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FORAMINIFERAL DATA FROM THE BALCOM CANYON SECTION, VENTURA BASIN, CALIFORNIA

by

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FORAMINIFERAL DATA FROM THE BALCOM CANYON SECTION, VENTURA BASIN, CALIFORNIA

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ABSTRACT

The distribution of the common benthic foraminiferal assemblages from the Balcom Canyon Section, Ventura Basin, California, is documented. These assemblages range in age from late Pliocene through Pleistocene. Benthic foraminifers characteristic of the Venturian, Wheelerian, and Hallian Stages are recognized. Planktic foraminifers indicative of coiling intervals CD12 through CD9/10 are present. These foraminiferal faunas indicate deposition shoaled from lower bathyal-abyssal depths to outer neritic depths during this period.

INTRODUCTION

The rich benthic foraminiferal assemblages contained in the thick Pliocene and Pleistocene marine strata (> 5,000 m) of the Ventura Basin are being examined as part of the Southern California Areal Mapping Project. The Balcom Canyon Section is the first section to be examined in detail. This section is south of the Oak Ridge Fault in the central part of the Ventura Basin (fig. 1). The Monterey (Modelo Formation of some authors), Pico (including the Santa Barbara Formation of some authors), San Pedro and Saugus Formations exposed in this section range in age from the late Miocene to Pleistocene. The Pico Formation rests unconformably on the Monterey Formation and is

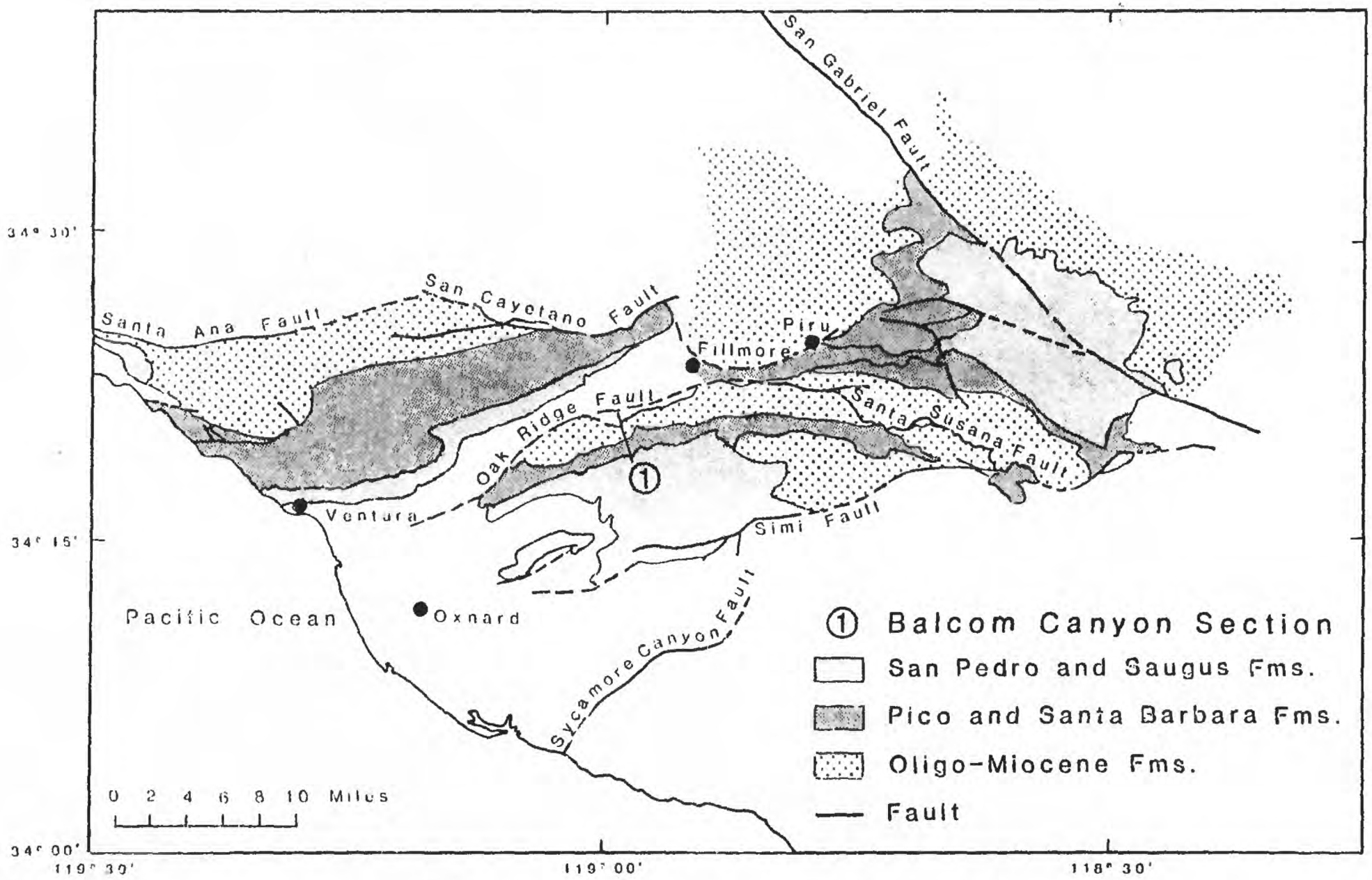

Figure 1. Index map of the Ventura Basin. Generalized geologic map of the Ventura Basin showing the location of the Balcom Canyon Section (modified from Jennings and Troxel, 1954). Figure shows the distribution of the Pico Formation (includes Santa Barbara Formation) in the Ventura Basin.

overlain by the San Pedro Formation (Ingle, 1978, 1980) (figs. 2 and 3). A detailed suite of samples was collected from the Pico Formation (fig. 4). All 172 samples were examined for foraminifers. Benthic foraminifers were picked and identified from all samples. Planktic foraminifers were picked and identified from 96 samples; 12 samples were barren and the remaining samples were not examined. The foraminiferal content of these samples is compiled here for reference and is discussed in other papers (Lagoe, 1987; McDougall, 1991). Tephrochronology of this section has been previously discussed by Sarna-Wojcicki and others (1984, 1987) and is summarized in figure 5.

The Balcom Canyon Section, which is well exposed along Balcom Canyon Road, southeast of Santa Paula, was collected in 1984 and 1986 by Andrei Sarna-Wojcicki, Kristin McDougall and assistants. Sample positions were surveyed along Balcom Canyon Road by Andrei Sarna-Wojcicki (fig. 4). Stratigraphic allocation of these samples is given in Appendix 1.

Foraminiferal samples were processed using both solvent (kerosene) and Quarternary-O and washed through a 230-mesh screen (63 microns). Splits containing approximately three hundred benthic foraminifers were picked from the residues and identified by Kristin McDougall (see Appendix 2 - Taxonomic notes and Appendix 3). Benthic foraminifers identified by Natland (1952) have been compared with the Balcom Canyon assemblages (see Appendix 2 and 4). Approximately 300 planktic foraminiferal specimens, abundance permitting, were picked and identified by M.B. Lagoe (see Appendix 2 and 5). Residues and benthic foraminiferal slides are on file with the Branch of Paleontology and Stratigraphy, U.S. Geological Survey, Menlo Park, California. Planktic

BALCOM CANYON SECTION

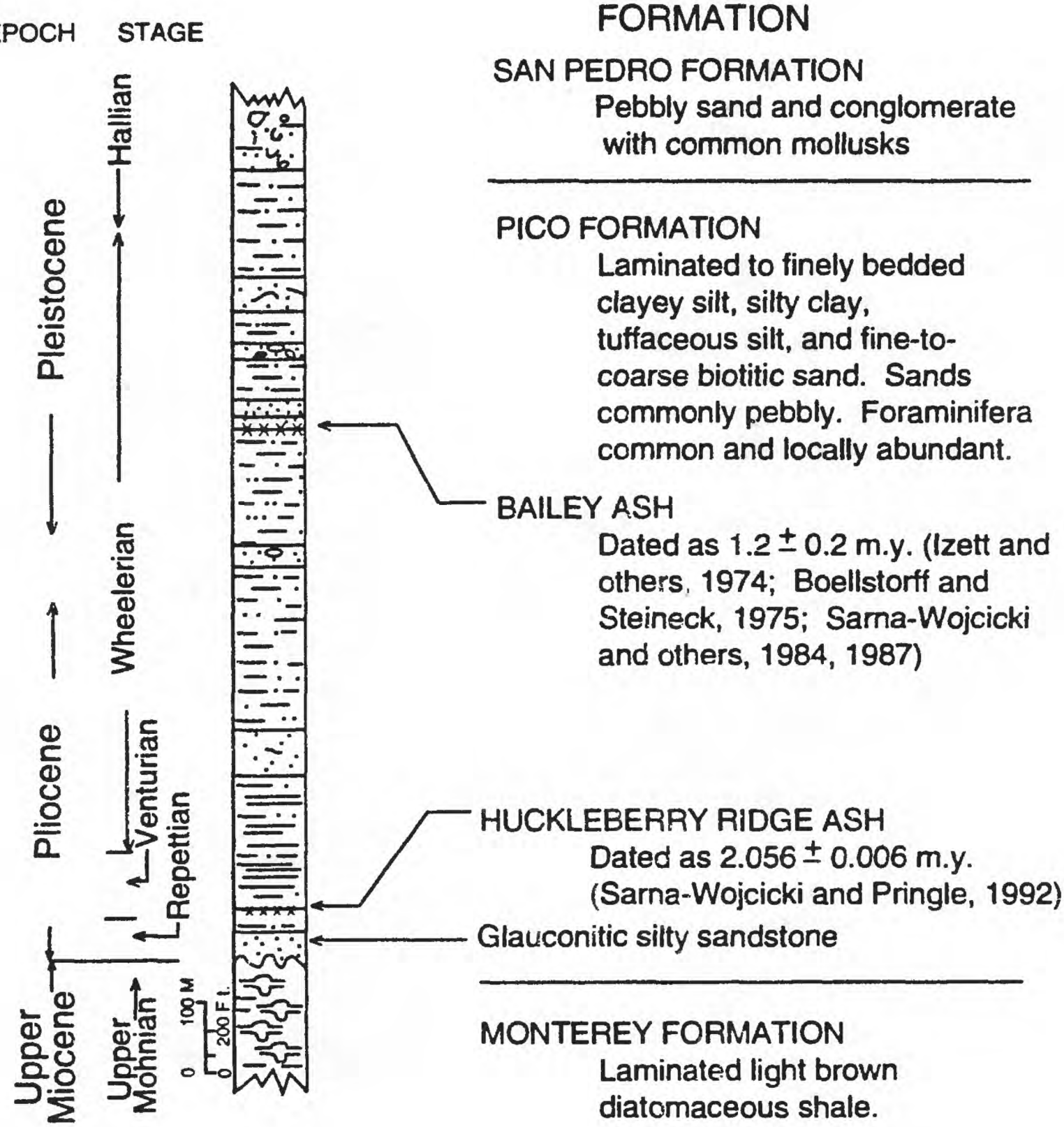

Figure 2. Generalized stratigraphic column for the Balcom Canyon Section, modified from Yeats (1967) and Ingle (1978, 1980).

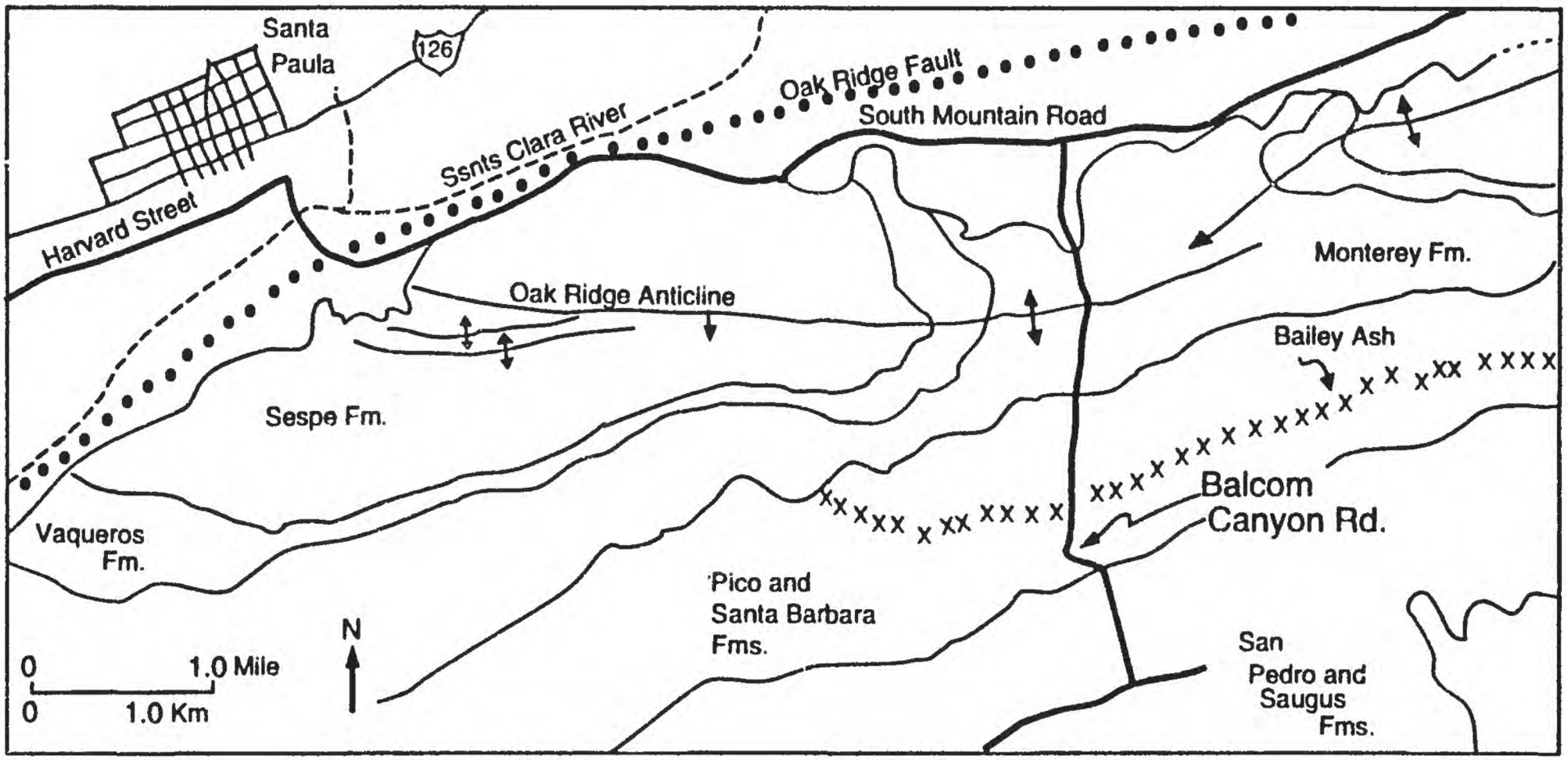

Figure 3. Geologic Map of the Balcom Canyon Section. Geology modified from Jennings and Troxel (1954) and Ingle (1980).

Figure 4. Location of samples along Balcom Canyon road.

foraminiferal slides are on file with the Department of Geological Sciences, University of Texas at Austin, Austin, Texas.

BIOSTRATIGRAPHY

Benthic foraminifers

The Venturian, Wheelerian, and Hallian benthic foraminiferal stages were defined by Natland (1952, 1957). The stages are recognized by the presence-absence of key benthic foraminiferal species as well as their relative abundance (fig. 5). These provincial stages reflect local environmental conditions such as basin filling and decreasing water depths rather than time. The apparent extinctions result from exclusion by environmental conditions as previously noted (Natland, 1952, 1957; Bandy, 1953; Bandy and Wilcoxon, 1970; Ingle, 1967, 1980). The use of other microfossil groups (Ingle, 1967, 1980; Lagoe, 1987; Lagoe and Thompson, 1988; Blake, 1991) as well as fission track ages (Boellstorff and Steineck, 1975), radiometric dates, magnetostratigraphy (Blackie and Yeats, 1977) and tephrochronology (Sarna-Wojcicki and others, 1984) has allowed calibration of the benthic foraminiferal stages. Currently the Repettian is early to late Pliocene in age ($\pm$ 4.8 to 2.5 Ma); the Venturian is late Pliocene ($\pm$2.5 to 1.9 Ma); the Wheelerian is latest Pliocene to early Pleistocene (approximately 1.9 to 0.8 Ma) and the Hallian is late Pleistocene ($\leq$ 0.8 Ma) (Blake, 1991) (fig. 6).

Benthic foraminiferal assemblages characteristic of the Pliocene though Pleistocene Venturian, Wheelerian, and Hallian Stages were recognized in the Balcom Canyon Section (fig. 7). Although benthic foraminifers are generally common in the Balcom Canyon Section, they were not found in samples from the part of the section assigned to the Pliocene Repettian Stage by Ingle (1978, 1980). Assemblages assigned to the Venturian

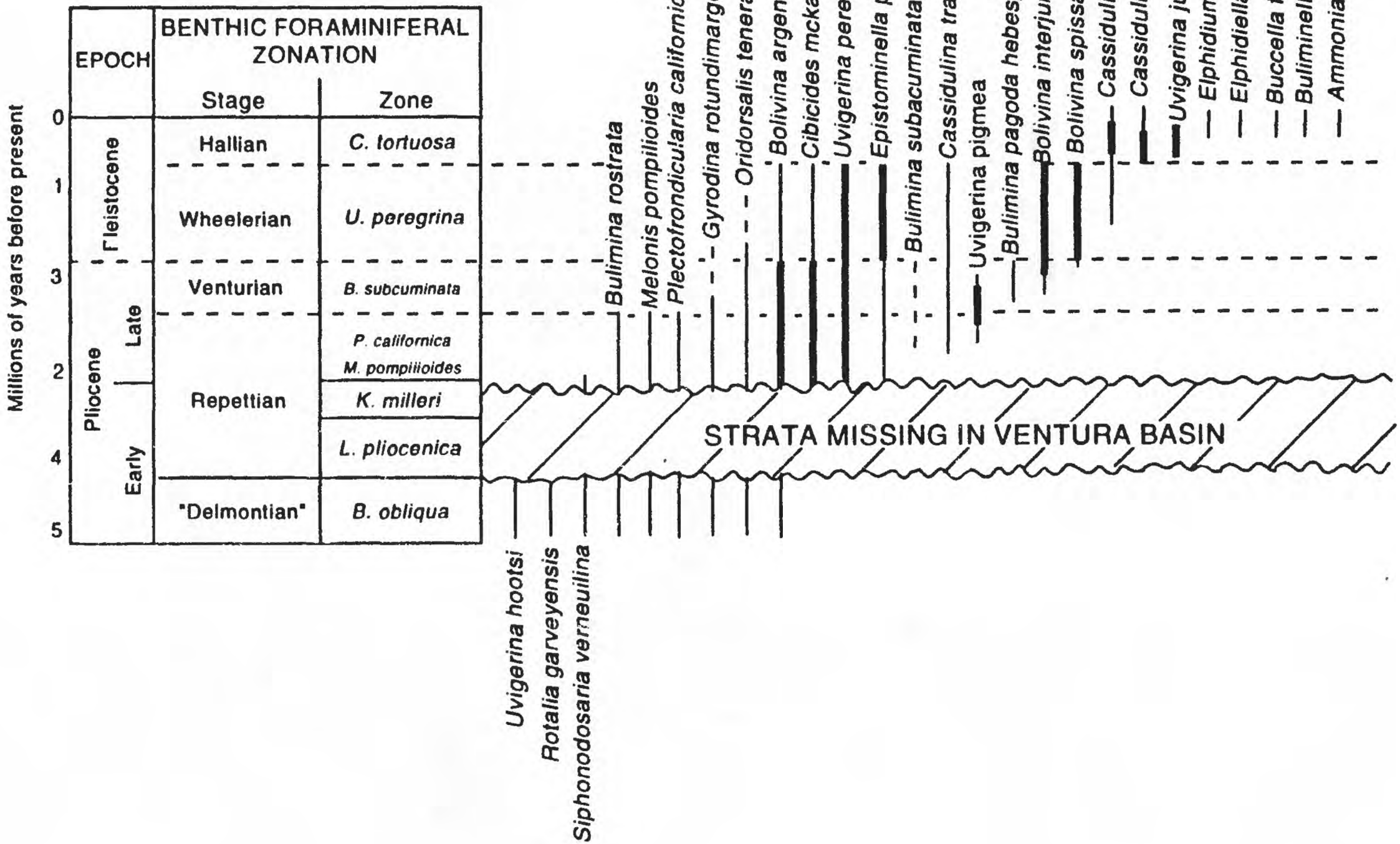

Figure 5. Key benthic foraminifers used to recognize the Pliocene-Pleistocene stages of Natland (1952, 1957). Relative abundance of species is shown by a solid line (rare to few) and heavy solid line (common to abundant).

