

THE SPECIES OF *BULIMINA* AND RELATED GENERA IN
THE COLLECTIONS OF THE
ALLAN HANCOCK FOUNDATION

(PLATES 29-36)

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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 N NW 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 N NW 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	¼ 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 Isl	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 SE 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 SExE 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 SExS 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 *Turrilinae*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.

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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, $34^{\circ} 00' 20''$ N.; $119^{\circ} 01' 20''$ W., $10\frac{3}{4}$ 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.

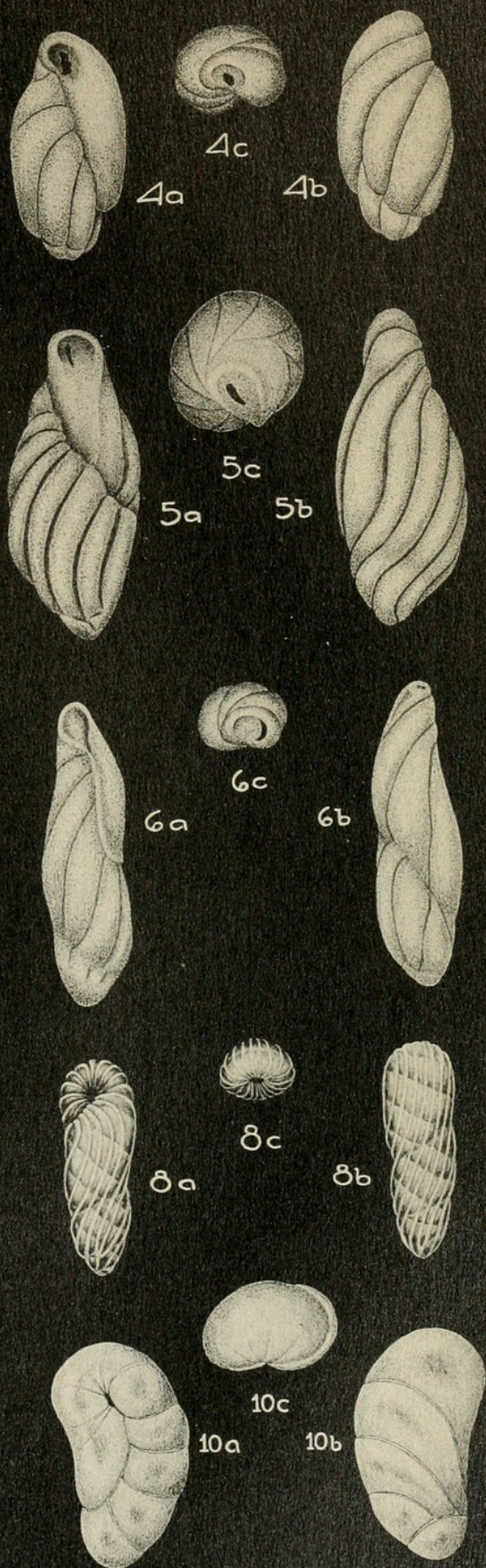
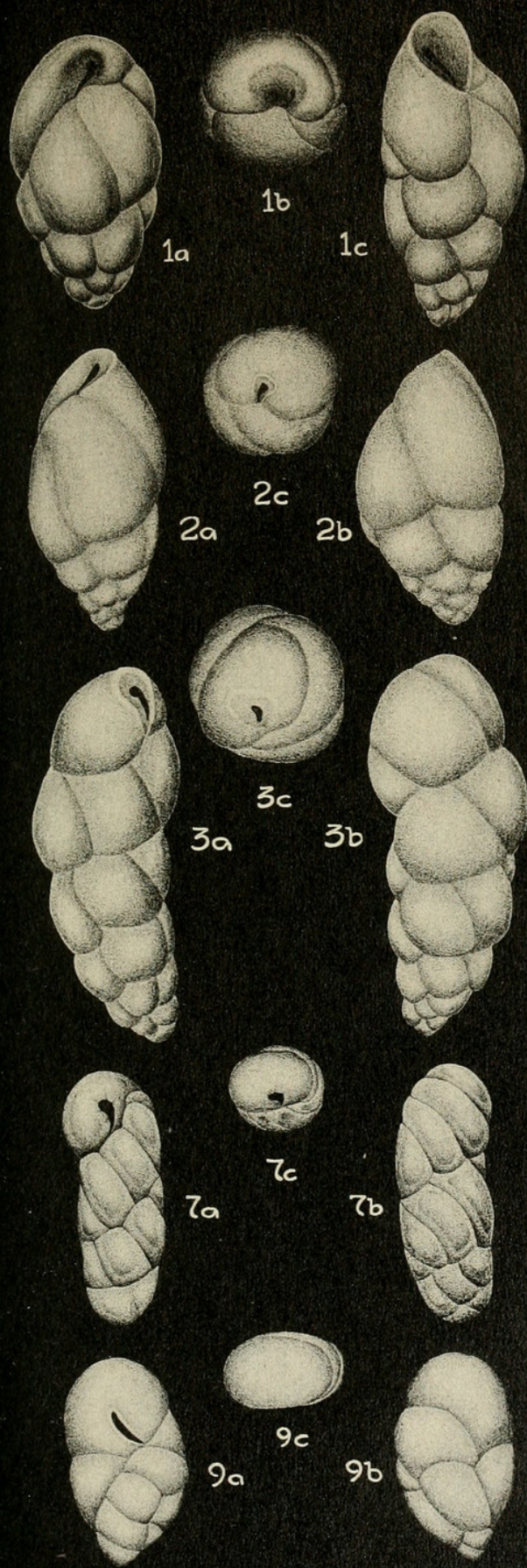
Test triserial, with the early portion increasing rapidly in diameter, the adult usually with the sides nearly parallel, sides flattened or very slightly concave, periphery acute but not distinctly keeled, usually entire but occasionally with a slight projection at the outer edge of the base of the chamber but not spinose; chambers distinct, not inflated, increasing very gradually in height as added in the adult portion; sutures distinct,

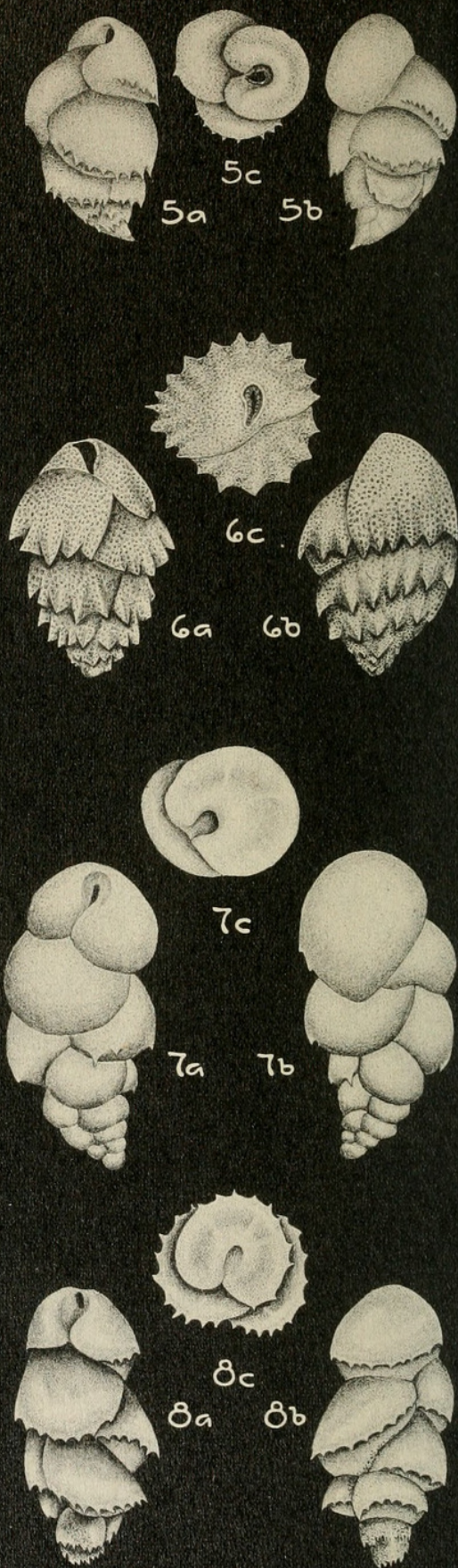
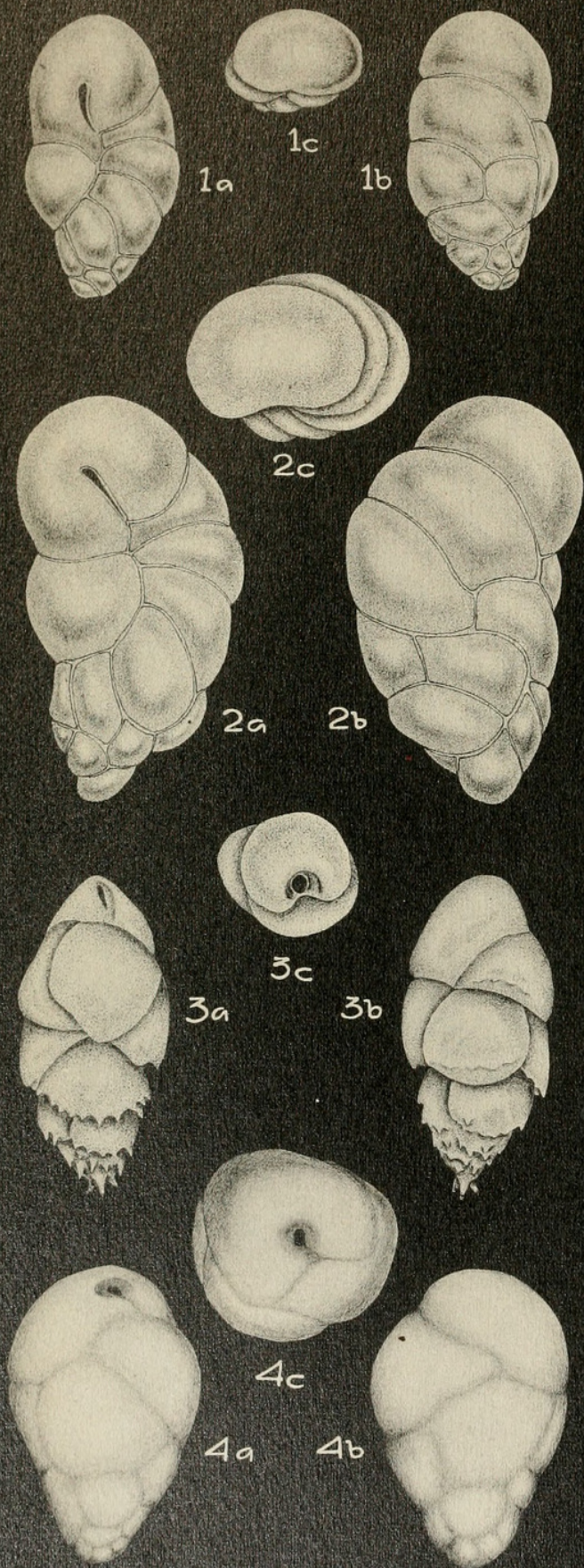
All illustrations were made by Miss Mary E. Taylor.

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 bassendorffensis* 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 pseudotorta* 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*¹

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 species¹

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

¹ 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. pigmaea* 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.

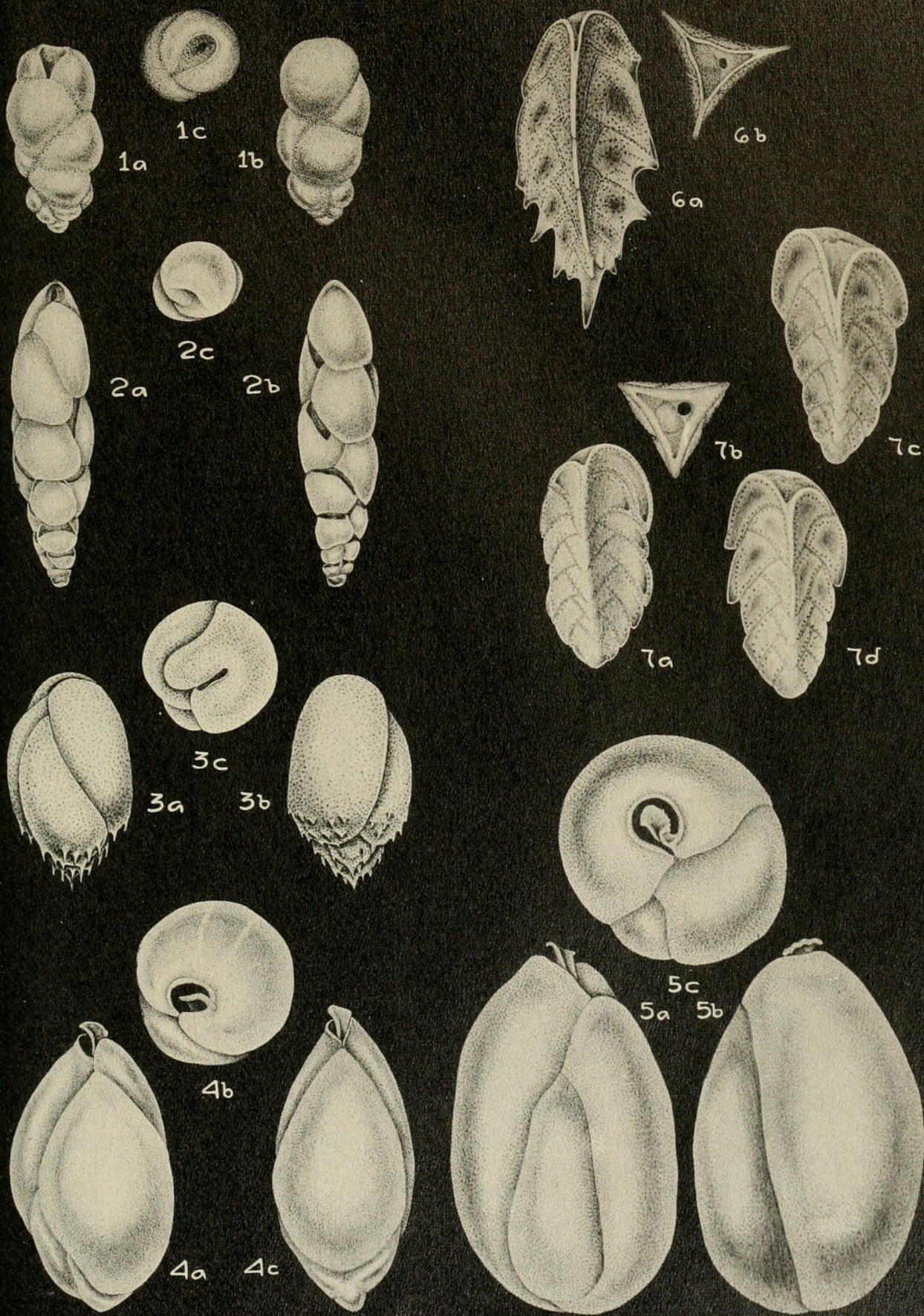
This species, based on Soldani's figures, was described from the Adriatic, and has not been recorded elsewhere.

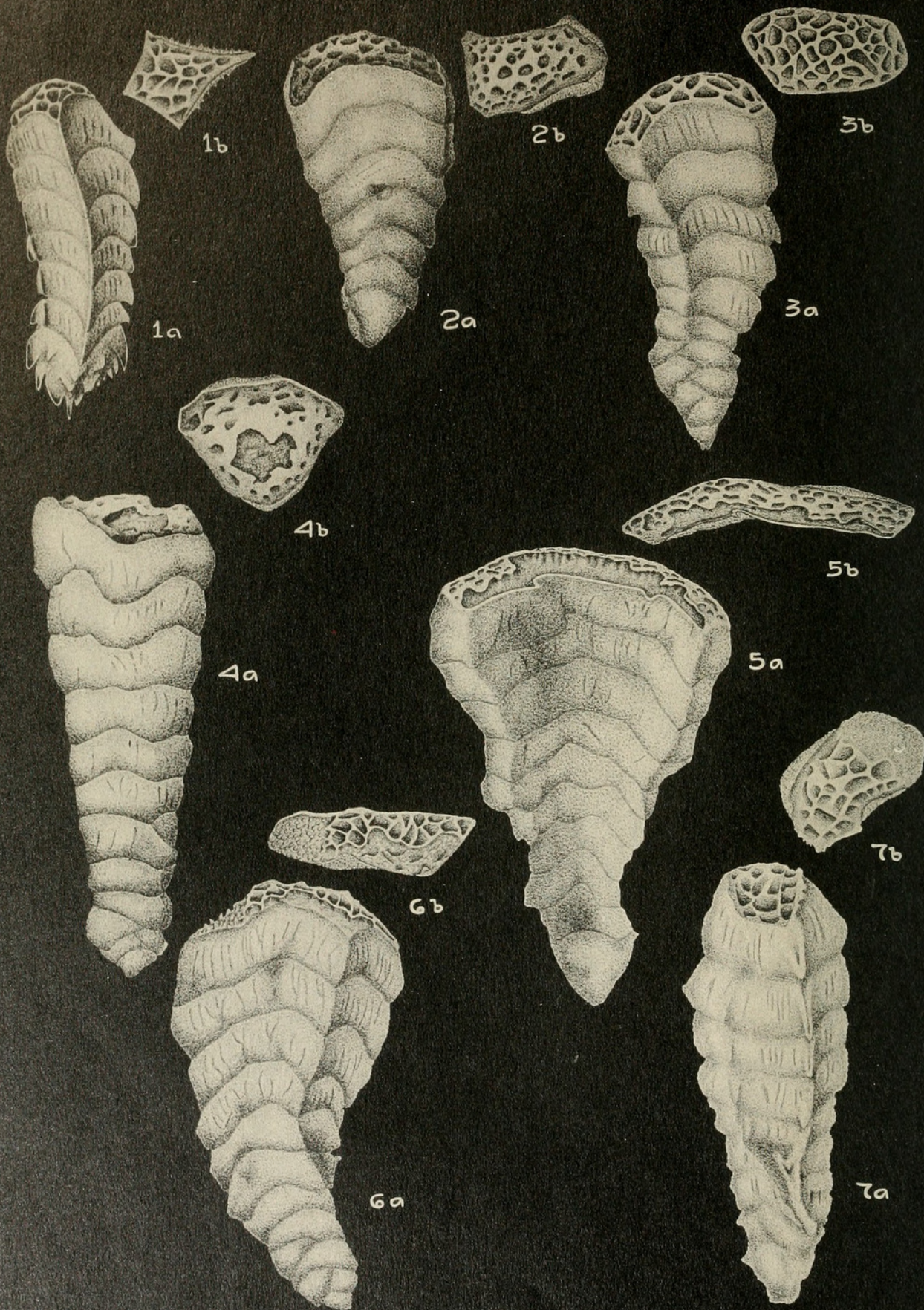
Distribution.—A number of specimens which appear to belong here were found in the Hancock material from Gibraltar (Station 648) and a single specimen from Port Said (Station 634).

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 4½ 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.

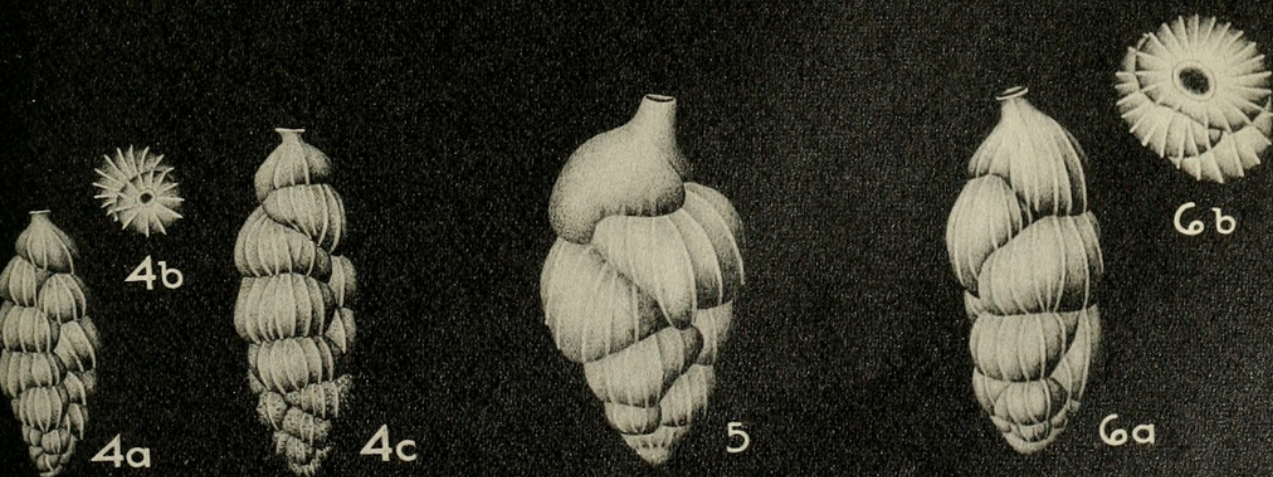
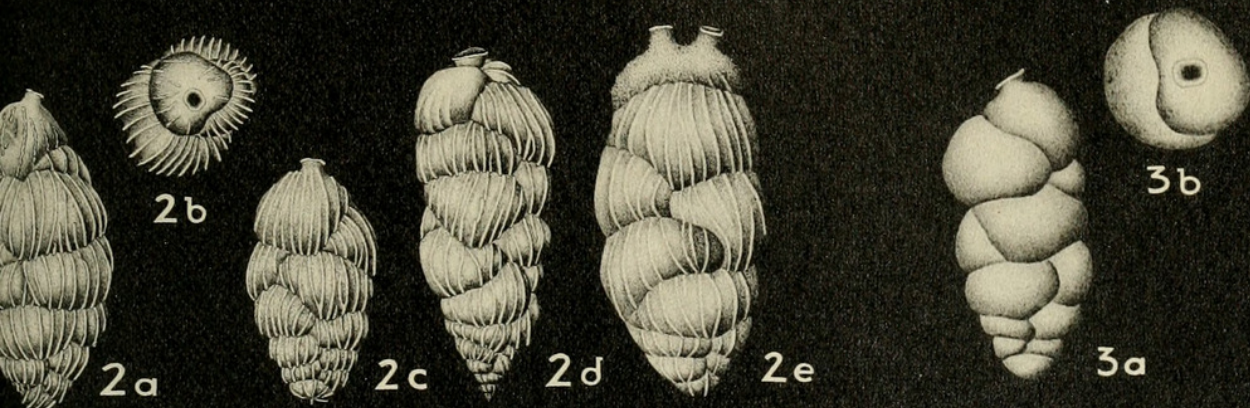
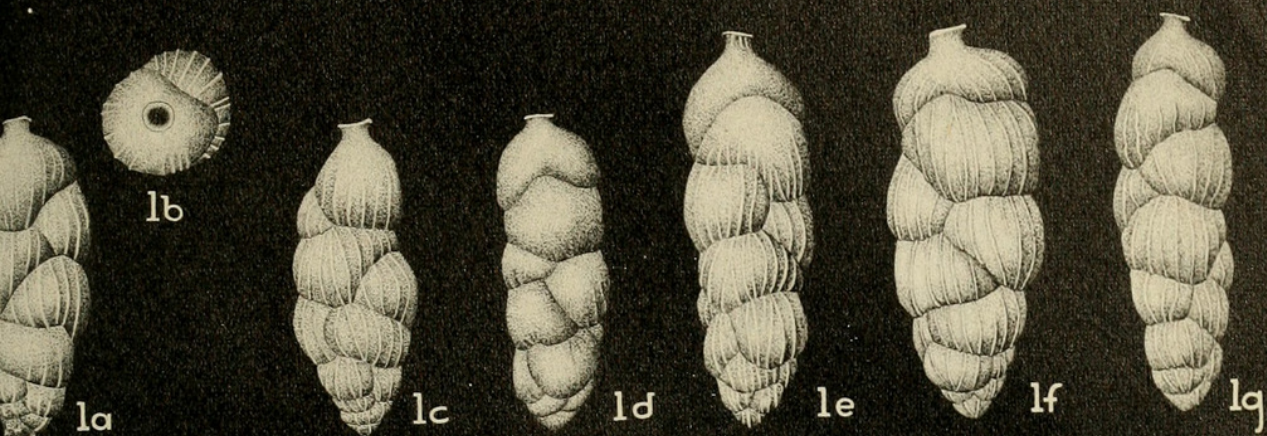
This species seems to be undescribed. It occurs at only two stations: 1150 and 1243, and with too few specimens available for adequate description.

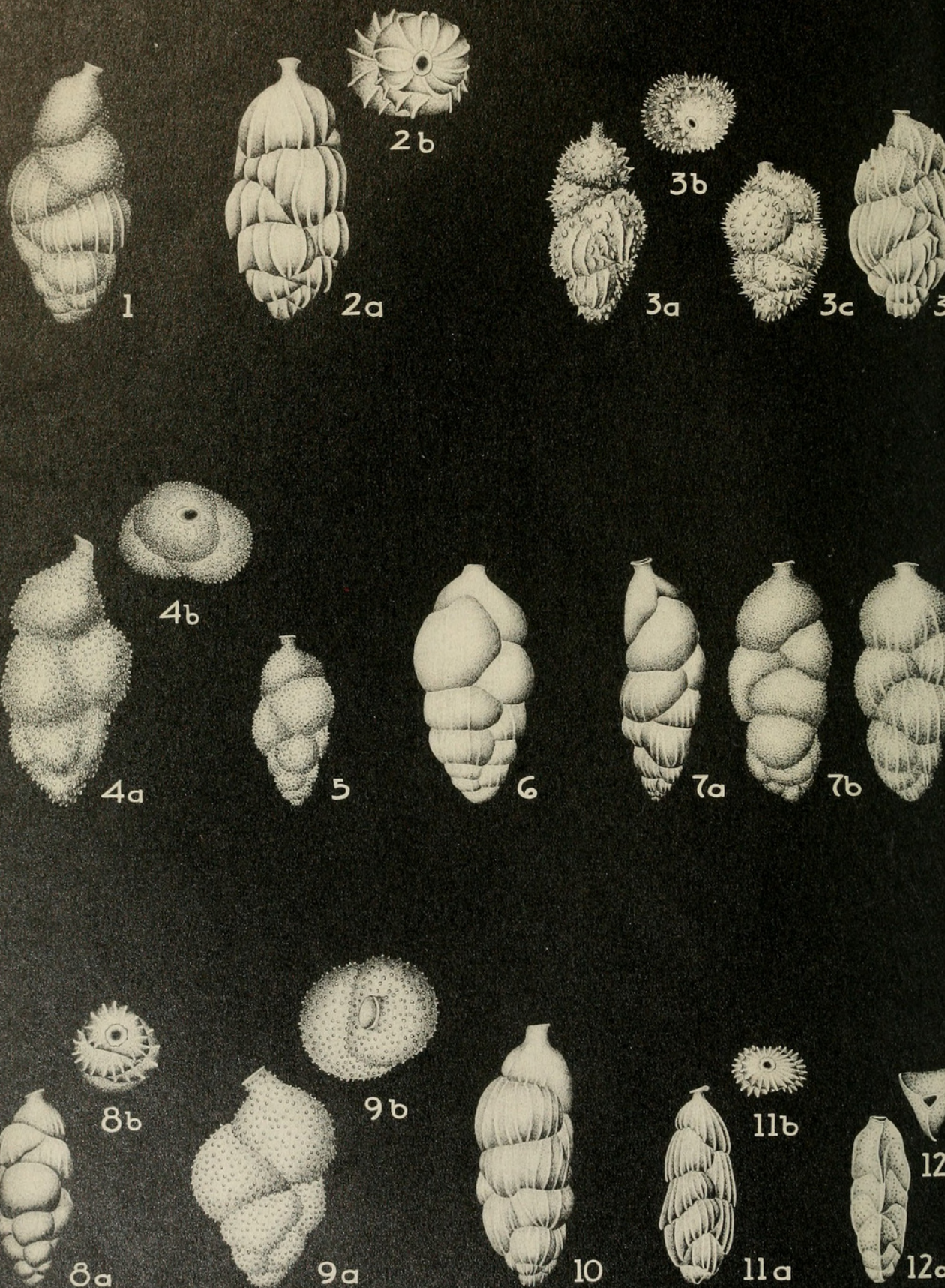
Distribution.—These stations are Point Dume in 47 fms and off Long Point, Catalina Island in 228 fms.

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.—Thalmann, 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

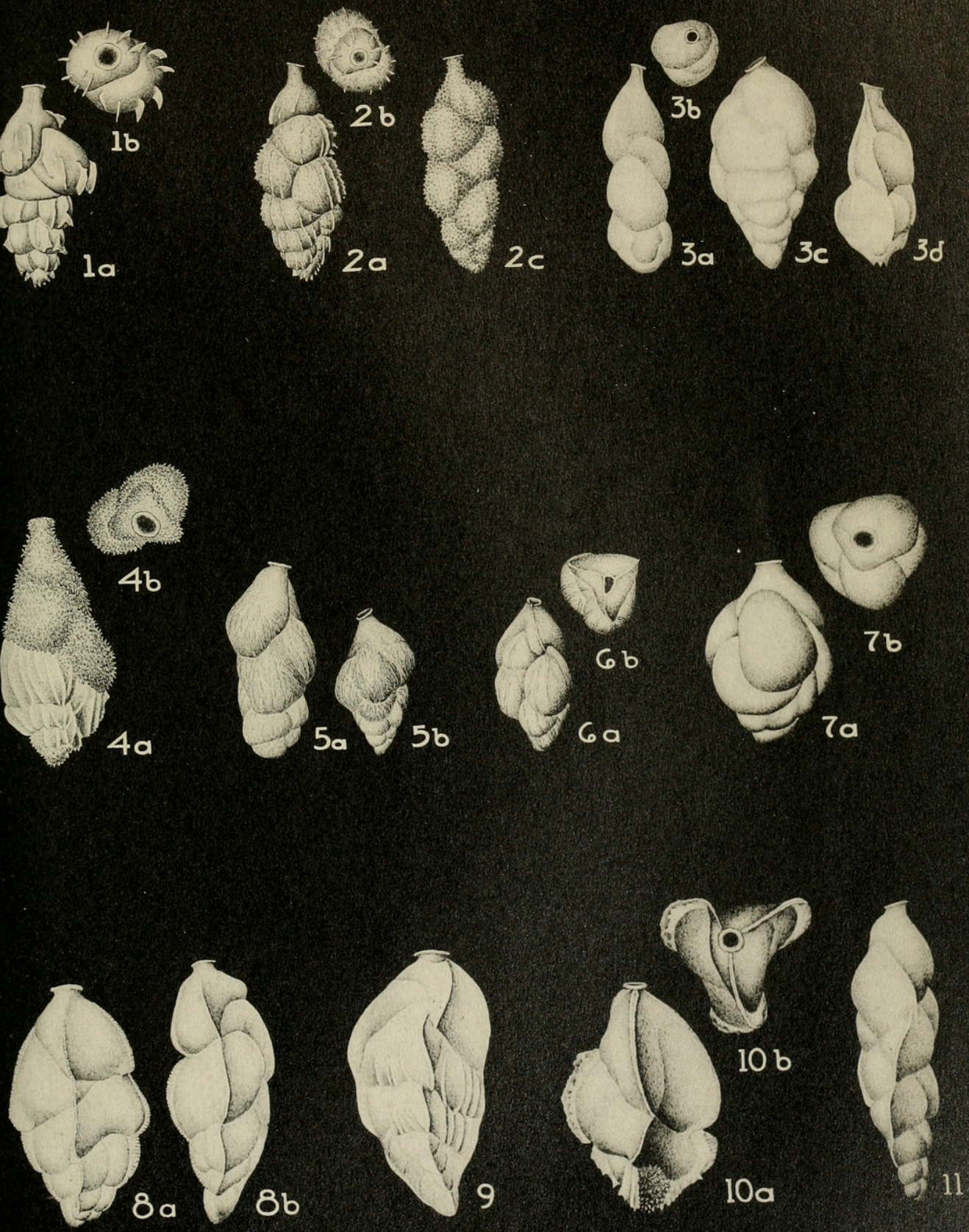
Plate 35, Figs. 8, 11

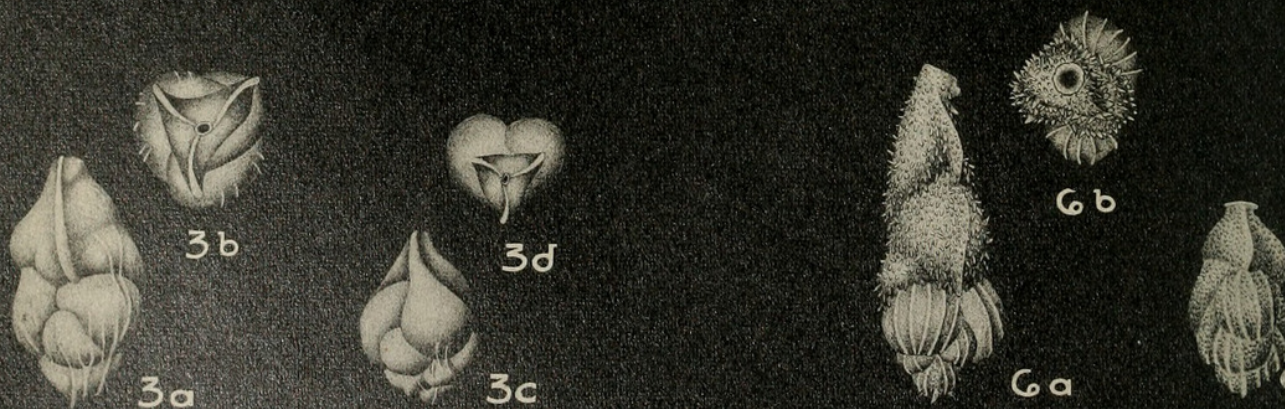
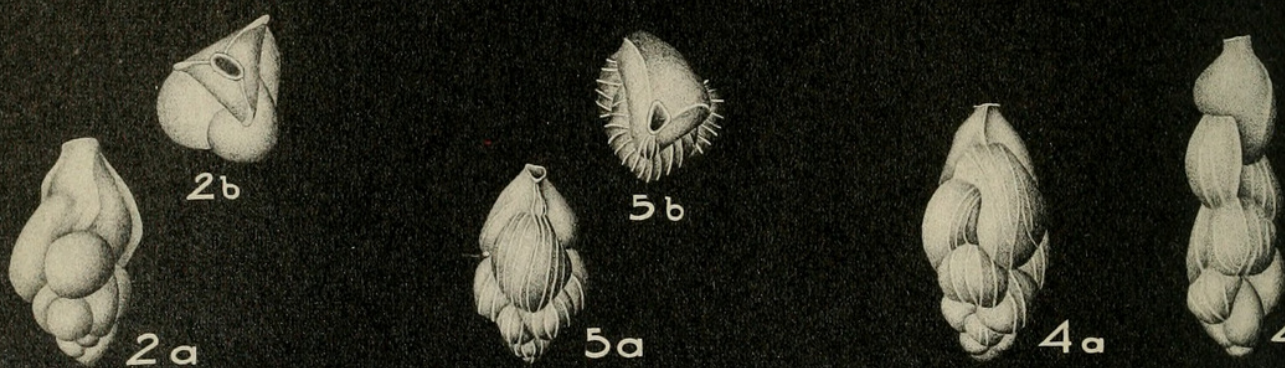
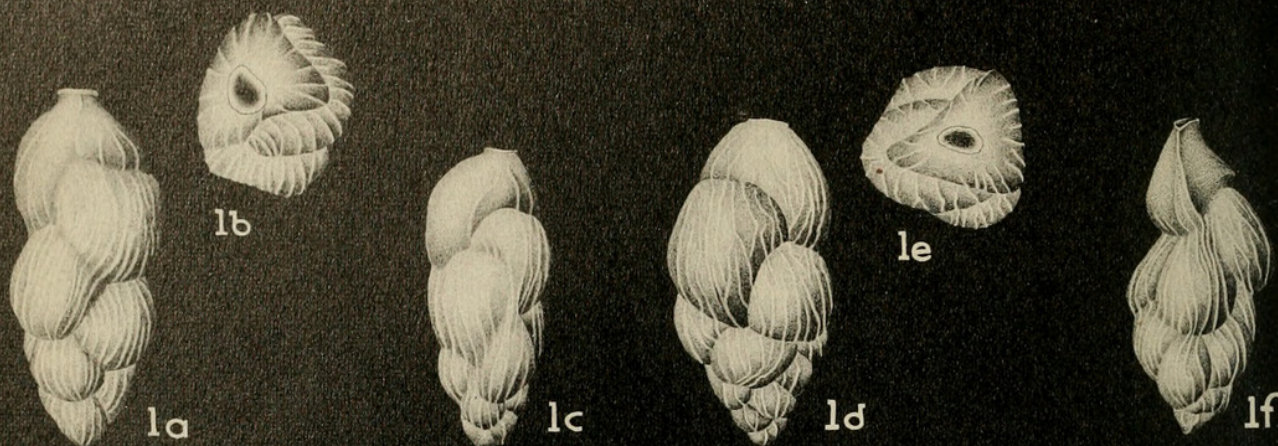
Angulogerina carinata Cushman, Bull. Scripps Instit. Oceanography, Tech. Ser., vol. 1, No. 10, 1927, p. 159, pl. 4, fig. 3; Contr. Cushman Lab. Foram. Res., vol. 8, 1932, p. 44, pl. 6, figs. 7, 8.—Coryell and Mossman, Journ. Pal., vol. 16, 1942, p. 245, pl. 36, fig. 56.

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. $18^{\circ} 33' 30''$ N., Long. $114^{\circ} 44' 00''$ 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.—Thalman, 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.



Cushman, Joseph A. and McCulloch, Irene Agnes. 1948. "The species of Bulimina and related genera in the collections of the Allan Hancock Pacific Foundation." *Allan Hancock Pacific expeditions. [Reports]* 6, 231–294.

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