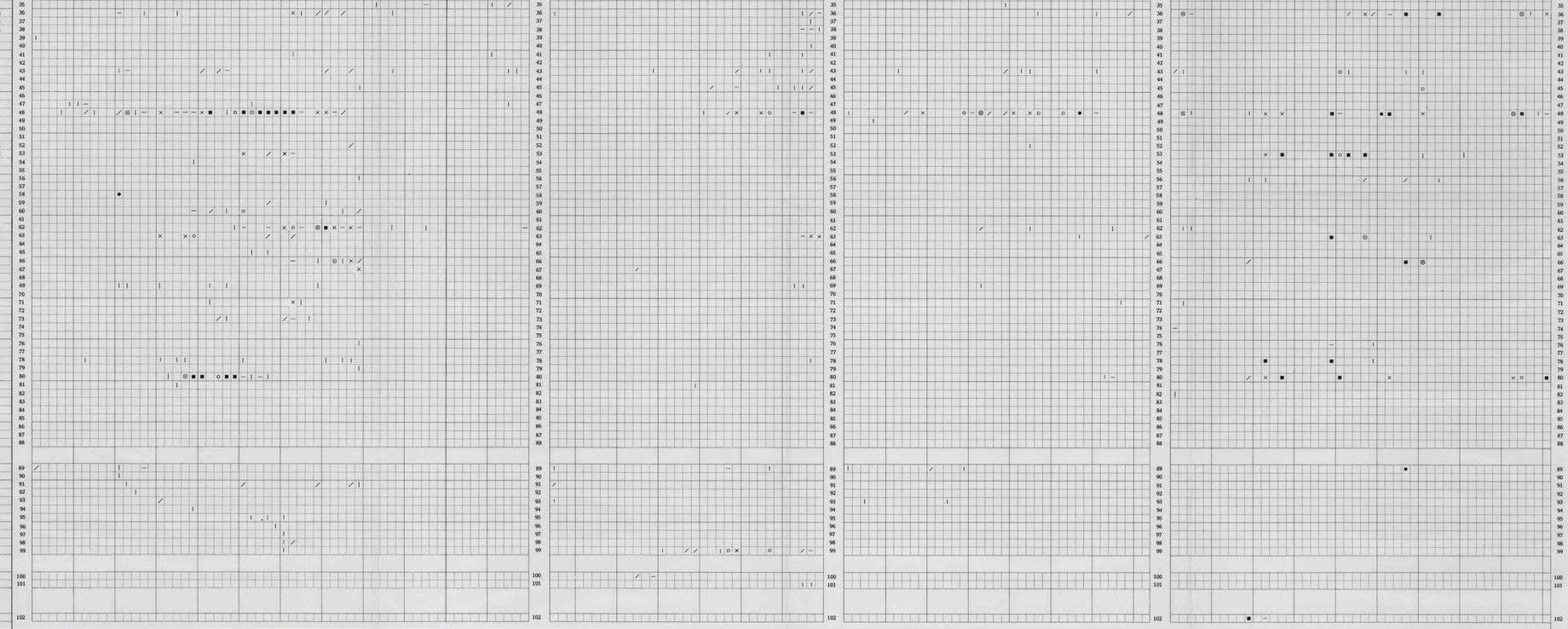
A Species (numbers refer to B)	B Species, in order of highest occurence
Angulogerina angulosa, 17	1 *Eponides callidus* Cushman and Cole
carinata, 54	2 *Epistominella pacifica* Cushman
Anomalina spp., 99	3 *Nonion scapham* (Fichtel and Moll)
Buliminella spp., 49	4 *Cibicides mckannai* Galloway and Wissler
Bolivina advena, 95	5 *Epistominella subperuviana* Cushman
advena var. *striatella*, 85	6 *Globigerina* spp.
argentea, 53	7 *Gaudryina aeonaria* Galloway and Wissler
imbricata, 14	8 *Buliminella elegantissima* (d'Orbigny)
interjuncta, 58	9 *Nonion incisum* Cushman
marginata var. *gracillima*, 87	10 *Cibicides hamiltonianus* (Cushman)
piscicornis, 48	11 *Rotalia soldanesia* Natland
pseudobeyrichi, 75	12 *Textularia* spp.
seminuda, 81	13 *Lagena* spp.
sinuata, 51	14 *Bolivina imbricata* Cushman
spinosa, 37	15 *Pullenia multilobata* Chapman
subadvena, 86	16 *Cassidulina limbata* Cushman and Hughes
Bolivinita californica, 90	17 *Angulogerina angulosa* Williamson
Buliminа denudata, 22	18 *Uvigerina* cf. *U. hootsi* Ruskin
ovula, 82	19 *Pullenia bulloides* d'Orbigny
pagoda, 65	20 *Nonionella miocenica* var. *atella* Cushman and Moyer
rostrata, 70	21 *Uvigerina* cf. *U. hispido-costata* Cushman and Todd
subacuminata, 59	22 *Buliminа denudata* Cushman and Parker
Buliminella curta, 26	23 *Virgulina* cf. *V. californiensis* Cushman
elegantissima, 8	24 *Nonion pompilioides* (Fichtel and Moll)
subfusiformis, 60	25 *Fissurina* spp.
Cassidulina californica, 38	26 *Buliminella curta* Cushman
cushmani, 28	27 *Virgulina nodosa* R. E. and K. C. Stewart
delicata, 80	28 *Cassidulina cushmani* R. E. and K. C. Stewart
limbata, 16	29 *Quinqueloculina* spp.
quadrata, 36	30 *Uvigerina peregrina* Cushman
translucens, 34	31 *Cibicides mckannai* Galloway and Wissler var.
Cheilostomella grandis, 79	32 *Sigmoilina* spp.
ovoidea, 74	33 *Globobulimina* spp.
Cibicides hamiltonianus, 10	34 *Cassidulina translucens* Cushman and Hughes
fletcheri, 94	35 *Cyclammina cancellata* H. B. Brady
mckannai, 4	36 *Cassidulina quadrata* Cushman and Hughes
mckannai var., 31	37 *Bolivina spinosa* Cushman
Cyclammina cancellata, 35	38 *Cassidulina californica* Cushman and Hughes
Dentalina communis, 40	39 *Polymorphina* spp.
Discorbis spp., 91	40 *Dentalina communis* (d'Orbigny)
Ehrenbergina bradyana, 101	41 *Siphotextularia* spp.
Epistominella bradyana, 62	42 *Nodogenerina lepidula* (Schwager)
pacifica, 2	43 *Globulina univerva* d'Orbigny
smithi, 63	44 *Reophax* spp.
subperuviana, 5	45 *Uvigerina hispida* Schwager
Eponides callidus, 1	46 *Planulina ariminensis* d'Orbigny
manifaldi, 93	47 *Haplophragmoides* spp.
cf. *E. peruvianus*, 100	48 *Bolivina pisciformis* Galloway and Morrey
tenerus, 67	49 *Bathysiphon* spp.
umbonatus, 77	50 *Nodogenerina advena* Cushman and Laiming
Fissurina spp., 25	51 *Bolivina nitinata* Galloway and Wissler
Frondicularia advena, 56	52 *Planulina ornata* (d'Orbigny)
Gaudryina aeonaria, 7	53 *Bolivina argentea* Cushman
Globigerina spp., 6	54 *Angulogerina carinata* Cushman
Globobulimina spp., 33	55 *Trochammina* spp.
Globocassidulina spp., 92	56 *Frondicularia advena* Cushman
Gyroidina rotundimargo, 66	57 *Nonionella globosa* Ishiwada
soldanii, 88	58 *Bolivina incurjuncta* Cushman
Haplophragmoides spp., 47	59 *Buliminа subacuminata* Cushman and R. E. Stewart
Kamerviella milleri, 64	60 *Buliminella subfusiformis* Cushman
Lagena spp., 13	61 *Virgulina cornuta* Cushman
Nodogenerina advena, 50	62 *Epistominella bradyana* Cushman
lepidula, 42	63 *Epistominella smithi* R. E. and K. C. Stewart
Nonion cf. *N. depressulum*, 98	64 *Kamerviella milleri* Natland
incisum, 9	65 *Buliminа pagoda* Cushman
pompilioides, 24	66 *Gyroidina rotundimargo* R. E. and K. C. Stewart
scapham, 3	67 *Eponides tenerus* (H. B. Brady)
Nonionella globosa, 57	68 *Pullenia miliformis* Coryell and Mossman
miocenica var. *atella*, 20	69 *Valvulineria araucana* (d'Orbigny)
pauciloba, 83	70 *Buliminа rostrata* H. B. Brady
pulchella, 84	71 *Robulus cushmani* (Galloway and Wissler)
Orbulina universa, 43	72 *Vermulina* spp.
Planulina ariminensis, 46	73 *Saccammina* spp.
ornata, 52	74 *Cheilostomella ovoidea* Reuss
Polymorphina spp., 39	75 *Bolivina pseudobeyrichi* Cushman
Pullenia bulloides, 19	76 *Robulus americanus* var. *spinosus* (Cushman)
miliformis, 68	77 *Eponides umbonatus* (Reuss)
multilobata, 15	78 *Robulus cultratus* Montfort
cf. *P. pedroana*, 102	79 *Cheilostomella grandis* Cushman
Quinqueloculina spp., 29	80 *Cassidulina delicata* Cushman
Reophax spp., 44	81 *Bolivina seminuda* Cushman
Robulus americanus var. *spinosus*, 76	82 *Buliminа ovula* d'Orbigny
cultratus, 78	83 *Nonionella pauciloba* Cushman
cushmani, 71	84 *Nonionella pulchella* Hada
Rotalia soldanesia, 11	85 *Bolivina advena* var. *striatella* Cushman
peruviana, 89	86 *Bolivina subadvena* Cushman
Saccammina spp., 73	87 *Bolivina marginata* var. *gracillima* Cushman
Sigmoilina spp., 32	88 *Gyroidina soldanii* d'Orbigny
Siphotextularia spp., 41	Species occurring in Towsley Canyon Section but not in Pico Canyon Section
Suggrunda spp., 96	
Textularia spp., 12	
Trochammina spp., 55	89 *Rotalia peruviana* Ehrenberg
Uvigerina hispida, 45	90 *Bolivinita angulina* Church
cf. *U. hootsi*, 21	91 *Discorbis* spp.
cf. *U. hootsi*, 18	92 *Globocassidulina* spp.
peregrina, 30	93 *Eponides manifaldi* Cushman
Vaginulina spp., 97	94 *Cibicides fletcheri* Galloway and Wissler
Valvulineria araucana, 69	95 *Bolivina advena* Cushman
Vermulina spp., 72	96 *Suggrunda* spp.
Virgulina cf. *V. californiensis*, 23	97 *Vaginulina*, spp.
cornuta, 61	98 *Nonion* cf. *N. depressulum* (Walker and Jacob)
nodosa, 27	99 *Anomalina*, spp
	Species occurring in Gavin Canyon Section but not in Pico Canyon or Towsley Canyon Sections
	100 *Eponides* cf. *E. peruvianus* (d'Orbigny)
	101 *Ehrenbergina bradyana* Cushman
	Species occurring in Holzer-Del Valle Section but not in Pico Canyon, Towsley Canyon, Gavin Canyon or Weldon-Gavin Divide Sections
	102 *Pullenia* cf. *P. pedroana* Kleinpell

C — Ecology of Recent forms: Depths, in hundreds of feet and bottom temperatures, in degrees centigrade

Species	Natland (1933) San Pedro channel Depth	Natland (1933) San Pedro channel Temperature	Crouch (1952) Southern California Temperature	Bandy (1953) San Francisco Depth	Bandy (1953) San Francisco Temperature	Bandy (1953) Point Arguello Depth	Bandy (1953) Point Arguello Temperature	Bandy (1953) San Diego Depth	Bandy (1953) San Diego Temperature	Butcher (1951) Cosmado Bank Depth
1 *Eponides callidus*										
2 *Epistominella pacifica*	7-65	8.5-2		9-70	5-1.5	7-22	6-5			
3 *Nonion scapham*	1-16	19-6		4-7	13-7	2-10	13-7	0.4-1	17-13	
4 *Cibicides mckannai*			8.5-2.3							3-33
5 *Epistominella subperuviana*										
6 *Globigerina* spp.										
7 *Gaudryina aeonaria*	1-24	13-5		1-4	13-8					5-11
8 *Buliminella elegantissima*	0-12	25-8		1-4	13-8	2-10	13-8			
9 *Nonion incisum*										
10 *Cibicides hamiltonianus*	1-25	13-5								
11 *Rotalia soldanesia*										
12 *Textularia* spp.										
13 *Lagena* spp.										
14 *Bolivina imbricata*										
15 *Pullenia multilobata*										
16 *Cassidulina limbata*	0.5-12	15-5	13-8.5	4-20	13-6	2-12	13-6	1-8	14-9	3-33
17 *Angulogerina angulosa*	1-15	13-6		4-7	13-7	2-12	11-6	2-8	13-9	3-27
18 *Uvigerina* cf. *U. hootsi*										
19 *Pullenia bulloides*	65-86	2.5	3-							
20 *Nonionella miocenica* var. *atella*	1-25	17-5		1-7	13-7	2-8	10-8	0.4-3	17-10	3-24
21 *Uvigerina* cf. *U. hispido-costata*										
22 *Buliminа denudata*						2-12	13-6	2-25	13-4	
23 *Virgulina* cf. *V. californiensis*										
24 *Nonion pompilioides*	65-90	2.5	3-1.7			80-110	2-1.5			
25 *Fissurina* spp.										
26 *Buliminella curta*										
27 *Virgulina nodosa*			4-							
28 *Cassidulina cushmani*	7-30	8.6-5								
29 *Quinqueloculina* spp.										
30 *Uvigerina peregrina*	9-65	8-2.5	8.5-3	5-70	17-2	6-80	11-4			6-33
31 *Cibicides mckannai* var.										
32 *Sigmoilina* spp.										
33 *Globobulimina* spp.										
34 *Cassidulina translucens*	7-18	8.6-6				8-60	5-4			4-33
35 *Cyclammina cancellata*	8-12	8.5-7.5								
36 *Cassidulina quadrata*	0.5-18	15-6						1-12	14-4	3-33
37 *Bolivina spinosa*	7-6.5	9-2.5	5-4			12-24	7-4			7-33
38 *Cassidulina californica*	1-26	13-5	5-	4-20	10-6			1-25	14-6	3-33
39 *Polymorphina* spp.										
40 *Dentalina communis*										
41 *Siphotextularia* spp.										
42 *Nodogenerina lepidula*										
43 *Globulina univerva*										
44 *Reophax* spp.										
45 *Uvigerina hispida*										
46 *Planulina ariminensis*										
47 *Haplophragmoides* spp.										
48 *Bolivina pisciformis*										
49 *Bathysiphon* spp.										
50 *Nodogenerina advena*										
51 *Bolivina nitinata*										
52 *Planulina ornata*	1-82	15-2.4						0-33	19-4	3-33
53 *Bolivina argentea*	5-44	8-2.5	3.5							6-32
54 *Angulogerina carinata*	9-29	13-5								3-24
55 *Trochammina* spp.										
56 *Frondicularia advena*	1-26	7-5								
57 *Nonionella globosa*										
58 *Bolivina incurjuncta*	9-28	8-5	3.5+							
59 *Buliminа subacuminata*			5-3							
60 *Buliminella subfusiformis*	1-65	13-2.5								
61 *Virgulina cornuta*	15-85	6.5-2.5	5-4							
62 *Epistominella bradyana*	9-13	8.5-7.5								3-33
63 *Epistominella smithi*			8.5-4			7-22	6-5			3-33
64 *Kamerviella milleri*										
65 *Buliminа pagoda*			4							
66 *Gyroidina rotundimargo*	20-30	6.5-5								
67 *Eponides tenerus*				9-70	5-1.5	24-110	4-1.5			
68 *Pullenia miliformis*										
69 *Valvulineria araucana*	10-65	8-2.5	5-4							9-30
70 *Buliminа rostrata*	65-90	2.5	3-1.7			35-110	5-1.4			
71 *Robulus cushmani*	1-40	13-5								
72 *Vermulina* spp.										
73 *Saccammina* spp.										
74 *Cheilostomella ovoidea*										
75 *Bolivina pseudobeyrichi*	10-35	8-3	5-4							0.5-24
76 *Robulus americanus* var. *spinosus*										
77 *Eponides umbonatus*	25-90	5-2.5	5-1.7							6-33
78 *Robulus cultratus*										
79 *Cheilostomella grandis*	4-35	10-3								4-28
80 *Cassidulina delicata*			8.5-1.7	9-70	5-1.5	10-25	12-5			10-33
81 *Bolivina seminuda*	11-27	8-5	5-4							4-30
82 *Buliminа ovula*	18-30	6-5								
83 *Nonionella pauciloba*										
84 *Nonionella pulchella*										
85 *Bolivina advena* var. *striatella*	1-15	12-7.5								
86 *Bolivina subadvena*	28-63	5-2.5	3+							3-12
87 *Bolivina marginata* var. *gracillima*										
88 *Gyroidina soldanii*	80+	2.5				35-110	5-1.4			
Species occurring in Towsley Canyon Section but not in Pico Canyon Section										
89 *Rotalia peruviana*						1-20	15-10			
90 *Bolivinita angulina*										
91 *Discorbis* spp.										
92 *Globocassidulina* spp.										
93 *Eponides manifaldi*										
94 *Cibicides fletcheri*								1-32	15-3	3-15
95 *Bolivina advena*										
96 *Suggrunda* spp.										
97 *Vaginulina*, spp.										
98 *Nonion* cf. *N. depressulum*										
99 *Anomalina*, spp										
Species occurring in Gavin Canyon Section but not in Pico Canyon or Towsley Canyon Sections										
100 *Eponides* cf. *E. peruvianus*										
101 *Ehrenbergina bradyana*			4-1.7							
Species occurring in Holzer-Del Valle Section but not in Pico Canyon, Towsley Canyon, Gavin Canyon or Weldon-Gavin Divide Sections										
102 *Pullenia* cf. *P. pedroana*										

D — Towsley Canyon Faunal samples fT1–fT60; Gavin Canyon Faunal samples fR1–fR33; Weldon-Gavin Divide Faunal samples fW16–fW52; Holzer-Del Valle Faunal samples fS1–fS45



EXPLANATION

A.—Species arranged alphabetically.

B.—Species arranged in order of highest stratigraphic occurrence.

C.—Reported temperature and depth tolerances of Recent benthonic forms off the coast of California.

D.—Abundance of specimens of species.

E.—Probable temperature of deposition of sample. Vertical lines are maximum-temperature ranges (taken from C) for each species with five individuals or more in the sample. Where temperature ranges in the same sample overlap, the temperature of deposition is assumed to lie within the common range; the tops and bottoms of common temperature ranges are connected by tie lines.

F.—Probable depth of deposition of samples. Vertical lines are depth ranges (taken from C) for each species with five individuals or more in the sample. Where the depth ranges in the same sample overlap, the depth of deposition is assumed to lie within the common range; the tops and bottoms of common ranges are connected by tie lines.

Abundance symbols used on (D)

|	1-2	○	17-32
/	3-4	◎	33-64
—	5-8	●	65-100
×	9-16	■	100+

[1] Deep-water, low-temperature forms *Nonion pompilioides* and *Pullenia bulloides* also present. These 2 species ignored in drawing depth and temperature ranges because of occurrence with 18 other species with common depth around 3000 feet, and common temperature around 5° C.

[2] Because data are insufficient, temperature ranges are not plotted for two species:
(a) *Epistominella bradyana*: given with limited depth and hence limited temperature in Natland's (1933) chart; much larger depth range in Butcher's (1951) chart, but no temperature given.
(b) *Virgulina nodosa*: Only data from Crouch: (1952) "Common offshore in water temperature below 4° C."

[3] *Cyclammina cancellata* plotted on both *E* and *F* but not used in drawing tie lines.

DISTRIBUTION OF FORAMINIFERA IN THE PICO FORMATION, TOWSLEY CANYON, GAVIN CANYON, WELDON-GAVIN DIVIDE, AND HOLSER-DEL VALLE SECTIONS

Identifications and chart by Patsy B. Smith

581734 O—62 (In pocket)