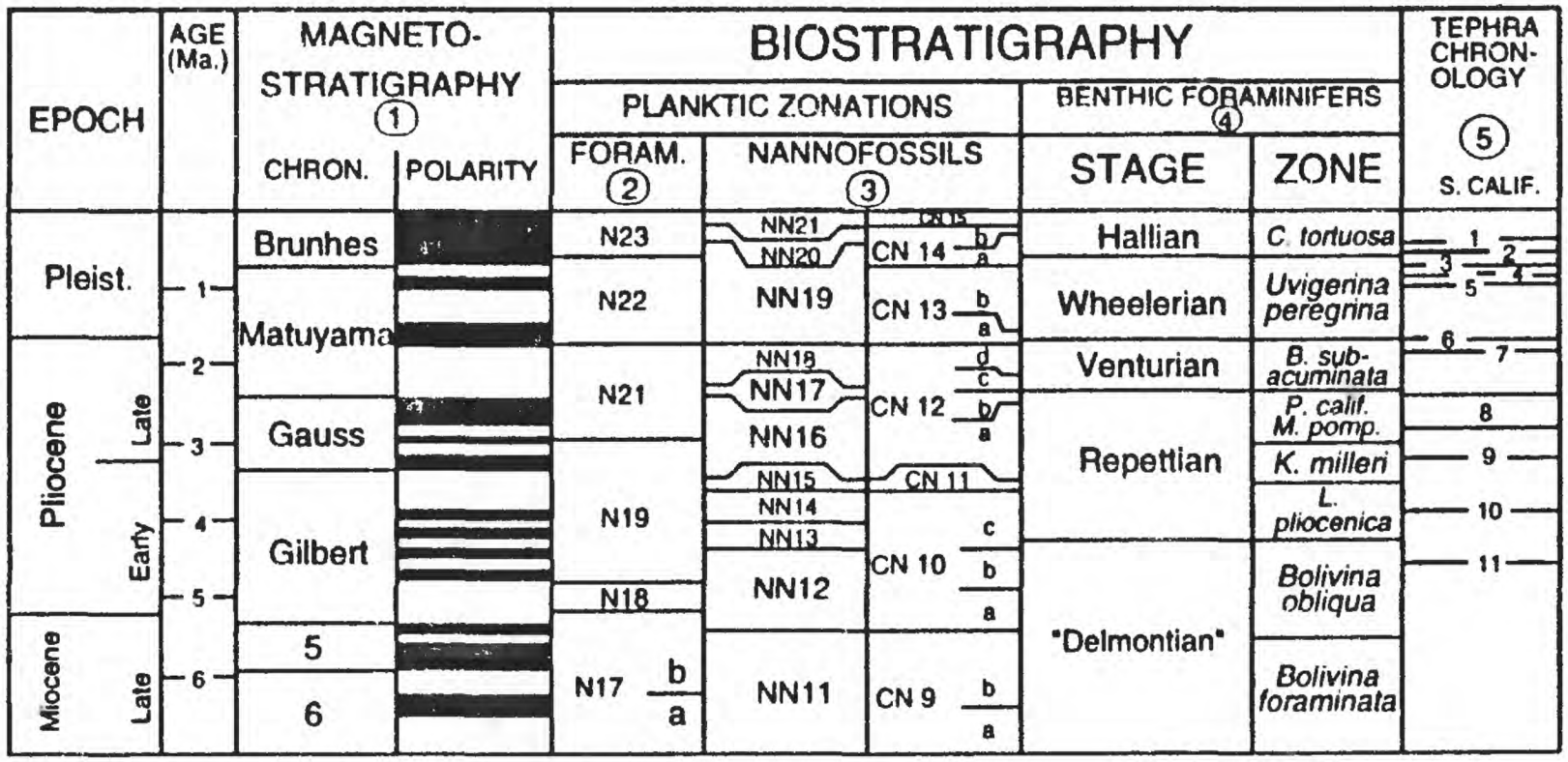

Figure 6. Correlation of late Cenozoic benthic foraminiferal stages with chrono-stratigraphic frameworks based on other microfossil groups, magnetostratigraphy and tephra. The benthic foraminiferal stages and zones (column 4; Kleinpell, 1938, 1980; Natland, 1952) are correlated with the international time scale and magneto-stratigraphy (column 1; Mankein and Dalrymple, 1979; Tauxe and others, 1983; Berggren and others, 1985), planktic foraminiferal zones (column 2; Blow, 1969, 1979), calcareous nannofossil zones (column 3; Martini, 1971; Bukry, 1973, 1975; Okada and Bukry, 1980) and tephrochronology (column 5; Sarna-Wojcicki and Myers, personal commun.in Bartow, 1992).

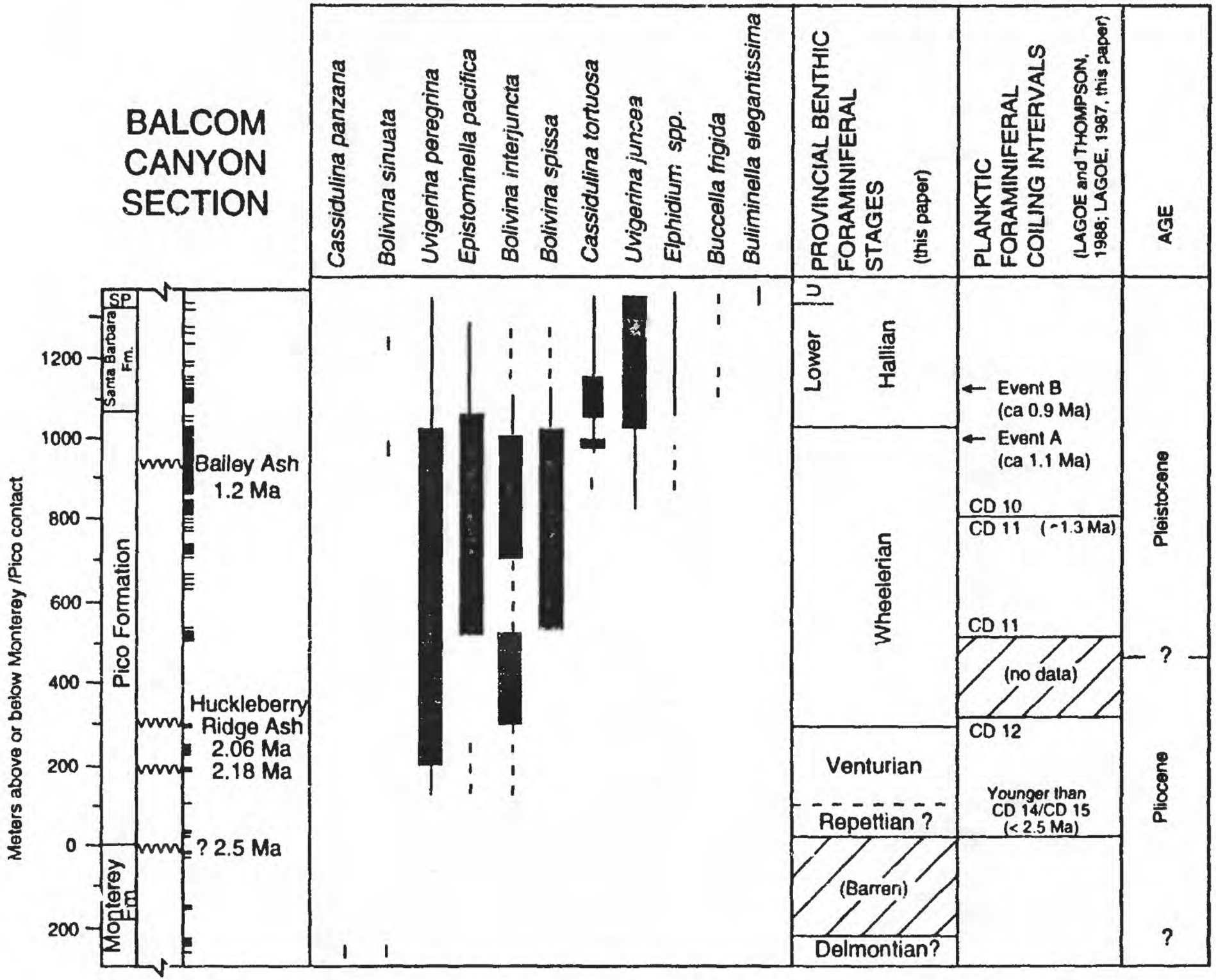

Figure 7. Biostratigraphy of the Balcom Canyon Section. Formations and samples in the Balcom Canyon Section are shown on the left. The distribution and relative abundance of the benthic foraminifers is shown in the center, and benthic foraminiferal stages, planktic coiling intervals, and age are shown on the right. The relative abundance of benthic foraminifers is indicated as rare (dashed line), few (solid line) and common to abundant (heavy solid line). *SP= San Pedro Formation.*

contain common to abundant *Uvigerina peregrina*, and a few *Epistominella pacifica* and *Bolivina interjuncta*. The Venturian-Wheelerian boundary is placed at the point where *Bolivina interjuncta* becomes abundant. The oldest abundant occurrence of *B. interjuncta* (33% of the benthic foraminiferal fauna) is in sample 86KM-67 (6 meters below the Huckleberry Ridge Ash). *Bolivina interjuncta* is, however, absent from sample 86KM-90 (3 m below the Huckleberrry Ash) and fluctuates greatly in abundance in the interval above the ash. *Bolivina interjuncta* does not become a consistently abundant component of the fauna until sample 86KM-53 (approximately 400 m above the Huckleberry Ridge Ash). The Wheelerian-Hallian boundary is placed between the last abundant occurrences of *Uvigerina peregrina*, *Epistominella pacifica*, *Bolivina interjuncta* and *Bolivina spissa*, and the first abundant occurrences of *Cassidulina tortuosa* and *Uvigerina juncea*. The boundary falls in a 2 meter interval between sample 84-KM-40 and 84-KM-41. The youngest assemblage in the section (84-KM-75) may represent the upper Hallian Stage as *Buliminella elegantissima* appears and the abundance of *Cassidulina tortuosa* and *Uvigerina juncea* decline.

Planktic foraminifers

Lagoe and Thompson (1988) summarized previous work on using coiling shifts in *Neogloboquadrina pachyderma* to correlate Pliocene and Pleistocene sections in California and compiled a biostratigraphic framework using these shifts and origination/extinction datums of temperate planktic foraminifers (fig. 8). The coiling curve for *Neogloboquadrina pachyderma* in the Balcom Canyon Section is summarized in figure 9. Biostratigraphic interpretations are made by reference to the framework of Lagoe and Thompson (1988) and to previously studied sections in the Ventura Basin (Wheeler Canyon and Santa Paula

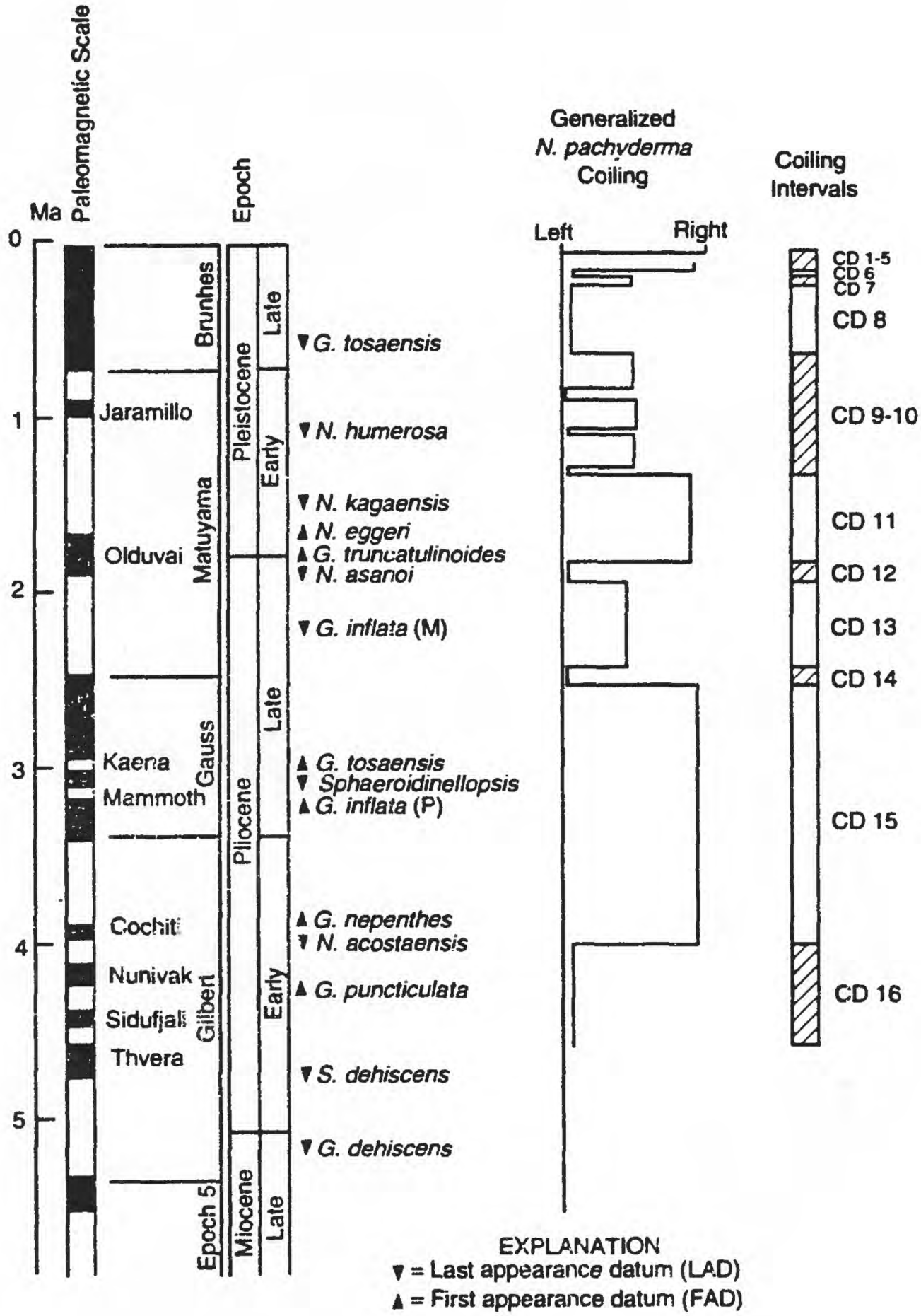

Figure 8. The North Pacific chronostratigraphic framework after Lagoe and Thompsom (1988). Magnetostratigraphy (after Berggren and others, 1985) is shown on left, planktic foraminiferal evolutionary datums are shown in the center, and generalized coiling curve of *Neogloboquadrina pachyderma* and informally name coiling intervals are shown on the right (CD = coiling dominance) (Lagoe and Thompson, 1988).

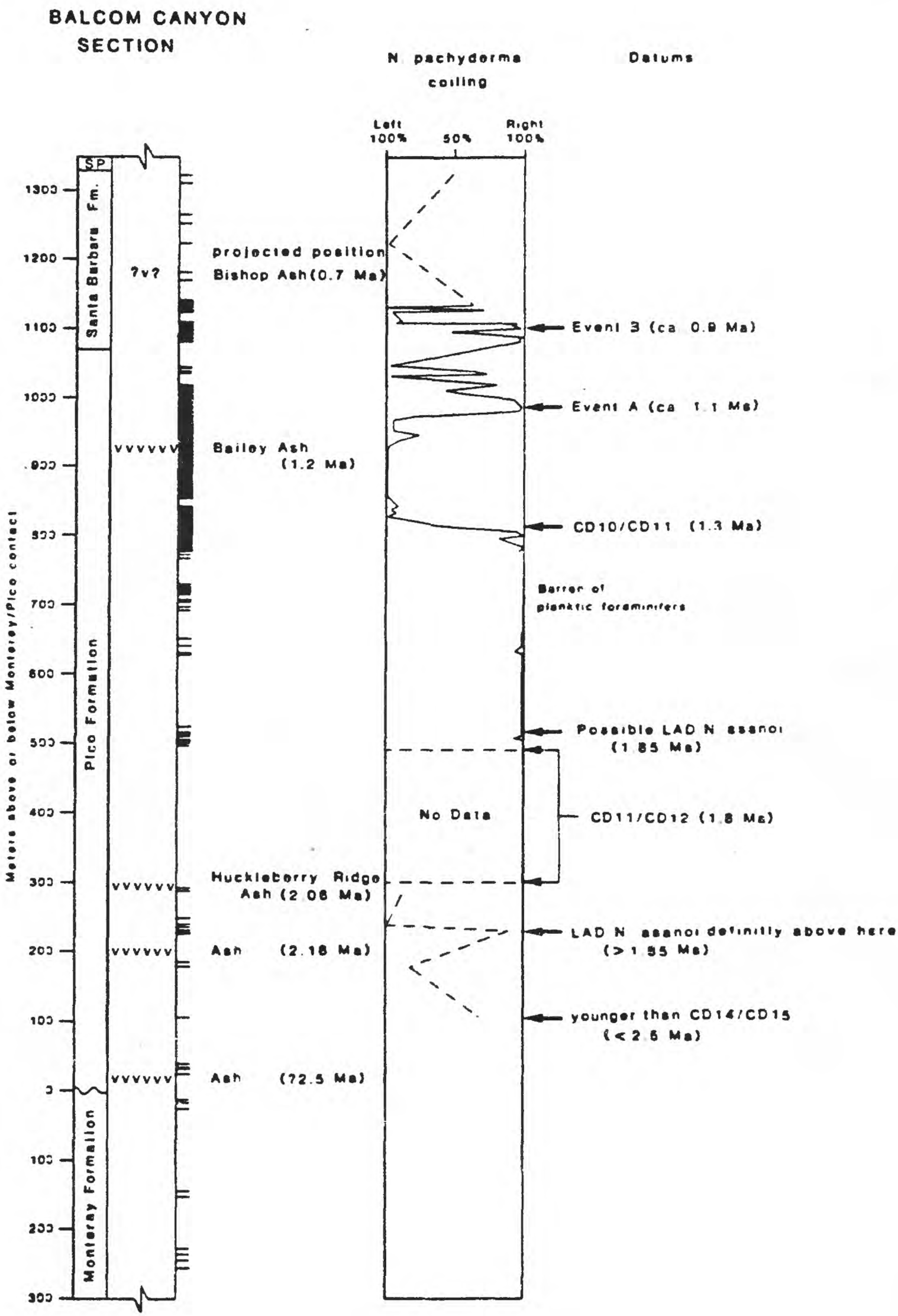

Figure 9. Planktic biostratigraphy of the Balcom Canyon Section. Planktic foraminiferal datums and the coiling curve for *Neogloboquadrina pachyderma* are shown. The probable position of the Bishop Ash in this section is shown. This ash has been identified to the west in Sexton and Hall Canyons, but has not been found in Balcom Canyon (Sarna-Wojcicki, personal communication, 1993). SP = San Pedro Formation

Creek). Interpretation is hindered in some places due to incomplete sampling, a function of discontinuous outcrop, particularly in the lower part of the Pico Formation.

The best constrained biostratigraphic horizon in the Balcom Canyon Section is the shift between coiling intervals CD9/10 and CD11 of Lagoe and Thompson (1988). This occurs just above sample 86KM-32, about 100 m below the Bailey Ash. Lagoe and Thompson assigned an age of 1.3 Ma to this shift, on the basis of paleomagnetic stratigraphy. The position of this horizon is consistent with the radiometric age of the Bailey Ash (1.2 $\pm$ 0.2 Ma). The next oldest coiling shift, between CD11 and CD12 occurs between samples 86KM-66 and 86KM-67. Unfortunately, a sample gap of approximately 200 m separates these samples. The CD11/CD12 shift is assigned an age of 1.8 Ma by Lagoe and Thompson (1988). Even though this horizon cannot be located precisely in the section because of the sample gap, it must occur above the Huckleberry Ridge Ash (2.01 Ma). The few samples in the lower part of the section exhibit widely varying coiling directions (fig. 9). This suggests that this part of the section falls in the CD12 to CD14 interval, which contains highly variable coiling directions at Wheeler Canyon (Lagoe and Thompson, 1988). The CD14/CD15 shift has not been reached in the oldest sample examined, 86KM-76, approximately 100 m above the base of the Pico Formation. This suggests that this sample is less than 2.5 Ma, in agreement with dating of the basal Pico Formation by diatoms (*Denticulopsis seminae* v. *fossilis* Zone, ca. 1.7-2.4 Ma; Barron, 1992).

Two right coiling peaks in the upper part of the section (fig. 9) were also recognized at Wheeler Canyon by Lagoe and Thompson (1988) though not given any specific notation. They are labelled Event A and Event B on Figure 9. Using sediment accumulation rates from lower in the section these could be assigned ages of about 1.1 Ma for Event A and 0.9 Ma for Event B. These ages are compatible with the radiometric ages

of the Bailey Ash below (1.2 Ma) and the projected position of the Bishop Ash (0.7 Ma) above, but should be considered preliminary because of the problem of using sediment accumulation rate extrapolations in turbiditic sediments.

The major extinction datum (LAD) observed in the Balcom Canyon Section is that associated with *Neogloboquadrina asanoi* (fig. 9). It is located possibly as high as sample 86KM-60, but these rare values may be due to reworking. It is definitely higher than sample 86KM-71, where it is common. The LAD probably occurs in the sample gap between 86KM-66 and 86KM-67. This datum has been assigned an age of 1.85 Ma by Lagoe and Thompson (1988).

Summary

Biostratigraphic interpretations from the planktic foraminiferal faunas (fig. 9) provide important age constraints on the section which are in general agreement with radiometric ages derived from key ash horizons. The biostratigraphic interpretations of the planktic foraminifers also provide age constraints which are in general agreement with the suggested ages of the benthic foraminiferal stages. In the Balcom Canyon Section, the Venturian-Wheelerian boundary is placed over a hundred meters below the CD11/CD12 boundary (1.82 Ma), just below the Huckleberry Ash (2.06 Ma) and above the highest common occurrence of *Neogloboquadrina asanoi* (>1.85 Ma, sample 86KM-69); thus the suggested age of 1.9 Ma for this boundary (Blake, 1991) is compatible with the planktic foraminiferal data and close to the age of the ash. The Wheelerian-Hallian boundary falls below planktic coiling peak B (approximately 0.9 Ma), above coiling peak A (1.1 Ma), and above the Bailey Ash (1.2 Ma). The suggested 0.8 Ma age of the Wheelerian-Hallian boundary (Blake, 1991) is slightly younger than the age suggested by the planktic coiling peaks.

The age of the peaks is, however, only approximate as the ages are based on sedimentation accumulation rates in a turbidite sequence.

PALEOECOLOGY

Paleoenvironmental analysis of the Balcom Canyon benthic foraminiferal assemblages indicates that the Pico Formation was initially deposited at bathyal depths and shallowed rapidly upsection (fig. 10). Species with upper depth limits in the upper middle bathyal biofacies (500-1500 m) are common throughout the lower Pico Formation but decline in abundance after 1.2 Ma (Bailey ash). Species with upper depth limits in the upper bathyal biofacies (150-500 m) are abundant in the upper and middle Pico Formation. Species diagnostic of the shallow oxygen minimum zone rapidly decline in the upper Pico Formation coincident with the rapid increase in inner and outer neritic species. Despite the increase in shelf species deposition continues to occur at bathyal depths (150-1500 m).

The use of upper depth limits in silled basins of the California borderland is not always an effective ecologic tool as the distribution of the benthic foraminiferal species is related to the water mass which is controlled by the sill depth. Douglas and Heitman (1979) identified a number of benthic foraminiferal assemblages associated with basin environments within the California borderland (Table 1). Species characteristic of the outer shelf, upper slope and lower slope recurrent species assemblages occur in the Balcom Canyon Section (fig. 11). Lower slope species dominate most of the section but decline rapidly in abundance in the upper Pico Formation where upper slope assemblages increase in abundance. Outer shelf assemblages dominate the uppermost Pico Formation and San Pedro formations. These dominance patterns indicate decreasing water depths as well as the presence of shallower water masses. The change from the East Pacific Intermediate

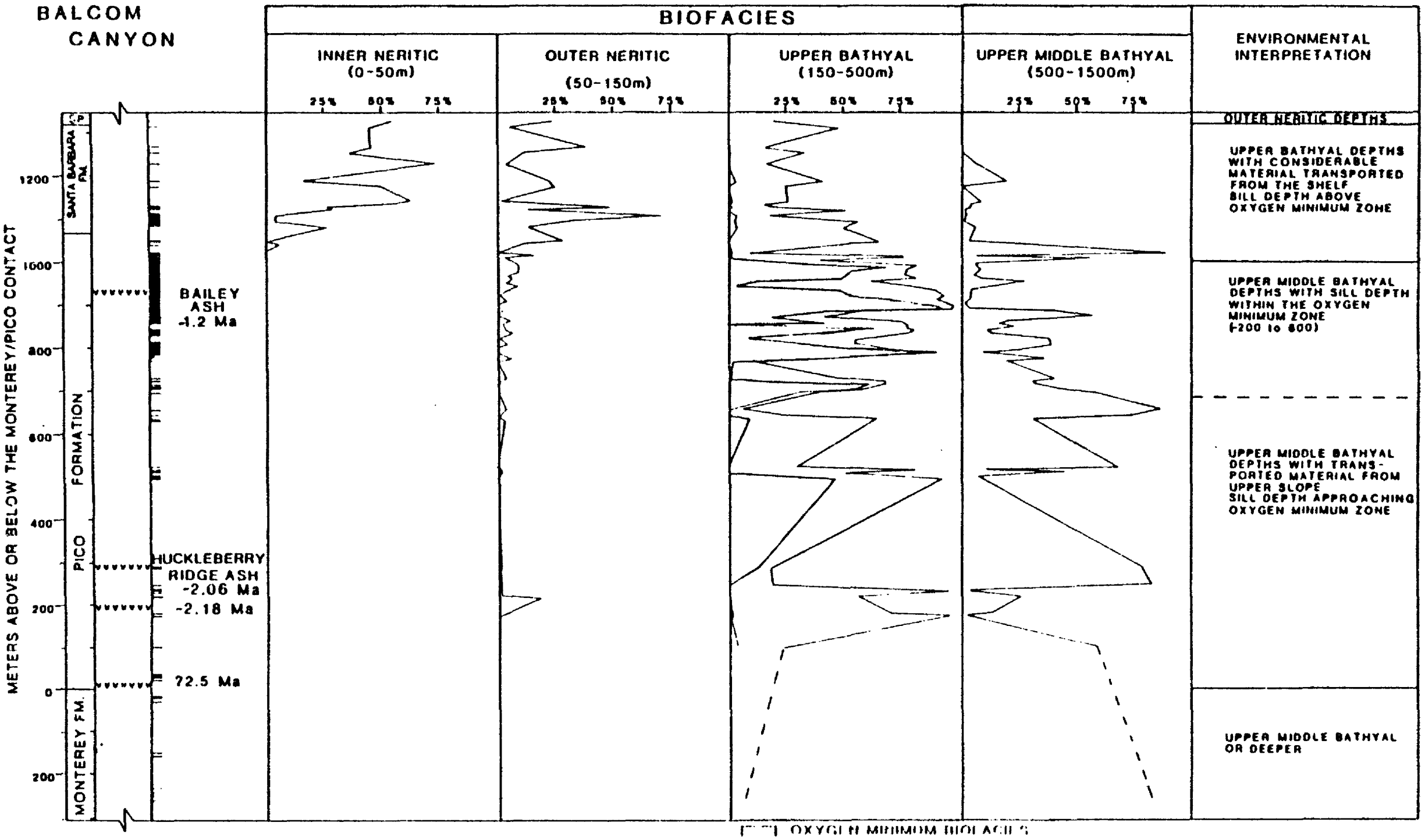

Figure 10. Paleoecologic analysis of the Balcom Canyon Section using the upper depth limits (UDL) of the benthic foraminiferal species. The UDLs of the benthic foraminifers are given in Appendix 2. SP = San Pedro Formation

Figure 11. Paleoecologic analysis of the Balcom Canyon Section using the recurrent species assemblages of Douglas and Heitman (1979). The abundance of the recurrent assemblages is given in percent of the total benthic foraminiferal assemblage. Recurrent species assemblages are given in Table 1. Abbreviations used in the environmental interpretation include: DR = depth range, EM = water mass, T = temperature, S = salinity, and O = oxygen content. SP = San Pedro Formation

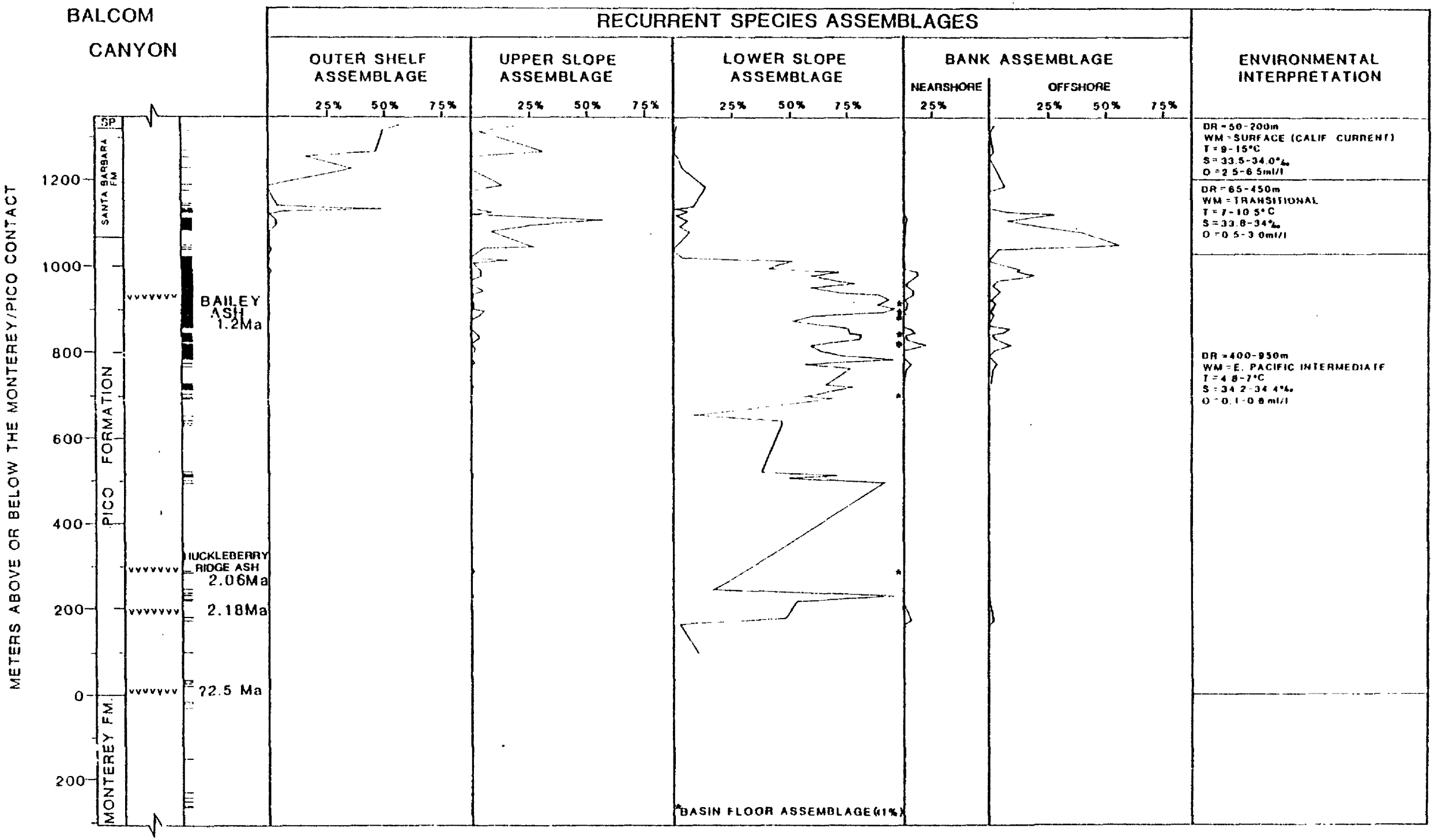

Table 1 Recurrent species assemblages of Douglas and Heitman (1979).

RECURRENT SPECIES ASSEMBLAGES	
Nearshore Basins	Offshore Basins
OUTER SHELF ASSEMBLAGE	
**Nonionella stella*	
**Nonionella basispinata*	
Bulimina denudata	
Quinqueloculina laevigata	
Buccella angulata	
BANK ASSEMBLAGE	BANK ASSEMBLAGE
**Cassidulina limbata*	*Astrononion stellatum*
**Cibicides fletcheri*	**Cassidulina limbata*
**Globocassidulina subglobosa*	*Cassidulina tortuosa*
Pullenia salisburyi	**Cassidulina depressa*
**Trifarina angulata*	**Cibicides fletcheri*
	**Globocassidulina subglobosa*
	Hanzawaia nitidula
UPPER SLOPE ASSEMBLAGE	**Rosalina columbiensis*
**Bolivina pacifica*	*Trifarina angulosa*[1]
Cassidulina depressa	
**Globobulimina pacifica*	
**Suggrundia eckisi*	
**Uvigerina juncea*	
**Uvigerina excellens*	
LOWER SLOPE ASSEMBLAGE	LOWER SLOPE ASSEMBLAGE
**Bolivina argentea*	*Bolivina argentea*
**Bolivina interjuncta*	**Bolivina spissa*
**Bolivina spissa*	*Bolivinita minuta*
Bolivinita minuta	*Cassidulina delicata*
Cassidulina delicata	**Epistominella smithi*
**Epistominella smithi*	*Globulimina spinifera*
**Loxostomum pseudobeyrichi*	*Gyroidina io*
**Uvigerina peregrina*	*Hoeglundina elegans*
Valvulineria araucana	*Uvigerina peregrina*
	Valvulineria araucana
BASIN FLOOR	BASIN FLOOR
Fursenkonia bramletti	*Fursenkonia bramletti*
Fursenkonia comuta	*Fursenkonia comuta*
Globobulimina affinis	*Loxostomum pseudobeyrichi* [2]

* species which numerically dominate

1 more common in nearhore basins

2 becomes Basin Floor species in outer basin

water mass to transitional and surface water masses relates to the decreasing sill depth. Bank assemblages present in the Balcom Canyon Section may be transported from the South Mountain Seaknoll (see Yeats, 1965). The increase in Bank assemblages in the upper Pico Formation probably indicates increased erosion of the seaknoll.

The generally low diversity planktic foraminiferal faunas, dominated by *Globigerina bulloides*, *Globigerina quinqueloba*, and *Neogloboquadrina pachyderma* would indicate subarctic to cool temperate paleoenvironments for the Balcom Canyon Section. Indications of tropical to subtropical environments (e.g. keeled globorotalids, *Globigerinoides* spp.) are absent or very rare in the samples studied. Paleotemperatures of surface waters can be interpreted from the coiling ratios of *Neogloboquadrina pachyderma*. Ingle (1973, 1977a, 1977b) has related coiling shifts in *N. pachyderma* to northward and southward migration of subarctic and temperate waters associated with the Alaska Gyre and California Current. Entirely left coiling populations of *N. pachyderma* are interpreted as representing surface water temperatures below 10° C, while entirely right coiling *N. pachyderma* are interpreted as representing surface water temperatures of 15 to 20-25° C. Thompson and Shackleton (1980) and Thompson (1981), in studies of the distribution of left and right coiling *N. pachyderma* in the modern northwestern Pacific Ocean, corroborate the interpretations of Ingle (1973, 1977a, 1977b). These studies in the Northwest Pacific show that coiling variations in *N. pachyderma* can be related to the position of the polar front. North of the polar front, left coiling *N. pachyderma* dominates with seasonal ranges in surface water temperatures from 3-12° C. South of the polar front, right coiling *N. pachyderma* dominates with seasonal ranges in surface water temperatures of 16-26° C.

Using the above as a framework, intervals within Balcom Canyon Section with consistent *N. pachyderma* coiling directions can be interpreted in terms of surface water temperatures. For example, the interval just above and below the Bailey Ash, samples 84-

KM-20 to 84-KM-1 and 86KM-1 to 86KM-27 (830 to 930 m above the base of the Pico Formation), contains 95-100% of the left coiling *N. pachyderma*. At that time, ca. 1.2 to 1.3 Ma, surface waters above the central Ventura Basin were cold (<10° C). Just below this interval is a section containing dominately right coiling *N. pachyderma*, samples 86KM-32 to 86KM-66 (approximately 500 to 810 m above the base of the Pico Formation). Surface waters at this time (ca. 1.3 to 1.8 Ma) were cool (>15° C). Parts of the section containing abruptly fluctuating coiling ratios in the uppermost part of the section (ca. 980 to 1150 m above the base of the Pico Formation) are more difficult to interpret in terms of surface water temperatures. These temperatures may indeed have been rapidly fluctuating in time due to instability in the location of major water mass boundaries or possibly due to variation in the intensity of local upwelling systems, periodically bringing colder waters to the surface. Alternatively, these intervals of abruptly varying coiling ratios may also reflect periods of reworking, which could introduce specimens with differing coiling ratios from the prevailing environment. Support for the latter interpretation comes from the benthic foraminiferal fauna which indicates an increase in transported bank assemblages in the upper Pico Formation and suggests erosion of the South Mountain Seaknoll. Further work is obviously needed to explain these intervals characterized by abruptly varying coiling ratios.

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Appendix 1 - Stratigraphic allocation of samples in the Balcom Canyon Section, Ventura Basin, California

Sample number	Meters above base of formation	Sample number	Meters above base of formation
84-KM-75	1326.6	84-KM-34	996.8
84-KM-74	1312.2	84-KM-33	994.5
84-KM-73	1265.8	84-KM-32	992.4
84-KM-72	1251.7	84-KM-31	990.0
84-KM-71	1223.8	84-KM-30	987.5
84-KM-70	1181.6	84-KM-29	985.2
84-KM-69	1171.2	84-KM-28	980.0
84-KM-68	1151.1	84-KM-27	977.7
84-KM-67	1149.1	84-KM-26	976.6
84-KM-66	1142.9	84-KM-25	972.3
84-KM-65	1139.5	84-KM-24	969.7
84-KM-64	1138.0	84-KM-23	968.1
84-KM-63	1135.2	84-KM-22	966.4
84-KM-62	1125.1	84-KM-21	964.8
84-KM-61	1109.5	84-KM-20	962.1
84-KM-60	1107.0	84-KM-19	959.9
84-KM-59	1105.2	84-KM-18	957.9
84-KM-58	1103.2	84-KM-17	955.7
84-KM-57	1100.8	84-KM-16	953.8
84-KM-56	1099.1	84-KM-15	951.8
84-KM-55	1096.8	84-KM-14	949.9
84-KM-54	1094.8	84-KM-13	947.9
84-KM-53	1092.6	84-KM-12	945.9
84-KM-52	1090.8	84-KM-11	944.2
84-KM-51	1088.3	84-KM-10	942.2
84-KM-50	1085.5	84-KM-9	940.6
84-KM-49	1083.6	84-KM-8	938.6
84-KM-48	1047.4	84-KM-7	936.6
84-KM-47	1045.7	84-KM-6	934.6
84-KM-46	1043.3	84-KM-5	932.8
84-KM-45	1039.9	86KM-101	931.8
84-KM-44	1037.6	86KM-100	930.9
84-KM-43	1020.1	84-KM-4	930.8
84-KM-42	1017.8	86KM-99	930.0
84-KM-41	1016.3	84-KM-3	929.1
84-KM-40	1014.1	86KM-98	929.0
84-KM-39	1009.1	86KM-97	928.2
84-KM-38	1006.4	84-KM-2	927.2
84-KM-37	1003.8	86KM-96	927.0
84-KM-36	1001.8	86KM-95	926.0
84-KM-35	999.2	84-KM-1	925.1
		BAILEY ASH	924.9

Sample number	Meters above base of formation
86KM-106	924.9
84-KM-76	924.4
86KM-107	923.7
86KM-108	922.5
84-KM-77	921.8
86KM-109	921.6
86KM-1	920.5
84-KM-78	919.9
86KM-110	919.8
86KM-111	919.8
86KM-112	917.9
84-KM-79	917.6
86KM-2	916.7
84-KM-80	916.1
86KM-113	914.7
86KM-3	912.1
86KM-4	910.5
86KM-5	907.0
86KM-6	904.0
86KM-7	900.0
86KM-8	896.5
86KM-9	894.0
86KM-10	890.5
86KM-11	888.0
86KM-12	883.0
86KM-13	880.0
86KM-14	877.5
86KM-15	874.0
86KM-16	870.0
86KM-17	867.0
86KM-18	863.5
86KM-19	860.5
86KM-20	857.5
86KM-21	855.0
86KM-22	842.5
86KM-23	839.0
86KM-24	835.0
86KM-25	832.5
86KM-26	829.5
86KM-27	827.0
86KM-28	822.5
86KM-29	817.5
86KM-30	814.5
86KM-31	810.5
86KM-32	807.5
86KM-33	804.5
86KM-34	802.5
86KM-35	797.5
86KM-36	795.0
86KM-37	793.0
86KM-38	788.0
86KM-39	785.0
86KM-40	782.0
86KM-41	778.0
86KM-42	772.0
86KM-43	769.0
86KM-44	730.0
86KM-45	727.0
86KM-46	723.0
86KM-47	721.0
86KM-48	718.0
86KM-49	715.0
86KM-50	710.5
86KM-51	708.0
86KM-52	704.5
86KM-53	699.5
86KM-54	694.8
86KM-55	653.0
86KM-56	643.0
86KM-57	633.0
86KM-58	629.5
86KM-59	526.0
86KM-60	515.0
86KM-61	512.0
86KM-62	509.5
86KM-63	505.0
86KM-64	502.5
86KM-65	499.5
86KM-66	497.0
HUCKLEBERRY RIDGE	
ASH	294.0
86KM-90	291.0
86KM-67	288.0
86KM-92	249.5
86KM-69	239.0
86KM-70	236.0
86KM-71	232.5
86KM-93	228.0

Sample number	Meters above base of formation
86KM-72	226.5
ASH	197.0
86KM-73	184.0
86KM-74	179.6
86KM-76	100.5
ASH	15.0

Appendix 2 - Taxonomic Notes

Planktic foraminifers

The taxonomy used in identifying the planktic foraminifers from the Balcom Canyon Section follows Lagoe and Thompson (1988), and Saito and others (1981). Listed below are the taxa recognized in this study with original generic designations. See Lagoe and Thompson (1988), Saito and others (1981), and Kennett and Srinivasan (1983) for illustrations and original citations for these species.

Globigerina bulloides d'Orbigny, 1826
Globigerina quinqueloba Natland, 1938
Globigerina umbilicata Orr and Zaitzeff, 1971
Globigerinita glutinata (Egger) = *Globigerina glutinata* Egger, 1893
Globigerinita uvula (Ehrenberg) = *Pylodexia uvula* Ehrenberg, 1861
Globigerinoides ruber (d'Orbigny) = *Globigerina rubra* d'Orbigny, 1839
Globorotalia scitula (Brady) = *Pulvinulina scitula* Brady, 1882
Neogloboquadrina asanoi (Maiya, Saito and Sata) = *Globoquadrina asanoi* Maiya, Saito and Sata, 1976.
See Lagoe and Thompson (1988) for discussion of this species and its recognition under other names in studies of California Plio-Pleistocene sections.
Neogloboquadrina humerosa (Takayangi and Saito) = *Globorotalia humerosa* Takauanagi and Saito, 1962.
Neogloboquadrina pachyderma (Ehrenberg) = *Aristerospira pachyderma* Ehrenberg, 1861.
Orbulina universa d'Orbigny, 1839.

Benthic foraminifers

These notes represent an attempt to bring California benthic foraminiferal taxonomic nomenclature into conformity with nomenclature used worldwide. Taxonomic nomenclature used by Natland (1952) is updated (Appendix 4) and included in this section. Environmental data and known stratigraphic ranges are also summarized for various species.

Alveolophragmium scitulum (Brady)

Haplophragmoides scitulum (Brady) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 1, fig. 2a,b.
Alveolophragmium scitulum (Brady) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 228, pl. 1, fig. 7a,b.
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Ammodiscus sp.

Ammodiscus sp. (*minutum*) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 1, fig. 3a,b.
Ammodiscus? sp. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 227.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Ammodiscus incertus (d'Orbigny)

Operculina incerta d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 49, pl. 6, figs. 16-17.

Ammodiscus pacificus Cushman and Valentine - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 1, figs. 4a,b, 5.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Ammonia beccari (Linne)

Nautilus beccarii Linne, 1758, Systema Naturae, p. 710.

Rotalia beccarii (Linne) - - Natland, 1952, unpub. Ph. D., pl. 15, fig. 6, 7a,b,c. - - Haller, 1980, p. 257, pl. 10, fig. 6a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Astacolus sp.

COMMENTS: Specimens can be assigned to genus only.

OCCURRENCE: Balcom Canyon

Astrononion spp.

COMMENTS: Specimens can be assigned to genus only.

OCCURRENCE: Balcom Canyon

Astrononion stellatum Cushman and Edwards

Astrononion stellatum Cushman and Edwards, 1937, Contr. Cushman Lab. Foram. Res., v. 13, p. 32, pl. 3, figs. 9-11.

Nonion stelligerum - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, (checklist).

ECOLOGY: *Astrononion stellatum* is a common species in the bank assemblage of the offshore basins in the California basins (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bathysiphon arenaria Cushman

Bathysiphon arenaria Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 129, pl. 1, fig. 2. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 1, fig. 1a,b.- - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 227, pl. 1 fig. 2.

COMMENTS: Haller (1980) noted similarity to *Bathysiphon eocenica.*

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bathysiphon spp.

COMMENTS: These are probably worm tubes and are not included in the total foraminiferal counts. These specimens were picked only in the 1984 samples but not in the 1986 samples.

OCCURRENCE: Balcom Canyon (not on checklist)

Bolivina acuminata Natland

Bolivina subadvena Cushman *acuminata* Natland, 1946, in Cushman and Gray, 1946, Cushman Lab. Foram. Res., Spec. Pub., no. 19, p. 34, pl. 5, fig. 46.

Bolivina panamensis - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 22a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina advena striatella Cushman

Bolivina advena Cushman var *striatella* Cushman, 1925, Contr. Cushman Lab. Foram. Res., v. 1, p. 30, pl. 5, fig. 3 - - Natland, 1952, unpub. Ph.D., Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 5a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina argentea Cushman

Bolivina argentea Cushman, 1926, Contr. Cushman Lab. Foram. Res., v. 2, p. 42, pl. 6, fig. 5. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 9, figs. 10a,b, 11a,b, 12, 13. - - Martin, 1952, Contr. Cushman Lab. Foram. Res., v. 3, p. 128, pl. 21, figs. 5a-b, 6a-b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub. no. 28, p. 28-29, plate-figs. 1-10.

Brizalina argentea (Cushman) - - Matoba and Yamaguchi, 1982, Initial Reports Deep Sea Drilling Project, v. 64, p. 1036.

COMMENTS: *Bolivina argentea* of Douglas (1981) is probably synonomous with *B. interjuncta* of this study.

RANGE: Pliocene to Holocene (Culver and Buzas, 1986; Martin, 1952; Finger, 1990)

ECOLOGY: *Bolivina argentea* has an upper depth limit in the upper middle bathyal biofacies (Ingle, 1980) and in the California borderland the upper depth limit approximates the upper limit of 100% southern water (Douglas, 1981). This species is most abundant in low oxygen waters ($\leq$ 1 ml/l) commonly found in the basins of the California borderland (Douglas, 1981; Blake, 1981). The upper depth limit of *Bolivina argentea* is 380 m in the continental borderland (Douglas, 1981).

Bolivina argentea is typical of the group I, lower slope assemblage in both the nearshore and offshore basins of the California continental borderland and is a dominant species in the nearshore basins (Douglas and Heitman, 1979). Along the eastern Pacific margin, Culver and Buzas (1986) report *Bolivina argentea* only south of Point Conception. This species, however, is common all along the California coast (Mullins and others, 1985; Quinterno and Gardner, 1987; McGann, 1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina beyrichi Reuss

Bolivina beyrichi Reuss, 1851, Deut. Geol. Gesel., Zeit., v. 3, p. 83, pl. 6, fig. 51. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 1, 2, 3a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina girardensis Rankin

Bolivina girardensis Rankin in Cushman and Kleinpell, 1934, Contr. Cushman Lab. Foram. Res., v. 10, p. 17, pl. 3, fig. 7. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. , p. 42-43, plate-figs. 1-9.

RANGE: late Miocene, Mohnian to Pliocene (Finger, 1990)

ECOLOGY: *Bolivina girardensis* has an upper depth limit in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Bolivina humilis Cushman and McCulloch

Bolivina seminuda Cushman *humilis* Cushman and McCulloch, 1942, Allan Hancock Pacific Expeditions, v. 6, p. 211, pl. 26, figs. 1-6.

Bolivina humilis Cushman and McCulloch - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 17a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina interjuncta Cushman

Bolivina costata d'Orbigny *interjuncta* Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 41, pl. 6, fig. 3.

Bolivina interjuncta Cushman - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 90, pl. 11, figs. 10-13. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, figs. 6a,b, 12. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 248, pl. 8, fig. 15a,b.

Bolivina costata d'Orbigny *bicostata* Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 42. - - Cushman, 1937, Cushman Lab. Foram. Res., Spec. Pub., no. 9, pl. 22, fig. 23.

COMMENTS: The difference between these two species is the presence or absence of anastomosing costae: *B. bicostata* has no anastomosing costae present whereas *B. interjuncta* has anastomosing costae present in the upper part of the test. A complete gradation from no anastomosing costate to anastomosing costate is observed on specimens present in the Balcom Canyon Section. *Bolivina interjuncta* is the senior synonym.

ECOLOGY: Although the upper depth limit of *Bolivina interjuncta* is on the shelf edge (Ingle and Keller, 1980), the upper bathyal biofacies given by Ingle (1980) is used in this paper. High abundances of *Bolivina interjuncta* have been noted in the upper bathyal oxygen minimum zone along the East Pacific Margin (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina marginata Cushman

Bolivina marginata Cushman, 1918, U.S. Geol. Survey, Bull., no. 676, p. 48, pl. 10, fig. 1.

ECOLOGY: The upper depth limit of *Bolivina marginata* is in the upper bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina pisciformis Galloway and Morrey

Bolivina pisciformis Galloway and Morrey, 1929, p. 36, pl. 5, fig. 10. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 19a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina pseudospissa Kleinpell

Bolivina pseudospissa Kleinpell, 1938, Miocene Stratigraphy of California, AAPG, p. 279, pl. 21, fig. 6.

ECOLOGY: The upper depth limit of *Bolivina pseudospissa* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Bolivina punctata d'Orbigny

Bolivina punctata d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 63, pl. 8, figs. 10-12. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 4a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina seminuda Cushman

Bolivina seminuda Cushman, 1911, U.S. Nat. Hist. Mus. Bull., v. 74, p. 34, tf. 55. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 10a,b, 11a,b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 129, pl. 12, figs. 8a-b.

ECOLOGY: The upper depth limit of *Bolivina seminuda* is on the shelf edge but the most abundant occurrences of this species are in the shallow oxygen minimum zone along the East Pacific Margin (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina semiperforata Martin

Bolivina semiperforata Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 129, pl. 21, figs. 10a-b, 11a-b. - - White, 1956, Jour. Paleo., v. 30, p. 252, pl. 29, fig. 11a-b.

OCCURRENCE: Balcom Canyon

Bolivina sinuata Galloway and Wissler

Bolivina sinuata Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 71, pl. 11, figs. 9a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, figs. 13a,b, 14. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 129, pl. 22,

figs. 1a-b. - - White, 1956, Jour. Paleo., v. 30, p. 252, pl. 29, figs. 12a,b.- - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 50-51, plate-figs. 1-8.

RANGE: late Miocene, Mohnian to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Bolivina sinuata* is in the upper bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina spissa Cushman

Bolivina subadvena Cushman *spissa* Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 45, pl. 6, fig. 8. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 249, pl. 8, figs. 9a,b; 10a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 24, fig. 5.

Bolivina spissa Cushman - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 72, pl. 11, figs. 14-16. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, figs. 1, 2, 3, 4, 5. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 130, pl. 22, figs. 2a-b, 3a-b.

ECOLOGY: Ingle and Keller (1980) give the upper depth limit of *Bolivina spissa* as in the upper bathyal biofacies where they find high abundances of this species associated with oxygen-rich, low salinity Antarctic Intermediate Water along the East Pacific Margin. High abundances of this species are also found in the low oxygen waters (> 0.5 to 1.7 ml/l) of the basins in the California borderland (Douglas, 1981; Blake, 1981).

Bolivina spissa is a dominant species in the lower slope assemblage of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979). Along the eastern Pacific margin, *Bolivina spissa* is most common south of Point Conception, although there are few occurrences just north of the Point (Culver and Buzas, 1986) and off northern California (Quinterno and Gardner, 1987; McGann, person. comm., 1993).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina spp.

COMMENTS: These specimens are too pooly preserved to be identified to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina subadvena Cushman

Bolivina subadvena Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 44, pl. 6, fig. 6. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, figs. 7, 8a,b, 9a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivina vaughani Cushman

Bolivina vaughani Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 146, pl. 5, fig. 11. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 20a,b.

ECOLOGY: The upper depth limit of *Bolivina vaughani* is in the less turbulent outer part of the inner neritic biofacies; its upper depth limit is however, usually given as in

the outer neritic biofacies where it tends to be most common, particularily in the warmer tropical surface waters (Ingle, 1980; Ingle and Keller, 1980). This species is particularily abundant in the well oxygenated waters (5-6 ml/l) of the shelf (Douglas, 1981; Blake, 1981).

Along the eastern Pacific margin, *Bolivina vaughani* is most common south of the Marin headlands (Culver and Buzas, 1986) and ranges from the Oregonian to Panamanian provinces of Buzas and Culver (1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bolivina woodringi Kleinpell

Bolivina woodringi Kleinpell, 1938, Miocene Stratigraphy of California, AAPG, p. 285, pl. 21, figs. 4-5. - - Finger, 1990, Cushman Lab. Foram. Res., Spec., Pub., no. 28, p. 56-57, plate-figs. 1-10.

RANGE: Late Miocene to Pliocene, Mohnian to "Delmontian" (Finger, 1990)

ECOLOGY: The upper depth limit of *Bolivina woodringi* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Bolivinita minuta Natland

Bolivina minuta Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 146, pl. 5, fig. 10. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 10, fig. 21a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bolivinita quadrilatera (Schwager)

Textilaria quadrilatera Schwager, 1866, Novara Exped., Geol. Theil, v. 2, p. 253, pl. 7, fig. 103.

Bolivinita quadrilatera (Schwager) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 244, pl. 6, fig. 14a,b.

Bolivinita angelina Church - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 7, fig. 7a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Buccella frigida (Cushman)

Pulvinulina frigida Cushman, 1920, U.S. National Museum Bull., v. 104, p. 12.

Eponides frigidus (Cushman) - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 23, fig. 5.

Eponides mansfieldi Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 14, fig. 5a,b,c.

ECOLOGY: The upper depth limit of *Buccella frigida* is in the inner neritic biofacies (Ingle, 1980). *Buccella frigida* ranges from the Aluetian to the California provinces of Buzas and Culver (1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Buccella parkerae Andersen

Buccella parkerae Andersen, 1952, Wash. Acad. Sci. Jour., v. 42, p. 149, text-fig. 9 (p. 147).

OCCURRENCE: Balcom Canyon

Buccella tenerrima Bandy

Rotalia tenerrima Bandy, 1950, Jour. Paleo., v. 24, p. 278, pl. 13, figs. 3.

Buccella tenerrima (Bandy) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 253, pl. 9, fig. 2a-c.

Eponides cf. *frigidus* (Cushman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 14, fig. 6a,b,c (called *Eponides ornata* on checklist).

ECOLOGY: *Buccella tenerrima* is considered a cosmopolitan species by Culver and Buzas (1986) and found in both the Oregonian and Panamaian provinces of Buzas and Culver (1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bulimina denudata Cushman and Parker

Bulimina pagoda Cushman var. *denudata* Cushman and Parker, 1938, Contr. Cushman Lab. Foram. Res., v. 14, p. 57, pl. 10, figs. 1, 2.

Bulimina denudata Cushman and Parker - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 24, fig. 11. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 245.

ECOLOGY: *Bulimina denudata* ranges from the Oregonian to Panamanian provinces of Buzas and Culver (1990). It is found rarely off San Francisco where the cooler California surface waters dominate and commonly (10-20% of the fauna) south of Point Conception where warmer waters dominate (Ingle and Keller, 1980; Culver and Buzas, 1986). The upper depth limit of *Bulimina denudata* is in the inner neritic biofacies (Ingle and Keller, 1980).

Bulimina denudata is a dominant species in the outer shelf assemblages of the nearshore basins in the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon

Bulimina inflata Sequenza

Bulimina inflata Sequenza, 1862, Eco Peloritano, Giornale Sci., Lette. and Arti., ser. 2, v. 5, p. 109, pl. 1, fig. 10.

Bulimina subcalva Cushman and Stewart - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, figs. 13a,b, 14a,b, 15, 16.

Bulimina subacuminata Cushman and Stewart emended. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 245, pl. 7, fig. 2a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bulimina pagoda hebespinata Stewart and Stewart

Bulimina pagoda hebespinata Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 63, pl. 8, figs. 3a,b. - - White, 1956, Jour. Paleo., v. 30, pl. 253, pl. 30, figs. 6a,b.

Bulimina pagoda includes *Bulimina pagoda hebespinata* Stewart and Stewart - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 12a,b.

ECOLOGY: The upper depth limit of *Bulimina pagoda hebespinata* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bulimina pulchella d'Orbigny

Bulimina pulchella d'Orbigny, 1839, Voyage dans l'Amerique Meridionale; Foraminiferes, v. 5, p. 50, pl. 1, figs. 6, 7. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, figs. 17a,b, 19a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Bulimina rostrata Brady

Bulimina rostrata Brady, 1884, Report on the Scientific Results of the Voyage of the H.M.S. Challenger during the years 1873-1876, Zoology, v. 9, p. 408, pl. 51, figs. 14, 15. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 24, fig. 5. - - White, 1953, Jour. Paleo., v. 30, pl. 253, pl. 30, fig. 7a,b.

Bulimina fossa Cushman and Parker - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 5a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 244, pl. 7, figs. 3a,b.

ECOLOGY: The upper depth limit of *Bulimina rostrata* is in the lower middle bathyal biofacies (Ingle, 1980; Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bulimina subacuminata Cushman, Stewart, and Stewart

Bulimina subacuminata Cushman, Stewart, and Stewart, 1930, Trans., San Diego Society of Natural History, v. 6, p. 65, pl. 5, figs. 2, 3a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 10a,b, 11a,b; pl. 9, fig. 1. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 132, pl. 22, figs. 12a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 245, pl. 7, figs. 1a-b, 2a-b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 64-65, plate-figs. 1-7.

RANGE: Pliocene to Holocene (Martin, 1952); Miocene, Saucesian to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Bulimina subacuminata* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Bulimina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Buliminella basispinata Stewart and Stewart

Buliminella curta Cushman *basispinata* Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 63, pl. 8, fig. 6. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 133, pl. 23, figs. 2a-b.

OCCURRENCE: Balcom Canyon

Buliminella curta Cushman

Buliminella curta Cushman, 1925, Contr. Cushman Lab. Foram. Res., v. 1, p. 33, pl. 5, fig. 13. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 5a,b, 6a,b- - White, 1953, pl. 254, pl. 30, fig. 12a,b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 68-69, plate-figs. 1-8.

COMMENTS: This group includes specimens assigned to *Buliminella curta* var *basispinata* Stewart and Stewart by Natland (1952, pl. 8, fig. 7a,b, 8, 9a,b).

RANGE: Oligocene (Zemorrian) to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Buliminella curta* is in the outer neritic biofacies (Ingle, 1980). Blake (1991) considers this species an indicator of low oxygen conditions.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Buliminella elegantissima d'Orbigny

Buliminella elegantissima d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 51, pl. 7, figs. 13, 14.

Buliminella elegantissima (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 3a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 24, fig. 5. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 244, pl. 6, figs. 12a-b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 70-71, plate-figs. 1-8.

RANGE: Oligocene (Zemorrian) to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Buliminella elegantissima* is in the inner neritic biofacies (Ingle, 1980). These species thrive in the inner neritic zone regardless of the latitude (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Buliminella subfusiformis Cushman

Buliminella subfusiformis Cushman 1925, Contr. Cushman Lab. Foram. Res., v. 1, p. 33, pl. 5, fig. 12. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 134, pl. 23, figs. 6a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 4. - - White, 1953, Jour. Paleo., v. 30, pl 255, pl. 30, fig. 13. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 244, pl. 6, figs. 11, 13a,b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 74-75, plate-figs. 1-9.

RANGE: Oligocene (Zemorrian) to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Buliminella subfusiformis* is in the upper bathyal, oxygen-minimum biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina californica Cushman and Hughes

Cassidulina californica Cushman and Hughes, 1925, Contr., Cushman Lab. Foram. Res.,v. 1, p. 12, pl. 2, fig. 1. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 78, pl. 12, figs. 6, 7. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 16, fig. 9a,b, 10a,b, 11. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3. p. 134, pl. 24, fig. 2a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 1. - - White, 1956, Jour. Paleo., v. 30, p. 255, pl. 31, fig. 1a,b.

Islandiella californica (Cushman and Hughes) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 138-139, plate-figs. 1-6.

RANGE: Miocene to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Cassidulina californica* is in the upper bathyal biofacies but may be transitional between outer neritic and upper bathyal biofacies (Ingle, 1980). *Cassidulina californica* (*Islandiella californica* of some authors) ranges from the Aluetian to the California province (Culver and Buzas, 1986; Buzas and Culver, 1991)

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina corbyi Cushman and Hughes

Cassidulina corbyi Cushman and Hughes, 1925, Contr., Cushman Lab. Foram. Res., v. 1, p. 14, pl. 2, fig. 3. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 6, 7a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Cassidulina cushmani Stewart and Stewart

Cassidulina cushmani Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 71, pl. 9, fig. 5. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 11a,b, 13a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 5. - - White, 1956, Jour. Paleo., v. 30, p. 255, pl. 30, fig. 2a,b.

COMMENTS: The aperture is an elongate narrow slit following curve of preceeding chamber.

ECOLOGY: The upper depth limit of *Cassidulina cushmani* is in the upper middle bathyal biofacies and is associated with the Antarctic Intermediate Water, cool, high salinity, oxygen-rich water (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina delicata Cushman

Cassidulina delicata Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 168, pl. 6, fig. 5. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 4.

Cassidulina cushmani Stewart and Stewart - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 135, pl. 24, figs. 5a-b.

Paracassidulina delicata (Cushman) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 186-187, plate-figs. 1-8.

Cassidulina parisi Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 2a,b.

RANGE: late Miocene to Holocene

ECOLOGY: *Cassidulina delicata* is a comopolitian species (Culver and Buzas, 1986), with an upper depth limit that is transitional between upper bathyal and upper

middle bathyal biofacies (Ingle, 1980). *Cassidulina delicata* suggests low oxygen conditions (Blake, 1981). *Cassidulina delicata* is a common species in the group I, lower slope assemblage of the nearshore basins and a dominant species in the group I, lower slope assemblages of the offshore basins in the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina depressa Asano and Nakamura

Cassidulina subglobosa Brady *depressa* Asano and Nakamura, 1937, Japanese Jour. Geol. Geogr., Trans. Abstr., v. 14, p. 148, pl. 13, fig. 8.

Cassidulina depressa Asano and Nakamura - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 391.

ECOLOGY: *Cassidulina depressa* dominates the outer neritic biofacies off southern California and is a common species in the upper slope assemblage of the nearshore basins and a dominant species in the bank assemblages of the offshore basins of the California continental borderland (Douglas and Heitman, 1979). *Cassidulina depressa* may be present in the inner neritic biofacies but in greatly reduced abundances (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon

Cassidulina laevigata d'Orbigny

Cassidulina laevigata d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 282, pl. 15, figs. 4-5, 5 bis. - - Phleger and Parker, 1951, Geol Soc. Amer., Memior, v. 46, p. 27, pl. 14, figs. 6a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 12a,b. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 391, pl. 6, fig. 7.

ECOLOGY: The upper depth limit of *Cassidulina laevigata* is in the upper bathyal to upper middle bathyal biofacies (Smith, 1964; Ingle, 1980). Forms which lack the well developed keel of *C. laevigata carinata* first appear on the outer shelf off Central America (Smith, 1964)

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina laevigata carinata Silvestri

Cassidulina laevigata d'Orbigny *carinata* Silvestri, 1896, Accad. Pont. Nuovi Lincei, Memoirs, v. 15, p. 104, pl. 2, fig. 10a-c. - - Phleger and Parker, 1951, Geol Soc. Amer., Memoirs, v. 46, p. 27, pl. 14, figs. 7a-b. - - White, 1956, Jour. Paleo., v. 30, p. 255, pl. 31, fig. 3a,b. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 391.

Islandiella carinata (Silvestri) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 140-141, plate-figs. 1-8.

COMMENTS: Only forms with a distinct keel described as thin carinae by Cushman (1922) are included in this species. This variation is probably an ecologic variation of *C. laevigata* d'Orbigny since the trend recognized by Smith (1964) indicates the periphery becomes more acute and develops a keel as depth increases off Central America. Smith (1964) noted keels on specimens below 150 m.

RANGE: Oligocene to Pliocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Cassidulina laevigata carinata* is in the upper middle bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon

Cassidulina limbata Cushman and Hughes

Cassidulina limbata Cushman and Hughes, 1925, Contr., Cushman Lab. Foram. Res., v. 1, p. 12, pl. 2, fig. 2. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 78, pl. 12, fig. 12. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 1a,b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 135, pl. 24, fig. 6a-b.

ECOLOGY: *Cassidulina limbata* ranges from the Aluetian to the California province of Buzas and Culver (1990). Its upper depth limit is transitional between outer neritic and upper bathyal biofacies (Ingle, 1980). *Cassidulina limbata* is a dominant species in the bank assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina lomitensis Galloway and Wissler

Cassidulina lomitensis Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 79, pl. 12, fig. 10. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 18, fig. 3a,b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 135, pl. 24, figs. 7a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 5. - - White, 1956, Jour. Paleo., v. 30, p. 256, pl. 31, fig. 4a,b.

ECOLOGY: The upper depth limit of *Cassidulina lomitensis* is transitional between the outer neritic and the upper bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon

Cassidulina minuta Cushman

Cassidulina minuta Cushman, 1933, Contr. Cushman Lab Foram. Res., v. 9, p. 92, pl. 10, fig. 3. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 391.

ECOLOGY: Although *Cassidulina minuta* is listed as rare off Monterey and common south of Point Conception (Culver and Buzas, 1986), it is thought to range from the Aluetian to the Panamanian province of Buzas and Culver (1990). The upper depth limit of *Cassidulina minuta* is in the outer neritic biofacies (Smith, 1964; Ingle, 1980).
OCCURRENCE: Balcom Canyon

Cassidulina oblonga Reuss

Cassidulina oblonga Reuss, 1850, K. Akad. Wiss. Wien, Math.-Nat. Cl., Denkschr., Bd. 1, p. 376, pl. 48, figs. 5, 6.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina spp.

COMMENTS: *Cassidulina* spp. includes specimens assigned to *Cassidulina crassaformis* m.s. Natland, (1952, p. 152, pl. 17, fig. 5 a,b.); *Cassidulina pacifica* m.s. Natland (1952, p. 154, pl. 17, fig. 14 a,b.); *Cassidulina reflexsa* of Natland (1952, checklist); and *Cassidulina spira* m.s. Natland (1952, p. 155, pl. 18, fig. 1a,b.) as well as specimens which are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina tortuosa Cushman and Hughes

Cassidulina tortuosa Cushman and Hughes, 1925, Contr., Cushman Lab. Foram. Res., v. 1, p. 14, pl. 2, fig. 4. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 2a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 3. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 260, pl. 12, fig. 4a,b,c.

ECOLOGY: *Cassidulina totuosa* is a cosmopolitan species (Culver and Buzas, 1986) with an upper depth limit transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980). *Cassidulina tortuosa* is a dominant species in the bank assemblage of the offshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina transluscens Cushman and Hughes

Cassidulina transluscens Cushman and Hughes, 1925, Contr., Cushman Lab. Foram. Res., v. 1, p. 15, pl. 2, fig. 5. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 80, pl. 12, fig. 11. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 9, 10a,b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 136, pl. 24, figs. 4a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 6. - - White, 1956, Jour. Paleo., v. 30, p. 256, pl. 31, fig. 5a,b.

ECOLOGY: Although the upper depth limit of *Cassidulina transluscens* is given as in the upper bathyal biofacies, the upper depth limit of this species is transitional between the outer shelf and upper bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cassidulina tumida Natland

Cassidulina tumida Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 148, pl. 6, figs. 2-3. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 8a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Cassidulinella pliocenica Natland

Cassidulinella pliocenica Natland, 1940, Jour. Paleo., v. 14, p. 570-571, pl. 69, figs. 5, 6a-c. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 18, fig. 4a,b,c.

RANGE: Species has been found in the upper Pliocene of the Los Angeles and Ventura basins (Natland, 1940).

OCCURRENCE: Balcom Canyon

Cassidulinoides bradyi (Norman)

Cassidulina bradyi Norman, 1881, Quart. Jour. Micr. Sci., n.s., v. 21, p. 59.

Cassidulinoides bradyi (Norman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 18, fig. 3a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 261, pl. 13, fig. 6a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Cassidulinoides tenuis Phleger and Parker

Cassidulinoides tenuis Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 27, pl. 4, figs. 14-17.

Rutherfordoides tenuis (Phleger and Parker) - - Kohl, 1985, Bull. Amer. Paleo., v. 88, p. 89, pl. 18, fig. 5.

ECOLOGY: The upper depth limit of *Cassidulinoides tenuis* is in the upper middle bathyal biofacies (Smith, 1964).

OCCURRENCE: Balcom Canyon

Chilostomella oolina Schwager

Chilostomella oolina Schwager, 1878, Geol. (Reale com. Geol. Italiana), Boll., v. 9, p. 527, pl. 1, fig. 16. - - Phelger and Parker, 1951, Geol. Soc. Amer., Memoir, v. 46, p. 29, pl. 15, fig. 10. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 19, fig. 5a,b. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 391.

ECOLOGY: *Chilostomella oolina* is a cosmopolitan species (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cibicides fletcheri Galloway and Wissler

Cibicides fletcheri Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 64, pl. 10, figs. 8-9. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 125, pl. 20, figs. 2a-b. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 392

Anomalina schmitti Cushman and Wickenden - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 1a,b,c.

COMMENTS: Specimens included in this species were restricted to forms with a flat spiral side and a convex umbilical side. Forms with a concave spiral side are identified as *C.* cf. *C. fletcheri.*

ECOLOGY: *Cibicides fletcheri* is a cosmopolitan species (Culver and Buzas, 1986; Buzas and Culver, 1991). Its upper depth limit is in the inner neritic biofacies (Ingle, 1980). *Cibicides fletcheri* is a dominant species in the bank assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cibicides lobatulus (d'Orbigny)

Truncatulina lobatulus d'Orbigny, 1839, Histoire naturelle des Iles Canaries, v. 2, p. 134, pl. 2, figs. 22-24.

Cibicides lobatulus (d'Orbigny) - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 22, fig. 4.

ECOLOGY: *Cibicides lobatulus* is a cosmopolitan species (Culver and Buzas, 1986; Buzas and Culver, 1991). Its upper depth limit is in the inner neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Cibicides mckannai Galloway and Wissler

Cibicides mckannai Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 65, pl. 10, figs. 5-6. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 8a,b,c, 9. - - White, 1956, Jour. Paleo., v. 30, p. 249, pl. 28, fig. 6a,b,c. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 392.

Cibicidoides mckannai (Galloway and Wissler) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 86-87, plate-figs. 1-8.

RANGE: Middle Miocene to Holocene (Finger, 1990)

ECOLOGY: Although *Cibicides mckannai* is found most commonly south of Point Conception (Culver and Buzas, 1986), its range is though to be from the Aluetian to the Panamanian province of Buzas and Culver (1990). Its upper depth limit is in the upper bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cibicides spiralis Natland

Cibicides spiralis Natland, 1938, Bull., Scripps Inst. Ocean, Tech. Ser., v. 4, p. 151, pl. 7, fig. 7. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 7a,b,c.

Cibicides mckannai Galloway and Wissler var. *spiralis* Natland - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 266, pl. 18, fig. 1a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Cibicides/Cibicidoides spp.

COMMENTS: This designation includes species assigned to *Cibicides concideus* (Natland, 1952) and *Cibicides repettensis* (Natland, 1952) as well as specimens which can not be identified to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Cibicidoides bradyi (Trauth)

Truncatulina bradyi Trauth, 1918, K. Akad. Wiss. Wien, Math.-Nat. Kl., Denkschr., Bd. 95, p. 235.

Cibicidoides bradyi (Trauth) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 392.

ECOLOGY: The upper depth limit of *Cibicidoides bradyi* is in the upper middle bathyal biofacies (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon

Cibicidoides wuellerstorffi (Schwager)

Anomalina wuellerstorffi Schwager, 1866, Novara Exped., Geologisch Theil, v. 2, p. 258, pl. 7, figs. 105, 107.

Planulina wuellerstorfi (Schwager) - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, pl. 33, pl. 18, figs. 11a, b; pl. 19, figs. 1, b-3a, b.

Cibicidoides wuellerstorffi (Schwager) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 392.

ECOLOGY: *Cibicidoides wuellerstorffi* is generally associated with the warmer parts of the Antarctic Bottom Water, Pacific Deep Water, and North Atlantic Deep Water where temperatures are 1.9-3.0°C, the water is well-oxygenated and moderately saline (34.7-35.0 °/$_{oo}$) (Lohmann, 1978; Schnitker, 1980; Corliss, 1983).

OCCURENCE: Balcom Canyon

Cyclammina cancellata Brady

Cyclammina cancellata Brady, 1879, p. 62. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 1, fig. 6a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Cyclammina spp.

COMMENTS: The designation includes specimens which are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Dentalina baggi Galloway and Wissler

Dentalina baggi Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 49, pl. 8, figs. 14, 15. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 118, pl. 17, figs. 6a-b.

ECOLOGY: Along the East Pacific Margin, *Dentalina baggi* is found from Point Conception south (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Dentalina soluta Reuss

Dentalina soluta Reuss, 1851, Deut. Geol. Gesel., Zeit. v. 3, p. 60, pl. 3, fig. 4 a,b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 3, figs. 12, 13, 14, 15a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Dentalina spp.

COMMENTS: This designation includes specimens assigned to *Dentalina lawndalensis* m.s. Natland (1952, p. 102, pl. 3, fig. 10 a,b) as well as specimens too poorly preserved or broken to identify to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Discorbis spp.

COMMENTS: Specimens can only be identified to genus.

OCCURRENCE: Balcom Canyon

Dyocibicides perforatus Cushman and Valentine

Dyocibicides perforata Cushman and Valentine, 1930, Stanford Univ. Dept. Geol., Contr., v. 1, p. 31, pl. 10, fig. 3.

OCCURRENCE: Balcom Canyon

Ehrenbergina bradyi Cushman

Ehrenbergina bradyi Cushman, 1922, U.S. Nat. Mus. Bull., no. 104, p. 134, pl. 26, fig. 5. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 18, fig. 6a,b,c,d. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, pl. 6, fig. 8.

ECOLOGY: Species of *Ehrenbergina* are most common at depths of 2.3 to 4.2 km in the Atlantic (Lohmann, 1978). This depth association has been adopted for all species of *Ehrenbergina* in this study. Examples of depth associations in the Pacific are given under the species. Deviations from the lower bathyal to abyssal association are stressed.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Elphidiella hannai (Cushman and Grant)

Elphidium hannai Cushman and Grant, 1927, San Diego Soc. Nat. Hist., Trans., v. 5, p. 77, pl. 8, fig. 1.

Elphidiella hannai (Cushman and Grant) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 7, fig. 6a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 241, pl. 6, figs. 1a,b.

ECOLOGY: Along the East Pacific Margin, *Elphidiella hannai* is common from Point Conception north, with rare occurrences in the Santa Barbara Basin of southern California (Culver and Buzas, 1986). *Elphidiella hannai* migrated south during cooler periods in the late Neogene when the California Current moved south of its present position.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Elphidium articulatum (d'Orbigny)

Polystomella articulata d'Orbigny, 1939, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, p. 30, pl. 3, figs. 9-10.

Elphidium articulatum (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 113, pl. 6, fig. 12a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Elphidium crispum (Linne)

Nautilus crispus Linne, 1758, Systema Naturae, p. 709.

Elphidium crispum (Linne) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 7, figs. 1, 2a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Elphidium frigidum Cushman

Elphidium frigidum Cushman, 1933, Smithsonian Inst. Misc. Coll., v. 89, p. 5, pl. 1, fig. 8. - - Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, p. 99, pl. 18, figs. 4-9.

OCCURRENCE: Balcom Canyon

Elphidium gunteri Cole

Elphdium gunteri Cole, 1931, Florida State Geol. Survey Bull., no. 6, p. 34, pl. 4, figs. 9-10.

OCCURRENCE: Balcom Canyon

Elphidium spp.

COMMENTS: This designation includes specimens assigned to *Elphidium acutum* m.s. Natland (1952, p. 116, pl. 7, fig. 5a,b) as well as specimens too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Elphidium translucens Natland

Elphidium translucens Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 144, pl. 5, figs. 3, 4. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 22, fig. 9.

Elphidium poeyanum (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 13, 14a,b, 16, 17a,b.

ECOLOGY: Although *Elphidium translucens* is considered a cosmopolitan species (Culver and Buzas, 1986), its range is thought to be from the Oregonian to the Panamanian province of Buzas and Culver (1990). The depth limit of *Elphidium transluscens* is in the inner neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Elphidium tumidum Natland

Elphidium tumidum Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 144, pl. 5, figs.

Elphidium hughesi Cushman and Grant - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 15a,b.

ECOLOGY: Although *Elphidium tumidum* is considered a cosmopolitan species (Culver and Buzas, 1986), its range is thought to be from the Aluetian to the Panamanian province of Buzas and Culver (1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Epistominella bradyana (Cushman)

Pulvinulinella bradyana Cushman, 1927, Bull, Scripps Inst. Ocean., Tech. Ser., v. 1, p. 165, pl. 5, figs. 11-13.

Pulvinulinella (*Epistominella*) *bradyana* Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 16, fig. 3a,b,c.

Epistominella bradyana (Cushman) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 136, pl. 24, figs. 9a-b. - - White, 1956, Jour. Paleo., v. 30, p. 257, pl. 31, fig. 7a,b,c. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393.

ECOLOGY: *Epistominella bradyana* is a cosmopolitan species which is commonly found in the California borderland (Culver and Buzas, 1986). Buzas and Culver (1990) indicate it ranges from the Oregonian to the Panamanian province. The upper depth limit of *Epistominella bradyana* is in the outer neritic biofacies (Smith, 1964).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Epistominella exiqua (Brady)

Epistominella exiqua Brady, 1884, Report on the Scientific Results of the Voyage of the H.M.S. Challenger during the years 1873-1876, Zoology, v. 9, p. 696, pl. 103, figs. 13-14.

Pulvulinella (*Epistominella*) *umbilicatula* m.s. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 16, fig. 2a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Epistominella pacifica (Cushman)

Pulvinulinella pacifica Cushman, 1927, Bull, Scripps Inst. Ocean., Tech. Ser., v. 1, p. 165, pl. 5, figs. 14, 15.

Pulvinulinella (*Epistominella*) *pacifica* Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 16, fig. 1a,b,c, 6.

Epistominella pacifica (Cushman) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 136, pl. 24, figs. 8a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 23, fig. 2. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 254, pl. 10, fig. 5a,b,c; 6a,b,c.

ECOLOGY: The upper depth limit of *Epistominella pacifica* is in the upper middle bathyal biofacies (Ingle, 1980). *Epistominella pacifica* is commonly found associated with Antarctic Intermediate Water, cool, high salinity, oxygen-rich water (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Epistominella subperuviana (Cushman)

Pulvinulinella subperuviana Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 73-80, pl. 9, fig. 9.

Pulvinulinella (*Epistominella*) cf. *subperuviana* Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 16, fig. 4a,b,c, 5a,b,c.

Epistominella subperuviana (Cushman) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 254, pl. 10, fig. 7a,b,c.

Pseudoparrella subperuviana (Cushman) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 210-211, plate-figs. 1-9.

RANGE: Oligocene to Holocene (Finger, 1990)

ECOLOGY: *Epistominella subperuviana* first appears at the shelf edge (Ingle and Keller, 1980). In this paper the upper depth limit is placed in the upper bathyal biofacies (Ingle, 1980; Resig, 1981) - - Resig (1981) finds this species associated with temperatures of 7-13° C, a salinity range of 34.6 $^{0}/_{00}$ and an oxygen content of less than 1 ml/l.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Epistominella smithi (Stewart and Stewart)

Pulvinulinella smithi Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 70, pl. 9, fig. 4.

Epistominella smithi (Stewart and Stewart) - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 23, fig. 7. - - White, 1956, Jour. Paleo., v. 30, p. 257, pl. 32, fig. 1a,b,c. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 98-99, plate-figs. 1-8.

COMMENTS: Forms with a lobate periphery are assigned to this species. Similar but not lobate peripheries are assigned to *E. pacifica*.

RANGE: Miocene to Pliocene (Finger, 1990)

ECOLOGY: *Epistominella smithi* is a cosmopolitan species which is found commonly in the California borderland (Culver and Buzas, 1986). Its upper depth limit is transitional between upper bathyal and upper middle bathyal biofacies (Ingle, 1980). *Epistominella smithi* is a dominant species in the group II, lower slope assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979). *Epistominella smithi* suggests low oxygen conditions (Blake, 1981).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Eponides healdi Stewart and Stewart

Eponides healdi Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 70, pl. 8, fig. 8. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles,pl. 14, figs. 7a,b,c. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 256, pl. 11, figs. 4a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Eponides spp.

COMMENTS: This designation includes specimens assigned to *Eponides* sp. 5, *Eponides* cf. *E. rosaformis* Cushman and Kleinpell of Natland (1952, pl. 15, figs. 1a,b,c), and *Eponides* sp. B of Natland (1952).

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Fissurina alveolata (Brady)

Lagena alveolata Brady, 1884, Report on the Scientific Results of the Voyage of the H.M.S. Challenger during the years 1873-1876, Zoology, v. 9, p. 487, pl. 60, figs. 30, 32.

Fissurina alveolata (Brady) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393, pl. 2, fig. 7.

OCCURRENCE: Balcom Canyon

Fissurina bobjonegoroensis (Boomgaart)

Entosolenia bobjonesoroensis Boomgaart in Thalmann, 1950, Cushman Lab. Foram. Res., Contr., v. 1, p. 42.

Fissurina bobojonesgoroensis (Boomgaart) - - Kohl, 1985, Bull. American Paleo., v. 88, p. 55, pl. 15, fig. 1.

OCCURRENCE: Balcom Canyon

Fissurina kugleri (Cushman and Stainforth)

Entosolenia kugleri Cushman and Stainforth, 1945, Cushman Lab. Foram. Res., Spec. Pub., no. 14, p. 45, pl. 7, fig. 5.

Fissurina kugleri (Cushman and Stainforth) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393.

OCCURRENCE: Balcom Canyon

Fissurina marginata (Montagu)

Verminulum marginatum Montagu, 1803, Testacea Britannica, p. 524.

Fissurina marginata (Montagu) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 123, pl. 18, figs. 12a-b. - - Kohl, 1985, p. 55, pl. 15, fig. 5. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393.

OCCURRENCE: Balcom Canyon

Fissurina obscurocostata Galloway and Wissler

Fissurina obsucurocostata Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 52, pl. 9, fig. 1.

OCCURRENCE: Balcom Canyon

Fissurina orbignyana Sequenza

Fissurina (Fissurine) orbignyana Sequenza, 1862, Eco Peloritano, Giornale Sci., Lette. and Arti., ser. 2, v. 5, p. 66, pl. 2, figs. 25-26.

Fissurina orbignyana Sequenza - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 393.

OCCURRENCE: Balcom Canyon

Fissurina spp.

COMMENTS: This designation includes species which are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Fursenkoina cornuta (Cushman)

Virgulina cornuta Cushman, 1913, U.S. Nat. Museum, Bull., v. 74, p. 637, pl. 80, fig. 1. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 133, pl. 23, figs. 9a-b.

Cassidulinoides cornuta (Cushman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 18, fig. 7a,b,c,d, 8a,b,c. - - White, 1956, Jour. Paleo., v. 30, p. 256, pl. 31, fig. 6a,b,c.

COMMENTS: (Natland, 1952) "This species is usually placed in *Virgulina*. This designation is here considered erroneous because this form has no triserial portion, but is biserial throughout. It might be deserving of a new generic name such as *Pseudo-cassidulinoides* because there are no definitely coiled chambers initially."

ECOLOGY: *Fursenkoina cornuta* is a dominant species in the basin floor assemblages of both the nearshore and offshore basins of the California continental borderland (*Cassidulinoides cornuta* of Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Fursenkoina schrebersiana (Czjzek)

Virgulina schreibersiana Czjeck, 1848, Haidinger's Nat. Wiss., Abh. 2, p. 147, pl. 13, figs. 18-21. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 9, figs. 6a,b, 8a,b.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Fursenkoina spp.

COMMENTS: This designation includes species which are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Fursenkoina nodosa Stewart and Stewart

Virgulina nodosa Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 64, pl. 8, fig. 4. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 124, pl. 9, fig. 9.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Gaudryina arenaria Galloway and Wissler

Gaudryina arenaria Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 68, pl. 11, fig. 5. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 2, fig. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 21, fig. 9.

ECOLOGY: Although *Gaudryina arenaria* is found primarily from the Marin headlands south, it ranges from the Aluetian to the California province of Buzas and Culver (1990). The upper depth limit of *Gaudryina arenaria* is in the outer neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Glandulina laevigata (d'Orbigny)

Nodosaria (Glandulina) laevigata d'Orbigny, 1826, Annales Science Naturelle, ser. 1, v. 7, p. 252, pl. 10, figs. 1-3.

Glandulina laevigata (d'Orbigny) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 118, pl. 17, figs. 3a-b. - - White, 1956, Jour. Paleo., v. 30, p. 246, pl. 27,

figs. 4, 5a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 237, pl. 4, fig. 13. - - Kohl, 1985. Bull. American Paleo., v. 88, p. 54, pl. 14, fig. 2. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

Pseudoglandulina laevigata (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 5, figs. 9a,b.

ECOLOGY: The upper depth limit of *Glandulina laevigata* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Globobulimina pacifica Cushman

Globobulimina pacifica Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 67, pl. 14, fig. 12. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 74, pl. 11, fig. 18. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 9, fig. 3a,b, 5a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177. - - Kohl, 1985, Bull. Amer. Paleo., v. 88, p. 67, pl. 21, fig. 1.- - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394, pl. 4, fig. 1.

ECOLOGY: *Globobulimina pacifica* is a cosmopolitan species (Culver and Buzas, 1986). Its upper depth limit is transitional between outer neritic and upper bathyal biofacies (Ingle, 1980). Keller and Ingle (1980) find *Globobulimina pacifica* associated with the shallow oxygen minimum zone in the upper bathyal biofacies. *Globobulimina pacifica* is a dominant species in the upper slope assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Globobulimina pyrula (d'Orbigny)

Bulimina pyrula d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 184, pl. 11, figs. 9-10.

OCCURRENCE: Balcom Canyon

Globobulimina spinifera Cushman

Bulimina spinifera Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 151, pl. 2, fig. 15. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, figs. 21a,b, 22a,b.

COMMENTS: probably synonomous with *B. pyrula* d'Orbigny var. *spinescens* Brady

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Globocassidulina subglobosa (Brady)

Cassidulina subglobosa Brady, 1881, Quart. J. Micr. Sci., v. 21, p. 60. - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 27. pl. 14, figs. 11-13. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 88, pl. 30, figs. 3-4.

Globocassidulina subglobosa - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

Cassidulina s.n.q. *subglobosa* - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 17, fig. 4a,b.

ECOLOGY: *Globocassidulina subglobosa* is a cosmopolitan species (Culver and Buzas, 1986; Buzas and Culver, 1991) which has been found associated with warmer AABW, warmer PDW, NADW, Indian Bottom Water, and Antarctic Intermediate Water. It is associated with decreased oxygen conditions. The upper depth limit of *Globocassidulina subglobosa* is in the upper bathyal biofacies (Ingle, 1980). *Globocassidulina subglobosa* is a dominant species in the bank assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979).

Depth, water-mass and biofacies associations of *Globocassidulina subglobosa* are highly variable. In the Gulf of Mexico, *G. subglobosa* occurs in the upper bathyal biofacies (Pflum and Frerichs, 1976); in the Atlantic Ocean, Lohmann (1978) associates this species with depth of 2.5 km and in the Pacific Woodruff (1985) associates this species with shallow, early Miocene assemblages (less than 2.5 km). This species occurs in association with *Uvigerina peregrina* in the North Atlantic NADW (Schnitker, 1980), and South Atlantic Circumpolar Deep Water (Lohman, 1978; Gofas, 1978; Schnitker, 1980). In the South Pacific PDW *Globocassidulina subglobosa* is associated with *E. umbonifera* (Gofas, 1978; Schnitker, 1980). Both species become less aboundant in the upper part of the PDW (Schnitker, 1980). A similar association is also noted in the Indian Ocean where the abundance of *G. subglobosa* increase slightly as the temperature of the AABW increases (Corliss, 1979b).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Guttulina quinquecosta Cushman and Ozawa

Guttulina quinquecosta Cushman and Ozawa - - Natland, 1952, pl. 5, figs. 4a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Gyroidina altiformis Stewart and Stewart

Gyroidina soldanii d'Orbigny *altiformis* Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 67, pl. 9, fig. 2. - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 22, pl. 11, figs. 15a, b, 16a, b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 13, fig. 13a,b,c, 14.

Gyroidina altiformis (Stewart and Stewart) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 125, pl. 19, figs. 8a-b. - - White, 1956, Jour. Paleo., v. 30, pl. 248, pl. 28, fig. 4a,b,c. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

Gyroidinoides altiformis (Stewart and Stewart) - - Kohl, 1985, Bull. American Paleo., v. 88, p. 95, pl. 34, fig. 3.

Hansenisca altiformis (Stewart and Stewart) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 124-125, plate-figs. 1-8.

RANGE: Oligocene (Zemorrian) to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of Gyroidina altiformis is in the upper bathyal biofacies Ingle (1980). Smith (1964), however, finds the upper depth limit in the lower middle bathyal biofacies off Central America.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Gyroidina condoni (Cushman and Schenck)

Eponides condoni Cushman and Schenck, 1928, Univ. Calif., Berkeley, Dept. Geol. Sci., Bull., v. 17, p. 313, pl. 44, figs. 6-7.

Gyroidina condoni (Cushman and Schenck) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

OCCURRENCE: Balcom Canyon

Gyroidina multilocula Coryell and Mossman

Gyroidina soldanii d'Orbigny *multilocula* Coryell and Mossman, 1942, Jour. Paleo., v. 16, p. 237, pl. 36, fig. 20. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 125, pl. 20, fig. 1a-c. - - White, 1956, Jour. Paleo., v. 30, p. 249, pl. 28, fig. 5a,b,c.

OCCURRENCE: Balcom Canyon

Gyroidina rotundimargo Stewart and Stewart

Gyroidina soldanii (d'Orbigny) var. *rotundimargo* Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 68, pl. 9, fig. 3. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 13, fig. 15a,b,c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Gyroidina soldanii d'Orbigny

Gyroidina soldanii d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 278, modeles no. 36. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 14, fig. 2a,b,c. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

ECOLOGY: Along the East Pacific margin, the upper depth limit of *Gyroidina soldanii* is in the lower bathyal biofacies (Ingle, 1980; Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Gyroidina spp.

COMMENTS: This designation includes specimens to poorly preserved to identify.

OCCURRENCE: Balcom Canyon

Hanzawaia illingi (Nuttall)

Truncatulina illingi Nuttall, 1928, Geol. Soc. London, Quart. Jour., v. 84, p. 99, pl. 7, figs. 11, 17; p. 99, tf. 5.

ECOLOGY: Along the East Pacific margin, the upper depth limit of *Hanzawaia illingi* is in the outer neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Hanzawaia nitidula (Brady)

Cibicidina basiloba (Cushman) var. *nitidula* Bandy, 1953, Jour. Paleo., v. 27, p. 178, pl. 22, fig. 3.

Cibicides basiloba (Cushman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 5a,b,c.

ECOLOGY: Although *Hanzawaia nitidula* is found primarily in the southern California borderland and south (Culver and Buzas, 1986), its range is though to be from the California to the Panamanian province of Buzas and Culver (1990). Its upper depth limit is in the outer neritic biofacies (Ingle, 1980). Blake (1976) considers this species a indicator of warmer water. *Hanzawaia nitidula* is a dominant species in the bank assemblages of the offshore basins of the California continental borderland (Douglas and Heitman, 1979).

The upper depth limit of *Hanzawaia nitidula* is in the less turbulent parts of the inner neritic biofacies and is most common in the tropical surface water masses. Generally found in regions influenced by the Northern Equatorial current (Ingle and Keller, 1980), thus Blake (1976), Ingle (1980), and Ingle and Keller (1980) believed this species migrated into the borderland in abundance during warm periods when the Californica Current/Equatorial Current boundary was north of its present location.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Haplophragmoides spp.

COMMENTS: This designation includes specimens that are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Hoeglundina elegans (d'Orbigny)

Rotalia elegans d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 276, modeles no. 6.

Epistomina elegans (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 15, fig. 8a,b,c.

Hoeglundina elegans (d'Orbigny) - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 22, pl. 12, figs. 1a, b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 23, fig. 9. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 59, pl. 14, figs. 4-5. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394.

ECOLOGY: Along the East Pacific margin, *Hoeglundina elegans* is found primarily in the California borderland (Culver and Buzas, 1986). It has been found associated with warmer Pacific Deep Water, Pacific Intermediate Water, upper North Atlantic Deep Water, and Arctic Intermediate Water. It is associated with lower oxygen conditions. The upper depth limit of *Hoeglundina elegans* is in the upper bathyal biofacies (Smith, 1964; Ingle, 1980). *Hoeglundina elegans* is a common species in the group II, lower slope assemblages of the offshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Karreriella grammostomata (Galloway and Wissler)

Gaudryina grammostomata Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 69, pl. 11, fig. 6.

Karreriella grammostomata (Galloway and Wissler) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 96, pl. 2, fig. 7a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Lagena acuticosta Reuss

Lagena acuticosta Reuss, 1862, K. Akad. Wiss. Wien, Math.-Naturw. Cl., Sitzber, Bd. 44, Abth. 1, p. 305. pl. 1, fig. 4. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 120, pl. 17, figs. 13a-b.

OCCURRENCE: Balcom Canyon

Lagena amphora Reuss

Lagena amphora Reuss, 1863, K. Akad. Wiss. Wien, Math.-Naturw. Cl., Sitzber, Bd. 46, Abth. 1, p. 330, pl. 4, fig. 57.

ECOLOGY: Although rare *Lagena amphora* are found off the Monterey Peninsula, it is found commonly in the California borderland and south (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Lagena costata (Williamson)

Entosolenia costata Williamson, 1858, On the Recent Foraminifera of Great Britian, Ray Society, p. 9, pl. 1, fig. 18.

Lagena costata (Williamson) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 394, pl. 2, fig. 2.

OCCURRENCE: Balcom Canyon

Lagena elongata (Ehrenberg)

Miliola elongata Ehrenberg, 1844, K. Preuss. Akad. Wiss Berlin, Monatsber., p. 274.

Lagena elongata (Ehrenberg)- - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 121, pl. 18, figs. 2a-b.

ECOLOGY: *Lagena elongata* is found commonly in the California borderland and south (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Lagena flatulenta Loeblich and Tappan

Lagena flatulenta Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, p. 60, pl. 11, figs. 9, 10.

OCCURRENCE: Balcom Canyon

Lagena hexagona (Williamson)

Entosolenia squamosa (Montagu) var. *hexagona* Williamson, 1848, p. 20, pl. 2, fig. 23.

Lagena hexagona (Williamson) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 121, pl. 18, figs. 2a-b. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 395.

Oolina hexagona (Williamson) - - Kohl, 1985, Bull. American Paleo., v. 88, p. 57, pl. 16, fig. 4.

OCCURRENCE: Balcom Canyon

Lagena laevis (Montagu)

Vermiculum laeve Montagu, 1803, Testacea Britannica, J.S. Hollis, p. 524.

Lagena laevis (Montagu) - - Kohl, 1985, Bull. American Paleo., v. 88, p. 40, pl. 8, fig. 6. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 395.

OCCURRENCE: Balcom Canyon

Lagena scalariformis (Williamson)

Entosolenia squamosa (Montagu) *scalariformis* Williamson, 1858, On Recent foraminifera of Great Britian, Ray Society, p. 13, pl. 1, fig. 30. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 121, pl. 18, figs. 2a-b.

OCCURRENCE: Balcom Canyon

Lagena setigera Millett

Lagena clavata (d'Orbigny) var *setigera* Millett, 1901, p. 491, pl. 8, figs 9a,b.

Lagena setigera Millett - - Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, p. 66, pl. 11, figs. 23, 24. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 41, pl. 8, fig. 8.

OCCURRENCE: Balcom Canyon

Lagena semistriata Williamson

Lagena striata (Monatgu) var *semistriata* Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, v. 1, p. 14, pl. 1, figs. 9-10.

OCCURRENCE: Balcom Canyon

Lagena spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Lagena striata (d'Orbigny)

Oolina striata d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 21, pl. 5, fig. 12.

Lagena striata (d'Orbigny) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 395, pl. 2, fig. 4. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 121, pl. 18, figs. 6a-b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 236, pl. 4, fig. 9.

ECOLOGY: *Lagena striata* is a cosmopolitan species (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Lagena sulcata (Walker and Jacob)

Serpula sulcata Walker and Jacob in Kanmacher, 1798, Adams' Essays on the microscope, Ed. 2, Dillon and Keating, p. 634, pl. 14, fig. 5.

Lagena sulcata (Walker and Jacob) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 237.

ECOLOGY: *Lagena sulcata* is found commonly from Point Conception south (Culver and Buzas, 1986).
OCCURRENCE: Balcom Canyon

Lagena sulcata laevicosta Cushman and Gray

Lagena sulcata (Walker and Jacob) *laevicosta* Cushman and Gray, 1946, Cushman Lab. Foram. Res., Contr., v. 22, p. 68, figs. 8a-b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 122, pl. 18, figs. 8a-b.
OCCURRENCE: Balcom Canyon

Lagena vulgaris Williamson

Lagena vulgaris Williamson, 1858, On the Recent Foraminifera of Great Britian, Ray Society, p. 3, pl. 1, fig. 5, 5a. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 122, pl. 18, figs. 9a-b.
OCCURRENCE: Balcom Canyon

Lagena williamsoni (Alcock)

Entosolenia williamsoni Alcock, 1865, Proceed. Lit. Phil. Soc. Manchester, v. 4, p. 193.
Lagena williamsoni (Alcock) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 122, pl. 18, figs. 10a-b.
OCCURRENCE: Balcom Canyon

Laticarinina pauperata (Parker and Jones)

Pulvinulina repanda (Fitchell and Moll) var. *menardii* (d'Orbigny) subvar. *pauperata* Parker and Jones, 1865, Roy. Soc. London, Philos. Trans., v. 155, p. 395, pl. 16, figs. 50, 51a,b.
Laticarinina pauperata (Parker and Jones) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 4a,b.
Laticarinina halophora (Stache) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 255, pl. 10, fig.1a,b.
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Leibusella pliocenica (Natland)

Leibusella pliocenica (Natland) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 97, pl. 2, fig. 8, 9a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 231, pl. 1, fig. 8.
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Lenticulina cushmani (Galloway and Wissler)

Robulus cushmani Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 51, pl. 8, fig. 11. - - Natland, 1952, unpub. Ph. D. Diss., Univ. of Calif. Los Angeles, pl. 3, fig. 7a,b. - - White, 1956, Jour. Paleo., v. 30, p. 247, pl. 27, fig. 8a,b.

Lenticulina cushmani (Galloway and Wissler) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 395. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 233, pl. 3, fig.4a-b.

Robulus cf. *cushmani* (Galloway and Wissler) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 3, fig. 6a,b.

ECOLOGY: Although Blake (1976) considers this species to be a warm water species, Haller (1980) finds this species throughout the Humboldt Basin in the Pliocene.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Lenticulina spp.

COMMENTS: This designation includes specimens assigned to *Lenticulina flexuosa* of Natland (1952) as well as specimens to poorly preserved to identify.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Loxostomum pseudobeyrichi (Cushman)

Bolivina pseudobeyrichi Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 45. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 7a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 248, pl. 8, fig. 11a,b,c.

ECOLOGY: *Loxostomum pseudobeyrichi* is a dominant species in the lower slope assemblage of the nearshore basins and the basin floor assemblage of the offshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Martinottiella communis (d'Orbigny)

Clavulina communis d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 196, pl. 12, figs. 1-2.

Clavulina (*Listerella*) *communis* - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 2, fig. 10a,b.

Martinottiella communis (d'Orbigny) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 230, pl. 1, fig. 9.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Martinotiella pallida (Cushman)

Clavulina communis pallida Cushman, 1927, Bull, Scripps Inst. Ocean., Tech. Ser., v. 1, p. 138, pl. 2, fig. 1.

Clavulina (*Listerella*) *pallida* Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 2, fig. 11, 12a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Melonis barleeanus (Williamson)

Nonionina barleeana Williamson, 1858, On Recent Foraminifera of Great Britian, Ray Society, p. 32, pl. 3, figs. 68, 69.

Nonion barleeanus (Williamson) - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 21, fig. 8.

Melonis barleeanus (Williamson) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 166-167, plate-figs. 1-8.
Nonion pacificum (Cushman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 3a,b, 4, 5.
RANGE:middle Miocene (Luisian) to Holocene (Finger, 1990)
ECOLOGY: *Melonis barleeanus* is a cosmopolitan species (Culver and Buzas, 1986). The upper depth limit of *Melonis barleeanus* is transitional between the upper middle bathyal to lower middle bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Melonis pompilioides (Fitchel and Moll)

Nautilus pompilioides Fitchel and Moll, 1798, Testacea microscopica, aliaque minuta ex generibus Argonauta et Nautilus, ad naturam picta et descripta, Wien, Camesina, p. 31, pl. 2, figs. a-c.
Nonion pompilioides (Fitchel and Moll) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 123, pl. 19, figs. 2a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 2a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 21, fig. 12. - - White, 1956, Jour. Paleo., v. 30, p. 247, pl. 27, fig. 9a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 265, pl. 16, fig. 5a,b.
Melonis pompilioides (Fitchel and Moll) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 168-169, plate-figs. 1-8.
RANGE: Oligocene to Holocene (Finger, 1990)
ECOLOGY: The upper depth limit of *Melonis pompilioides* is in the lower bathyal biofacies (Ingle, 1980; Ingle and Keller, 1980).
OCCURRENCE: Balcom Canyon (cf.), Wheeler Canyon (Natland, 1952)

Miliammina fusca (Brady)

Quinqueloculina fusca Brady in Brady and Robertson, 1870, Ann. Mag. Nat. Hist., ser. 4, v. 6, p. 286, pl. 11, fig. 2.
OCCURRENCE: Balcom Canyon

Nodosaria anomala Reuss

Nodosaria (Nodosaria) anomala Reuss, 1866, K. Akad. Wiss., Wien, Math.-Naturw., Cl., Denkschr., Bd. 25, Abt. 1, p. 129, pl. 1, figs. 20-22.
Nodosaria anomala Reuss - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 119, pl. 17, figs. 7a-b.
Nodosaria (robusta) moniliformis Ehrenberg - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 104, pl. 4, fig. 1a,b, 2, 3, and 4.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Nodosaria hispida d'Orbigny

Nodosaria hispida d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 35, pl. 1, figs. 24-25.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Nodosaria lamellata Cushman and Stainforth

Nodosaria lamellata Cushman and Stainforth, 1945, Cushman Lab. Foram. Res., Spec. Pub., no. 14, p. 24.- - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

Nodosaria sp. (*pliocenica* var. *hispida*) Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 4, figs. 12a,b.

Nodosaria tosta Schwager - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 4, figs. 16a,b.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Nodosaria longiscata d'Orbigny

Nodosaria longiscata d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 32, pl. 1, figs. 10-12. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 120, pl. 17, figs. 11a-b. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 43, pl. 6, fig. 3. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

Nodosaria arundinea Schwager - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 4, fig. 13, 14, 15. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 234.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Nodosaria spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Nodosaria tympaniplectriformis Schwager

Nodosaria tympaniplectriformis Schwager, 1866, Novara Exped., Geol. Theil, v. 2, p. 215, pl. 5, fig. 34. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 105, pl. 4, fig. 10a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 235, pl. 3, fig. 10.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Nonion spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Nonionella auricula Heron-Allen and Earland

Nonionella auricula Heron-Allen and Earland, 1930, Roy. Micr. Soc., Jour. ser. 3, v. 50, p. 192, pl. 5, figs. 68-70.

OCCURRENCE: Balcom Canyon

Nonionella basispinata (Cushman and Moyer)

Nonion pizarrense Berry *basispinata* Cushman and Moyer, 1930, Contr., Cushman Lab. Foram. Res., v. 6, p. 54, pl. 7, fig. 18. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 6 (also listed as *Nonion auris*).

Nonionella basispinata (Cushman and Moyer) - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 21, fig. 9, 13. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

ECOLOGY: *Nonionella basispinata* is a cosmopolitan species (Culver and Buzas, 1986) which ranges from the Aluetian to the Panamanian provinces along the East Pacific margin (Buzas and Culver, 1991). Its upper depth limit is in the inner neritic biofacies (Ingle, 1980; Ingle and Keller, 1980). *Nonionella basispinata* is a dominant species in the outer shelf assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Nonionella costifera (Cushman)

Nonionina costifera Cushman, 1926, Contr., Cushman Lab. Foram. Res., v. 2, p. 90, pl. 13, figs. 2a-c. - - White, 1956, Jour. Paleo., v. 30, p. 247, pl. 27, fig. 10a,b,c.

Pseudononion costiferum (Cushman) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 202-203, plate-figs. 1-9.

RANGE: Oligocene to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Nonionella costifera* is in the inner neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Nonionella grateloupii (d'Orbigny)

Nonionina grateloupii d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, p. 46, pl. 6, figs. 6-7.

Nonion grateloupii (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 1a,b, 7 (listed as *Nonion scaphum* on checklist)

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Nonionella miocenica Cushman

Nonionella miocenica Cushman, 1926, p. 64. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 239, pl. 5, fig. 4a-c. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 182-183, plate-figs. 1-8.

RANGE: Oligocene to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Nonionella miocenica* is in the inner neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Nonionella spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Nonionella stella Cushman and Moyer

Nonionella miocenica Cushman *stella* Cushman and Moyer, 1930, Contr., Cushman Lab. Foram. Res., v. 6, p. 56, pl. 7, fig. 17. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 6, figs. 10a,b,c.

Nonionella stella Cushman and Moyer - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 22, fig. 2. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

ECOLOGY: *Nonionella stella* is a cosmopolitan species (Culver and Buzas, 1986; Buzas and Culver, 1991). Its upper depth limit is in the inner neritic biofacies (Ingle, 1980; Ingle and Keller, 1980). *Nonionella stella* is a dominant species in the outer shelf assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979). Ingle and Keller (1981) associate this species with the shallow oxygen minimum zone.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Oolina melo d'Orbigny

Oolina melo d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 20, pl. 5, fig. 9. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 58, pl. 16, fig. 5. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

Lagena melo (d'Orbigny) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 236, pl. 4, fig. 11.

ECOLOGY: *Oolina melo* is a cosmopolitan species (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Oridorsalis multiseptus (Koch)

Pulvinulina umbonata (Reuss) *multiseptus* Koch, 1926, Eclogae Geol. Helv., v. 19, p. 749, tf. 25.

Oridorsalis multiseptus (Koch) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

OCCURRENCE: Balcom Canyon

Oridorsalis subtenera (Galloway and Wissler)

Rotalia subtenera Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 60, pl. 10, fig. 4.

Eponides subtenera (Galloway and Wissler) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 142, pl. 14, fig. 3a, b, c.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Oridorsalis umbonatus (Reuss)

Rotalia umbonata Reuss, 1851, Deut. Geol. Gesel., Zeit., v. 3, p. 75, pl. 5, fig. 35.

Eponides umbonatus (Reuss) - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 22, pl. 11, figs. 10a, b, 13a, b, 14a, b.

Oridorsalis umbonatus (Reuss) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 257, pl. 11, fig. 3a,b,c.- - Kohl, 1985, Bull. American Paleo., v. 88, p. 95, pl. 33, fig. 6; pl. 34, figs. 1-2. - - McDougall, 1985, Initial Reports of

the Deep Sea Drilling Project, v. 84, p. 396, pl.6, fig. 11. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 182-183, plate-figs. 1-9.

Eponides tenera (Reuss) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 14, fig. 4a,b,c.

COMMENTS: Haller places *Pulvinulina umbonata* Reuss of Natland (1952) in synonomy but gives figure and plate for *E. tenera*.

RANGE: Tertiary

ECOLOGY: The upper depth limit of *Oridosalis umbonatus* is in the upper middle bathyal biofacies (Ingle, 1980). *Oridorsalis umbonatus* is associated with the Antarctic bottom Water, Pacific Deep Water, and North Atlantic Deep Water and indicates higher oxygen values and upwelling (Lohmann, 1978; Schnitker, 1980; Corliss, 1983).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Orthomorphina rohri (Cushman and Stainforth)

Nodogenerina rohri Cushman and Stainforth, 1945, Cushman Lab. Foram. Res., Spec. Pub., no. 14, p. 39, pl. 5, fig. 26.

Orthomorphina rohri (Cushman and Stainforth) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 396.

OCCURRENCE: Balcom Canyon (aff.)

Orthomorphina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Parafissurina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Planulina ariminensis d'Orbigny

Planulina ariminensis d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 280, pl. 14, figs. 1-3. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 66, pl. 11, fig. 2. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 265, pl. 16, fig. 7a,b,c.

Planulina cf. *ariminensis* d'Orbigny - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 19, fig. 14a,b.

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Planulina exorna Phleger and Parker

Planulina exorna Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 32, pl. 18, figs. 5-7.

OCCURRENCE: Balcom Canyon

Planulina ornata (d'Orbigny)

Truncatulina ornata d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 40, pl. 6, figs. 7, 9.

Planulina ornata (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 20, fig. 2a,b, 3. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 24, fig. 4. - - White, 1956, Jour. Paleo., v. 30, p. 250, pl. 28, fig. 7a,b,c.

ECOLOGY: *Planulina ornata* is a cosmopolitan species (Culver and Buzas, 1986) which ranges from the Oregonian to the Panamanian province along the East Pacific margin (Buzas and Culver, 1991). Its upper depth limit is in the outer neritic biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Plectofrondicularia advena (Cushman)

Frondicularia advena Cushman, 1923, p. 141, pl. 20. figs. 1-2. - - Galloway and Wissler, 1927, Jour. Paleo., v. 1, pl. 47, pl. 8, figs. 7, 8. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 5, figs. 2a,b, 3. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 117, pl. 17, figs. 2a-b.

Plectofrondicularia advena (Cushman) - - White, 1956, Jour. Paleo., v. 30, p. 252, pl. 30, fig. 2a,b. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 45, pl. 9, figs. 8, 9. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 397.- - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 242, pl. 6, fig. 6.

Proxifrons advena (Cushman)- - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 200-201, plate-figs. 1-7.

RANGE: Miocene to Holocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Plectofrondicularia advena* is in the lower middle bathyal biofacies (Cushman, 1922; Ingle in Finger, 1990).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Plectofrondicularia californica Cushman and Stewart

Plectofrondicularia californica Cushman and Stewart, 1926, p. 39, pl. 6, figs. 9-11. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 7, figs. 8, 9, 10, 11. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 243, pl. 6, fig. 9.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Plectofrondicularia miocenica Cushman

Plectofrondicularia miocenica Cushman, 1926, Contr. Cushman Lab. Foram. Res., v. 2, p. 58, pl. 7, figs. 10, 11; pl. 8, figs. 11, 12. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 243, pl. 6, fig. 8.

Parafrondicularia mioceneica (Cushman) - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 188-189, plate-figs. 1-11.

RANGE: Oligocene to Pliocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Plectofrondicularia miocenica* is in the lower middle bathyal biofacies (Ingle in Finger, 1990).

OCCURRENCE: Balcom Canyon

Plectofrondicularia spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Praeglobobulimina affinis (d'Orbigny)

Bulimina affinis d'Orbigny, 1839, Voyages dans l'Amerique Meriodionale; Foraminiferes, v. 5, p. 105, pl. 2, figs. 25, 26. - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 15, pl. 7, figs. 21-22. - - White, 1956, Jour. Paleo., v. 30, p. 253, pl. 30, fig. 4a,b.

Globobulimina affinis (d'Orbigny) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 246, pl. 7, fig. 6a-b.

Praeglobobulimina affinis (d'Orbigny) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 397, pl. 4, figs. 3-4.

ECOLOGY: Although rare occurrences of *Praeglobobulimina affinis* are reported off San Francisco, it is most common south of Point Conception (Culver and Buzas, 1986). *Praeglobobulimina affinis* is thought to range from the Oregonian to the Panamanian provinces along the East Pacific margin (Buzas and Culver, 1991). Its upper depth limit is in the upper middle bathyal biofacies (Ingle, 1980). *Praeglobobulimina affinis* is a common species in the basin floor assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Praeglobobulimina auriculata (Bailey)

Bulimina auriculata Bailey, 1851, Smithsonian Contr. to Knowledge, v. 2, p. 12, figs. 25-27.

Globobulimina auriculata (Bailey) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 246, pl. 7, fig. 7a-b.

Praeglobobulimina auriculata (Bailey) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 397.

ECOLOGY: *Praeglobobulimina auriculata* is a most common in the California borderland (Culver and Buzas, 1986).

OCCURRENCE: Balcom Canyon

Praeglobobulimina ovata (d'Orbigny)

Bulimina ovata d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 185, pl. 11, figs. 13-14.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Praeglobobulimina ovula (d'Orbigny)

Bulimina ovula d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 51, pl. 1, figs. 10, 11.

Bulimina (*Desinobulimina*) *ovula* d'Orbigny - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 9, figs. 2a,b, 4.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Praeglobobulimina pupoides

Bulimina pupoides d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., pl. 11, fig. 11-12.

OCCURRENCE: Balcom Canyon

Pullenia bulloides (d'Orbigny)

Nonionina bulloides d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 107, pl. 5, figs. 9, 10.

Pullenia bulloides (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 19, fig. 4a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Pullenia miocenica Kleinpell

Pullenia miocenica Kleinpell, 1938, Miocene Stratigraphy of California, AAPG, p. 338, pl. 14, fig. 6. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 214-215, plate-figs. 1-8.

RANGE: Oligocene to Miocene (Finger, 1990)

ECOLOGY: The upper depth limit of *Pullenia miocenica* is transitional between upper middle bathyal and lower middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Pullenia quinqueloba (Reuss)

Nonionina quinqueloba Reuss, 1851, Deut. Geol. Gesel., Zeit., v. 3, p. 71, pl. 5, fig. 31.

Pullenia quinqueloba (Reuss) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 19, fig. 8a,b.

Pullenia subcarinata (d'Orbigny) - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 262, pl. 14, fig. 5a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Pullenia salisburyi Stewart and Stewart

Pullenia salisburyi Stewart and Stewart, 1930, Jour. Paleo., v. 4, p. 72, pl. 8, fig. 2. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 19, fig. 7a,b. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 93, pl. 32, fig. 7. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 397.

COMMENTS: Restricted to specimens with 6 or more chambers and a compressed test.

ECOLOGY: *Pullenia salisburyi* is found in the Aluetian, Californian and Panamanian provinces (Buzas and Culver, 1991). *Pullenia salisburyi* is common in the California borderland and is frequently found in the bank assemblages of the nearshore basins (Culver and Buzas, 1986; Douglas and Heitman, 1979). Ingle (1980) cites the upper depth limit of this species as outer neritic biofacies whereas

Smith (1964) considers the upper depth limit to be in the upper bathyal biofacies. The deeper limit was used in this study.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Pullenia subcarinata d'Orbigny

Pullenia subcarinata d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 28, pl. 5, figs. 23-24.
OCCURRENCE: Balcom Canyon

Pullenia spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Pyrgo rotalaria Loeblich and Tappan

Pyrgo rotalaria Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, p. 47, pl. 6, figs. 5-6. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 397.
OCCURRENCE: Balcom Canyon

Pyrgo spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Quinqueloculina akneriana d'Orbigny

Quinqueloculina akneriana d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 290, pl. 18, figs. 16-21. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 3, fig. 3a,b,c. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 231, pl. 2, fig. 8.
ECOLOGY: The upper depth limit of *Quinqueloculina akneriana* is in the inner neritic biofacies (Ingle, 1980)
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Quinqueloculina laevigata d'Orbigny

Quinqueloculina laevigata d'Orbigny, 1839, Histoire naturelle des Iles Canaries, v. 2, pt. 2, p. 145, pl. 3, figs. 31-33.
ECOLOGY: *Quinqueloculina laevigata* is a common in the outer shelf assemblages of the nearshore basins (Douglas and Heitman, 1979).
OCCURRENCE: Balcom Canyon

Quinqueloculina seminulum (Linne)

Serpula seminulum Linne, 1758, Systema Naturae, p. 786.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Quinqueloculina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Reusella sp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Rhabdammina spp.

COMMENTS: Specimens are too poorly preserved to identify but are probably *R. eocenica.*
OCCURRENCE: Balcom Canyon

Rosalina columbiensis (Cushman)

Discorbis columbiensis Cushman, 1925, Contr. Cushman Lab. Foram. Res., v. 1, p. 43, pl. 6, fig. 13.
Rosalina columbiensis (Cushman) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 398, pl. 5, fig. 1.
ECOLOGY: *Rosalina columbiensis* is a cosmopolitan species (Culver and Buzas, 1986) which is dominant in the inner neritic biofacies (Ingle and Keller, 1980) and in the bank assemblages of the offshore basins of the California continental borderland (Douglas and Heitman, 1979).
OCCURRENCE: Balcom Canyon (cf.)

Rosalina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Rotalia garveyensis Natland

Rotalia garveyensis Natland, 1938, Bull., Scripps Inst. Ocean., Tech. Ser., v. 4, p. 147, pl. 6, fig. 6.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Rotalia spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Rotorbinella lomaensis (Bandy)

Rotalia lomaensis Bandy, 1953, Jour. Paleo., v. 27, p. 179, pl. 22, fig. 6.

ECOLOGY: *Rotorbinella lomaensis* (= *Discorbis lomaensis*) is a cosmopolitan species which ranges from the Orgonian to Californian provinces along the East Pacific margin (Culver and Buzas, 1986; Buzas and Culver, 1991).
OCCURRENCE: Balcom Canyon

Rotorbinella versiformis (Bandy)

Rotalia versiformis Bandy, 1953, Jour. Paleo., v. 27, p. 179, pl. 22, fig. 5.
Discorbis rosaceus (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 13, fig. 8a,b,c.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Saccammina spp.

COMMENTS: Specimens are too poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon

Sigmoilina tenuis (Czjzek)

Quinqueloculina tenuis Czjzek, 1848, Haidinger's Nat. Wiss., Abh. 2, p. 149, pl. 13, figs. 31-34.
Sigmoilina tenuis (Czjzek) - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 8, pl. 4, fig. 7. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 3, fig. 4a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 232, pl. 2, figs. 9a,b. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 36, pl. 5, fig. 5. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 398, pl. 1, fig. 7.
ECOLOGY: The upper depth limit of *Sigmoilina tenuis* is in the upper middle bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Sigmoilina torta (Galloway and Wissler)

Polymorphina torta Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 55, pl. 9, fig. 5.
OCCURRENCE: Balcom Canyon

?*Siphogenerina* spp.

Nodosaria raphanistrum (Linne) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 104, pl. 4, fig. 5, 6a,b, 7.
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Siphonodosaria verneuili (d'Orbigny)

Dentalina verneuili d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 48, pl. 2, figs. 7, 8.
Ellipsonodosaria verneuili (d'Orbigny) - - Cushman and Stainforth, 1945, p. 54, pl. 9, fig. 11. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 13, figs. 1a,b, 2, 3, 4a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Siphotextularia flintii (Cushman)

Textularia flintii Cushman, 1911, U.S. Nat. Hist. Museum Bull., v. 74, p. 21, figs. 36a-b. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 2, fig. 1a,b.

Siphotextularia flintii (Cushman) - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 117, pl. 17, figs., 1a-c. - - White, 1956, Jour. Paleo., v. 30, p. 256, pl. 27, fig. 1a,b.

RANGE: Repettian, Pliocene (Natland, 1952)

OCCURRENCE: Balcom Canyon

Sphaeroidina bulloides d'Orbigny

Sphaeroidina bulloides d'Orbigny, 1826, Ann. Sci. Nat., ser., 1, v. 7, p. 267, modeles no. 65. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles. pl. 19, fig. 9. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 59, pl. 14, fig. 6. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 398, pl. 3, fig.

ECOLOGY: The upper depth limit of *Sphaeroidina bulloides* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Sphaeroidina spp.

COMMENTS: This group includes specimens identified as *S. cylindroides* of Natland (1952).

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Spiroplectammina sp.

COMMENTS: Specimens can not be identified to species.

OCCURRENCE: Balcom Canyon

Stainforthia concava (Hoeglund)

Virgulina concava Hoeglund, 1947, Uppsala Univ., Zool, Bidrag, Uppsala, v. 26, p. 257, pl. 23, figs. 3a,b, 4a,b.

OCCURRENCE: Balcom Canyon

Stilostomella adolphina (d'Orbigny)

Dentalina adolphina d'Orbigny, 1846, Foraminiferes fossiles du bassin tertiaire de Vienne (Autriche) (Due fossilen Foramniferen des tertiaeren Beckens von Wien), Gide et Comp., p. 51.

Stilostomella adolphina (d'Orbigny) - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 398.

ECOLOGY: The upper depth limit of *Stilostomella adolphina* is in the lower middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon

Stilostomella advena (Cushman and Laiming)

Nodogenerina advena Cushman and Laiming, 1931, Jour. Paleo., v. 5, p. 106, pl. 11, fig. 19. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 2a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Stilostomella lepidula (Schwager)

Nodosaria lepidula Schwager, 1866, Novara Exped., Geol. Theil, v. 2, p. 210, pl. 5, figs. 27-28.

Nodogenerina lepidula (Schwager) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 8, fig. 5a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Stilostomella spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Suggrunda eckisi Natland

Suggrunda eckisi Natland, 1950, in Anderson, 1950, Geol. Soc. Amer. Memoir, no. 43, p. 23, pl. 9, fig. 12. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 6a,b.

ECOLOGY: *Suggrunda eckisi* is a dominant species in the upper slope assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979). Also common in the upper bathyal, shallow oxygen minimum zone (Ingle and Keller, 1980).

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Suggrunda spp.

COMMENTS: Specimen is too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Textularia spp.

COMMENTS: This designation includes specimens assigned to *Textularia crassisepta* amd *Textularia* cf. *T. abbreviata* d'Orbigny by Natland (1952, pl. 2, fig. 2a, b).

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Trifarina angulosa (Williamson)

Uvigerina angulosa Williamson, 1858, On the Recent Foraminifera of Great Britian, Ray Society, p. 67, pl. 5, fig. 140.

Angulogerina angulosa (Williamson) - - Bandy, 1953, Jour. Paleo., v. 27, p. 176, pl. 25, fig. 13. - - Matoba and Yamaguchi, 1982, Initial Reports of the Deep sea Drilling Project, v. 64, p. 1036.

ECOLOGY: *Trifarina angulosa* is a cosmopolitan species (Buzas and Culver, 1991). Its upper depth limit is transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980). *Trifarina angulosa* is a dominant species in the bank assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979).
OCCURRENCE: Balcom Canyon

Trifarina carinata Cushman

Trifarina carinata Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 159, pl. 4, fig. 3.
Angulogerina carinata Cushman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 10a,b.- - Matoba and Yamaguchi, 1982, Initial Reports of the Deep Sea Drilling Project, v. 64, p. 1036.
ECOLOGY: The upper depth limit of *Trifarina carinata* is transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Trifarina hughesi (Galloway and Wissler)

Uvigerina hughesi Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 76, pl. 12, fig. 5.
Angulogerina hughesi (Galloway and Wissler) - - Bandy, 1953, Jour. Paleo., v. 27, p. 176. - - White, 1956, Jour. Paleo., v. 30, p. 260, pl. 32, fig. 10a,b.
ECOLOGY: *Trifarina hughesi* ranges from the Oregonian to Californian provinces (Buzas and Culver, 1991).
OCCURRENCE: Balcom Canyon

Trifarina occidentalis (Cushman)

Uvigerina occidentalis Cushman, 1923, U.S. Nat. Mus., Bull. no. 104, p. 169.
Angulogerina occidentalis (Cushman) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 11a,b
ECOLOGY: The upper depth limit of *Trifarina occidentalis* is transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Triloculina spp.

COMMENTS: This designation includes specimens assigned to *Triloculina triserialis* by Natland (1952) as well as specimens to poorly preserved to identify to species.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina auberiana d'Orbigny

Uvigerina auberiana d'Orbigny, 1839, Voyage dans l'Amerique Meridionale; Foraminiferes, v. 5, p. 106, pl. 2, figs. 23-24.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina baggi Galloway and Wissler

Uvigerina baggi Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 75, pl. 11, fig. 19.
Angulogerina baggi (Galloway and Wissler) - - Bandy, 1953, Jour. Paleo., v. 27, p. 176.
ECOLOGY: The upper depth limit of *Uvigerina baggi* is transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980)
OCCURRENCE: Balcom Canyon

Uvigerina curticosta (Cushman)

Uvigerina pigmea d'Orbigny *curticosta* Cushman, 1927, Bull, Scripps Inst. Ocean., Tech. Ser., v. 1, p. 157, pl. 4, fig. 1.
Uvigerina peregrina curticosta (Cushman) - - Matoba and Yamaguchi, 1982, p. 1049, pl. 2, figs. 10-12.
ECOLOGY: *Uvigerina curticosta* is a dominant species in the group II, lower slope assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979). Abundant populations of *Uvigerina curticosta* are found in environments where oxygen levels are low but not dyserobic and organic content is high (Douglas, 1981).
OCCURRENCE: Balcom Canyon

Uvigerina excellens Todd

Uvigerina excellens Todd in Cushman and McCulloch, 1948, Allan Hancock Pacific Expeditions, v. 6, p. 258, pl. 33, fig. 2a-e. - - Matoba and Yamaguchi, 1982, Initial Reports of the Deep Sea Drilling Project, v. 64, p. 1049, pl. 2, fig. 9.
Uvigerina attenuata Coryell and Mossman - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 13a,b (listed as *U. microcostata* on checklist).
COMMENTS: "This species differs from *U. peregrina* Cushman var. *curticosta* Cushman and var. *dirupta* Todd in its lower, more regular and much more numerous costae, and its more elongate shape."

Although *Uvigerina peregrina* is described as having 10 chambers per whorl (Cushman, 1923), Boersma (1984) typically finds 6-8 costae per whorl. This number is less than found on *Uvigerina excellens*, which is described as having 30 costae about the circumference of the test (Todd in Cushman and McCulloch, 1948). Boersma (1984) however considers *U. excellens* to be the Pacific form of *U. peregrina* and to be more elongate and have more numerous low costae.

ECOLOGY: In the California borderland, *Uvigerina excellens* is abundant when oxygen values are between 1.0 and 2.5 ml/l and organic carbon is 1-2 % of the total sediment. (Douglas, 1981). *Uvigerina excellens* is a dominant species in the upper slope assemblages of the nearshore basins of the California continental borderland (Douglas and Heitman, 1979).
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Uvigerina hispida Schwager

Uvigerina hispida Schwager, 1866, Novara Expedition, Geol. Theil, v. 2, p. 249, pl. 7, fig. 95. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 2a,b. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 136, pl. 25, figs. 1a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177. - - White, 1956, Jour. Paleo., v. 30, p. 258, pl. 32, fig. 2a,b. - - Haller, 1980, in The Miocene Stratigraphy of

California Revisited, AAPG, p. 249, pl. 8, fig. 1. - - Boersma, 1984, p. 74-76, figs. 1-4. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 73, pl. 24, fig. 4.

RANGE: middle Miocene to Recent (Boersma, 1984)

ECOLOGY: Along the East Pacific margin, the upper depth limit of *Uvigerina hispida* is in the upper middle bathyal biofacies, although it is most frequently associated with the lower middle bathyal biofacies (Ingle, 1980; Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina hispidocostata Cushman and Todd

Uvigerina hidspidocostata Cushman and Todd, 1945, Cushman LAb. Foram. REs., Spec. Pub., no. 15, p. 51, pl. 7, figs. 27, 31. - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 18, pl. 8, figs. 17-21, 23. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 136, pl. 25, figs. 2a-b. - - White, 1956, Jour. Paleo., v. 30, p. 258, pl. 32, fig. 3a,b. - - Boersma, 1984, p. 77-81, figs. 1-4. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 399.

COMMENTS: The presence of *U. hispidocostata* may reflect an increase in organic carbon related to Miocene glaciation (Woodruff, 1985).

RANGE: Miocene (N12) to Recent (Boersma, 1984)

ECOLOGY: The upper depth limit of *Uvigerina hispidocostata* is in the upper middle bathyal biofacies (Ingle, 1980). *Uvigerina hispidocostata* is common in areas of high surface productivity with cold, nutrient rich, oxygen depleted waters such as the North Atlantic Deep Water at depths of 600-4000 m (Boersma, 1984).

OCCURRENCE: Balcom Canyon

Uvigerina hootsi Rankin

Uvigerina hootsi Rankin, 1934, in Cushman and Kleinpell, 1934, Contr. Cushman Lab. Foram. Res., v. 10, p. 22, pl. 3, figs. 8-9. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, figs. 8, 9. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 137, pl. 25, figs. 3a-b. - - White, 1956, Jour. Paleo., v. 30, p. 258, pl. 32, fig. 5a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 249, pl. 8, fig. 12a,b. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 240-241, plate-figs. 1-8.

RANGE: Miocene to Holocene (Finger, 1990); Mohnian to Delmontian (Kleinpell, 1938)

ECOLOGY: The upper depth limit *Uvigerina hootsi* is in the upper middle bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina juncea Cushman and Todd

Uvigerina juncea Cushman and Todd, 1941, Cushman Lab. Foram. Res., Contr., v. 17, p. 78, pl. 20, figs. 4-11. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 11a,b, 12a,b (listed as *U. tenuistriata* on checklist chart). - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 137, pl. 25, figs. 4a-b.

COMMENTS: costae are narrow, low and seem to be widely spaced although there are 10 costae per chamber.

ECOLOGY: The upper depth limit of *Uvigerina juncea* is transitional between the outer neritic and upper bathyal biofacies (Ingle, 1980). *Uvigerina juncea* is a dominant species in the upper shelf assemblages of the nearshore basins of the California

continental borderland (Douglas and Heitman, 1979). Abundant *Uvigerina juncea* occur at low oxygen values of 1.0 to 2.0 ml/l; the highest abundances occur when the oxygen content is about 1.0 ml/l (Douglas, 1981). This species tends to prefer organic carbon values of ± 1 % of the total sediment (Douglas, 1981).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina peregrina Cushman

Uvigerina peregrina Cushman, 1923, p. 166, pl. 42, figs. 7-10. - - Phleger and Parker, 1951, Geol. Soc. Amer., Memoirs, v. 46, p. 18, pl. 8, figs. 22, 24-26. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 11, fig. 14a,b, 15, 16. - - Martin, 1952, Cushman Lab. Foram. Res., Contr., v. 3, p. 137, pl. 25, figs. 7a-b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 25, fig. 10. - - White, 1956, Jour. Paleo., v. 30, p. 259, pl. 32, fig. 7a,b. - - Haller, 1980, in The Miocene Stratigraphy of California Revisited, AAPG, p. 250. - - Kohl, 1985, Bull. American Paleo., v. 88, p. 73, pl. 24, fig. 7. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 399. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 242-243, plate-figs. 1-8.

RANGE: *Uvigerina peregrina* evolved in the Pliocene and ranges from the middle Pliocene, Gauss (± 3 Ma) to the Recent (Boersma, 1984).

ECOLOGY: The upper depth limit of *Uvigerina peregrina* is given as in the upper bathyal biofacies (Ingle, 1980). The upper depth limit of this species has, however, been noted at a variety of depths along the East Pacific Margin (Smith, 1964; Ingle and Keller, 1980).

The abundance of *Uvigerina* is usually related to low oxygen and high organic carbon (Streeter and Schacklton, 1979; Miller and Lohman, 1981; Douglas, 1981). In the California borderland, abundant *Uvigerina peregrina curticosta* are found in environments with low oxygen values (≤ 1.0 ml/l, not dyserobic) and sediments rich in organic matter (Douglas, 1981). The optimal environment for the *Uvigerina peregrina* floods found in the Plio-Pleistocene sediments of the Los Angeles and Ventura Basins is believed to be near the boundary of the oxygen minimum zone where the oxygen content is reduced and the input of organic matter is high.

Uvigerina peregrina and variants are most abundant during the Pleistocene glacials and tend to disappear during the interglacials which are associated with lower surface productivity decreased carbonate sedimentation and increased oxygen (Boersma, 1984).

High abundances of *Uvigerina peregrina* and *Globocassidulina subglobosa* are associated with the Circumpolar Deep Water in South Atlantic (Gofas, 1978; Lohmann, 1978; Schnitker, 1980). *Uvigerina* spp. and *E. exiqua* dominate the Indian Bottom Water (Corliss, 1979a; Schnitker, 1980). In the North Atlantic, *Uvigerina peregrina* appears to inhabit "old" oxygen-deficient glacial AABW.

"Floods" of *Uvigerina peregrina* found in the Pliocene and Pleistocene of the Ventura and Los Angeles Basins may indicate an optimal environment for this species, which based on modern distributions is near the boundaries of the oxygen minimum zone where there is high input of organic detritus and a reduced but not minimum level of oxygen (Douglas, 1981). Note that Douglas (1981) uses *Uvigerina peregrina curticosta* in most figures not *Uvigerina peregrina*.

Uvigerina peregrina is a dominant species in the group II, lower slope assemblages of both the nearshore and offshore basins of the California continental borderland (Douglas and Heitman, 1979).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina peregrina dirupta Todd

Uvigerina peregrina dirupta Todd in Cushman and McCulloch, 1948, Allan Hancock Pacific Expeditions, v. 6, p. 267, pl. 34, fig. 3.

RANGE: The oldest specimens of this species are from the Tasman Sea in sediments approximately 4.4 Ma (Boersma, 1984).

ECOLOGY: Along the East Pacific margin, the upper depth limit of Uvigerina peregrina dirupta is in the upper middle bathyal biofacies (Ingle, 1980) associated with the cool, high salinity oxygen-rich North Pacific Intermediate Water or the Anatarctic Intermediate Water masses (Ingle and Keller, 1980).

OCCURRENCE: Balcom Canyon

Uvigerina proboscidea Schwager

Uvigerina proboscidea Schwager, 1866, Novara Exped., Geol. THeil, Bd 2, Abt. 2, p. 250, pl. 7, fig. 96.

Uvigerina ampullacea Brady - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 9a,b.

OCCURRENCE: Wheeler Canyon (Natland, 1952)

Uvigerina rustica Cushman and Edwards

Uvigerina rustica Cushman and Edwards, 1938, Cushman Lab. Foram. Res., Contr., v. 14, p. 83, pl. 14, fig. 6. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 399.

Uvigerina pygmeae (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 1a,b

ECOLOGY: The upper depth limit of *Uvigerina rustica* is in the lower middle bathyal biofacies (Pflum and Frerichs, 1976).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina senticosa Cushman

Uvigerina senticosa Cushman, 1927, Bull., Scripps Inst. Ocean., Tech. Ser., v. 1, p. 159, pl. 3, fig. 14. - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 7a,b, 8a,b. - - Bandy, 1953, Jour. Paleo., v. 27, p. 177, pl. 25, fig. 12. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 399.

ECOLOGY: The upper depth limit of *Uvigerina senticosa* is in the lower bathyal biofacies (Ingle, 1980).

OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina semitrigonia Galloway and Wissler

Uvigerina semitrigonia Galloway and Wissler, 1927, Jour. Paleo., v. 1, p. 77, pl. 11, fig. 21.

Angulogerina semitrigonia (Galloway and Wissler) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 12, fig. 12a,b.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina spp.

COMMENTS: This designation includes specimens assigned to *Uvigerina gigantea* ms. by Natland (1952, p. 136, pl. 12, figs. 4a,b, 5, 6, as well as specimens too poorly preserved to identify.
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Uvigerina striata d'Orbigny

Uvigerina striata d'Orbigny, 1939, Voyage dans l'Amerique Meridionale; Foraminiferes, v. 5, p. 53, pl. 7, fig. 16.
OCCURRENCE: Balcom Canyon

Valvulineria araucana (d'Orbigny)

Rosalina araucana d'Orbigny, 1839, Voyage dans l'Amerique Meriodionale; Foraminiferes, v. 5, pt. 5, p. 44, pl. 6, figs. 16-18.
Valvulineria araucana (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, pl. 13, fig. 10a,b,c. - - White, 1956, Jour. Paleo., v. 30, p. 247, pl. 28, fig. 3a,b,c. - - McDougall, 1985, Initial Reports of the Deep Sea Drilling Project, v. 84, p. 399.
ECOLOGY: The upper depth limit of *Valvulineria araucana* is in the upper middle bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Valvulineria californica Cushman

Valvulineria californica Cushman, 1925, Contr. Cushman Lab. