. 9-11

Test elongate, several times as long as wide, somewhat compressed, especially in the early coiled portion, periphery with a distinct keel in the earlier portion, base broadly rounded; chambers distinct, numerous, those of the early portion close coiled and strongly compressed, later becoming uncoiled and inflated, increasing rather rapidly in height but of rather uniform width; sutures distinct, earlier ones strongly curved, later ones oblique and depressed; wall smooth; aperture radiate, on the dorsal angle of the last-formed chamber. Length up to 4.5 mm.; breadth up to nearly 1 mm.

Holotype (AHF no. 66) from Station 2005.

This species differs from *M. bacheii* Bailey in the more coiled early portion, nearly parallel sides, and the development of a distinct keel.

Stations: 1112, 1161, 1238, 278, 2005, 2010, 2029, 2033, 2057, 2097, 2098, 2131, 2156, 2160, 330, 406, 416, 432, 438, 441, and 452.

*Distribution.*—The type locality is San Jaime Bank, Lower California, Mexico in 75 fms. The first three stations listed are off the Channel Islands with a depth range of 38 to 150 fms., the average being 79 fms. Stations 278 through 2160 off Mexico and in the Gulf of California have a depth range of 44 to 95 fms., the average being 63 fms. Station 330, off Cocos Island, is 47 fms. and Stations 406 to 452, off Galapagos Islands, give a range of 24 to 100 fms., the average being 52 fms. The greatest number of specimens were found off Chatham Island, Galapagos.

**Marginulina bacheii** Bailey

Plate 40, Fig. 12

*Marginulina bacheii* Bailey, Smithsonian Contrib., vol. 2, Art. 3, 1851, p. 10, pl. ...., figs. 2-6.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 129, pl. 36, figs. 7-9; Bull. Geol. Soc. Amer., vol. 47, 1936, pp. 422, 428.—Parker, Bull. Mus. Comp. Zool., vol. 100, 1948, p. 239 (list), pl. 3, fig. 1.

*Marginulina ensis* Flint (not Reuss), Ann. Rep. U. S. Nat. Mus., 1897 (1899), p. 314, pl. 59, fig. 3.

Test much elongate, subcylindrical, only slightly tapering, often slightly curved, often somewhat compressed, especially in the early portion, ventral side usually somewhat lobulate; chambers distinct, becoming uncoiled very early, increasing rapidly in size as added; sutures distinct, depressed; wall smooth, aperture at the dorsal angle of the last-formed chamber, radiate. Length up to 4 mm.

The records for this species are all from the western Atlantic but the Pacific specimens are very similar and seem to be included in this species.

Stations: 1157, 1240, 223, 2024, 2065, 2067, 307, 411, 412, 459, 461, 468, 540, 611, and 615.

*Distribution.*—Two stations, off Santa Cruz and San Miguel Islands, have records of 74 and 35 fms. respectively. In the Gulf of California, Station 2024 shows a depth of 55 fms. At Secas Islands, Panama, the record is 40-80 fms. Off Galapagos Islands the depth range is 15 to 111 fms., the average being 54 fms. At Southampton, England, it was found in 8 fms. Specimens of this species were most numerous off Clarion Island in 53 fms.

### Genus **DENTALINA** d'Orbigny, 1826

#### **Dentalina consobrina** d'Orbigny, var. **emaciata** Reuss

Plate 40, Fig. 16

*Dentalina emaciata* Reuss, Zeitschr. deutsch. geol. Ges., vol. 3, 1851, p. 63, pl. 3, fig. 9.

*Nodosaria (Dentalina) consobrina* d'Orbigny, var. *emaciata* Reuss, Denkschr. Akad. Wiss. Wien, vol. 25, 1865, p. 132, pl. 2, figs. 12, 13.—H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 502, pl. 62, figs. 25, 26.—Flint, Ann. Rep. U. S. Nat. Mus. 1897 (1899), p. 310, pl. 56, fig. 1.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 56, pl. 27, fig. 9; Bull. 104, pt. 4, 1923, p. 78, pl. 13, figs. 3-5.

*Dentalina consobrina* d'Orbigny, var. *emaciata* Rzehak, Verh. Nat. Ver. Brünn, vol. 14, pt. 1, 1885, pp. 96, 105.—Liebus, Jahrb. Geol. Reichsanst., vol. 56, 1906, p. 353.—Cushman, Bull. 4, Florida State Geol. Survey, 1930, p. 28, pl. 5, fig. 2.—Cushman and Ponton, *idem*, Bull. 9, 1932, p. 61.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 25, pl. 7, fig. 7.—Wiesner, Deutsche Sud-Polar-Exped., vol. 20, Zool., 1931, p. 114.—Hada, Sci. Rep't Tohoku Imp. Univ., ser. 4, Biol., vol. 6, 1931, p. 96, text fig. 49.—Cushman and Cahill, U.S. Geol. Survey Prof. Paper 175-A, 1933, p. 14, pl. 5, fig. 3.—Coryell and Embich, Journ. Pal., vol. 11, 1937, p. 298, pl. 42, fig. 9.—di Napoli Alliata, Boll. Soc. Sci. Nat. Econ. Palermo, vol. 19, Anno 1936-7 (1937), p. 10; Boll. Soc. Geol. Ital., vol. 56, 1937, p. 412 (list).—LeRoy, Colorado School Mines Quart., vol. 36, No. 1, pt. 2, 1941, p. 74, pl. 1, fig. 18.—Bergquist, Bull. 49, Mississippi State Geol. Survey, 1942, p. 41.—Colom, Num. 3, Estudios Geologicos, Instit. Invest. Geol., 1946, p. 143, pl. 9, figs. 131, 132.—Cushman, U. S. Geol. Survey Prof. Paper 210-A, 1946, p. 4.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 13, pl. 2, figs. 23, 24.

There are numerous Recent and fossil records for this variety, many of which are without figures and others show considerable variation in the figures given.

Stations: 1003 and 1170.

*Distribution.*—This species has been recorded from Station 1003 and Station 1170 off San Clemente and Santa Catalina Islands in 13 and 88 fms., respectively.

### **Dentalina costai** (Schwager)

Plate 41, Figs. 15, 16

*Nodosaria costai* Schwager, *Novara-Exped.*, Geol. Theil, vol. 2, 1866, p. 229, pl. 6, fig. 62.

*Dentalina costai* Cushman, Bull. 161, U. S. Nat. Mus., pt. 2, 1933, p. 11, pl. 3, fig. 6.

*Dentalina* cf. *costai* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 14, pl. 3, fig. 4.

Test elongate, slender, tapering; last-formed chamber distinct, inflated; sutures distinct, slightly limbate, very slightly oblique; wall smooth; aperture radiate, terminal, at the peripheral angle. Length 1-1.8 mm.; diameter 0.15-0.20 mm.

The types of this species are from the Pliocene of Kar Nicobar in the Pacific and it has been recorded living from other Pacific stations and fossil in the Pleistocene of Timms Point, California.

Stations: 340, 343, 517, and 543.

*Distribution.*—Stations 340 and 343 are off Panama at Ladrões and at Medidor Islands in 54 and 32 fms., respectively. Stations 517 and 543 are off South America, Port Utria, Colombia, in 116 and 50 fms., respectively. The best material was found at Station 543 in 50 fms.

### **Dentalina decepta** (Bagg)

Plate 41, Figs. 11, 12

*Nodosaria decepta* Bagg, Bull. 513, U. S. Geol. Survey, 1912, p. 55, pl. 16, fig. 1.

*Dentalina decepta* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 49, pl. 8, figs. 12, 13.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 12, pl. 2, fig. 28.

*Marginulina costata* Bagg (not Batsch), Bull. 513, U. S. Geol. Survey, 1912, p. 62, pl. 18, fig. 4.

*Vaginulina linearis* Bagg (not Montagu), *idem*, p. 64, pl. 18, fig. 9.

*Vaginulina obliquistriata* Bagg (not Jones), *idem*, p. 65, pl. 18, figs. 10, 11.

*Nodosaria vertebralis* Bagg (not Batsch), *idem*, p. 60.

*Nodosaria obliqua* Bagg (not Linné), *idem*, p. 57.

*Nodosaria seminuda* Bagg (not Reuss), *idem*, p. 59, pl. 16, fig. 3.

Test fairly large for the genus, slightly curved, initial end with a single, stout spine, later part of test slightly lobulate; chambers distinct, inflated only in the later portion, increasing rather gradually and evenly in size as added; sutures distinct, only the later ones depressed; wall of the earlier portion with distinct longitudinal costae extending across the sutures, later portion smooth; aperture radiate, terminal, slightly projecting. Length up to 5 or 6 mm.; diameter up to 0.65 mm.

This somewhat variable form has been recorded from the Pleistocene of California and it is not surprising to find it living off the coast.

Stations: 1007, 1023, 1072, 1075, 1078, 1082, 1084, 1086, 1100, 1111, 1112, 1113, 1114, 1116, 1118, 1120, 1131, 1138, 1151, 1153, 1155, 1156, 1159, 1160, 1161, 1163, 1169, 1171, 1172, 1178, 1179, 1183, 1185, 1186, 1187, 1188, 1189, 1191, 1192, 1194, 1195, 1196, 1198, 1201, 1219, 1221, 1228, 1230, 1231, 1232, 1235, 1238, 1240, 1241, 1242, 1246, 207, 2024, 2033, 2097, 2098, 2151, 2156, 2157, 2158, 2159, 2160, 2168, 412, 414, 417, 461, 474, 475, and 608.

*Distribution*.—Stations 1007 through 1246 are off the Channel Islands and show a range in depth from 16 to 267 fms., the average being 60 fms. Stations 207 to 2168 give a range 23 to 95 fms. with 55 fms. being the average. The Galapagos Stations 412 to 475 show 45 to 195 fms., the average being 109 fms. Some of the best specimens were from San Miguel and Tower Islands.

### ***Dentalina californica* Cushman and Gray**

Plate 41, Figs. 8 -10

*Dentalina californica* Cushman and Gray, Contr. Cushman Lab. For. Res., vol. 22, 1946, p. 66, pl. 12, figs. 3-5; Special Publ. No. 19, 1946, p. 13, pl. 3, figs. 1-3.

Test elongate, slender, of nearly uniform diameter throughout, initial end terminating in a short spine; chambers few, of rather uniform size and shape, the proloculum longer than any of the succeeding chambers; sutures slightly depressed, strongly oblique; wall smooth; aperture terminal, radiate. Length 0.85-1.15 mm.; diameter 0.11-0.14 mm.

The types of this species are from the Pleistocene of Timms Point, California. Typical specimens occur at numerous stations off the coast, as follows:

Stations: 1068, 1095, 1102, 1168, 1215, 1238, 1243, 1245, 332, 409, 411, 540, 546, 601, 611, and 613.

*Distribution*.—Stations 1095 through 1245 are off the Channel Islands and show a depth range of 35 to 240 fms., the average being 71 fms. The Station 332 at Bahia Honda is 30-50 fms. The stations in the Galapagos, 409, 411 and 416 range from 15 to 111 fms. At Gorgona Island, Ecuador, Stations 540 and 546 show depths of 20 and 35 fms. Stations 601 to 613 indicate a depth average of 7 fms. for these European stations. Some of the best material came from Station 540 off Colombia in 25 fms.

### *Dentalina baggi* Galloway and Wissler

Plate 41, Figs. 13, 14

*Nodosaria pauperata* Bagg (not d'Orbigny), Bull. 513, U. S. Geol. Survey, 1912, p. 57, pl. 16, fig. 2.

*Nodosaria calomorpha* Bagg (not Reuss), *idem*, p. 53, pl. 15, fig. 3.

*Nodosaria farcimen* Bagg (not Soldani), *idem*, p. 56.

*Dentalina baggi* Galloway and Wissler, Journ. Pal., vol. 1, 1927, p. 49, pl. 8, figs. 14, 15.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 13, pl. 2, figs. 26, 27.

"Test elongate, slightly curved, circular in cross-section, the initial chamber round, somewhat larger than those immediately succeeding; chambers inflated, closely appressed, somewhat irregularly increasing in size; sutures depressed, limbate, slightly curved; wall smooth, very finely perforate; aperture terminal, produced, round, radiate, situated near the concave side of the test." Length up to 4 mm.; diameter up to 0.65 mm.

The types of this species are from the Pleistocene of Lomita Quarry, California, and it has been recorded from the Pleistocene of Timms Point, California.

Stations: 77, 1008, 1056, 1078, 1093, 1098, 1099, 1104, 1112, 1117, 1119, 1131, 1134, 1135, 1136, 1143, 1149, 1152, 1155, 1158, 1159, 1160, 1161, 1162, 1165, 1167, 1171, 1175, 1177, 1179, 1180, 1182, 1185, 1188, 1189, 1190, 1194, 1195, 1196, 1201, 1203, 1205, 1215, 1226, 1228, 1229, 1233, 1238, 1239, 1240, 1245, 1246, 225, 2069, 2158, 2168, and 2169.

*Distribution*.—Stations 1008 through 1246 are off the Channel Islands. The depth range is 19 to 212, the average being 54 fms. Stations 225 to 2169 off Cedros Island, show a range of 10 to 81, with 30 fms. being the average depth. Some of the best material came from Pt. Vicente.

**Dentalina cf. communis** d'Orbigny

Plate 41, Figs. 1-4

Very variable specimens similar to those figured occur at a number of stations. Some of these resemble d'Orbigny's species but others almost suggest *Vaginulina*.

Stations: 1000, 1063, 209, 222, 2005, 2029, 2062, 2098, 2155, 500, 535, 573, and 583.

*Distribution*.—Two stations off the Channel Islands show 38-41 fms. The stations off Mexico and in the Gulf of California show a depth range of 4 to 95 fms. with 40 fms. being the average depth. Off Ecuador and Peru the Stations 500-583 show a depth range of 10 to 22 fms. with 14 fms. being the average depth. Some of the best specimens came from Peru.

**Dentalina filiformis** (d'Orbigny)

Plate 40, Fig. 17

"*Orthoceratia filiformia aut capillaria*" Soldani, *Testaceographia*, vol. 2, 1798, p. 35, pl. 10, fig. *e*.

*Nodosaria filiformis* d'Orbigny, *Ann. Sci. Nat.*, vol. 7, 1826, p. 253.—Egger, *Abhandl. kön. bay. Akad. Wiss. München*, Cl. II, vol. 18, 1893, p. 340, pl. 11, fig. 4.—H. B. Brady, *Rep. Voy. Challenger, Zoology*, vol. 9, 1884, p. 500, pl. 63, figs. 3-5.—Chapman, *Proc. Zool. Soc. London*, 1895, p. 30.—Flint, *Ann. Rep. U. S. Nat. Mus.* 1897 (1899), p. 310, pl. 55, fig. 6.—Morton, *Proc. Portland Soc.*, vol. 2, 1897, p. 119.—Millett, *Journ. Roy. Micr. Soc.*, 1902, p. 523.—Chapman, *The Foraminifera*, 1902, p. 402; *Trans. New Zealand Inst.*, vol. 38, 1905, p. 93, pl. 3, fig. 6.—Goddard, *Records Australian Mus.*, vol. 6, 1907, p. 308.—Heron-Allen and Earland, *Journ. Roy. Micr. Soc.*, 1909, p. 427.—Chapman, *Journ. Linn. Soc., Zool.*, vol. 30, 1910, p. 412.—Cushman, *Bull.* 71, *U. S. Nat. Mus.*, pt. 3, 1913, p. 55, pl. 27, figs. 1-4.—Heron-Allen and Earland, *Proc. Roy. Irish Acad.*, vol. 31, pt. 64, 1913, p. 92.—Pearcey, *Trans. Roy. Soc. Edinburgh*, vol. 49, 1914, p. 1022.—Heron-Allen and Earland, *Trans. Linn. Soc. London*, ser. 2, vol. 11, 1916, p. 256.—Mestayer, *Trans. New Zealand Inst.*, vol. 48, 1916, p. 129.—Sidebottom, *Journ. Roy. Micr. Soc.*, 1918, p. 133.—Cushman, *Proc. U. S. Nat. Mus.*, vol. 56, 1919, p. 612; *Bull.* 100, *U. S. Nat. Mus.*, vol. 4, 1921, p. 194, pl. 34, fig. 9; *Bull.* 104, pt. 4, 1923, p. 76, pl. 12, figs. 1, 2.

*Dentalina filiformis* Schubert, Sitz. Deutsch. Nat. Med. Ver. Böhmen "Lotos", 1900, p. 49.—Howe and Wallace, Louisiana Geol. Bull. No. 2, 1932, p. 25, pl. 6, fig. 2.—Thalmann, Eclogae geol. Helvetiae, vol. 25, 1932, p. 304.—Cushman, Bull. Geol. Soc. Amer., vol. 47, 1936, p. 422.—Asano, Sci. Rep't Tohoku Imp. Univ., ser. 2 (Geol.), vol. 19, No. 2, 1938, p. 214 (26), pl. 27, (4), figs. 22, 47.—Kleinpell, Miocene Stratig. Calif., 1938, p. 210, pl. 22, fig. 1.—Bergquist, Bull. 49, Mississippi State Geol. Survey, 1942, p. 42, pl. 5, fig. 2.—Marchesini, Comm. Pont. Acad. Sci., vol. 6, No. 18, 1942, p. 752 (list).—Crespin, Bull. 9 (Pal. Ser. No. 4), Commonwealth of Australia, Min. Res. Survey, (mimeographed), 1943, p. 78 (list).—Valk, in Rutten and Hotz, Geol., Petrogr. and Paleont. Results Explor. Island of Ceram, 3rd ser., Geol., No. 1, 1945, p. 22.—Norvang, Zoology of Iceland, vol. 2, pt. 2, Foraminifera, 1945, p. 15.—Colom, Num. 3, Estudios Geologicos, Instit. Invest. Geol., 1946, p. 143, pl. 9, fig. 126.—Crespin, Trans. Roy. Soc. So. Australia, vol. 70, pt. 2, 1946, p. 297 (list).—Parker, Bull. Mus. Comp. Zoöl., vol. 100, 1948, p. 237 (list).

Test elongate, slender, arcuate, circular in transverse section, initial end with a slight spine; chambers numerous, increasing very gradually and rather uniformly in size as added; sutures oblique, slightly depressed in the later portion; wall smooth; aperture radiate, slightly projecting. Length up to 6 mm.; diameter up to 0.50 mm.

This is a very widely recorded species but some of the records seem somewhat doubtful.

Stations: 328, 412, 413, 438, 461, and 488.

*Distribution.*—Station 328 off Cocos Island shows a depth of 14 fms. Stations 412 to 488 are off the Galapagos Islands with a range of 14 to 160 fms. and an average of 67 fms.

### ***Dentalina subsoluta* (Cushman)**

Plate 40, Figs. 13-15

*Nodosaria soluta* H. B. Brady (not *Dentalina soluta* Reuss), Rep. Voy. Challenger, Zoology, vol. 9, 1884, p. 503, pl. 62, figs. 13-16; pl. 64, fig. 28.—Goës, Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 70, pl. 12, fig. 690; Bull. Mus. Comp. Zoöl., vol. 29, 1896, p. 62.—Flint, Ann. Rep. U. S. Nat. Mus. 1897 (1899), p. 310, pl. 56, fig. 3.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 53, pl. 26, figs. 9-11; Bull. 100, vol. 4, 1921, p. 192, pl. 34, figs. 5, 6.

*Nodosaria subsoluta* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 74, pl. 13, fig. 1.—Norvang, Zoology of Iceland, vol. 2, pt. 2, Foraminifera, 1945, p. 16.

Test large, elongate, more or less tapering, somewhat arcuate, initial end usually with a short but distinct spine; chambers few to many, very variable in their separation and increase in size, subglobular or slightly pyriform; sutures depressed in variable degree; wall smooth or occasionally very slightly costate; aperture terminal, radiate, slightly produced. Length up to 7 mm.

This species seems to belong really in *Dentalina*. Specimens show a wide variation as shown in our figures but there seem to be intermediate forms that unite them.

Stations: 1057, 1069, 1071, 1073, 1077, 1083, 1084, 1101, 1105, 1110, 1117, 1118, 1124, 1125, 1128, 1158, 1159, 1165, 1176, 1179, 1180, 1190, 1196, 1198, 1199, 1200, 1205, 1212, 1219, 1229, 1230, 1233, 1238, 1246, 2070, and 487.

*Distribution*.—Stations 1057 through 1246 are off the Channel Islands. They show a depth range of 35 to 490 fms. with the average being 111 fms. One record off Mexico, Station 2070, shows 250 fms. and one record, Station 487, off Chatham Island is for 400 fms. Specimens were most abundant off Santa Rosa Island in 56 fms.

### ***Dentalina hancocki*** Cushman and McCulloch, new species

Plate 41, Fig. 7

Test elongate, slightly curved, early portion irregularly quadrangular in section with raised angles, later with globular chambers, first with longitudinal costae ending in spinose projections above the basal suture, latest ones smooth; chambers of the early part increasing very slowly in size as added, quadrate, later globular; sutures distinct, earlier ones somewhat curved and not depressed, in the adult strongly depressed and nearly straight; wall with continuous longitudinal costae in the early part, then costae confined to a single chamber and finally smooth; aperture in the adult with an elongate, cylindrical neck with slightly radiate lip. Length of holotype 1.20 mm.; diameter 0.14 mm.

Holotype (AHF no. 67) from Station 1080.

This distinctive species is very rare, being represented by a single specimen in our material.

Station: 1080.

*Distribution*.—The type locality, Station 1080, is off San Clemente Island in 150 fms.



**Dentalina cf. mucronata** (Neugeboren)

Plate 41, Fig. 5

Variable specimens one of which is figured may be placed under this species with some question until a larger series is available.

Stations: 1129, 1207, 406, 412, 413, 414, 416, 432, 461, 488, 553, 555, 587, and 667.

*Distribution.*—Stations 1129 and 1207 are off the Channel Islands, off Pt. Fermin in 18 fms. and off Catalina in 600 fms. Stations 406 to 488 are located in the Galapagos Islands with a depth range of 35-111 fms. The average is 90 fms. Three stations off Colombia, South America, 553-587, have an average depth of 62 fms. One record at Port of Spain shows a depth of 45 fms. The best specimens came from off Colombia and the Galapagos Islands.

**Dentalina cf. calomorpha** (Reuss)

Plate 41, Fig. 6

Rare specimens similar to that figured may be referred to this species with some question.

Stations: A-2, 1006, 1068, 1231, 265, 2017, and 514.

*Distribution.*— Station A-2 is Wrangell, Alaska in 2 fms. Stations 1006, 1068, and 1231 are San Nicolas, San Miguel and Santa Rosa Islands in 63, 39, and 45 fms. respectively. Stations 265 and 2017 are in the Gulf of California with 16 and 20 fms. Station 514, off Colombia, South America, is 16 fms. The number was greater at Wrangell, Alaska, than elsewhere.

**Dentalina cf. jugosa** Williamson

Plate 41, Fig. 17

A few specimens in the Hancock collection are somewhat like forms which have been referred to Williamson's species.

Stations: 306, 412, 415, 461, 468, and 606.

*Distribution.*—Station 306 is at Cocos Island in 17 fms. Stations 412-468 are in the waters of Galapagos Islands with a depth range 17 to 111 fms., the average being 57 fms. Station 606 at Monaco is from 30 fms. The best material came from off Albemarle Island.

**Dentalina ? sp.**

Plate 41, Fig. 18

The figured specimen somewhat suggests a megalospheric form of a *Marginulina* but not enough specimens are available to warrant placing it definitely.

Station: 415.

*Distribution*.—Station 415 is off Duncan Island, Galapagos, at a depth of 55 fms.

Genus **NODOSARIA** Lamarck, 1812

**Nodosaria** cf. **intercellularis** H. B. Brady

Plate 41, Fig. 19

Very rare specimens in the Hancock collection have the peculiar ornamentation as in the specimen here figured. It somewhat suggests Brady's species although in our specimen the interrupted costae continue throughout the test instead of on the later chambers only.

Station: 634.

*Distribution*.—Station 634 consists of a bottom sample collected in the Harbor at Port Said, no depth given but it was presumably very shallow water, possibly from the anchor of "World Liner."

**Nodosaria** cf. **perversa** Schwager

Plate 41, Figs. 26-32

The series of figured specimens gives an idea of the variation in this form which is referred with some question to Schwager's species. More than one species may be represented but there are intermediate forms which seem to interrelate the whole series.

Stations: 4, 57, 60, 73, 80, 83, 109, 113, 118, 1000, 1005, 1007, 1008, 1009, 1010, 1011, 1016, 1017, 1063, 1068, 1090, 1097, 1099, 1100, 1108, 1119, 1125, 1137, 1140, 1143, 1151, 1157, 1158, 1159, 1160, 1165, 1166, 1167, 1172, 1173, 1177, 1184, 1185, 1188, 1190, 1194, 1195, 1200, 1201, 1203, 1216, 1218, 1224, 1229, 1231, 1232, 1234, 1238, 1239, 1240, 1242, 1245, 1246, 207, 210, 213, 219, 220, 223, 225, 226, 227, 256, 264, 284, 286, 2036, 2069, 2070, 2097, 2113, 2114, 2131, 2164, 2166, 409, 412, 414, 417, 460, 466, 468, 472, 473, 474, 519, 542, 543, 558, 606, and 611.

*Distribution*.—Stations 109-1246 are off the Channel Islands with a depth range of 16 to 180 fms., the average being 60 fms. Stations 207-2166 are off Mexico and in the Gulf of California with a depth range of 15 to 280 fms., the average being 84 fms. In the Galapagos Islands, Stations 409-474, the range in depth was 9 to 175 fms., with an average of 54 fms. Off South America the depth range was 7 to 80 fms., the average being 38 fms. The records for the collections in European waters are for shallow waters. Some of the best material came from Guadalupe Island waters in 200 fms.

**Nodosaria flintii** Cushman

Plate 41, Fig. 20

*Nodosaria obliqua* H. B. Brady (part) (not Linné), Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 513, pl. 64, figs. 20-22.—Goës (part), Kongl. Svensk. Vet. Akad. Handl., vol. 25, No. 9, 1894, p. 70, pl. 12, figs. 691, 692.—Flint, Ann. Rep. U. S. Nat. Mus. 1897 (1899), p. 311, pl. 57, fig. 4.—Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 59, pl. 25, fig. 5.

*Nodosaria flintii* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 85, pl. 14, fig. 1.—Thalman, Eclogae geol. Helvetiae, vol. 25, 1932, p. 304.

Test elongate, very slightly tapering, initial end with a distinct spine; chambers increasing very slightly in size as added in the megalospheric form, somewhat inflated; sutures distinct, slightly depressed, nearly straight; wall with numerous fine longitudinal costae independent of the sutures; aperture terminal, radiate.

This is a variable species but the specimen figured seems to come within the limits of the species.

Station: 1107.

*Distribution.*—The single station record in relatively shallow waters off Long Point, Catalina Island, suggests the need to seek much additional material for further study for its occurrence in Eastern Pacific waters.

**Nodosaria subscalaris** Cushman

Plate 41, Figs. 21-24

*Nodosaria subscalaris* Cushman, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 654; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 201, pl. 36, fig. 2.

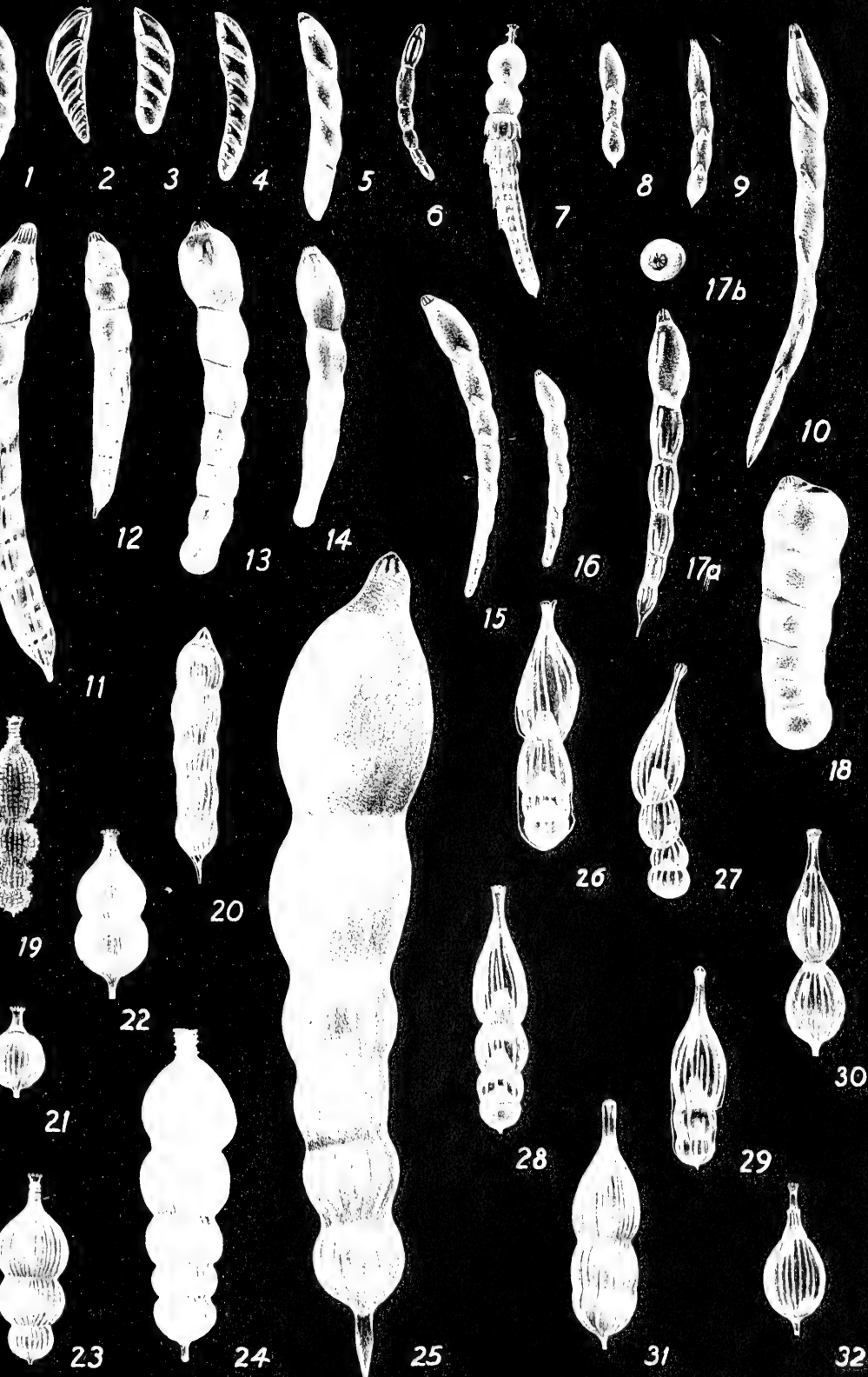
The series of specimens here figured shows the considerable variation in this species which is referred to *N. subscalaris* described from the western Pacific. While most of the characters are similar, the aperture in our specimens has a distinct neck and lip with transverse costae instead of longitudinal ones. The species is very common in the Hancock material.

Stations: A-2, 3, 83, 113, 114, 1006, 1008, 1015, 1016, 1017, 1082, 1090, 1097, 1098, 1099, 1100, 1109, 1110, 1114, 1116, 1131, 1134, 1136, 1138, 1143, 1144, 1145, 1150, 1153, 1154, 1158, 1160, 1161, 1163, 1165, 1166, 1167, 1173, 1174, 1177, 1194, 1195, 1201, 1203, 1215, 1219, 1220, 1221, 1229, 1231, 1232, 1239, 203, 213, 225, 226, 286, 2157, 509, 603, 606, 644, 648, and 653.

## EXPLANATION OF PLATE 41

Figs.

- 1-4. *Dentalina* cf. *communis* d'Orbigny. X 33, p. 314.
5. *Dentalina* cf. *mucronata* (Neugeboren). X 14, p. 317.
6. *Dentalina* cf. *calomorpha* (Reuss). X 33, p. 317.
7. *Dentalina hancocki* Cushman and McCulloch, n. sp. X 33. Holotype, p. 316.
- 8-10. *Dentalina californica* Cushman and Gray. X 33, p. 312.
- 11, 12. *Dentalina decepta* (Bagg). X 14, p. 311.
- 13, 14. *Dentalina baggi* Galloway and Wissler. X 14, p. 313.
- 15, 16. *Dentalina costai* (Schwager). X 33, p. 311.
17. *Dentalina* cf. *jugosa* Williamson. X 37. *a*, front view; *b*, apertural view, p. 317.
18. *Dentalina* ? sp. X 37, p. 317.
19. *Nodosaria* cf. *intercellularis* H. B. Brady. X 33, p. 318.
20. *Nodosaria flintii* Cushman. X 14, p. 319.
- 21-24. *Nodosaria subscalaris* Cushman. X 33. 21, Proloculum. 22-24, Later stages, p. 319.
25. *Nodosaria* sp. X 33, p. 324.
- 26-32. *Nodosaria* cf. *perversa* Schwager. X 65. 32, Proloculum. 26-30, Various stages and variations, p. 318.





## EXPLANATION OF PLATE 42

Figs.

- 1-3. *Nodosaria pauciloculata* Cushman. X 65. Showing variations, p. 324.
4. *Pseudoglandulina laevigata* (d'Orbigny). X 65, p. 325.
- 5-7. *Pseudoglandulina comatula* (Cushman). X 33. 7, Proloculum. 5, 6, Later stages, p. 325.
- 8-12. *Saracenaria angularis* Natland. X 33, p. 326.
13. *Saracenaria* sp. X 37, p. 327.
- 14-21. *Vaginulina exilis* Cushman and McCulloch, n. sp. 14-16, X 14. 17-21, X 37. 17, Holotype. 14, 15, 19, Megalospheric forms. 16-18, 20, 21, Microspheric forms, p. 327.

*Distribution.*—Beginning with the Station A-2, Wrangell, Alaska, and including the stations through 1239 off the Channel Islands, the depth range of this species is from 2 to 117 fms. off Catalina Island. The average depth is 37 fms. The stations 207-2157, off Mexico and in the Gulf of California, have a range from 15 to 96 fms. with 44 being the average, additional records off Colombia, Monaco, Penang, Suez, Gibraltar, and Kobe, Japan are from shallow waters also. Specimens were quite numerous off Anacapa Island in 51 fms.

### **Nodosaria pauciloculata** Cushman

Plate 42, Figs. 1-3

*Nodosaria pauciloculata* Cushman, Proc. U. S. Nat. Mus., vol. 51, 1917, p. 655; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 205, pl. 36, figs. 10-12.—Makiyama, Mem. College Sci., Kyoto Imp. Univ., ser. B, vol. 7, 1931, p. 41 (list).

Test with the earliest chambers close set, later ones becoming separated, initial end rounded with a very small, short spine; chambers few, gradually becoming separated; sutures depressed, more so in the later chambers; wall ornamented with a few longitudinal costae usually not reaching the base of the chamber; aperture with an elongate, tapering neck, usually with a slight lip.

The species has been recorded from the western Pacific.

Stations: 411, 412, 413, 416, 417, 432, 450, 461, 467, and 473.

*Distribution.*—The Stations 411 through 473 are all in waters of the Galapagos Islands. The depths range from 9 to 100 fms. with the average being 53 fms. Specimens were more numerous off Hood Island in 75 fms.

### **Nodosaria** sp.

Plate 41, Fig. 25

Very rare specimens of the form figured occur in the Hancock collection but more specimens are needed to give a specific name definitely.

Station: 2070.

*Distribution.*—Station 2070, off Guadalupe Island in 250 fms., has been one of the most interesting of all the bottom samples studied thus far.



Genus **PSEUDOGLANDULINA** Cushman, 1929**Pseudoglandulina laevigata** (d'Orbigny)

Plate 42, Fig. 4

Specimens from several stations are of the form here figured and may be referred to d'Orbigny's species. So many forms have been referred to this species, especially without figures, that it is impossible to give a complete synonymy.

Stations: 1130, 1150, 212, 603, 604, 606, 622, 640, 644, 654, and 658.

*Distribution.*—Stations 1130 and 1150 are off San Pedro and Point Dume, where specimens were most numerous in 81 and 47 fms. respectively, with the exception of Station 212 off Mexico. The other records are off Algeria, Genoa, Monaco, Suez, Singapore, Shanghai and Bombay, with a depth range of 5 to 75 fms., the average being 24 fms.

**Pseudoglandulina comatula** (Cushman)

Plate 42, Figs. 5-7

*Nodosaria comatula* Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 83, pl. 14, fig. 5.—Nuttall, Quart. Journ. Geol. Soc., vol. 84, 1928, p. 84, pl. 5, fig. 3.

*Pseudoglandulina comatula* Nuttall, Journ. Pal., vol. 6, 1932, p. 16.—Palmer and Bermudez, Mem. Soc. Cubana Hist. Nat., vol. 10, 1936, p. 274.—Hedberg, Journ. Pal., vol. 11, 1937, p. 673, pl. 91, figs. 9, 10.—Ellisor, Bull. Amer. Assoc. Petr. Geol., vol. 24, No. 3, 1940, pl. 4, fig. 1.—Palmer, Mem. Soc. Cubana Hist. Nat., vol. 14, 1940, p. 284.—Renz, Proc. 8th Amer. Sci. Congress, 1942, pp. 545, 546 (lists).—Thalmann, Amer. Midland Nat., vol 28, 1942, p. 464.—Cushman and Todd, Special Publ. No. 15, Cushman Lab. Foram. Res., 1945, p. 29, pl. 4, fig. 25.—Colom, Num. 3, Estudios Geologicos, Instit. Invest. Geol., 1946, p. 72, pl. 9, figs. 212-214.—Cushman and Renz, Special Publ. No. 22, Cushman Lab. Foram. Res., 1947, p. 17.—Stainforth, Journ. Pal., vol. 22, 1948, p. 131, pl. 24, figs. 2, 3.

Test usually short and stout, initial end broadly rounded, usually with a small central spine, circular in transverse section; chambers inflated; giving a somewhat lobulate appearance to the periphery; sutures fairly distinct, slightly depressed; wall ornamented by numerous, fine longitudinal costae; aperture central, terminal, radiate, slightly projecting. Length up to 1.10 mm.; diameter 0.40 mm.

From the records this species has a wide distribution, both fossil and Recent. Our figures show various stages of development.

Station: 52.

*Distribution.*—The single station record for this species in the Hancock collections was a sample collected at Conway Bay, Indefatigable Island in 1932, at low tide.

Genus **SARACENARIA** DeFrance, 1824

**Saracenaria angularis** Natland

Plate 42, Figs. 8-12

*Saracenaria angularis* Natland, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 3, No. 10, 1933, table; vol. 4, No. 5, 1938, p. 143, pl. 5, figs. 1, 2.

“Test elongate, chambers rapidly increasing in size, triangular in cross section, margins carinate, with a wide keel of clear shell material; sutures distinct, depressed slightly, obliquely set; walls smooth, thin, almost translucent; aperture radiate, at the apex of the chamber. Length 0.77 mm.; breadth 0.55 mm.; thickness 0.55 mm.”

The types of this species are from off the southern coast of California. It has probably been referred to as “*S. italica* DeFrance” in records from the upper Pliocene and Pleistocene of the Los Angeles Basin. It is very common and typical in our present material.

Stations: 1005, 1007, 1060, 1068, 1072, 1075, 1076, 1078, 1081, 1082, 1106, 1112, 1118, 1131, 1139, 1152, 1156, 1158, 1160, 1161, 1165, 1168, 1171, 1175, 1177, 1179, 1180, 1184, 1186, 1201, 1203, 1204, 1205, 1218, 1221, 1222, 1231, 1238, 1240, 1246, 207, 226, 249, 283, 2008, 2010, 2012, 2016, 2017, 2023, 2024, 2037, 2051, 2063, 2064, 2065, 2067, 2093, 2096, 2097, 2098, 2136, 2137, 2144, 2145, 2149, 2156, 2157, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2168, 2169, 340, 412, 416, 473, 506, 517, 540, 543, 547, 553, 558, 653, and 655.

*Distribution.*—Stations 1005 through 1246 are off the Channel Islands. The depth range for these records is 26 to 160 fms. with an average of 50 fms. Stations 207 through 2169 are off Mexico and in the Gulf of California with a depth range of 10 to 138 fms., the average being 30 fms. Stations 340 through 558 place this species at Panama, off South America, and in the Galapagos Islands in 20 to 116 fms., with the average being 67 fms. Stations 653 and 655 are off Kobe and Shanghai in 45 and 90 fms. respectively. The largest number of specimens was found in the bottom samples at the Outer Gorda Bank, Mexico.

**Saracenaria** sp.

Plate 42, Fig. 13

Very rare specimens from Station 222, 4-10 fms., in small bay west of Braithwaite Bay, Socorro Island, Mexico, and Station 223, 53 fms., Sulphur Bay, Clarion Island, Mexico, show a more elongate form than the preceding but not enough specimens are available to place it specifically.

Stations: 222 and 223.

Genus **VAGINULINA** d'Orbigny, 1826**Vaginulina exilis** Cushman and McCulloch, new species

Plate 42, Figs. 14-21

Test elongate, slender, early portion strongly compressed and somewhat coiled, later in a rectilinear series and nearly circular in section, initial end rounded; chamber distinct, earlier ones very low and increasing gradually in height and becoming inflated; sutures distinct, somewhat thickened, later ones depressed and more oblique; wall finely costate; aperture terminal, radiate, with a distinct neck. Length up to 3 mm.; diameter up to 0.40 mm.

Holotype (AHF no. 68) from Station 411, 45 fms., north of Duncan Island, Galapagos Islands.

The microspheric forms of this species are like *Vaginulina* but the megalospheric forms might be placed in *Dentalina* if the others were not present.

Stations: 328, 329, 330, 406, 411, 412, 429, 438, 450, 461, 474, 481, and 488.

*Distribution*.—These records place this species off Cocos Island and in the waters of the Galapagos Islands. The depth range is 12 to 175 fms. with an average of 80 fms. The largest number of specimens were found in the sample off Albemarle Island in 80 fms.

Genus **FRONDICULARIA** DeFrance, 1824**Frondicularia gigas** Church

Plate 43, Figs. 1-4

*Frondicularia gigas* Church, Journ. Pal., vol. 3, 1929, p. 303, text figs. 1, 2.

Test very large, strongly compressed, about twice as long as broad, periphery rounded, initial end with two or three short but coarse spines; chambers distinct, the earlier ones spiral, later taking on the typical inverted V-shape, increasing but slightly in height as added, slightly if

at all inflated; sutures distinct, often slightly depressed in the later portion; wall smooth. Length up to 8 mm.; breadth up to 3.5 mm.

This large and distinct species was described from 30-40 fathoms, off Whites' Landing, Santa Catalina Island, California, and has apparently not been recorded since. There are numerous typical specimens in the collections from off the California coast.

Stations: 1056, 1057, 1117, 1128, 1130, 1135, 1136, 1143, 1144, 1158, 1159, 1165, 1168, 1177, 1180, 1221, 1224, 1230, 1246, and 2169.

*Distribution.*—Stations 1056 to 1246 are off the Channel Islands. Beginning with Santa Cruz and Santa Rosa Islands on the north the depth range is 47 to 160 fms. off Catalina Island, the average depth being 61 fms. The additional record, Station 2169, is off Cedros Island in 55 fms. Station 1130 off San Pedro in 81 fms. yielded the largest number of specimens.

### ***Frondicularia californica*** Cushman and McCulloch, new species

Plate 43, Figs. 5-8

Test of medium size for the genus, strongly compressed, periphery rounded, initial end with a single, short spine, early portion rapidly increasing in width, in the adult with the sides nearly parallel in the middle then tapering rapidly toward the apertural end, in rare specimens with a third series of chambers developed in the last-formed portion at right angles to the main body of the test; chambers numerous, distinct, not inflated, rapidly increasing in length but only slightly increasing in height as added; sutures distinct, slightly thickened but not raised; wall smooth; aperture radiate, terminal. Length of adult specimens up to 2.30 mm.; breadth 0.85 mm.

Holotype (AHF no. 69) from Station 2009.

This species differs from *F. sagittula* Van den Broeck in the more elongate form, initial end with a single spine, and nearly parallel sides in the adult.

Stations: 1113, 1118, 1185, 1188, 1189, 1195, 1198, 1238, 2005, 2009, 2065, 2072, 2158, and 2160.

*Distribution.*—The type locality is Inner Gorda Bank, Lower California, Mexico, 23° 00' 50" N, 109° 31' 05" W in 112 fms. Stations 1113 through 1238 are in the waters of the Channel Islands. The range beginning with 48 fms. off San Miguel Island, 40 fms. off Santa Barbara Island, 37 fms. off San Clemente to 160 fms. off Catalina Island, gives an average depth of 71 fms. Stations 2005-2160 off Mexico show

a range of depth from 44 to 163 fms. with the average being 88 fms. The largest number of specimens in one collection was off Santa Barbara Island in 40 fms.

Subfamily **Lageninae**

Genus **LAGENA** Walker and Jacob, 1798

**Lagena acuticosta** Reuss, var.

Plate 43, Figs. 9, 10

A great many forms have been assigned to this species which like many species of *Lagena* is very variable. A group of these forms is figured here and other intermediate forms might have been included to show the close relationships of the different ornamentations.

Stations: A-1, A-2, A-15, C-12, Or. 7, Or. 8, Or. 9, 1, 3, 4, 39, 80, 82, 123, 127, 144, 1005, 1008, 1009, 1010, 1011, 1013, 1014, 1017, 1019, 1024, 1062, 1063, 1093, 1096, 1097, 1099, 1100, 1103, 1107, 1108, 1110, 1111, 1112, 1114, 1119, 1121, 1123, 1125, 1130, 1133, 1136, 1137, 1139, 1141, 1142, 1143, 1148, 1150, 1151, 1153, 1157, 1158, 1161, 1162, 1163, 1165, 1167, 1168, 1170, 1172, 1177, 1179, 1182, 1190, 1193, 1194, 1195, 1196, 1200, 1205, 1210, 1219, 1220, 1221, 1223, 1228, 1229, 1230, 1232, 1233, 1234, 1242, 1245, 1246, 207, 208, 209, 224, 227, 232, 291, 2000, 2002, 2008, 2070, 2157, 2159, 2164, 473, 616, and 648.

*Distribution.*—Stations A-1 through 1246 show a continuous range from Alaska to numerous stations in the waters off the Channel Islands. The depth range established by these records is 2 to 340 fms. with the average being 56 fms. Stations 218 through 2167 are records with the exception of Station 291 in Concepcion Bay, Gulf of California, off the West Coast of Mexico showing a range of 10 to 250 fms., the average being 70 fms. Additional records from Hood Island, Gibraltar and Australia give an average depth of 40 fms. The numbers of specimens found in the several collections showed little variation as to abundance.

**Lagena amphora** Reuss

Plate 43, Figs. 11-14

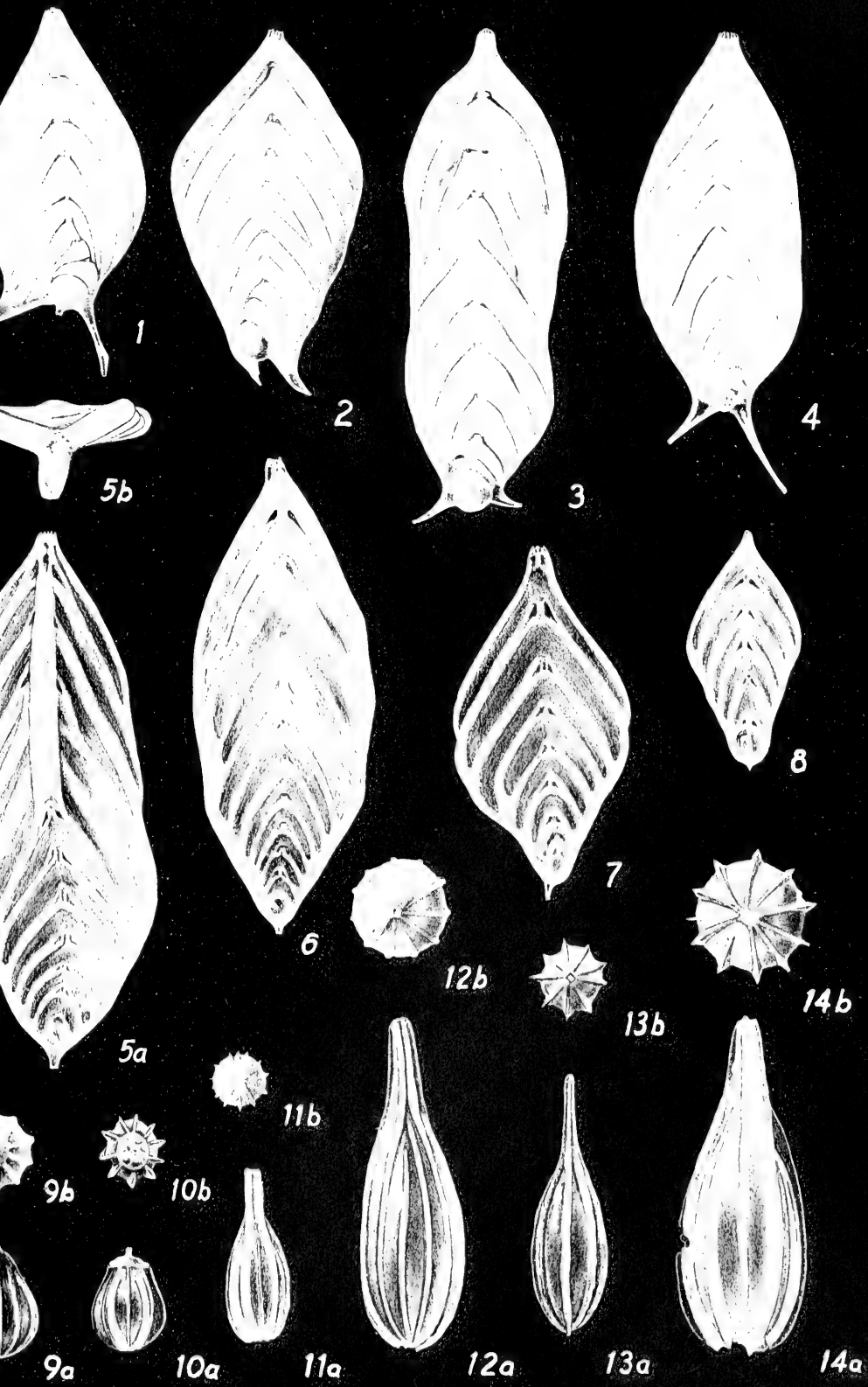
This species has been placed by some authors as a variety of *L. costata* (Williamson) but seems to be quite different. The forms which we have figured as belonging to Reuss' species have an elongate flask-shaped test, the basal end acute or slightly rounded, the apertural end much extended as in the type. The surface of the test has numerous high, elongate costae, some very long extending from the base of the test to the aperture with others limited to the body of the test and ending at the base of the neck.

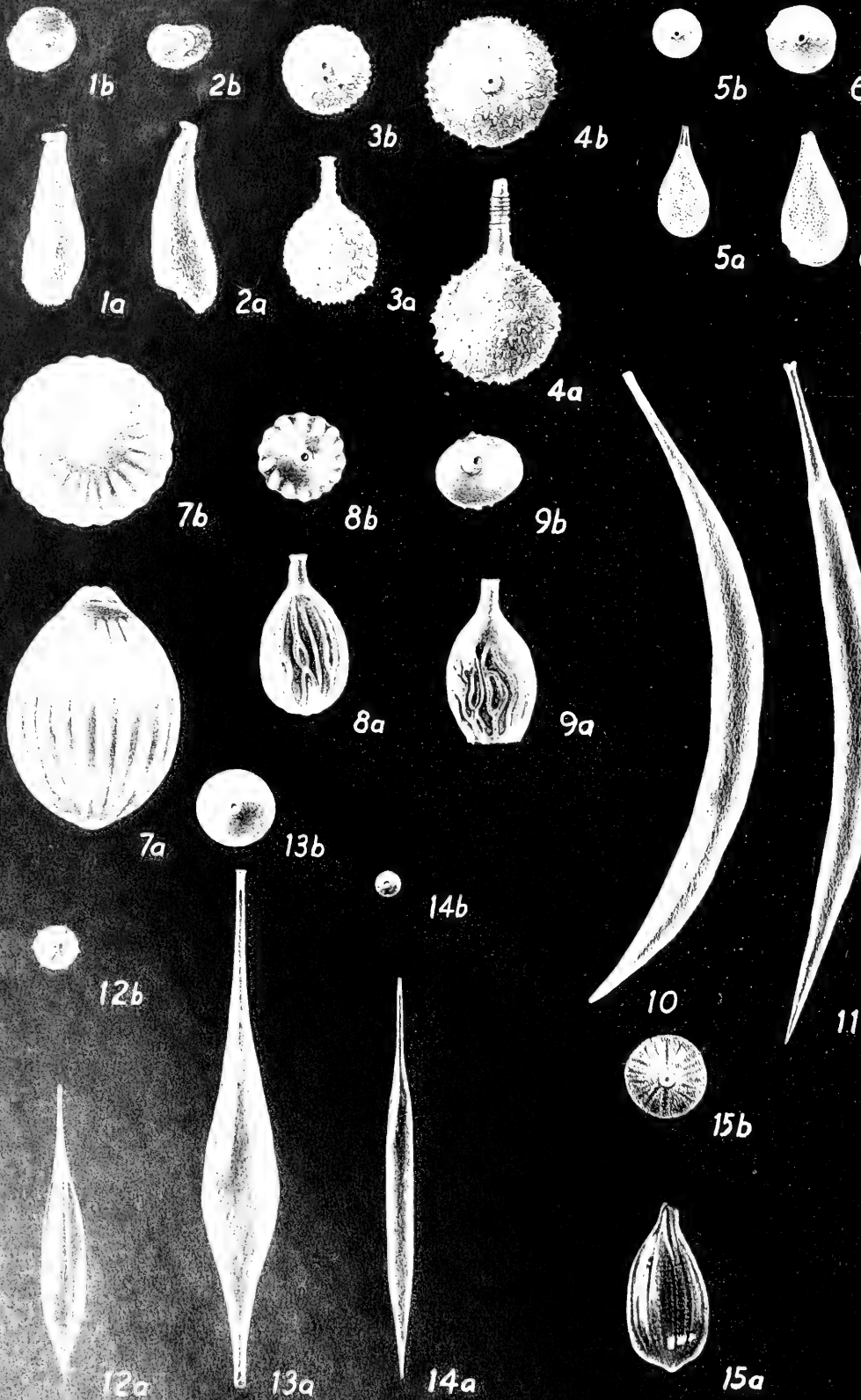
## EXPLANATION OF PLATE 43

Figs.

- 1-4. *Fronicularia gigas* Church. X 14, p. 327.  
5-8. *Fronicularia californica* Cushman and McCulloch, n. sp. X  
33. 5, Holotype. 6-8, Paratypes, earlier stages, p. 328.  
9, 10. *Lagena acuticosta* Reuss, var. X 65, p. 329.  
11-14. *Lagena amphora* Reuss. X 65, 329.

In all specimens, *a*, front view; *b*, apertural view.







## EXPLANATION OF PLATE 44

Figs.

- 1, 2. *Lagena apiculata* Reuss, var. *punctulata* Sidebottom. X 65, p. 334.
- 3, 4. *Lagena aspera* Reuss. X 65, p. 334.
- 5, 6. *Lagena chasteri* Millett. X 65, p. 335.
7. *Lagena costata* (Williamson). X 65, p. 335.
- 8, 9. *Lagena curvilineata* Balkwill and Wright. X 65, p. 336.
- 10, 11. *Lagena dentaliniformis* Bagg. X 33, p. 337.
12. *Lagena distoma* Parker and Jones. X 65, p. 337.
13. *Lagena clavata* Williamson. X 65, p. 336.
14. *Lagena elongata* (Ehrenberg). X 65, p. 338.
15. *Lagena cf. fieldeniana* H. B. Brady. X 65, p. 338.

In all specimens, *a*, front view; *b*, apertural view.

The form in some respects resembles *L. sesquistriata* Bagg but in others is quite different.

Stations: Or. 10, 80, 1007, 1008, 1016, 1068, 1090, 1096, 1097, 1098, 1099, 1103, 1108, 1117, 1123, 1126, 1134, 1135, 1136, 1140, 1150, 1151, 1153, 1158, 1159, 1165, 1172, 1179, 1180, 1188, 1193, 1201, 1205, 1206, 1218, 1220, 1222, 1223, 1225, 1228, 1230, 1232, 1234, 1238, 1240, 1243, 1246, 218, 225, 227, 299, 2070, 2087, 2140, 2164, 2167, 315, 341, and 417.

*Distribution.*—Stations 1007 through 1246 are in the waters off the Channel Islands with a depth range of 18 to 285 fms., the average being 72 fms. Stations off the coast of Mexico and in the Gulf of California show a depth range of 18 to 250 with an average of 90 fms. Stations off Central America, Panama and off Duncan Island, Galapagos show an average depth of 49 fms. The most specimens found in one collection was 1097 off Redondo Beach in 96-124 fms.

***Lagena apiculata* Reuss, var. *punctulata* Sidebottom**

Plate 44, Figs. 1, 2

*Lagena apiculata* Reuss, var. *punctulata* Sidebottom, Journ. Quekett Micr. Club, ser. 2, vol. 11, 1912, p. 382, pl. 14, figs. 21-23; vol. 12, 1913, p. 165; Journ. Roy. Micr. Soc., 1918, p. 129.

The figured specimens in their shape and peculiar surface somewhat suggest this variety described from the Southwest Pacific. They may possibly belong in *Entosolenia*.

Stations: 503, 509, and 563.

*Distribution.*—Stations 503, 509, and 563 off Colombia, Ecuador, and Peru in 18, 45, and 19 fms. respectively. This species occurred rarely at these stations with a depth average of 27 fms.

***Lagena aspera* Reuss**

Plate 44, Figs. 3, 4

Specimens with a generally globular form, long cylindrical neck usually with transverse costae, a slight lip, and the surface of the test with coarse spinose projections are referred to Reuss' species. The name has been very widely used and for a great variety of forms making a definite synonymy impossible without studying the specimens themselves. There is quite a difference between these specimens and those referred here to *L. hispidula* Cushman.

Stations: 82, 144, 1198, 1200, 546, 547, 557, and 637.

*Distribution*.—Stations 82 through 1200 are all near Catalina Island with a depth range of 116 to 147 fms., the average being 123 fms. Off Panama and Colombia the depths average is only 35 fms. At Station 637, Kobe, Japan, the depth was only 7 fms. The numbers of specimens in each haul were approximately the same.

### **Lagena chasteri** Millett

Plate 44, Figs. 5, 6

*Lagena chasteri* Millett, Journ. Roy. Micr. Soc., 1901, p. 11, pl. 1, fig. 11.—Sidebottom, Journ. Quekett Micr. Club, ser. 2, vol. 11, 1912, p. 398, pl. 16, fig. 31; vol. 12, 1913, p. 180.—Earland, *Discovery* Reports, vol. 10, 1934, p. 144.

Our specimens are very similar to the type figures from the Malay Archipelago and also to those figured by Sidebottom from the Southwest Pacific. The flask-shaped test with broadly rounded base, gradually tapering apertural end, and the finely pitted surface are the characters which seem to distinguish this species.

Stations: 1064, 1231, 2070, 409, 412, 413, 414, 417, 466, 468, 469, 472, and 473.

*Distribution*.—Two stations, 1064, and 1231, are off Santa Barbara and Santa Rosa Islands in 27 and 45 fms. respectively. Station 2070 is off Guadalupe Island, Mexico, in 250 fms. Stations 409-473 are in the waters of Galapagos Islands with an average depth range of 44 fms. This species seems to occur in greatest abundance off Charles Island.

### **Lagena costata** (Williamson)

Plate 44, Fig. 7

Our specimens may be referred to Williamson's species which has been used to include many different costate forms. Some of the forms referred to this species undoubtedly belong in *Entosolenia*.

Stations: A-2, 2, 82, 110, 1086, 1096, 1151, 1160, 1163, 1165, 1168, 1178, 1205, 1228, 2070, and 414.

*Distribution*.—Station A-2, Wrangell, Alaska has a depth record of 2 fms. Stations 2 through 1228, off the Channel Islands, show a depth range of 18 to 250 fms. with 71 fms. for the average depth. Farther south at Guadalupe Island, and at Duncan Island, Galapagos the depths were 250 and 68 fms. respectively. More abundant material of these species was found off Santa Cruz Island in 46 fms.

**Lagena clavata** Williamson

Plate 44, Fig. 13

Our figured specimen rather closely resembles the type figure of this species. The test is elongate and fusiform with the basal end drawn out into an elongate spinose projection and the apertural end with a very long tapering neck with a distinct lip. Many forms of very varying characters have been assigned to this species some of which evidently do not belong in Williamson's species and it is impossible to give a complete synonymy.

Stations: 3, 119, 1184, 235, 2070, 602, 626, 637, 653, 664, and 666.

*Distribution.*—At only three local stations thus far has this species been discovered. Stations 235 and 2070 are off Mexico in a depth range of 17 to 250 fms. Station 602 is at Naples in 5 fms. Three different collections are from Kobe, Japan. These collections together with those from Colombo Bay and Bombay give a range of 5 to 45 fms.

**Lagena curvilineata** Balkwill and Wright

Plate 44, Figs. 8, 9

*Lagena curvilineata* Balkwill and Wright, Proc. Roy. Irish Acad., ser. 2, vol. 3, 1882, p. 548 (list); in Balkwill and Millett, Journ. Micr., vol. 3, 1884, p. 21, pl. 2, fig. 3; Trans. Roy. Irish Acad., vol. 28, Sci., 1885, p. 338, pl. 14, figs. 21-24.—H. B. Brady, Journ. Roy. Micr. Soc., 1887, p. 902.—Halkyard, Trans. Manchester Micr. Soc., 1889, p. 13, pl. 2, fig. 3.—Kiaer, Rep't Norwegian Fish. and Mar. Invest., vol. 1, No. 7, 1900, p. 40.—Millett, Journ. Roy. Micr. Soc., 1901, p. 488, pl. 8, fig. 5.—Millett, Recent Foram. Galway, 1908, p. 5, pl. 2, fig. 3.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 78, pl. 6, fig. 7; Journ. Roy. Micr. Soc., 1916, p. 45.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 13, pl. 2, figs. 5-9.

This is a peculiarly ornamented species as may be seen from the various figures referred to it. Our specimens are not as complex in their ornamentation as some of the types but may be placed here until more material is available for study. Most of the records are from the North Atlantic off the British Isles but it is also recorded from the Malay region.

Station: 312.

*Distribution.*—This station is off the Secas Islands at Panama in 14 fms.

**Lagena dentaliniformis** Bagg

Plate 44, Figs. 10, 11

*Lagena dentaliniformis* Bagg, Bull. 513, U. S. Geol. Survey, 1912, p. 45, pl. 13, figs. 1, 2.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 21, pl. 4, figs. 10, 11.

Test elongate, slender, curved, basal end extending out into a distinct point, apertural end with an elongate, tapering neck and a slightly dentate lip, middle portion with the sides nearly parallel; wall smooth, thin, and translucent. Length up to 3 mm.; diameter up to 0.2 mm.

The types of this species are from the Pleistocene of Timms Point, near San Pedro, California, and it has not been recorded elsewhere.

Stations: Or. 10, 84, 144, 1005, 1007, 1010, 1013, 1056, 1062, 1070, 1103, 1107, 1110, 1111, 1112, 1116, 1118, 1131, 1143, 1144, 1147, 1151, 1152, 1154, 1157, 1159, 1160, 1161, 1164, 1165, 1167, 1168, 1178, 1180, 1185, 1186, 1188, 1190, 1196, 1201, 1202, 1228, 1229, 1231, 1238, 1240, 1241, 1242, 207, 269, 2035, 2036, and 312.

*Distribution*.—One record, Station Or. 10, is off the coast of Oregon in 26 to 58 fms. Stations 84 through 1242 are all in the waters of the Channel Islands with a depth range of 10 to 340 fms., the average being 80 fms. Stations 2035 and 2036 extend the range southward into the Gulf of California at Angel de la Guardia Island in 46 to 75 fms. Station 312 places it off Panama in 14 fms. At present a greater abundance of these forms has been found off Santa Rosa, Santa Cruz, and Catalina Islands in 42 and 132 fms. respectively.

**Lagena distoma** Parker and Jones

Plate 44, Fig. 12

From the records this is a very variable species. It is elongate with a long spinose initial end and the apertural end with an elongate, slender neck, the main body of the test elongate with the sides nearly parallel in the middle, and the surface with numerous very fine longitudinal costae.

Stations: A-2, A-16, 80, 1005, 1006, 1068, 1083, 1102, 1103, 1123, 1158, 1161, 1192, 1200, 1201, 1203, 1204, 1206, 1215, 1216, 1218, 1220, 1221, 1224, 1229, 1230, 1231, 1234, 1238, 1240, 1245, 1246, 213, 2070, 607, and 613.

*Distribution*.—With the exception of the A-2 Station off Wrangell, Alaska, Stations 84-1242 are off the Channel Islands. The range in depth is 7 to 285 fms. with the average being 70 fms. Station 2070 places this species as far south as Guadalupe Island in 250 fms. Stations 607 and 613 are in European waters. The number of specimens seemed to vary greatly; the best records are for Wrangell, Alaska.

**Lagena elongata** (Ehrenberg)

Plate 44, Fig. 14

Specimens, similar to that figured, with a very slender elongate test tapering at the base into a long spine and at the apertural end into an elongate slender neck, the central portion with the sides parallel for a large part of the length, and the wall smooth, may be referred to Ehrenberg's species. These somewhat resemble *L. distoma* Parker and Jones but have a more cylindrical test and a smooth surface.

Stations: Or. 10, 79, 80, 113, 114, 144, 1005, 1006, 1010, 1011, 1016, 1068, 1081, 1087, 1095, 1096, 1097, 1099, 1103, 1105, 1106, 1107, 1108, 1110, 1116, 1117, 1121, 1124, 1125, 1135, 1136, 1146, 1150, 1157, 1158, 1159, 1164, 1165, 1168, 1173, 1179, 1182, 1184, 1196, 1200, 1203, 1205, 1206, 1210, 1215, 1218, 1221, 1223, 1224, 1225, 1228, 1229, 1230, 1234, 1239, 1240, 1244, 1245, 1246, 227, 265, and 2070.

*Distribution.*—The first record is off the Oregon coast in 26 to 58 fms.; the Stations 79 through 1246 are in the waters of the Channel Islands, with a depth range of 31 to 340 fms., the average depth being 88 fms. Two records off Guadalupe Island are 200 and 395 fms. In the Gulf of California at Angel de la Guardia Island the depth is 16 fms. Some of the best material came from the region of Guadalupe Island.

**Lagena cf. fieldeniana** H. B. Brady

Plate 44, Fig. 15

Specimens similar to that figured quite strongly resemble this species which from the records is rather widely distributed.

Stations: 1205 and 1228.

*Distribution.*—This species recorded at two stations only, off Catalina and Santa Rosa Islands in 108 and 104 fms. respectively. This species is a rare form thus far in the collections at the Foundation.

**Lagena cf. filicosta** Reuss

Plate 45, Figs. 2-4

Our specimens quite closely resemble this species. The neck is broken at the tip in all the figured specimens but the shape and general appearance and the ornamentation are very close to Reuss' species.

Stations: A-2, Or. 1, Or. 10, 35, 79, 82, 1089, 1095, 1096, 1097, 1123, 1150, 1210, 1211, 1243, 218, 226, 227, 256, 294, 2070, 2166, 409, 413, 460, 463, 472, 509, 514, 538, 540, 546, 556, 563, 643, and 659.

*Distribution.*—From Wrangell, Alaska, in 2 fms. and from the coast of Oregon in shallow water from 26 to 58 fms. in depth, this species was

observed. Stations 35 through 1243 are from the waters of the Channel Islands showing a range of 6 to 489 fms. with an average of 131 fms. Stations 218 through 2166 are along the coast of Mexico and in the Gulf of California in a depth range of 24 to 250 fms. with the average being 117 fms. Stations 409 through 472, in the Galapagos Islands, show a consistent range in shallow waters 15 to 35 fms. Stations 509 through 563 off the coast of South America have a depth range of 12 to 45 fms. Stations 643 and 659, Bombay and Capetown, respectively, were shallow waters also. The largest number of specimens came from Station 409, James Bay, Galapagos Islands.

### **Lagena flexa** Cushman and Gray

Plate 45, Fig. 1

*Lagena flexa* Cushman and Gray, Contr. Cushman Lab. Foram. Res., vol. 22, 1946, p. 68, pl. 12, figs. 18-21; Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 22, pl. 4, figs. 16-19.

"Test elongate, distinctly bent toward the apertural end, base truncate, apertural end tapering, sides nearly parallel; wall distinctly but finely perforate, the base with very short costae, apertural end with a tapering neck, turning to one side, with a slight lip. Length 0.28-0.40 mm.; diameter 0.10-0.15 mm."

The types of this species are from the Pleistocene of Timms Point, near San Pedro, California. Typical Recent specimens occur in the Hancock collection.

Stations: 409, 417, 435, 458, 460, 463, and 659.

*Distribution*.—Stations 409 through 463 are located in the waters of the Galapagos Islands. The depth range for these stations is 8 to 55 fms. with 23 fms. being the average depth. An additional record comes from a bottom sample taken in the harbor at Capetown. The largest number of specimens were found in the collections off Charles Island, Galapagos, in 23 fms.

### **Lagena hispidula** Cushman

Plate 45, Figs. 8-10

*Lagena hispidula* Cushman, Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 14, pl. 5, figs. 2, 3.—Heron-Allen and Earland, *Discovery* Reports, vol. 4, 1932, p. 364, pl. 10, fig. 6.—Earland, *idem*, vol. 7, 1933, p. 113; vol. 10, 1934, p. 152, pl. 6, figs. 58-60; vol. 13, 1936, p. 47.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 21, pl. 4, fig. 6.

Test subglobular, broadly rounded at the base, the opposite end abruptly narrowed to a slender, elongate neck of nearly uniform diameter, the outer end occasionally with a slight lip; surface finely hispid throughout.

Our specimens seem to belong to this species largely known living from the Pacific and recorded from the Pleistocene of Timms Point, near San Pedro, California.

Stations: 82, 1008, 1010, 1016, 1044, 1082, 1095, 1096, 1106, 1108, 1109, 1110, 1116, 1117, 1121, 1125, 1136, 1143, 1148, 1149, 1150, 1157, 1165, 1167, 1168, 1177, 1184, 1200, 1211, 1215, 1218, 1223, 1225, 1234, 1238, 1239, 1246, 225, 2053, 2154, 415, 417, 516, 540, 547, 583, 606, and 609.

*Distribution.*—Stations 82 through 1246 are in the waters of the Channel Islands with a depth range of 16 to 489 fms. the average being 53 fms. Stations 225-2154 off Mexico record 32 to 55 fms. Stations 415, 417 off the Galapagos and Stations 516 through 583 are all shallow water records 10 to 55 fms. with the average being 34 fms. Two additional records, Stations 606 and 609, Monaco and Balestrand, show a record of 8 and 32 fms. respectively. Only a few specimens were found in all of these collections.

### ***Lagena implicata*** Cushman and McCulloch, new species

Plate 45, Figs. 5-7

Test elongate, the basal part truncated, the apertural end decidedly twisted outside of the line of the axis, sides of the main body of the test nearly parallel, becoming rapidly tapering at the apertural end with a distinct neck; wall ornamented with a few longitudinal costae some of which continue from the base to the apertural end, others intermediate do not extend onto the tapering portion. Length 0.45-0.65 mm.; diameter 0.07-0.15 mm.

Holotype (AHF no. 70) from Station 1201.

This species differs from *L. striatopunctata* Parker and Jones, var. *excentricitas* Cushman and McCulloch, n. var., in the more slender form, and simple costae. It may be related to *L. sesquistriata* Bagg.

Stations: 144, 1008, 1010, 1016, 1111, 1168, 1195, 1201, 1210, 1218, 1222, 1223, 1229, 1231, 1238, 1246, and 299.

*Distribution.*—The type locality is 2½ miles SE Church Rock, Catalina Island, 33° 16' 40" N, 118° 17' 10" W in 80 fms. Stations 144 through 1246 are in the waters off the Channel Islands in depths from 38 to 120 fms., the average depth being 54 fms. An additional record, Station 299, is San Jose del Cabo, Mexico, in 82 fms. This species is not abundant at any station.



**Lagena inepta** Cushman and McCulloch, new species

Plate 45, Figs. 11-13

Test small, having the main body globular or slightly longer than broad, basal end broadly rounded, apertural end extended into a short, almost cylindrical, neck with a slight lip; wall ornamented with raised costae sometimes elongate toward the apertural end but usually making up a very irregular polygonal pattern. Length 0.25-0.30 mm.; diameter 0.15-0.20 mm.

Holotype (AHF no. 71) from Station 215.

This species differs from *Entosolenia squamosa* (Montagu) in its very definite neck, irregular surface ornamentation, and lack of an internal tube. It somewhat resembles *L. curvilineata* Balkwill and Wright but differs in its more globular test and more definitely polygonal ornamentation.

Stations: 202, 205, 215, 514, and 557.

*Distribution*.—The type locality is Tangola-Tangola, Mexico, in 15-20 fms. where it occurred in greater abundance. Other stations are off Mexico and South America in shallow waters with a depth range of 8 to 29 fms.

**Lagena laevis** (Montagu)

Plate 45, Figs. 14-16

Many forms have been assigned to this species. Those here figured seem closely related to *L. perlucida* (Montagu) but lack the costae at the base. Specimens vary considerably in the relative length of the main body of the test.

Stations: Or. 7, Or. 9, 83, 1015, 1099, 1102, 1121, 1125, 1128, 1135, 1136, 1142, 1149, 1168, 1194, 1199, 1212, 1215, 1246, 218, 2070, 2135, 2162, 410, 458, 466, 474, 511, 514, 542, 543, 546, 629, and 660.

*Distribution*.—In addition to the two records off the coast of Oregon, Stations 83 through 1246 are off the Channel Islands with a depth range of 17 to 490 fms., with an average being 82 fms. Stations 218 through 2162 are off the coast of Mexico with a depth average of 113 fms. Stations 410-474 are off Galapagos Islands with a range from 9 to 175 fms., the average being 52 fms. Stations 511-546, off South America, have an average depth of 40 fms. Some specimens collected at Singapore in shallow water were placed in this species also.

**Lagena laevis** (Montagu), var. **baggi** Cushman and Gray

Plate 45, Fig. 17

*Lagena laevis* Bagg (part) (not Montagu), Bull. 513, U. S. Geol. Survey, 1912, p. 48, pl. 13, figs. 5-8 (not figs. 10, 11; pl. 14, figs. 23, 24).

*Lagena laevis* (Montagu), var. *baggi* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 18, pl. 3, figs. 26, 27.

Variety differing from the typical in the more nearly spherical body of the test, shorter neck and distinct and thickened lip and occasionally a short basal spine.

This is a common form in the Pleistocene of Timms Point, near San Pedro, California, and the Recent forms in the Hancock collection seem identical.

Stations: A-2, 109, 1154, 1159, 1178, 1215, 260, 418, 503, 513, and 519.

*Distribution.*—Station A-2, Wrangell, Alaska, in 8 fms., Stations 109 through 1215, Station 412 in 111 fms. off the Galapagos Islands, 260 in the Gulf of California, Stations 503-519 extend the range southward in the Eastern Pacific. Some of the best material was found in the waters of the Galapagos Islands in 111 fms.

**Lagena laevis** (Montagu), var.

Plate 45, Fig. 18

The figured specimen seems related to *L. laevis* (Montagu) and in some respects to var. *baggi* Cushman and Gray. The basal end, however, is broad and has a peculiar spinose ornamentation. The form is here figured for reference until more specimens show its true relationships.

Station: 514.

*Distribution.*—Station 514 is off the coast of Colombia, South America, in 16 fms.

**Lagena perlucida** (Montagu)

Plate 46, Figs. 1, 2

*Vermiculum perlucidum* Montagu, Test. Brit., 1803, p. 525, pl. 14, fig. 3.

*Lagena perlucida* Brown, Illus. Conch. Great Britain, 1827, flyleaf, pl. 1, fig. 29; ed. 2, 1844, p. 3, pl. 56, fig. 29.—Schlumberger, Feuille Jeunes Nat., vol. 13, 1882, pl. 1, fig. 2.—Heron-Allen and Earland, Proc. Roy. Irish Acad., vol. 31, pt. 64, 1913, p. 78; Trans. Zool. Soc. London, vol. 20, 1915, p. 659; Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 246; Journ. Roy. Micr. Soc., 1916, p. 45.—Cushman, Contr.

Cushman Lab. Foram. Res., vol. 3, 1927, p. 123, pl. 24, fig. 3.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 165.—Cushman, Bull. 4, Florida State Geol. Survey, 1930, p. 29, pl. 5, fig. 5.—Cushman and Parker, Contr. Cushman Lab. Foram. Res., vol. 7, 1931, p. 6, pl. 1, fig. 22; Proc. U. S. Nat. Mus., vol. 80, Art. 3, 1931, p. 8, pl. 3, fig. 6.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 2, 1933, p. 20, pl. 4, figs. 6-8.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 18, pl. 3, figs. 17-20.—Cushman and Todd, Special Publ. No. 21, 1947, p. 11, pl. 2, fig. 5.

*Lagena vulgaris* Williamson, var. *perlucida* Williamson, Recent Foram. Gt. Britain, 1858, p. 5, pl. 1, figs. 7, 8.

There is much question as to the use of Montagu's name for the form figured. Most authors have used it for forms similar to those here figured, a flask-shaped test with a short cylindrical neck and slightly developed lip, the base slightly truncate and the test thin and smooth with the exception of a series of short, longitudinal costae near the base of the test.

Stations: A-16, Or. 10, 4, 39, 58, 76, 1008, 1093, 1108, 1123, 1125, 1210, 218, 225, 227, 229, 2089, 2137, 2154, 409, 413, 417, 450, 460, 468, 472, 514, 543, 602, 604, 606, 608, 609, 613, 615, 636, 640, 642, 649, 655, 659, and 664.

*Distribution.*—These stations extend from Seward, Alaska, in 10 fms. southward along the coast to Station 543, Port Utria, Colombia, in 50 fms. Stations 602-655 are additional records from numerous ports all over the world. The average depth for all the stations is 25 fms. The specimens of this species seem to be rather abundant in the waters of the Galapagos Islands.

### ***Lagena perlucida* (Montagu), var.**

Plate 46, Figs. 3, 4

The form represented by the figured specimens is difficult to place. It may be a variety of *L. perlucida* (Montagu) with the base having a few short, projecting spines rather than definite costae.

Stations: A-2, Or. 9, Or. 10, 114, 1006, 1125, 1149, 460, 506, 542, 556, 603, 607, 608, 609, 613, 615, 622, 655, and 664.

*Distribution.*—Beginning with Station A-2, Wrangell, Alaska, in 8 fms. southward off the coast of Oregon in 35-58 fms., four stations off southern California in 30 to 132 fms., one station off James Island in 16 fms. and three stations off South America constitute the records thus far for this species in the shallow waters of the Eastern Pacific, the average depth being 45 fms. Stations 603-664 represent collections taken in many parts of the world with an average depth of 8 fms.

**Lagena pliocenica** Cushman and Gray

Plate 46, Figs. 5-8

*Lagena pliocenica* Cushman and Gray, Contr. Cushman Lab. Foram. Res., vol. 22, 1946, p. 68, pl. 12, figs. 22-25; Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 19, pl. 3, figs. 39-42.—Cushman and Todd, Special Publ. No. 21, 1947, p. 11, pl. 1, fig. 30.

Test with the main portion roughly triangular in longitudinal section, the sides slightly convex and the greatest width near the base; wall of the middle portion smooth but with a fine granular appearance and nearly opaque; base with a few raised costae radiating out from the center of the lower face; apertural end with an elongate, tapering neck ornamented with longitudinal costae, occasionally tending to become slightly spiral. Length 0.30-0.40 mm.; diameter 0.25-0.28 mm.

The types of this species are from the Pleistocene of Timms Point, near San Pedro, California. It has also been recorded from off the state of Washington and occurs in typical form in the Hancock collection. A series showing some of the variations is figured.

Stations: 1, 1006, 1016, 1042, 1143, 1144, 1158, 1159, 1165, 1166, 1167, 1168, 1229, 1231, 1233, 1234, 1239, 1240, 2003, 2157, and 2163.

*Distribution.*—All but three of these stations are off the Channel Islands with the range in depth being 31 to 105 fms. The average depth is 50 fms. Stations 2003, 2157 and 2163, off the coast of Mexico, are not far distant from the Channel Islands.

**Lagena pliocenica** Cushman and Gray, var.**discrepans** Cushman and Gray

Plate 46, Fig. 9

*Lagena pliocenica* Cushman and Gray, var. *discrepans* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 19, pl. 3, figs. 35-38.

Variety differing from the typical form in the angled periphery near the base and the costae largely confined to the very basal part.

The types of this variety are also from Timms Point, near San Pedro, California. Typical specimens occur at these stations.

Stations: A-1, 1041, 1042, 1129, 1157, and 1167.

*Distribution.*—Stations A-1, Ketchikan, Alaska, in 8 fms., again at Monterey Bay, Point Pinos, Point Fermin and San Miguel constitute the range for these studies. The average depth is 28 fms.

**Lagena pliocenica** Cushman and Gray, var.  
**timmsana** Cushman and Gray

Plate 46, Fig. 10

*Lagena pliocenica* Cushman and Gray, var. *timmsana* Cushman and Gray, Contr. Cushman Lab. Foram. Res., vol. 22, 1946, p. 68, pl. 12, figs. 15-17; Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 19, pl. 3, figs. 43, 44.

Variety differing from the typical form in the more globular body of the test, the sides curving inward toward the base without a definite angle, and the surface smooth and translucent above the costate portion.

The types of this variety are also from Timms Point, near San Pedro, California.

Stations: C-10, 1160, and 640.

*Distribution*.—C-10 off the coast at Santa Cruz, Station 1160 off Santa Rosa Island and Station 640 at Singapore extend the known range. The average depth for these stations is 13 fms.

**Lagena semilineata** J. Wright

Plate 46, Fig. 11

*Lagena semilineata* J. Wright, Proc. Belfast Nat. Field Club, 1884-85 (1886), Appendix 9, p. 320, pl. 26, fig. 7.—Chaster, First Rep't Southport Soc. Nat. Sci., 1890-91 (1892), p. 60.—J. Wright, Irish Nat., vol. 9, 1900, p. 54 (list).—Sidebottom, Journ. Quekett Micr. Club, ser. 2, vol. 12, 1913, p. 173, pl. 15, fig. 27.—Heron-Allen and Earland, Trans. Linn. Soc. London, ser. 2, vol. 11, 1916, p. 246, pl. 41, figs. 21, 22.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 49, pl. 9, figs. 12, 13.—Earland, *Discovery* Reports, vol. 10, 1934, p. 161, pl. 7, figs. 19, 20; vol. 13, 1936, p. 51.

Test elongate, flask-shaped, initial end with a short spine, apertural end extended out into a long cylindrical neck, basal portion of the test with numerous longitudinal costae, upper portion smooth.

Our figured specimen seems to be very close to the type but other figures referred to this species differ in the coarseness of the costae and the shape of the test.

Stations: A-16, 1009, 1074, and 1174.

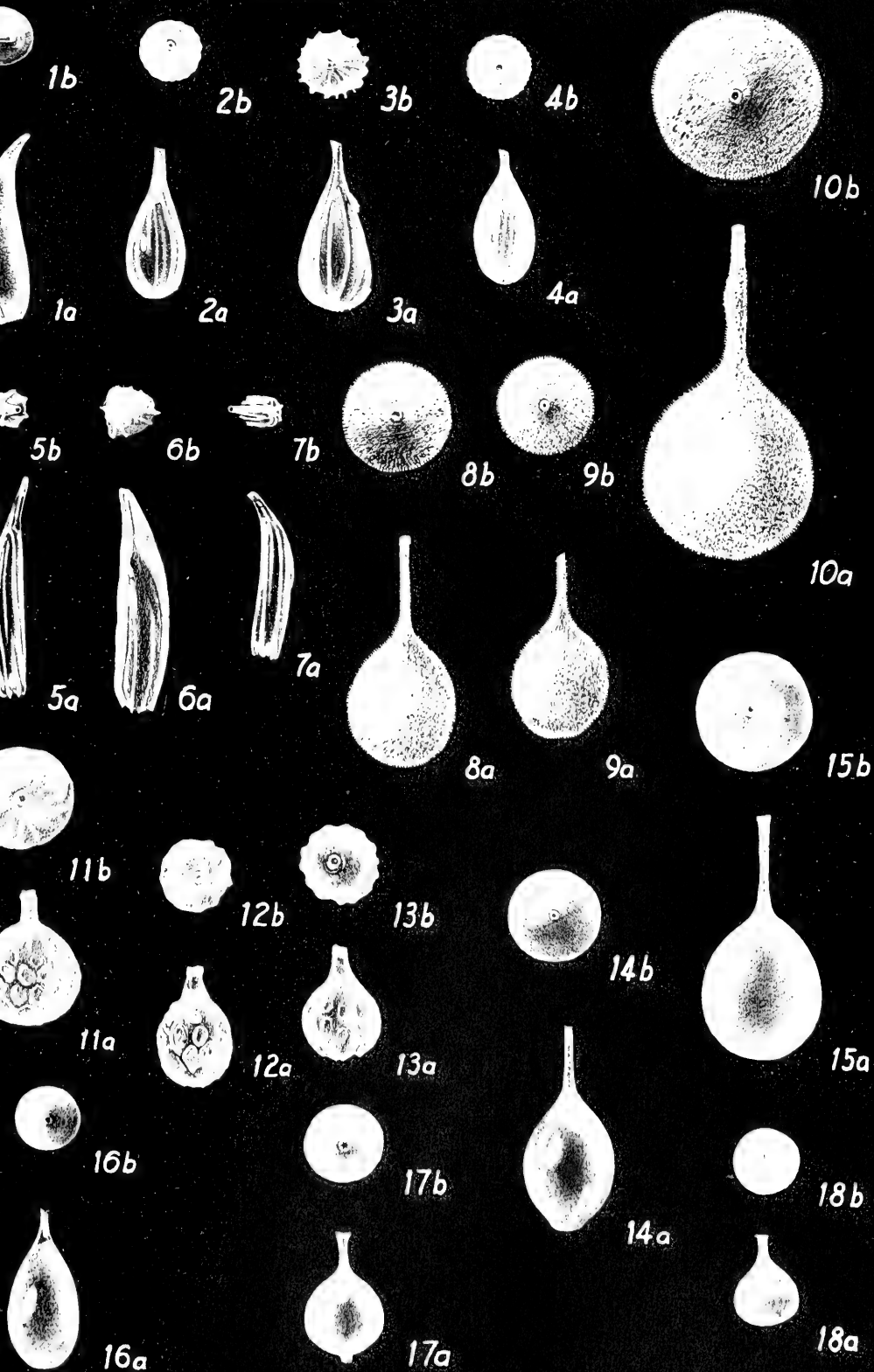
*Distribution*.—With the exception of Station A-16, Simpson Bay, Alaska, all of the other stations are off the Channel Islands. The average depth is 40 fms. There were only a few specimens at all of these stations.

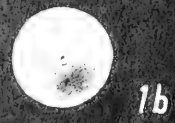
## EXPLANATION OF PLATE 45

Figs.

1. *Lagena flexa* Cushman and Gray. X 65, p. 339.
- 2-4. *Lagena* cf. *flicosta* Reuss. X 65, p. 338.
- 5-7. *Lagena implicata* Cushman and McCulloch, n. sp. X 65. 5, Holotype. 6, 7, Paratypes, p. 340.
- 8-10. *Lagena hispidula* Cushman. X 65, p. 339.
- 11-13. *Lagena inepta* Cushman and McCulloch, n. sp. X 65. 11, Holotype. 12, 13, Paratypes, p. 341.
- 14-16. *Lagena laevis* (Montagu). X 65, p. 341.
17. *Lagena laevis* (Montagu), var. *baggi* Cushman and Gray. X 65, p. 342.
18. *Lagena laevis* (Montagu), var. X 65, p. 342.

In all specimens, *a*, front view; *b*, apertural view.





1b



2b



3b



4b



1a



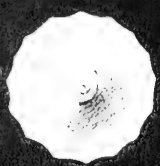
2a



3a



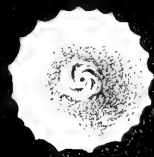
4a



5b



6b



7b



8b



5a



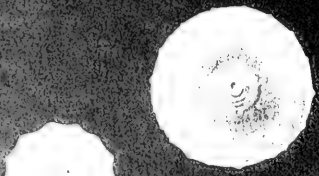
6a



7a



8a



9b



10b



11b



12b



13b



14b



15b



9a



10a



11a



12a



13a



14a



15a



## EXPLANATION OF PLATE 46

Figs.

- 1, 2. *Lagena perlucida* (Montagu). X 65, p. 342.
- 3, 4. *Lagena perlucida* (Montagu), var. X 65, p. 343.
- 5-8. *Lagena pliocenica* Cushman and Gray. X 65, p. 344.
  9. *Lagena pliocenica* Cushman and Gray, var. *discrepans* Cushman and Gray. X 65, p. 344.
  10. *Lagena pliocenica* Cushman and Gray, var. *timmsana* Cushman and Gray. X 65, p. 345.
  11. *Lagena semilineata* J. Wright. X 65, p. 345.
- 12-15. *Lagena sesquistriata* Bagg. X 65, p. 350.

In all specimens, *a*, front view; *b*, apertural view.

**Lagena sesquistriata** Bagg

Plate 46, Figs. 12-15

*Lagena sesquistriata* Bagg, Bull. 513, U. S. Geol. Survey, 1912, p. 50, pl. 13, figs. 12-14.—Cole, Bull. Amer. Pal., vol. 14, No. 53, 1928, p. 209, (9), pl. 2, fig. 8.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 21, pl. 4, fig. 7.

Our specimens may belong to this species described from the Pleistocene of Timms Point, near San Pedro, California, and recorded from the Eocene of Mexico. As shown in our figures the form is somewhat variable, the elongate costae extend forward along the neck and are somewhat variable in number.

Stations: 4, 35, 79, 80, 144, 1006, 1009, 1011, 1022, 1023, 1042, 1063, 1064, 1068, 1071, 1076, 1079, 1090, 1095, 1117, 1119, 1121, 1122, 1123, 1132, 1141, 1143, 1150, 1151, 1153, 1158, 1159, 1160, 1161, 1164, 1168, 1176, 1178, 1184, 1185, 1190, 1195, 1205, 1210, 1212, 1218, 1223, 1224, 1226, 1228, 1229, 1230, 1231, 1232, 1234, 1239, 1240, 1244, 1246, 225, 226, 227, 249, 260, 265, 266, 271, 275, 288, 292, 2002, 2008, 2033, 2034, 2035, 2053, 2070, 2113, 2132, 2142, 2157, 2162, 2164, 2165, 2169, 331, 339, 409, 519, 538, 543, and 653.

*Distribution.*—Stations 4 through 1246 are off the Channel Islands with a depth of 6 to 240 fms. Stations 226 through 2169 constitute numerous records off the coast of Mexico and in the Gulf of California with a depth range of 10 to 200 fms. Stations 331 through 543 off Central America, Galapagos Islands and South America show a depth range of 7 to 50 fms. Station 653 places this species also at Kobe, Japan, in 45 fms.

**Lagena cf. striata** (d'Orbigny)

Plate 47, Figs. 1-4

The series of specimens figured on our plate shows a considerable amount of variation but in general seems to come within the limits of this species. Very many forms have been assigned to this species and no synonymy can be given with any degree of accuracy. d'Orbigny's types were from off the Falkland Islands.

Stations: A-2, 52, 76, 1006, 1016, 1071, 1097, 1103, 1108, 1109, 1110, 1118, 1121, 1134, 1135, 1138, 1139, 1141, 1148, 1149, 1150, 1165, 1166, 1167, 1173, 1175, 1177, 1184, 1212, 1215, 1216, 1218, 1220, 1223, 1230, 1234, 1243, 1246, 218, 226, 315, 339, 409, 503, 506, 514, 546, 547, 553, 556, 558, 563, 606, 613, 625, 627, 629, 640, 649, 659, and 661.

*Distribution.*—Stations 1006 through 1246 are off the Channel Islands with a depth range of 7 to 490 fms., with the average being 82 fms. Two records are off Mexico, one off Central America and one off the Galapagos Islands with a depth range of 15 to 48 fms. Stations 503 through 563 are off the coast of South America from shore to 50 fms. Stations 606 through 661 are collections from ports around the world in depths from shore to 270 fms.

***Lagena striatopunctata* Parker and Jones**

Plate 47, Figs. 5-9

It is difficult to give a full synonymy of this species or a complete description. Many forms have been assigned to it. There is a wide variation in the specimens in the Hancock collection and a number of these are here figured to show this range.

Stations: A-2, 80, 1007, 1042, 1064, 1151, 1153, 1158, 1160, 1161, 1164, 1165, 1167, 1168, 1176, 1184, 1185, 1186, 1207, 1210, 1211, 1219, 1220, 1223, 1228, 1230, 1232, 1233, 1238, 1239, 1240, 1243, 1246, 227, 258, 2008, 2036, 2063, 2070, 2156, 2157, 409, 417, 460, 461, 478, and 608.

*Distribution.*—Stations 80 through 1246 are stations off the Channel Islands with a depth range of 27 to 489 fms., the average depth being 106 fms. Stations 227 through 2157 are off Mexico and in the Gulf of California with a depth range of 41 to 450 fms. Five stations, 409-478, show a similar range, 16 to 80 fms. with 42 for the average depth. Station 608 is located in European waters. Specimens were not numerous at any of these stations.

***Lagena striatopunctata* Parker and Jones, var.**

***complexa* Sidebottom**

Plate 47, Figs. 10, 11

*Lagena striatopunctata* Parker and Jones, var. *complexa* Sidebottom, Journ. Quekett Micr. Club, ser. 2, vol. 11, 1912, p. 393, pl. 16, fig. 11; vol. 12, 1913, p. 176.—Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 21, pl. 4, figs. 1-4.

The specimens with the intermediate area with fine pits in longitudinal lines are referred to Sidebottom's variety. The types are from the Southwest Pacific and it is recorded from the Pleistocene of Timms Point, near San Pedro, California.

Stations: 1005, 1006, 1009, 1071, 1150, 1157, 1159, 1160, 1168, 1218, 1226, 1227, 1230, 1232, 1233, 1234, 1238, 1239, 1242, 299, and 2070.

*Distribution.*—With two exceptions all of these stations are off the Channel Islands in 47 to 212 fms. with 65 fms. being the average depth. Stations 299 and 2070 off Mexico are 82 and 250 fms. in depth respectively. Specimens of this species were not abundant in any of the collections.

***Lagena striatopunctata*** Parker and Jones,  
var. ***excentricitas*** Cushman and McCulloch, new variety  
Plate 47, Figs. 12, 13

Variety differing from the typical form in the axis of the test decidedly bent at the apertural end, and the costae fewer and more prominent. Holotype of variety (AHF no. 72) from Station 468.

This varietal form in our material seems rather distinctive but like the other varieties shows a considerable degree of variation. It is somewhat like specimens from the Tropical Pacific referred to *L. desmophora* Rymer-Jones (Cushman, Bull. 161, U. S. Nat. Mus., pt. 2, 1933, pl. 7, figs. 11-14) but the present form has fewer costae and a more rounded base.

Stations: 1160, 1246, 329, 409, 414, 435, 461, 468, 472, 473, and 474.

*Distribution.*—Station 468, the type locality is Charles Island one-half mile south of Black Beach in 20 fms. Stations 409 through 474 are additional records from the Galapagos Islands with a range of 15 to 175 fms., the average being 56.

***Lagena striatopunctata*** Parker and Jones,  
var. ***cista*** Cushman and McCulloch, new variety  
Plate 47, Figs. 14, 15

Variety differing from the typical form in the axis of the test decidedly bent at the apertural end, in having somewhat fewer but very distinct costae and the intermediate wall areas nearly filling the intercostal space and flush with the costae as shown in end view, the wall in between the costae almost transparent, and the main body of the test elongate box-shaped with the walls parallel in their middle parts.

Holotype of variety (AHF no. 73) from Station 461.

Stations: 1068, 1195, 227, 411, 417, 460, 461, 466, 468, 473, 478, 543, and 547.

*Distribution.*—Station 461, the type locality is Tagus Cove, Albatross Island, in 80 fms. Additional records in the Galapagos Islands are Stations 460 through 478 showing a depth range of 16 to 80 fms., the

average being 42 fms. Two records off the Channel Islands, Stations 1068 and 1195, are in 39 and 50 fms. respectively. One record, Station 227, is off Mexico in 200 fms. Off South America, Stations 543 and 547 are 50 and 40 fms. respectively, more specimens seemed to be present in Tagus Cove in 80 fms.

**Lagena striatopunctata** Parker and Jones,  
var. **gemma** Cushman and McCulloch, new variety  
Plate 47, Fig. 16

Variety differing from the typical form in the perforated costae being more numerous, low and rounded, leaving almost no intercostal areas, and thus the test appears to be almost entirely covered with beading in longitudinal lines.

Holotype of variety (AHF no. 74) from Station 468.

Somewhat similar forms are figured by Millett from the Malay Archipelago (Journ. Roy. Micr. Soc., 1901, p. 489, pl. 8, fig. 6) and by Sidebottom from the Southwest Pacific (Journ. Quekett Micr. Club, ser. 2, vol. 11, 1912, p. 392, pl. 16, figs. 7, 8, 10) but our specimens differ in having a rounded, not truncated, base.

Stations: A-20, 256, 2008, 2035, 2097, 466, 468, 573, and 583.

*Distribution.*—Station 468, the type locality, is one-half mile south of Black Beach, Charles Island, in 20 fms. Additional records include A-20, Anderson Bay, Alaska, shore collecting. Stations 256-2097 are all off Mexico with a depth range of 38 to 70 fms. with the average being 65 fms. Station 466 is off Charles Island in 23 fms. and two stations are off South America in 15 and 10 fms. respectively. Specimens were not numerous at any of the stations.

**Lagena striatopunctata** Parker and Jones,  
var. **spiralis** H. B. Brady  
Plate 47, Figs. 17, 18

*Lagena spiralis* H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, p. 468, pl. 114, fig. 9.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 2, 1933, p. 30, pl. 7, figs. 15, 16; Special Publ. No. 5, Cushman Lab. Foram. Res., 1933, pl. 21, fig. 24; Foraminifera, 4th Ed., 1948, Key, pl. 21, fig. 24.

*Lagena striatopunctata* Parker and Jones, var. *spiralis* Millett, Journ. Roy. Micr. Soc., 1901, p. 489, pl. 8, fig. 7.—Sidebottom, Journ. Quekett Micr. Club, ser. 2, vol. 11, 1912, p. 394, pl. 16, fig. 14; vol. 12, 1913, p. 176; Journ. Roy. Micr. Soc., 1918, p. 130.

Variety differing from the typical form in having the costae in a distinct spiral.

It is difficult to determine whether this spirally costate form should be regarded as a variety or a distinct species. In our present material there seems to be intermediate forms which would suggest a varietal standing for this form. Not all the references are given but only the Recent ones that seem to belong here.

Stations: 214, 2070, and 616.

*Distribution.*—Stations 214 and 2070 are off Clarion and Guadalupe Islands in 15 and 250 fms. respectively. Specimens from Station 616, Nole Island, Whit Sunday, Australia, collected at low tide, have been placed here also. The best material was found off Clarion Island in 157 fms.

***Lagena striatopunctata* Parker and Jones,  
var. *tricosta* Cushman and Gray**

Plate 47, Figs. 19, 20

*Lagena striatopunctata* Parker and Jones, var. *tricosta* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 21, pl. 4, fig. 5.

Variety differing from the typical form in having three prominent raised perforated costae nearly equally placed on the surface of the test.

The types of this variety are from the Pleistocene of Timms Point, near San Pedro, California. Recent specimens in the Hancock collection have the three prominent perforated costae usually in a somewhat twisted position as shown in our figures and seem to be included under this variety.

Stations: 258, 2131, and 510.

*Distribution.*—Station 258 in the Gulf of California, San Francisco Bay in 16 fms., Station 2131, north of Isla Partida, Mexico, in 62-85 fms. and Station 510, San Francisco Bay, Colombia, extend the range southward from San Pedro. The specimens were rare at all of these stations.

***Lagena striatopunctata* Parker and Jones, var.**

Plate 47, Figs. 21, 22

A few specimens, two of which are figured, are evidently closely related to this species but have the base somewhat truncated and the costae extended backward and slightly projecting. They suggest *Lagena plumigera* H. B. Brady in some characters but seem to belong distinctly within the varietal group of *L. striatopunctata*.

Station: 2070.

*Distribution.*—Station 2070 is off Guadalupe Island, Mexico, in 250 fms.

***Lagena submagnifica* Cushman and Gray**

Plate 48, Fig. 1

*Lagena submagnifica* Cushman and Gray, Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 22, pl. 4, figs. 12-15.

“Test with the body nearly spherical, but slightly longer than broad, base rounded, apertural end with a very long, tubular neck and a slightly developed lip; surface with very fine spinose projections with a tendency to fusion at the surface, especially at opposite sides of the test, but easily broken away. Length 0.45-0.55 mm.; diameter 0.23-0.27 mm.”

The types of this rather unique species are from the Pleistocene of Timms Point, near San Pedro, California. It is of interest, therefore, to find typical specimens in this Recent Hancock collection.

Stations: 1097, 1107, 1118, 1125, 1132, 1135, 1136, 1139, 1148, 1149, 227, 269, 415, 417, 512, and 513.

*Distribution.*—Stations 1097-1149 are off the Channel Islands with a depth range of 26 to 340 fms., the average being 96. Stations 227 and 269 are off Guadalupe Island in 200 fms. and off Angel de la Guardia in 125 fms. Stations 415 through 513 are off the Galapagos Islands and the coast of South America in 48 to 58 fms. This species was not abundant at any of these stations.

***Lagena cf. sulcata* (Walker and Jacob)**

Plate 48, Fig. 2

Many different forms have been assigned by various authors to this species. The form here figured is referred to it with some question and the synonymy is not given as so many of the records are without figures or show such a variety of forms.

Stations: Or. 10, 1007, 1079, 1110, 1118, 1127, 1167, 1173, 1180, 1181, 1211, 1218, 1220, 1225, 1243, 2057, 2070, 2097, 542, 606, 607, 613, and 659.

*Distribution.*—Station Or. 10, Winchester Bay, Oregon, in 26-58 fms. is the most northern record in this study. Stations 1007 through 1243 are off the Channel Islands, the depth ranging from 54 to 489 fms. with the average depth being 136 fms. Stations 2057-2097 off the coast of Mexico in 23 to 255 fms. and Station 542, Gorgona Island, Colombia, extend the range southward. Stations 606-659 place this species in widely scattered ports: Monaco, Leish, Rotterdam and Capetown. This species was not abundant at any of these stations.

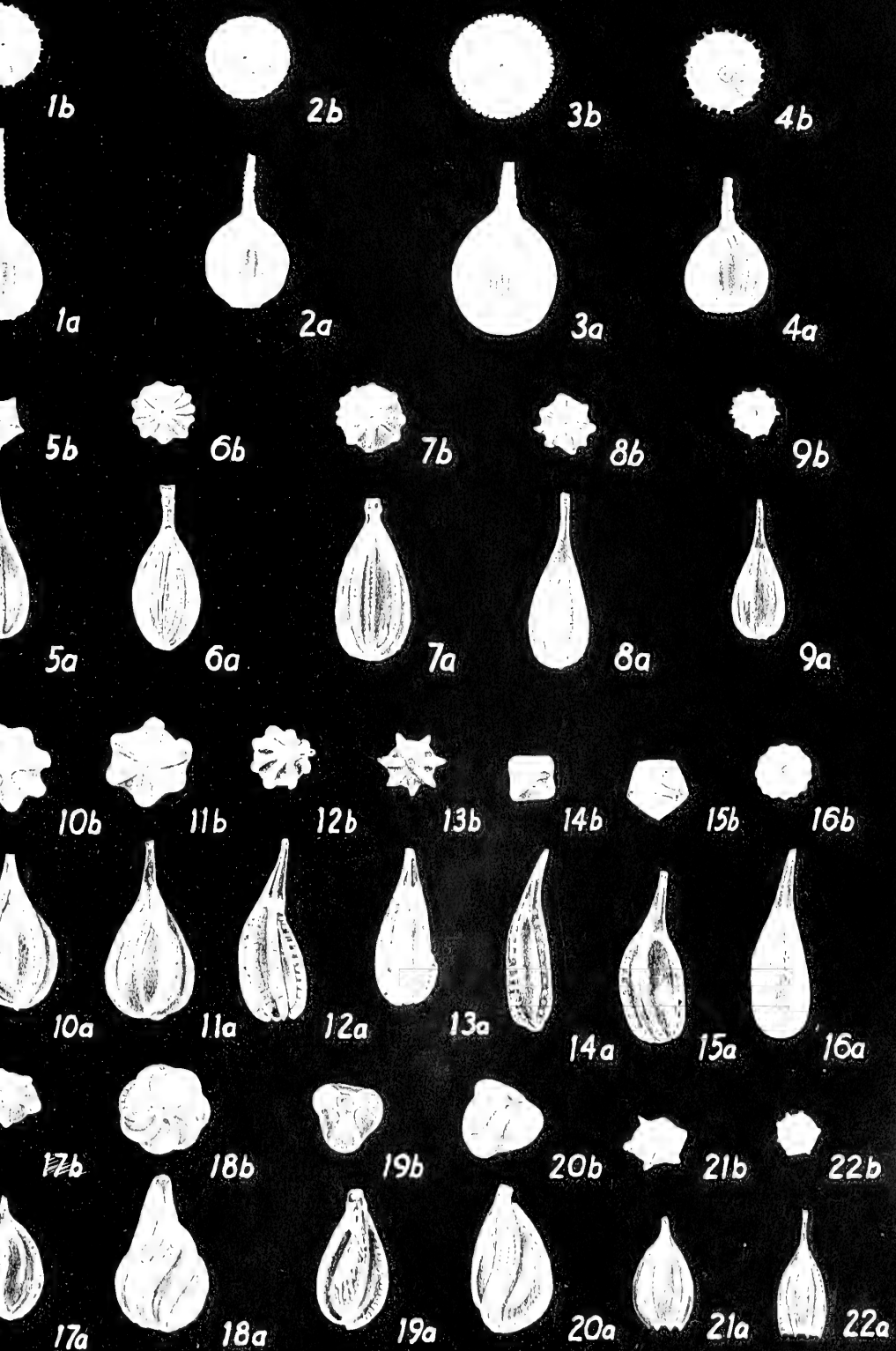
## EXPLANATION OF PLATE 47

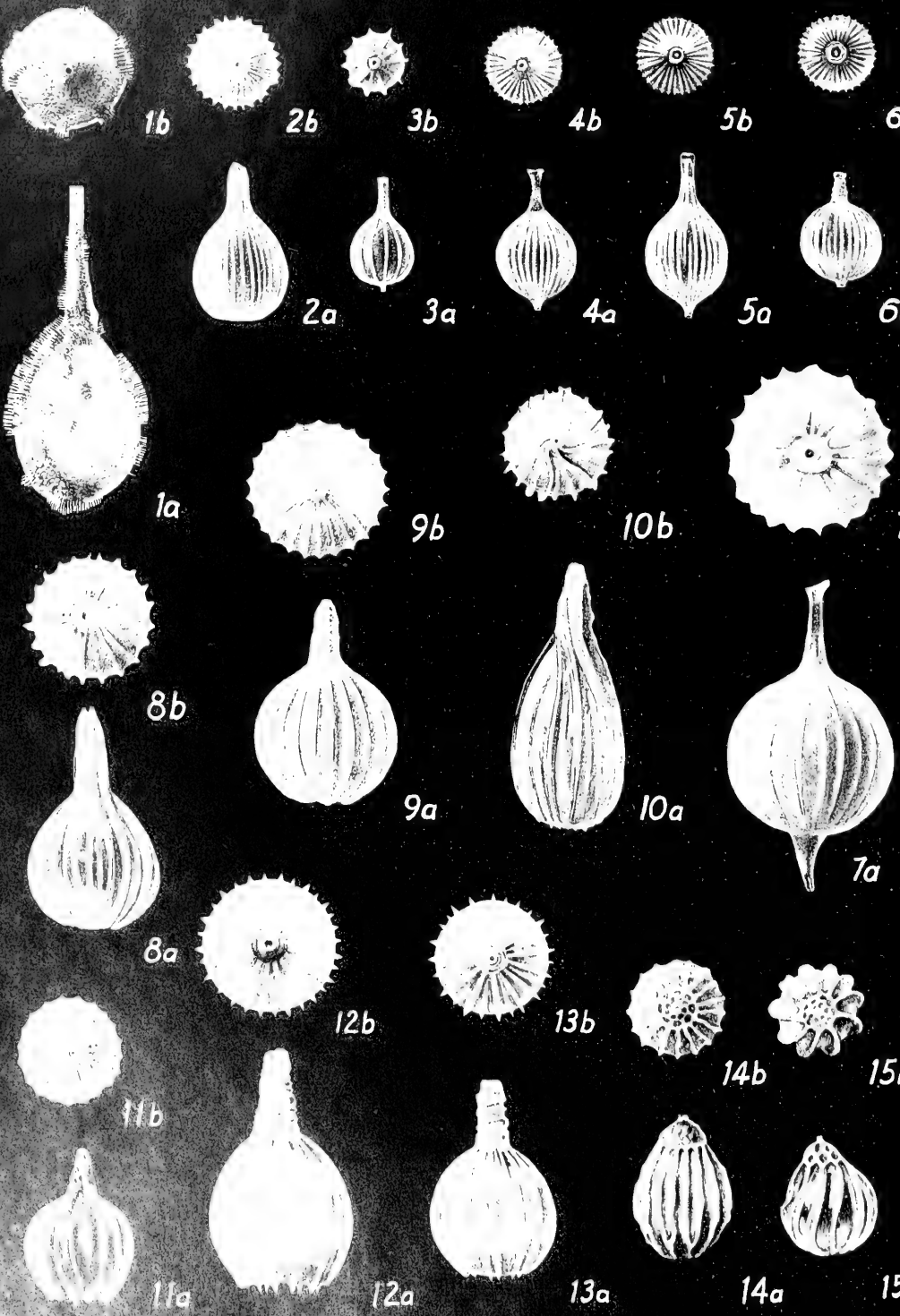
Figs.

- 1-4. *Lagena* cf. *striata* (d'Orbigny). X 65, p. 350.
- 5-9. *Lagena striatopunctata* Parker and Jones. X 65, p. 351.
- 10, 11. *Lagena striatopunctata* Parker and Jones, var. *complexa* Sidebottom. X 65, p. 351.
- 12, 13. *Lagena striatopunctata* Parker and Jones, var. *excentricitas* Cushman and McCulloch, n. var. X 65. 12, Holotype. 13, Paratype, p. 352.
- 14, 15. *Lagena striatopunctata* Parker and Jones, var. *cista* Cushman and McCulloch, n. var. X 65. 14, Paratype. 15, Holotype, p. 352.
16. *Lagena striatopunctata* Parker and Jones, var. *gemma* Cushman and McCulloch, n. var. X 65. Holotype, p. 353.
- 17, 18. *Lagena striatopunctata* Parker and Jones, var. *spiralis* H. B. Brady. 17, X 65, 18, X 110, p. 353.
- 19, 20. *Lagena striatopunctata* Parker and Jones, var. *tricosta* Cushman and Gray. X 65, p. 354.
- 21, 22. *Lagena striatopunctata* Parker and Jones, var. X 65, p. 354.

In all specimens, *a*, front view; *b*, apertural view.







## EXPLANATION OF PLATE 48

Figs.

1. *Lagena submagnifica* Cushman and Gray. X 65, p. 355.
2. *Lagena* cf. *sulcata* (Walker and Jacob). X 65, p. 355.
- 3-7. *Lagena sulcata* (Walker and Jacob), var. *spicata* Cushman and McCulloch, n. name. X 65, p. 360.
- 8-10. *Lagena sulcata* (Walker and Jacob), var. *laevicostata* Cushman and Gray. X 65, p. 361.
- 11-13. *Lagena sulcata* (Walker and Jacob), var. *peculiaris* Cushman and McCulloch, n. var. X 65. 12, Holotype. 11, 13, Paratypes, p. 361.
- 14, 15. *Lagena williamsoni* (Alock). X 65, p. 362.

In all specimens, *a*, front view; *b*, apertural view.

**Lagena sulcata** (Walker and Jacob),  
var. **spicata** Cushman and McCulloch, new name

Plate 48, Figs. 3-7

*Lagena sulcata*, apiculate forms, H. B. Brady, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 58, figs. 4, 17 (?).—Sidebottom, Journ. Roy. Micr. Soc., 1918, p. 130.

*Lagena sulcata* (Walker and Jacob), var. *apiculata* Cushman (not *Lagena apiculata* Reuss), Bull. 71, U. S. Nat. Mus., pt. 3, 1913, p. 23, pl. 9, figs. 3, 4; Proc. U. S. Nat. Mus., vol. 56, 1919, p. 609; Bull. 100, U. S. Nat. Mus., vol. 4, 1921, p. 180; Bull. 104, pt. 4, 1923, p. 58, pl. 11, fig. 2.—Galloway and Morrey, Bull. Amer. Pal., vol. 15, No. 55, 1929, p. 20, pl. 2, fig. 9.—Cushman and Moyer, Contr. Cushman Lab. Foram. Res., vol. 6, 1930, p. 53.—Cushman and Laiming, Journ. Pal., vol. 5, 1931, p. 101, pl. 11, fig. 2.—Thalman, Eclogae geol. Helvetiae, vol. 25, 1932, p. 303.—Earland, *Discovery* Reports, vol. 10, 1934, p. 165.—Kleinpell, Miocene Stratig. Calif., 1938, p. 227.—Cushman, Contr. Cushman Lab. Foram. Res., vol. 15, 1939, p. 60, pl. 10, fig. 28.—Cushman and Gray, *idem*, vol. 22, 1946, p. 68, pl. 12, fig. 12; Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 20, pl. 3, figs. 49, 50.—Cushman and Todd, Special Publ. No. 21, 1947, p. 11, pl. 2, fig. 3.

Variety differing from the typical in having the basal end drawn out into a stout spine, the apertural end with a tapering cylindrical neck with a phialine lip, usually without other ornamentation, body of the test with numerous longitudinal costae as in the typical form. This variety is fairly common in the Pacific in fairly deep water.

As will be noted from the figures, there is a considerable amount of variation in the forms assigned to this variety but they seem to form a continuous series.

Stations: A-1, A-2, 2, 3, 4, 39, 47, 80, 83, 106, 109, 110, 113, 114, 133, 144, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1016, 1017, 1019, 1063, 1068, 1071, 1096, 1097, 1100, 1102, 1106, 1108, 1109, 1110, 1114, 1116, 1119, 1121, 1123, 1125, 1133, 1134, 1135, 1136, 1137, 1138, 1139, 1140, 1143, 1145, 1148, 1150, 1151, 1152, 1153, 1156, 1157, 1158, 1160, 1165, 1166, 1167, 1168, 1170, 1171, 1172, 1174, 1175, 1176, 1178, 1181, 1183, 1184, 1190, 1193, 1198, 1199, 1200, 1203, 1205, 1216, 1217, 1218, 1220, 1221, 1223, 1225, 1228, 1229, 1230, 1231, 1232, 1234, 1238, 1239, 1240, 1245, 1246, 202, 213, 224, 225, 226, 293, 299, 2012, 2086, 2113, 2157, 2164, 2169, 409, 412, 417, 435, 460, 461, 463, 466, 472, 473, 474, 516, 519, 543, 546, 553, 556, 601, 603, 606, 611, 613, 615, 616, 626, 627, 637, 649, and 661.

*Distribution*.—Beginning with Station A-1, Ketchikan, Alaska, southward with Stations 2 through 1246 the depth range is from 8 to 175 fms., with the average depth being 56 fms. Another series of stations off Mexico, Stations 202-2169, give a depth range of 8 to 200 fms. with 54 fms. being the average. Stations 409 through 556 off the Galapagos Islands and the coast of South America show records of 5 to 175 fms. Stations 601 to 661 include ports all over the world giving additional shallow water records. More material was found in the stations off Galapagos than elsewhere.

**Lagena sulcata** (Walker and Jacob),  
var. **laevicostata** Cushman and Gray

Plate 48, Figs. 8-10

*Lagena sulcata* (Walker and Jacob), var. *laevicostata* Cushman and Gray, Contr. Cushman Lab. Foram. Res., vol. 22, 1946, p. 68, pl. 12, figs. 13, 14; Special Publ. No. 19, Cushman Lab. Foram. Res., 1946, p. 20, pl. 3, figs. 47, 48.

Variety differing from the typical form in the elongate, tapering neck and the much higher plate-like costae of which a few continue along the neck to the apertural end.

Variations of this variety described from Timms Point, near San Pedro, California, are here figured.

Stations: Or. 9, 82, 1090, 1103, 1111, 1116, 1117, 1149, 1173, 1174, 1177, 1196, 1200, 1212, 1226, 1243, 2008, 2036, 2070, and 573.

*Distribution*.—Station Or. 9 off the coast of Oregon, Stations 82-1243 off the Channel Islands show a depth range of 45 through 490 fms., an average depth of 113 fms. Stations 2008-2070 off the coast of Mexico range from 70 to 250 fms. The range is extended also to Peru; Station 563 is Independencia Bay, Peru, in 45 fms.

**Lagena sulcata** (Walker and Jacob),  
var. **peculiaris** Cushman and McCulloch, new variety

Plate 48, Figs. 11-13

Variety differing from the typical form in having two series of alternating longitudinal costae, one series extending the full length of the body of the test and ending in acute projections at the base, the other series alternating with the longer ones, shorter and limited to the central portion of the test; apertural end extended into an elongate slightly tapering neck with transverse costae often crossed by the more elongate series of the body of the test.

Holotype of variety (AHF no. 75) from Station 1151.

Stations: A-2, 1000, 1006, 1007, 1108, 1112, 1117, 1136, 1139, 1143, 1148, 1151, 1160, 1163, 1177, 1186, 1223, 1226, 1228, 1229, 1232, 1245, 1246, 215, 228, 252, 259, 269, 2012, 2013, 2058, 2096, 2108, 2110, 2112, 2137, 2138, 2141, 2143, 2157, 2168, 312, 412, 505, 510, and 583.

*Distribution.*—Station 1151 is one mile NE San Miguel Island  $34^{\circ} 05' 05''$  N  $120^{\circ} 20' 40''$  W in 35 fms. Stations 1000-1246 are also off the Channel Islands, the depth range being 37 to 212 fms. with the average being 65 fms. Stations 215-2168 are off the coast of Mexico with a depth range of 6 to 125 fms., the average being 40 fms. Off Central America, Galapagos Islands and South America, Stations 312-583 show a depth range of 4 to 35 fms.

### **Lagena williamsoni** (Alcock)

Plate 48, Figs. 14, 15

*Entosolenia williamsoni* Alcock, Proc. Lit. Philos. Soc., vol. 4, 1865, p. 193.

*Lagena williamsoni* Wright, Proc. Belfast Nat. Field Club, 1876-77, Appendix 4, p. 104, pl. 4, fig. 14.—Cushman, Bull. 104, U. S. Nat. Mus., pt. 4, 1923, p. 61, pl. 11, figs. 8, 9; Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 146; Contr. Cushman Lab. Foram. Res., vol. 5, 1929, p. 70, pl. 11, figs. 7, 8.—Cushman, Stewart, and Stewart, Trans. San Diego Soc. Nat. Hist., vol. 6, 1930, p. 59, pl. 8, fig. 5.—Heron-Allen and Earland, Journ. Roy. Micr. Soc., vol. 50, 1930, p. 165.—Cushman, Bull. 161, U. S. Nat. Mus., pt. 2, 1933, p. 34, pl. 8, fig. 8.

“Test subglobular to pyriform, broadest toward the base, apertural end tapering to a short slender neck; wall ornamented with a few high platelike costae, occasionally twisted, coalescing at the upper end and forming a collar made up of a reticulate network below the neck.”

This species evidently is widely distributed in the Recent oceans. It is probably related to forms that have been assigned to *L. acuticosta* Reuss. In the Hancock material it is quite variable and two unusual forms are figured on our plate. One of these has the costae in a distinct spiral and the other has them bifurcate toward the base.

Stations: 1010, 1103, 1110, 1117, 1139, 1147, 1167, 1180, 1182, 1198, 1205, 1218, 1224, 1226, 1246, and 227.

*Distribution.*—Stations 1010 through 1246 all off the Channel Islands with a depth range of 10 to 285 fms., with the depth average being 75 fms. A single record, Station 227, Guadalupe Island, Mexico, was 200 fms. Some of the best material was found off San Diego, California.

- Astacolus californicus*, 303  
  *planulatus*, 303  
*Cristelaria peregrina*, 302  
  *reniformis*, 303  
  *variabilis*, 302  
*Darbyella*, 295  
*Dentalina*, 310, 316, 327  
  *baggi*, 313, 320, 321  
  *californica*, 312, 320, 321  
  *calomorpha*, 317, 320, 321  
  *communis*, 314, 320, 321  
  *consobrina*  
    var. *emaciata*, 306, 307, 310  
  *costai*, 311, 320, 321  
  *decepta*, 311, 320, 321  
  *emaciata*, 310  
  *filiformis*, 306, 307, 314, 315  
  *hancocki*, 316, 320, 321  
  *jugosa*, 317, 320, 321  
  *mucronata*, 317, 320, 321  
  *soluta*, 315  
  *sp.*, 317, 320, 321  
  *subsoluta*, 306, 307, 315  
*Entosolenia*, 295, 334, 335  
  *squamosa*, 341  
  *williamsoni*, 362  
*Fronicularia*, 327  
  *californica*, 328, 330, 331  
  *gigas*, 327, 330, 331  
  *sagittula*, 328  
*Lagena*, 295, 329  
  *acuticosta*, 329, 330, 331, 362  
  *amphora*, 329, 330, 331  
  *apiculata*, 360  
    var. *punctulata*, 332, 333, 334  
  *aspera*, 332, 333, 334  
  *chasteri*, 332, 333, 335  
  *clavata*, 332, 333, 336  
  *costata*, 329, 332, 333, 335  
  *curvilineata*, 332, 333, 336, 341  
  *dentaliniformis*, 332, 333, 337  
  *desmophora*, 352  
  *distoma*, 332, 333, 337  
  *elongata*, 332, 333, 338  
  *fieldeniana*, 332, 333, 338  
  *filicosta*, 338, 346, 347  
  *flexa*, 339, 346, 347  
  *hispidula*, 334, 339, 346, 347  
  *implicata*, 340, 346, 347  
  *inepta*, 341, 346, 347  
  *laevis*, 341, 342, 346, 347  
    var., 342, 346, 347  
    var. *baggi*, 342, 346, 347  
  *perlucida*, 341, 342, 343, 348, 349  
    var., 343, 348, 349  
  *pliocenica*, 344, 348, 349  
    var. *discrepans*, 344, 348, 349  
    var. *timmsana*, 345, 348, 349  
  *plumigera*, 354  
  *semilineata*, 345, 348, 349  
  *sesquistriata*, 334, 340, 348, 349, 350  
  *spiralis*, 353  
  *striata*, 350, 356, 357  
  *striatopunctata*, 351, 354, 356, 357  
    var., 354, 356, 357  
    var. *cista*, 352, 356, 357  
    var. *complexa*, 351, 356, 357  
    var. *excentricitas*, 340, 352, 356, 357  
    var. *gemma*, 353, 356, 357  
    var. *spiralis*, 353, 356, 357  
    var. *tricosta*, 354, 356, 357  
  *submagnificata*, 355, 358, 359  
  *sulcata*, 355, 358, 359, 360  
    var. *apiculata*, 360  
    var. *laevicostata*, 358, 359, 361  
    var. *peculiaris*, 358, 359, 361  
    var. *spicata*, 358, 359, 360  
  *vulgaris*  
    var. *perlucida*, 343  
    *williamsoni*, 358, 359, 362  
*Lagenidae*, 295  
*Lageninae*, 329  
*Lenticulina*, 302  
  *peregrina*, 302, 304, 305  
*Marginulina*, 308, 317  
  *bracheii*, 306, 307, 309  
  *costata*, 311  
  *ensis*, 309  
  *glabra*, 306, 307, 308  
  *hancocki*, 306, 307, 309  
*Nodosaria*, 318  
  *calomorpha*, 313  
  *comatula*, 325  
  *costai*, 311  
  *decepta*, 311  
  (*Dentalina*) *consorbina*  
    var. *emaciata*, 310  
  *farcimen*, 313  
  *filiformis*, 314  
  *fiintii*, 319, 320, 321  
  *intercellularis*, 318, 320, 321  
  *obliqua*, 312, 319  
  *pauciloculata*, 322, 323, 324  
  *pauperata*, 313

- perversa*, 318, 320, 321
  - seminuda*, 312
  - soluta*, 315
  - sp.*, 320, 321, 324
  - subscalaris*, 319, 320, 321
  - subsoluta*, 316
  - vertebralis*, 312
- Nodosariinae, 295
- Planularia, 303
  - californica*, 303, 304, 305
  - planulata*, 303, 306, 307
- Pseudoglandulina, 325
  - comatula*, 322, 323, 325
  - laevigata*, 322, 323, 325
- Robulina limbosa*, 297
- Robulus*, 295, 297
- cultratus*, 296, 298, 299, 300, 301
    - var.*, 296
  - limbosus*, 297, 300, 301, 304, 305
  - occidentalis*
    - var. novangliae*, 295
  - orbicularis*, 296, 300, 301
  - strongi*, 295, 298, 299
- Saracenaria, 326
  - angularis*, 322, 323, 326
  - italica*, 326
  - sp.*, 322, 323, 327
- Vaginulina, 314, 327
  - exilis*, 322, 323, 327
  - linearis*, 311
  - obliquestriata*, 312
- Vermiculum perlucidum*, 342



508.3  
L87

INDEX

Allan Hancock Foundation Publications of The University of Southern California, Volume 6. Plate Illustrations are in bold face.



- abbreviata, Textularia, 116, **123**  
Textularia cf., 140  
Textularia agglutinans var., 129
- abyssorum, Astrorhiza, 32  
Rhabdammina, 31, **35**  
var. robusta, Rhabdammina, 32
- acanthia, Bulimina, 243, **254**
- acerosa var. pacifica, Bolivina, 185, **197**
- aculeata, Bulimina, 242  
Reussella, 251, 256
- acuta, Textularia, 118
- acuticosta, Lagena, 329, **331**, 362
- adelaidana, Bolivina marginata var., 200, **208**, 213
- advena, Bolivina, 186, **197**  
Eggerella, **76**, 95, 97  
Haplophragmoides, 72, 79  
Verneuilina, 95  
var. striatella, Bolivina, 187, **197**
- advenum, Haplophragmoides, **55**, 72
- aenariensis, Bolivina, 187, 189, 195, **197**
- aequa, Reussella, 251, **263**
- agglutinans, Ammobaculites, 90  
Textularia, 115, 117, **123**, 141  
forma jugosa, Textularia, 139  
var. abbreviata, Textularia, 129  
var. fistula, Textularia, 127
- agglutinatus, Reophax, **45**, 59
- agrestis, Angulogerina, **284**, 288  
Bolivina beyrichi var., 204
- albatrossi, Angulogerina, 277, 278, **283**, 286  
Bolivina, 188, **197**, **198**  
var. hirsuta, Angulogerina, 278, **283**, 288  
var. ornata, Angulogerina, 277, 278, **283**
- Ammobaculites, 83  
agglutinans, 90  
calcareus, 90  
cassis, **65**, 83, 89, 90  
catenulatus, **65**, 90  
foliaceus, **65**, 88  
ineptus, **65**, 89
- Ammodiscidae, 69
- Ammodiscus, 69, 71  
(Glomospira) gordialis, 71  
gordialis, 70  
minutissimus, **55**, 70, 71  
pacificus, **55**, 69, 70  
(Ammodiscus) gordialis, Trocham-
- mina, 70
- Ammofrondicularia, 68, 69  
angusta, 69  
compressa, **46**, 68
- amphora, Lagena, 329, **331**
- angularis, Saracenaria, **322**, 326
- Angulogerina, 257, 277  
agrestis, **284**, 288  
albatrossi, 277, 278, **283**, 286  
var. hirsuta, 278, **283**, 288  
var. ornata, 277, 278, **283**
- angulosa, 279, **283**, 289
- baggi, 281, **283**, 290, 293
- byramensis, 292
- carinata, 281, **283**, 287  
var. bradyana, **283**, 287  
var. vana, **283**, 286, 287
- fluens, **284**, 288
- hughesi, 281, **284**, 289, 290, 293  
var. picta, **284**, 290, 293
- occidentalis, **284**, 291
- semirigona, **284**, 292
- angulosa, Angulogerina, 279, **283**, 289  
Uvigerina, 259, 279, 287, 289, 291
- angusta, Ammofrondicularia, 69  
apiculata, Lagena, 360  
Lagena sulcata var., 360  
var. punctulata, Lagena, **332**, 334
- arenaria, Gaudryina, **66**, 91
- arenata, Gaudryina, 93  
Pseudarcella, **36**, 43
- argentea, Bolivina, 188, **198**, 212
- articulata, Polystomella, 171  
Textularia, 115, 118, **123**, 131
- articulatum, Elphidium, **165**, 171
- aspera, Lagena, **332**, 334
- Astacolus californicus, 303  
planulatus, 303
- Astrononion, 168  
stellatum, **156**, 168  
viragoense, **156**, 168
- Astrorhiza, 31  
abyssorum, 32  
hancocki, 31, **35**  
limicola, 31
- Astrorhizidae, 31
- astutia, Textularia, 116, 119, **123**
- atlantica, Gaudryina, 93  
Gaudryina (Pseudogaudryina), **66**, 93  
Textularia, 93  
var. pacifica, Gaudryina (Pseudogaudryina), **75**, 94

MAY 24 1955

- aura, Textularia, 119, **123**  
 auricula, Nonionella, **155**, 159, 161  
 auriculata, Bulimina, 249  
     Bulimina (Desinobulimina), 249, **263**  
 auris, Nonionina, 161  
 austriaca, Robertina, 240, **253**  
 bacheii, Marginulina, **306**, 309  
 baggi, Angulogerina, 281, **283**, 290, 293  
     Dentalina, 313, **321**  
     Lagena laevis var., 342, **347**  
     Uvigerina, 281  
 barbata, Bulimina, 248, **263**  
 barrettii, Textulariella, 97  
 basiloba, Nonionella, **156**, 162  
 basispinata, Nonion pizarrense var., 158  
 basispinatum, Nonion pizarrense var., **155**, **156**, 158  
 bassendorffensis, Buliminella, 236, **253**  
 beyrichi var. alata, Bolivina, 204  
 bicostata, Bolivina costata var., 195  
     Bolivina interjuncta var., 189, 195, **207**  
 Bifarina, 225  
     elongata, 221  
     hancocki, 225, **228**  
     pacifici, 225, **228**  
     zanzibarensis, 225, 230  
 Bolivina, 179, 185  
     acerosa var. pacifica, 185, **197**  
     advena, 186, **197**  
         var. striatella, 187, **197**  
     aenariensis, 187, 189, 195, **197**  
     albatrossi, 188, **197**, **198**  
     argentea, 188, **198**, 212  
     beyrichi var. alata, 204  
     bradyi, 190  
     bramlettei, 189, **198**  
     compacta, 188, 190, **207**  
     convallaria, 221  
     costata, 191, **207**  
         var. bicostata, 195  
         var. interjuncta, 194  
     doniezi, 192, **207**  
     goudkoffi, 192, **207**  
     imbricata, 193, **207**  
     interjuncta, 194, **207**  
         var. bicostata, 189, 195, **207**  
     laevigata, 195, **208**  
     limbata, 222, 223  
         var. costulata, 223  
     marginata var. adelaidana, 200, **208**, 213  
     mayori, 224  
     minuta, 201, **208**  
     paula, 202, **208**, 210  
     pisciformis, 201, **208**  
     plicata, 203, **208**  
     plicatella, 214  
     pseudobeyrichi, 190, 203, **217**  
     pseudoplicata, 204, 214, **217**  
     pygmaea, 204, **217**  
     quadrata, 205, **217**  
     rhomboidalis, 215  
     robusta var. compacta, 190  
     seminuda, 210, **217**  
         var. foraminata, 211  
         var. humilis, 211, **218**  
     sinuata, 193  
     spissa, 211, **218**  
     striatula, 212, **218**  
     subadvena, 212  
         var. serrata, 213, **218**, **227**  
         var. spissa, 211  
     subexcavata, 204, 214, **227**  
     textularioides, 188  
     tongi, 214  
         var. filocostata, 214, **227**  
     torqueata, 215, **227**  
     tortuosa, 220, **227**  
 bradyana, Angulogerina carinata var., **283**, 287  
     Listerella, **76**, 100  
     Uvigerina peregrina var., 266, **274**  
 bradyi, Bolivina, 190  
     Placopsilina, **86**, 112  
     Trifarina, **274**, 293  
 bramlettei, Bolivina, 189, **198**  
 brevior, Buliminella, 235, **253**  
 brownii, Cushmanella, 163  
 Bulimina, 242  
     acanthia, 243, **254**  
     aculeata, 242  
     auriculata, 249  
     barbata, 248, **263**  
     denudata, 245, **254**  
     (Desinobulimina) auriculata, 249, **263**  
     elegans, 242, 248  
         var. marginata, 246  
     elegantissima, 236  
     elongata, 242  
         var. subulata, 242, **254**  
     aff. elongata var. subulata, 242  
     etnea, 243  
     exilis var. tenuata, 248, **263**  
     fusiformis var. marginata, 247  
     gibba var. marginata, 247  
     marginata, 244, 245, 246, **254**  
     ovata, 242  
     pagoda var. denudata, 245  
         var. hebespinata, 244, **254**

- patagonica, 247  
   var. glabra, 247, **263**  
 presli var. marginata, 246  
 pseudotorta, 243, **254**  
 pulchella, 244, 245, 246  
 pupoides var. marginata, 246  
 pyrula, 249  
 serrata, 246  
 spinosa, 242  
 williamsoniana, 239  
**Buliminella**, 235  
   bassendorffensis, 236, **253**  
   brevior, 235, **253**  
   cf. *B. elegantissima*, 237  
   curta, 235, **253**  
   elegantissima, 236, **253**  
     var. limbosa, 238, **253**  
     var. tenuis, 238, **253**  
   parallela, 239, **253**  
   subfusiformis, 248  
     var. tenuata, 248  
**Buliminidae**, 185  
**Bulimininae**, 242  
**Buliminoides**, 239  
   williamsoniana, 239, **253**  
**bulia**, Placopsilina, 49  
   Pseudoplacopsilina, 49  
   Tholosina, **36**, 49  
 byramensis, Angulogerina, 292  
 calcareus, Ammobaculites, 90  
 californica, Dentalina cf., 312, **321**  
   Fronicularia, 328, **331**  
   Planularia, 303, **305**  
   Robertina, 241, **253**  
 californicus, Astacolus, 303  
 calomorpha, Dentalina cf., 317, **321**  
   Nodosaria, 313  
 calva, Textularia, 115, 120, **123**  
 canariensis, Haplophragmoides, 73  
   Uvigerina, 271  
   var. distoma, Uvigerina, 259  
   var. striata, Uvigerina, 261  
 candeiana, Textularia, 115, 120, **121**,  
   **123**  
   Textularia sagittula var., 121  
 carinata, Angulogerina, 281, **283**, 287  
   Trochammina, **86**, 109  
   var. bradyana, Angulogerina,  
   **283**, 287  
   var. vana, Angulogerina, **283**,  
   286, 287  
**Carterina**, 110,  
   spiculotesta, 110  
**Cassidulina charlottensis**, 241  
 cassis, Ammobaculites, **65**, 83, 89, 90  
   Haplophragmium, 83  
   Lituola, 83  
 catenulatus, Ammobaculites, **65**, 90  
 cenomana, Placopsilina, 112  
 charlottensis, Cassidulina, 241  
   Robertina, 241, **254**  
   Trochammina, **85**, 104  
 chasteri, Lagena, **332**, 335  
**Chrysalidinella**, 256  
   dimorpha, 256  
   spectabilis, 256, **264**  
 cista, Lagena striatopunctata var., 352,  
   **357**  
   clavata, Lagena, **332**, 336  
   clavigera, Hyperammina, 52  
   Clavulina communis, 100  
     var. pallida, 100  
 columbiense, Haplophragmoides, **55**,  
   72, 79, 83  
   var. evolutum, Haplophragmoides,  
   **55**, **56**, 73  
 comatula, Nodosaria, 325  
   Pseudoglandulina, **322**, 325  
 communis, Clavulina, 100  
   Dentalina cf., 314, **321**  
   Reophax, **45**, 68  
   var. pallida, Clavulina, 100  
 compacta, Bolivina, 188, 190, **207**  
   Bolivina robusta var., 190  
 complexa, Lagena striatopunctata var.,  
   351, **357**  
 compressa, Ammofrondicularia, **46**, 68  
   Proteonina, **35**, 42  
 concava var. heterostoma, Textularia,  
   139  
 conica, Textularia, 115, **124**, 126  
   var. corrugata, Textularia, 126  
 consecta, Textularia, 118  
 consobrina var. emaciata, Dentalina,  
   **306**, 310  
   var. emaciata, Nodosaria (Denta-  
   lina), 310  
 convallaria, Bolivina, 221  
 convallarium, Loxostoma, 221, **227**  
 corrugata, Textularia, **124**, 126, 141  
   conica var., 126  
 costai, Dentalina, 311, **321**  
   cf., 311  
   Nodosaria, 311  
 costata, Bolivina, 191, **207**  
   Lagena, 329, **332**, 335  
   Marginulina, 311  
   var. bicostata, Bolivina, 195  
   var. interjuncta, Bolivina, 194  
 costulata, Bolivina limbata var., 223  
   Loxostoma limbata var., 223  
 costulatum, Loxostoma limbatum var.,  
   223, **228**  
**Cribrigoësella**, 99  
   pacifica, **76**, 99  
   robusta, 99

- crispa*, Polystomella, 175  
*crispum*, Elphidium, **166**, 174, 177  
   var. *subcrispum*, Elphidium, **166**, 176  
*crispus*, Nautilus, 174  
*Cristellaria peregrina*, 302  
   *reniformis*, 303  
   *variabilis*, 302  
*cultratis*, Robulus cf., 296, **299**  
   var., Robulus cf., 296, **299**, **300**  
*curta*, Buliminella, 235, **253**  
*curtus*, Reophax, **36**, 58  
*curtirostrata*, Uvigerina peregrina var., 259, 266, **274**  
   *pigmea* var., 266  
*curvilineata*, Lagena, **332**, 336, 341  
*Cushmanella*, 163  
   *brownii*, 163  
   *primitiva*, **156**, 163  
*cushmani*, Uvigerina, 257, **273**  
*Cyclammina*, 90  
   *pusilla*, **66**, 90  
*Darbyella*, 295  
*decepta*, Dentalina, 311, **321**  
   *Nodosaria*, 311  
*decora*, Nonionella, **155**, 160  
*deltoidea*, Textularia, 129  
*Dentalina*, 310, 316, 327  
   *baggi*, 313, **321**  
   *californica*, 312, **321**  
   cf. *calomorpha*, 317, **321**  
   cf. *communis*, 314, **321**  
   *consobrina* var. *emaciata*, **306**, 310  
   *costai*, 311, **321**  
   cf. *costai*, 311  
   *decepta*, 311, **321**  
   *emaciata*, 310  
   *filiformis*, **306**, 314  
   *hancocki*, 316, **321**  
   cf. *jugosa*, 317, **321**  
   cf. *mucronata*, 317, **321**  
   *soluta*, 315  
   *subsolata*, **306**, 315  
   ?sp., 317, **321**  
 (Dentalina) *consobrina* var. *emaciata*,  
   *Nodosaria*, 310  
*dentaliniformis*, Lagena, **332**, 337  
   *Reophax*, **46**, 63  
*denudata*, Bulimina, 245, **254**  
   *pagoda* var., 245  
*depressulum* var. *matagordanum*,  
   Nonion, 145, **155**  
*depressus*, Reophax, **45**, 62  
 (Desinobulimina) *auriculata*, Buli-  
   mina, 249, **263**  
*desmophora*, Lagena, 352  
*diffflugiformis*, Proteonina, **35**, 39, 42  
   *Reophax*, 39, 41  
   *Saccamina*, 39  
   var. *lagenarium*, Proteonina, **35**,  
   40  
   var. *lagenarium*, Reophax, 41  
*diffflugiformis-lagenarium*, Proteonina,  
   41  
*dimorpha*, Chrysalidinella, 256  
*dirupta*, Uvigerina peregrina var., 259,  
   267, **274**  
*discorbis*, Trochammina, **85**, 106  
*discrepans*, Lagena pliocenica var.,  
   344, **348**  
*distoma*, Lagena, **332**, 337, 338  
   *Uvigerina canariensis* var., 259  
*doniezi*, Bolivina, 192, **207**  
*Eggerella*, 95  
   *advena*, **76**, 95, 97  
   *pusilla*, **76**, 96  
   *scabra*, 98  
*elegans*, Bulimina, 242, 248  
   *Plecanium*, 118  
   var. *marginata*, Bulimina, 246  
*elegantissima*, Bulimina, 236  
   *Buliminella*, 236, **253**  
   cf. *Buliminella*, 237  
   var. *limbosa*, *Buliminella*, 238,  
   **253**  
   var. *tenuis*, *Buliminella*, 238, **253**  
*elongata*, Bifarina, 221  
   *Bulimina*, 242  
   *Hyperammina*, 50, 51  
   *Lagena*, **332**, 338  
   *Marsipella*, 33, 52  
   *Textularia*, 118  
   var. *laevigata*, *Hyperammina*, 51  
   var. *subulata*, *Bulimina*, 242, **254**  
   var. *subulata*, *Bulimina* aff., 242  
*Elphidiella*, 177  
   *hannai*, **166**, 177  
*Elphidium*, 169  
   *articulatum*, **165**, 171  
   *crispum*, **166**, 174, 177  
   var. *subcrispum*, **166**, 176  
   *frigidum*, **165**, 171  
   *granulosum*, 172  
   *hannai*, 177  
   *hughesi*, 170  
   *incertum*, 170, 172  
   var. *lene*, **165**, 170  
   *pustulosum*, **166**, 176  
   *simplex*, **165**, 169  
   *spinatum*, **165**, 173, 174  
   var. *magnificum*, **166**, 173  
   *stimulum*, **166**, 174  
   *translucens*, **165**, 172  
   *tumidum*, **165**, 170  
   *emaciata*, Dentalina, 310  
   *consobrina* var., **306**, 310

- Nodosaria* (*Dentalina*) *consobrina* var., 310  
*ensis*, *Marginulina*, 309  
*Entosolenia*, 295, 334, 335  
*squamosa*, 341  
*williamsoni*, 362  
*espersoni*, *Textularia*, 136  
*etnea*, *Bulimina*, 243  
*evolutum*, *Haplophragmoides columbiense* var., 55, 56, 73  
*excellens*, *Uvigerina*, 258, 273  
*excentricitas*, *Lagena striatopunctata* var., 340, 352, 357  
*excentricus*, *Reophax*, 45, 60  
*exilis*, *Vaginulina*, 322, 327  
var. *tenuata*, *Bulimina*, 248, 263  
*farcimen*, *Nodosaria*, 313  
*fieldeniana*, *Lagena* cf., 332, 338  
*filacostata*, *Bolivina tongi* var., 214, 227  
*flicosta*, *Lagena* cf., 338, 347  
*filiformis*, *Dentalina*, 306, 314  
*Nodosaria*, 314  
*fistula*, *Textularia*, 124, 127  
*agglutinans* var., 127  
*Flabellamina*, 69  
*flexa*, *Lagena*, 339, 347  
*flintii*, *Goësella*, 76, 98, 99  
*Nodosaria*, 319, 321  
*fluens*, *Angulogerina*, 284, 288  
*foliacea*, *Textularia*, 124, 128  
var. *oceanica*, *Textularia*, 124, 128  
*foliaceum*, *Haplophragmium*, 88  
*foliaceus*, *Ammobaculites*, 65, 88  
*foraminata*, *Bolivina seminuda* var., 211  
*friabilis*, *Hyperammina*, 36, 50  
*frigidum*, *Elphidium*, 165, 171  
*Fronicularia*, 327  
*californica*, 328, 331  
*gigas*, 327, 331  
*sagittula*, 328  
*fusca*, *Psammosphaera*, 38  
var. *parva*, *Psammosphaera*, 38  
*fusifformis*, *Lituola*, 41  
*Proteonina*, 41  
*Reophax*, 41  
var. *marginata*, *Bulimina*, 247  
*Gaudryina*, 91, 94  
*arenaria*, 66, 91  
*arenata*, 93  
*atlantica*, 93  
*pauperata*, 66, 92  
(*Pseudogaudryina*) *atlantica*, 66, 93  
var. *pacifica*, 75, 94  
*rugosa*, 93  
*subglabrata*, 66, 92  
var., 66, 93  
*triangularis*, 91  
*gemma*, *Lagena striatopunctata* var., 353, 357  
*gibba* var. *marginata*, *Bulimina*, 247  
*gigas*, *Fronicularia*, 327, 331  
*glabra*, *Bulimina patagonica* var., 247, 263  
*Marginulina*, 306, 308  
*glabrella*, *Millettella*, 36, 43  
*Globobulimina*, 250  
*pacifica*, 250, 263  
*Glomospira*, 70  
*gordialis*, 55, 70  
(*Glomospira*) *gordialis*, *Ammodiscus*, 71  
*Goësella*, 98  
*flintii*, 76, 98, 99  
*parva*, 76, 98  
*rotundata*, 98  
*gordialis*, *Ammodiscus*, 70  
*Ammodiscus* (*Glomospira*), 71  
*Glomospira*, 55, 70  
*Gordiammina*, 71  
*Trochammina*, 70  
(*Ammodiscus*), 70  
*squamata* var., 70  
*Gordiammina gordialis*, 71  
*goudkoffi*, *Bolivina*, 192, 207  
*gramen*, *Textularia*, 124, 129  
*granulosum*, *Elphidium*, 172  
*grateloupi*, *Nonion*, 153, 155  
*Nonionina*, 153  
*hancocki*, *Astrorhiza*, 31, 35  
*Bifarina*, 225, 228  
*Dentalina*, 316, 321  
*Haplophragmoides*, 56, 79  
*Hopkinsina*, 276, 277, 283  
*Marginulina*, 306, 309  
*Nonion*, 155, 159  
*hannai*, *Elphidiella*, 166, 177  
*Elphidium*, 177  
*Haplophragmium cassis*, 83  
*foliaceum*, 88  
*lagenarium*, 40  
*latidorsatum*, 80  
*scitulum*, 78  
*subglobosum*, 80  
*Haplophragmoides*, 72  
*advena*, 72, 79  
*advenum*, 55, 72  
*canariensis*, 73  
*columbiense*, 55, 72, 79, 83  
var. *evolutum*, 55, 56, 73  
*hancocki*, 56, 79  
*planissima*, 78  
*planissimum*, 56, 78

- scitulum, **56**, 78  
 subglobosum, **56**, 80  
 subinvolutum, **65**, 83  
 tenuis, 82  
 tenuum, **65**, 82  
 trullissata, 81  
 trullissatum, **56**, 81, 83  
 veleronis, **65**, 82  
**harrisii**, Nouria, **86**, 112  
**hebespinata**, Bulimina pagoda var.,  
 244, **254**  
**heterostoma**, Textularia concava var.,  
 139  
**hirsuta**, Angulogerina albatrossi var.,  
 278, **283**, 288  
**hispidula**, Lagena, 334, 339, **347**  
**hootsi**, Uvigerina, 259, **273**  
**Hopkinsina**, 257, 276  
   hancocki, 276, 277, **283**  
   oceanica, 276, **283**  
**hughesi**, Angulogerina, 281, **284**, 289,  
 290, 293  
   Elphidium, 170  
   Uvigerina, 289  
   var. picta, Angulogerina, **284**,  
 290, 293  
**humilis**, Bolivina seminuda var., 211,  
**218**  
**Hyperammina**, 50  
   clavigera, 52  
   elongata, 50, 51  
     var. laevigata, 51  
   friabilis, **36**, 50  
   laevigata, 51  
   ramosa, 53  
   spiculifera, **36**, 52  
**Hyperamminidae**, 50  
   imbricata, Bolivina, 193, **207**  
   implicata, Lagena, 340, **347**  
   incertum, Elphidium, 170, 172  
     var. lene, Elphidium, **165**, 170  
   incilis, Uvigerina, 260, **273**  
   incisa, Nonion, 158  
     Nonionina, 158  
   incisum, Nonion, **155**, 158  
   indivisa, Rhizammina, 32  
   inepta, Lagena, 341, **347**  
     Rudigaudryina, **75**, 94, 95  
   ineptus, Ammobaculites, **65**, 89  
   inermis, Plecanium mariae var., 118  
   inflata, Rotalina, 102  
     Trochammina, **85**, 102, 105  
     var., Trochammina, 107  
   inflatus, Nautilus, 102  
   instabile, Loxostoma, 221, **227**, **228**  
   intercellularis, Nodosaria cf., 318, **321**  
   interjuncta, Bolivina, 194, **207**  
     Bolivina costata var., 194  
     var. bicostata, Bolivina, 189, 195,  
     **207**  
   italica, Saracenaria, 326  
   jacksonensis, Nonionella, 162  
   japonica var. mexicana, Nonionella,  
     **155**, 160  
   jugosa, Dentalina cf., 317, **321**  
     Textularia agglutinans forma, 139  
     sagittula var., 131  
   juncea, Uvigerina, 258  
   kellettae, Trochammina, **85**, 101  
   kernensis, Uvigerina, 261, **273**  
   laevicostata, Lagena sulcata var., **358**,  
     361  
   laevigata, Bolivina, 195, **208**  
     Hyperammina, 51  
       elongata var., 51  
     Pseudoglandulina, **322**, 325  
     Textularia variabilis var., 195  
   laevis, Lagena, 341, 342, **347**  
     var., Lagena, 342, **347**  
     var. baggi, Lagena, 342, **347**  
   Lagena, 295, 329  
   acuticosta, 329, **331**, 362  
   amphora, 329, **331**  
   apiculata, 360  
     var. punctulata, **332**, 334  
   aspera, **332**, 334  
   chasteri, **332**, 335  
   clavata, **332**, 336  
   costata, 329, **332**, 335  
   curvilineata, **332**, 336, 341  
   dentaliniformis, **332**, 337  
   desmophora, 352  
   distoma, **332**, 337, 338  
   elongata, **332**, 338  
   cf. fieldeniana, **332**, 338  
   cf. filicosta, 338, **347**  
   flexa, 339, **347**  
   hispidula, 334, 339, **347**  
   implicata, 340, **347**  
   inepta, 341, **347**  
   laevis, 341, 342, **347**  
     var., 342, **347**  
     var. baggi, 342, **347**  
   perlucida, 341, 342, 343, **348**  
     var., 343, **348**  
   plicocnica, 344, **348**  
   plicocnica var., discrepans, 344,  
   **348**  
     var. timmsana, 345, **348**  
   plumigera, 354  
   semilineata, 345, **348**  
   sesquistriata, 334, 340, **348**, 350  
   spiralis, 353  
   cf. striata, 350, **357**  
   striatopunctata, 351, 354, **357**  
     var., 354, **357**

- var. *cista*, 352, **357**  
 var. *complexa*, 351, **357**  
 var. *excentricitas*, 340, 352, **357**  
 var. *gemma*, 353, **357**  
 var. *spiralis*, 353, **357**  
 var. *tricosta*, 354, **357**  
*submagnifica*, 355, **358**  
*cf. sulcata*, 355, **358**  
*sulcata*, 360  
   var. *apiculata*, 360  
*sulcata* var. *laevicostata*, **358**, 361  
   var. *peculiaris*, **358**, 361  
   var. *spicata*, **358**, 360  
*vulgaris* var. *perlucida*, 343  
*williamsoni*, **358**, 362  
*lagenarium*, *Haplophragmium*, 40  
   *Proteonina difflugiformis* var., **35**, 40  
     *difflugiformis*, 41  
     *Reophax difflugiformis* var., 41  
*Lagenidae*, 295  
*Lageninae*, 329  
*lancea*, *Textularia*, **124**, 130  
*lanceolatum*, *Plecanium*, 118  
*latidorsatum*, *Haplophragmium*, 80  
   *Nonionina*, 80  
*lauta*, *Textularia*, 116, 130, **133**  
*lene*, *Elphidium incertum* var., **165**, 170  
*Lenticulina*, 302  
   *peregrina*, 302, **305**  
*limbata*, *Bolivina*, 222, 223  
   var. *costulata*, *Bolivina*, 223  
     *Loxostoma*, 223  
*limbatum*, *Loxostoma*, 222, **228**  
   var. *costulatum*, *Loxostoma*, 223, **228**  
*limbosa*, *Buliminella elegantissima* var., 238, **253**  
   *Robulina*, 297  
*limbosus*, *Robulus*, 297, **300**, **305**  
*limicola*, *Astrorhiza*, 31  
*linearis*, *Vaginulina*, 311  
*Listerella*, 100  
   *bradyana*, **76**, 100  
   *pallida*, **76**, 100  
*Lituola cassis*, 83  
   *fusiformis*, 41  
   *nautiloidea* var. *scorpiurus*, 42  
   *subglobosa*, 80  
*Lituolidae*, 72  
*lobata*, *Textularia*, 118  
*longicollis*, *Proteonina*, **35**, 42  
*Loxostoma*, 221  
   *convallarium*, 221, **227**  
   *instabile*, 221, **227**, **228**  
   *limbata* var. *costulata*, 223  
   *limbatum*, 222, **228**  
     var. *costulatum*, 223, **228**  
   *majori*, 222, 224, **228**  
*Loxostomum majori*, 224  
*lythostrota*, *Plecanium*, 131  
   *Textularia*, 115, 131, **133**  
*magnificum*, *Elphidium spinatum* var., **166**, 173  
*marginata*, *Bulimina*, 244, 245, 246, **254**  
   *elegans* var., 246  
   *fusiformis* var., 247  
   *gibba* var., 247  
*marginata*, *Bulimina presli* var., 246  
   *pupoides* var., 246  
   var. *adelaidana*, *Bolivina*, 200, **208**, 213  
*Marginulina*, 308, 317  
   *bacheii*, **306**, 309  
   *costata*, 311  
   *ensis*, 309  
   *glabra*, **306**, 308  
   *hancocki*, **306**, 309  
*mariae*, *Textularia*, 118  
   var. *inermis*, *Plecanium*, 118  
*Marsipella*, 33, 52  
   *elongata*, 33, 52  
*Marssonella*, 136  
*matagordanum*, *Nonion depressulum* var., 145, **155**  
*majori*, *Bolivina*, 224  
   *Loxostoma*, 222, 224, **228**  
   *Loxostomum*, 224  
*mexicana*, *Nonionella japonica* var., **155**, 160  
*Millettella*, 43  
   *glabella*, **36**, 43  
   *spinata*, **36**, 43  
*milletti*, *Spiroplectamma*, 131  
   *Textularia*, 131  
*minuta*, *Bolivina*, 201, **208**  
*minutissimus*, *Ammodiscus*, **55**, 70, 71  
*miocenica*, *Nonionella*, **156**, 161  
   var. *stella*, *Nonionella*, **156**, 162  
*moniliformis*, *Reophax*, 63  
*mucronata*, *Dentalina*, 317, **321**  
*nautiloidea* var. *scorpiurus*, *Lituola*, 42  
*Nautilus crispus*, 174  
   *inflatus*, 102  
*nitida*, *Trochamma*, **85**, 105  
*nodosa*, *Uvigerina*, 261, **273**  
*Nodosaria*, 318  
   *calomorpha*, 313  
   *comatula*, 325  
   *costai*, 311  
   *decepta*, 311  
   (*Dentalina*) *consobrina* var., *emaciata*, 310

- farcimen, 313  
 filiformis, 314  
 flintii, 319, **321**  
 cf. intercellularis, 318, **321**  
 obliqua, 312, 319  
 pauciloculata, **322**, 324  
 pauperata, 313  
 cf. perversa, 318, **321**  
 seminuda, 312  
 soluta, 315  
 subscalaris, 319, **321**  
 subsoluta, 316  
 vertebralis, 322  
 sp., **321**, 324  
 Nodosariinae, 295  
 nodulosa, Reophax, 61  
 Nonion, 145  
   depressulum var. matagordanum,  
   145, **155**  
   grateloupi, 153, **155**  
   hancocki, **155**, 159  
   incisa, 158  
   incisum, **155**, 158  
   pizarrense, 159  
     var. basispinata, 158  
     var. basispinatum, **155**, **156**,  
     158  
 Nonionella, 159, 163  
   auricula, **155**, 159, 161  
   basiloba, **156**, 162  
   decora, **155**, 160  
   jacksonensis, 162  
   japonica var. mexicana, **155**, 160  
   miocenica, **156**, 161  
     var. stella, **156**, 162  
   translucens, 163  
 Nonionidae, 145  
 Nonionina auris, 161  
   grateloupi, 153  
   incisa, 158  
   latidorsatum, 80  
   punctulata, 153  
 Nouria, 111  
   harrisii, **86**, 112  
   polymorphinoides, **86**, 111  
 novangliae, Robulus occidentalis var.,  
   295  
 obliqua, Nodosaria, 312, 319  
 obliquestriata, Vaginulina, 312  
 occidentalis, Angulogerina, **284**, 291  
   Uvigerina, 291  
   var. novangliae, Robulus, 295  
 oceanica, Hopkinsina, 276, **283**  
   Textularia foliacea var., **124**, 128  
 orbica, Textularia, 116, **133**, 136  
 orbicularis, Robulus, 296, **300**  
 ornata, Angulogerina albatrossi var.,  
   277, 278, **283**  
 ovata, Bulimina, 242  
 pacifica, Bifarina, 225, **228**  
   Bolivina acerosa var., 185, **197**  
   Cribrogoëssella, **76**, 99  
   Gaudryina (Pseudogaudryina) at-  
   lantica var., **75**, 94  
   Globobulimina, 250, **263**  
   Reussella, 251, **263**  
   Textulariella, **75**, 97  
   Trochammina, **85**, 103, 104, 105  
   var. simplex, Trochammina, **85**,  
   104  
 pacificus, Ammodiscus, **55**, 69, 70  
 pagoda var. denudata, Bulimina, 245  
   var. hebespinata, Bulimina, 244,  
   **254**  
 pallida, Clavulina communis var., 100  
   Listerella, **76**, 100  
 panamensis, Textularia, **133**, 136  
 parallela Buliminella, 239, **253**  
 parva, Goëssella, **76**, 98  
   Psammospaera, **35**, 38  
   fusca var., 38  
 patagonica, Bulimina, 247  
   var. glabra, Bulimina, 247, **263**  
 Patellina plicata, 109  
 pauciloculata, Nodosaria, **322**, 324  
 paula, Bolivina, 202, **208**, 210  
 pauperata, Gaudryina, **66**, 92  
   Nodosaria, 313  
 peculiaris, Lagena sulcata var., **358**,  
   361  
 Pelosina, 48  
   variabilis, **36**, 48  
 peregrina, Cristellaria, 302  
   Lenticulina, 302, **305**  
   Uvigerina, 266  
   var. bradyana, Uvigerina, 266,  
   **274**  
   var. curticoستا, Uvigerina, 259,  
   266, **274**  
   var. dirupta, Uvigerina, 259, 267,  
   **274**  
 perlucida, Lagena, 341, 342, 343, **348**  
   Lagena vulgaris var., 343  
   var., Lagena, 343, **348**  
 perlucidum, Vermiculum, 342  
 peruviana, Trochammina, 101  
 perversa, Nodosaria cf., 318, **321**  
 picta, Angulogerina hughesi var., **284**,  
   290, 293  
 pigmea, Uvigerina, 258, 266  
   var. curticoستا, Uvigerina, 266  
 pilulifer, Reophax, **46**, 68  
 pisciformis, Bolivina, 201, **208**  
 pizarrense, Nonion, 159  
   var. basispinata, Nonion, 158



- var. *basispinatum*, Nonion, **155**,  
**156**, 158
- Placopsilina*, 112  
*bradyi*, **86**, 112  
*bullata*, 49  
*cenomana*, 112
- Placopsiliniidae*, 112
- plaga*, *Textularia*, **133**, 137
- planissima*, *Haplophragmoides*, 78
- planissimum*, *Haplophragmoides*, **56**,  
 78
- Planularia*, 303  
*californica*, 303, **305**  
*planulata*, 303, **306**
- planulata*, *Planularia*, 303, **306**
- planulatus*, *Astacolus*, 303
- Plecanium elegans*, 118  
*lanceolatum*, 118  
*lythostrota*, 131  
*mariae* var. *inermis*, 118  
*rugosum*, 138  
*solita*, 142  
*spinulosum*, 118
- plicata*, *Bolivina*, 203, **208**  
*Patellina*, 109  
*Trochammina*, 109
- plicatella*, *Bolivina*, 214
- pliocenica*, *Lagena*, 344, **348**  
 var. *discrepans*, *Lagena*, 344, **348**  
 var. *timmsana*, *Lagena*, 345, **348**
- plumigera*, *Lagena*, 354
- polymorphinoides*, *Nouria*, **86**, 111
- Polystomella articulata*, 171  
*crispa*, 175
- polystropha*, *Verneuilina*, 95
- porrecta*, *Uvigerina*, 276
- presli* var. *marginata*, *Bulimina*, 246
- primitiva*, *Cushmanella*, **156**, 163
- proboscidea*, *Uvigerina*, 267, **274**  
 var. *vadescens*, *Uvigerina*, 268,  
**274**
- Proteonina*, 39  
*compressa*, **35**, 42  
*diffflugiformis*, **35**, 39, 42  
 var. *lagenarium*, **35**, 40  
*lagenarium*, 41  
*fusiformis*, 41  
*longicollis*, **35**, 42  
*sp.*, 33
- Psammosphaera*, 38  
*fusca*, 38  
 var. *parva*, 38  
*parva*, **35**, 38  
*rustica*, 39
- Pseudarcella*, 43  
*arenata*, **36**, 43
- pseudobeyrichi*, *Bolivina*, 190, 203, **217**  
 (*Pseudogaudryina*) *atlantica*, *Gaudryina*,  
*atlantica* var. *pacifica*, *Gaudryina*,  
**75**, 94
- Pseudoglandulina*, 325  
*comatula*, **322**, 325  
*laevigata*, **322**, 325
- Pseudoplacopsilina bulla*, 49
- pseudoplicata*, *Bolivina*, 204, 214, **217**
- pseudotorta*, *Bulimina*, 243, **254**
- pulchella*, *Bulimina*, 244, 245, 246
- punctulata*, *Lagena apiculata* var.,  
**332**, 334  
*Nonionina*, 153
- pupoides* var. *marginata*, *Bulimina*,  
 246
- pusilla*, *Cyclammina*, **66**, 90  
*Eggerella*, **76**, 96  
*Verneuilina*, 96
- pustulosum*, *Elphidium*, **166**, 176
- pygmaea*, *Bolivina*, 204, **217**
- pyrula*, *Bulimina*, 249
- quadrata*, *Bolivina*, 205, **217**
- ramosa*, *Hyperammina*, 53  
*Saccorhiza*, 53  
*Textularia*, 116, **133**, 138
- reniformis*, *Cristellaria*, 303
- Reophacidae*, 58
- Reophax*, 58, 59, 63, 111  
*agglutinatus*, **45**, 59  
*communis*, **45**, 68  
*curtus*, **36**, 58  
*dentaliniformis*, **46**, 63  
*depressus*, **45**, 62  
*diffflugiformis*, 39, 41  
 var. *lagenarium*, **41**  
*excentricus*, **45**, 60  
*fusiformis*, 41  
*moniliformis*, 63  
*nodulosa*, 61  
*pilulifer*, **46**, 68  
*scorpiurus*, **36**, 59  
*scottii*, **45**, 61, 63  
*spiculotestus*, **45**, 61  
*subfusiformis*, **45**, 62  
*sp.*, **45**, 63
- Reussella*, 251  
*aculeata*, 251, 256  
*aequa*, 251, **263**  
*pacifica*, 251, **263**
- Reussellinae*, 251
- Reussia spinulosa*, 251
- Rhabdammina*, 31  
*abyssorum*, 31, **35**  
 var. *robusta*, 32
- Rhabdogonium tricarinarum*, 293
- Rhizammina*, 32  
*indivisa*, 32

- sp., 32  
 Rhizamminidae, 32  
 rhomboidalis, Bolivina, 215  
 rigatus, Thameon, 175  
 Robertina, 240  
   austriaca, 240, **253**  
   californica, 241, **253**  
   charlottensis, 241, **254**  
 Robulina limbosa, 297  
 Robulus, 295, 297  
   cf. cultratus, 296, **299**  
     var., 296, **299, 300**  
   limbosus, 297, **300, 305**  
   occidentalis var. novangliae, 295  
   orbicularis, 296, **300**  
   strongi, 295, **299**  
 robusta, CribrogoëSELLA, 99  
   Rhabdammina abyssorum var., 32  
   var. compacta, Bolivina, 190  
 Rotalia spiculotesta, 110  
 rotaliformis, Trochammina, **86, 107,**  
   108, 109  
 Rotalina inflata, 102  
 rotundata, GoëSELLA, 98  
 Rudigaudryina, 94  
   inepta, 75, 94, 95  
 rugosa, Gaudryina, 93.  
   Textularia, **134, 138**  
 rugosum, Plecanium, 138  
 rustica, Psammosphaera, 39  
 Saccammina, 39  
   diffflugiformis, 39  
   sphaerica, 39  
 Saccaminidae, 38  
 Saccorhiza, 53  
   ramosa, 53  
 sagittula, Frondicularia, 328  
   var. candeiana, Textularia, 121  
   var. jugosa, Textularia, 131  
 Saracenaria, 326  
   angularis, **322, 326**  
   italica, 326  
   sp., **322, 327**  
 saulcyana, Textularia, 115, **134, 139**  
 scabra, Eggerella, 98  
 schencki, Textularia, **134, 140**  
 scitulum, Haplophragmium, 78  
   Haplophragmoides, **56, 78**  
 scoriurus, Lituola nautiloidea var., 42  
   Reophax, **36, 59**  
 scottii, Reophax, **45, 61, 63**  
 scrupula, Textularia, **134, 141**  
 secasensis, Textularia, **134, 141**  
 segundoensis, Uvigerina, 269, **274**  
 semilineata, Lagena, 345, **348**  
 seminuda, Bolivina, 210, **217**  
   Nodosaria, 312  
   Virgulina, 185, **197**  
   var. foraminata, Bolivina, 211  
   var. humilis, Bolivina, 211, **218**  
 semitrigona, Angulogerina, **284, 292**  
   Uvigerina, 292  
 senticosa, Uvigerina, 258, 269, **274**  
 serrata, Bolivina subadvena var., 213,  
   **218, 227**  
   Bulimina, 246  
 sesquistriata, Lagena, 334, 340, **348,**  
   350  
 simplex, Elphidium, **165, 169**  
   Trochammina pacifica var., **85,**  
   104  
 sinuata, Bolivina, 193  
 Siphogenerina, 271  
 solita, Plecanium, 142  
   Textularia, **134, 142**  
 soluta, Dentalina, 315  
   Nodosaria, 315  
 spectabilis, Chrysalidinella, 256, **264**  
 sphaerica, Saccammina, 39  
 spicata, Lagena sulcata var., **358, 360**  
 spiculifera, Hyperammina, **36, 52**  
 spiculotesta, Carterina, 110  
   Rotalia, 110  
 spiculotestus, Reophax, **45, 61**  
 spinata, Millettella, **36, 43**  
 spinatum, Elphidium, **165, 173, 174**  
   var. magnificum, Elphidium, **166,**  
   173  
 spinosa, Bulimina, 242  
 spinulosa, Reussia, 251  
 spinulosum, Plecanium, 118  
 spiralis, Lagena, 353  
   striatopunctata var., 353, **357**  
 Spiroplectammina, 131  
   milletti, 131  
 spissa, Bolivina, 211, **218**  
   subadvena var., 211  
 squamata var. gordialis, Trocham-  
   mina, 70  
 squamiformis, Trochammina, **86, 108**  
 squamosa, Entosolenia, 341  
 stella, Nonionella miocenica var., **156,**  
   162  
 stellatum, Astrononion, **156, 168**  
 stimulum, Elphidium, **166, 174**  
 striata, Lagena cf., 350, **357**  
   Uvigerina canariensis var., 261  
 striatella, Bolivina advena var., 187,  
   **197**  
 striatopunctata, Lagena, 351, 354, **357**  
   var., Lagena, 354, **357**  
   var. cista, Lagena, 352, **357**  
   var. complexa, Lagena, 351, **357**  
   var. excentricitas, Lagena, 340,  
   352, **357**  
   var. gemma, Lagena, 353, **357**

- var. *spiralis*, *Lagena*, 353, **357**  
 var. *tricosta*, *Lagena*, 354, **357**  
*striatula*, *Bolivina*, 212, **218**  
*strongi*, *Robulus*, 295, **299**  
*subadvena*, *Bolivina*, 212  
   var. *serrata*, *Bolivina*, 213, **218**,  
   **227**  
   var. *spissa*, *Bolivina*, 211  
*subcrispum*, *Elphidium crispum* var.,  
**166**, 176  
*subexcavata*, *Bolivina*, 204, 214, **227**  
*subfusiformis*, *Buliminella*, 248  
   *Reophax*, **45**, 62  
   var. *tenuata*, *Buliminella*, 248  
*subglabrata*, *Gaudryina*, **66**, 92  
   var., *Gaudryina*, **66**, 93  
*subglobosa*, *Lituola*, 80  
*subglobosum*, *Haplophragmium*, 80  
   *Haplophragmoides*, **56**, 80  
*subinvolutum*, *Haplophragmoides*, **65**,  
   83  
*submagnifica*, *Lagena*, 355, **358**  
*subperegrina*, *Uvigerina*, 260, 270, **274**  
*subscalaris*, *Nodosaria*, 319, **321**  
*subsoluta*, *Dentalina*, **306**, 315  
   *Nodosaria*, 316  
*subulata*, *Bulimina* aff. *elongata* var.,  
   242  
     *elongata* var., 242, **254**  
*sulcata*, *Lagena* cf., 355, **358**  
   *Lagena*, 360  
   var. *apiculata*, *Lagena*, 360  
   var. *laevicostata*, *Lagena*, **358**,  
   361  
   var. *peculiaris*, *Lagena*, **358**, 361  
   var. *spicata*, *Lagena*, **358**, 360  
*tenuata*, *Bulimina exilis* var., 248, **263**  
   *Buliminella subfusiformis* var., 248  
*tenuis*, *Buliminella elegantissima* var.,  
   238, **253**  
   *Haplophragmoides*, 82  
*tenuum*, *Haplophragmoides*, **65**, 82  
*textilarioides*, *Bolivina*, 188  
*Textularia*, 140  
   *abbreviata*, 116, **123**  
   cf. *abbreviata*, 140  
   *acuta*, 118  
   *agglutinans*, 115, 117, **123**, 141  
     *forma jugosa*, 139  
     var. *abbreviata*, 129  
     var. *fistula*, 127  
   *articulata*, 115, 118, **123**, 131  
   *astutia*, 116, 119, **123**  
   *atlantica*, 93  
   *aura*, 199, **123**  
   *calva*, 115, 120, **123**  
   *candeiana*, 115, 120, 121, **123**  
   *concava* var. *heterostoma*, 139  
   *conica*, 115, **124**, 126  
     var. *corrugata*, 126  
   *consecta*, 118  
   *corrugata*, **124**, 126, 141  
   *deltoides*, 129  
   *elongata*, 118  
   *espersoni*, 136  
   *fistula*, **124**, 127  
   *foliacea*, **124**, 128  
     var. *oceanica*, **124**, 128  
   *gramen*, **124**, 129  
   *lancea*, **124**, 130  
   *lauta*, 116, 130, **133**  
   *lobata*, 118  
   *lythostrota*, 115, 131, **133**  
   *mariae*, 118  
   *milletti*, 131  
   *orbica*, 116, **133**, 136  
   *panamensis*, **133**, 136  
   *plaga*, **133**, 137  
   *ramosa*, 116, **133**, 138  
   *rugosa*, **134**, 138  
   *sagittula* var. *candeiana*, 121  
     var. *jugosa*, 131  
   *saulecyana*, 115, **134**, 139  
   *schlencki*, **134**, 140  
   *scrupula*, **134**, 141  
   *secasensis*, **134**, 141  
   *solita*, **134**, 142  
   *trochus*, 136  
   *variabilis* var. *laevigata*, 195  
   *vola*, 116, **134**, 142  
*Textulariella*, 97  
   *barrettii*, 97  
   *pacifica*, **75**, 97  
*Textulariidae*, 115  
*Themeon rigatus*, 175  
*Tholosina*, 49  
   *bullata*, **36**, 49  
*timmsana*, *Lagena pliocenica* var., **345**,  
   **348**  
*tongi*, *Bolivina*, 214  
   var. *filacostata*, *Bolivina*, 214, **227**  
*torqueata*, *Bolivina*, 215, **227**  
*tortuosa*, *Bolivina*, 220, **227**  
*translucens*, *Elphidium*, **165**, 172  
   *Nonionella*, 163  
   *triangularis*, *Gaudryina*, 91  
*tricarinata*, *Triplasia*, 294  
   *Vaginulina*, 293, 294  
*tricarinatum*, *Rhabdogonium*, 293  
*tricosta*, *Lagena striatopunctata* var.,  
   354, **357**  
*Trifarina*, 257, 293  
   *bradyi*, **274**, 293  
*Triplasia tricarinata*, 294  
*triquetra*, *Verneuilina*, 93

- Trochammina**, 101  
 (*Ammodiscus*) *gordialis*, 70  
*carinata*, **86**, 109  
*charlottensis*, **85**, 104  
*discorbis*, **85**, 106  
*gordialis*, 70  
*inflata*, **85**, 102, 105  
   var., 107  
*kellettae*, **85**, 101  
*nitida*, **85**, 105  
*pacifica*, **85**, 103, 104, 105  
   var. *simplex*, **85**, 104  
*peruviana*, 101  
*plicata*, 109  
*rotaliformis*, **86**, 107, 108, 109  
*squamata* var. *gordialis*, 70  
*squamiformis*, **86**, 108  
*trullissata*, 81  
*vesicularis*, **86**, 106, 107
- Trochamminidae**, 101  
*trochus*, *Textularia*, 136  
*trullissata*, *Haplophragmoides*, 81  
   *Trochammina*, 81  
*trullissatum*, *Haplophragmoides*, **56**,  
 81, 83  
*tumidum*, *Elphidium*, **165**, 170
- Turriliniinae**, 235
- uncinata*, *Uvigerina*, 270, **274**
- Uvigerina**, 257, 267  
*angulosa*, 259, 279, 287, 289, 291  
*baggi*, 281  
*canariensis*, 271  
   var. *distoma*, 259  
   var. *striata*, 261  
*cushmani*, 257, **273**  
*excellens*, 258, **273**  
*hootsi*, 259, **273**  
*hughesi*, 289  
*incilis*, 260, **273**  
*juncea*, 258  
*kernensis*, 261, **273**  
*nodosa*, 261, **273**  
*occidentalis*, 291  
*peregrina*, 266  
   var. *bradyana*, 266, **274**  
   var. *curticosta*, 259, 266, **274**  
   var. *dirupta*, 259, 267, **274**  
   *pigmea*, 258, 266  
     var. *curticosta*, 266  
   *porrecta*, 276  
   *proboscidea*, 267, **274**  
     var. *vadescens*, 268, **274**  
   *segundoensis*, 269, **274**  
   *semitrigona*, 292  
   *senticosa*, 258, 269, **274**  
   *subperegrina*, 260, 270, **274**  
   *uncinata*, 270, **274**  
   sp., 258, 271, **274**
- Uvigeriniinae**, 257  
*vadescens*, *Uvigerina* *proboscidea* var.,  
 268, **274**
- Vaginulina**, 314, 327  
*exilis*, **322**, 327  
*linearis*, 311  
*obliquestriata*, 312  
*tricarinata*, 293, 294
- Valvulinidae**, 95  
*vana*, *Angulogerina* *carinata* var.,  
**283**, 286, 287  
*variabilis*, *Cristellaria*, 302  
   *Pelosina*, **36**, 48  
   var. *laevigata*, *Textularia*, 195  
*veleronis*, *Haplophragmoides*, **65**, 82  
*Vermiculum* *perlucidum*, 342  
*Verneuilina* *advena*, 95  
   *polystropha*, 95  
   *pusilla*, 96  
   *triquetra*, 93  
*Verneuilinidae*, 91  
*vertebralis*, *Nodosaria*, 312  
*vesicularis*, *Trochammina*, **86**, 106,  
 107  
*viragoense*, *Astrononion*, **156**, 168  
*Virgulina*, 185  
   *seminuda*, 185, **197**
- Virgulininae**, 185  
*vola*, *Textularia*, 116, **134**, 142  
*vulgaris* var. *perlucida*, *Lagena*, 343  
*williamsoni*, *Entosolenia*, 362  
   *Lagena*, **358**, 362  
*williamsoniana*, *Bulimina*, 239  
   *Buliminoides*, 239, **253**  
*zanzibarensis*, *Bifarina*, 225, 230













SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01379 4987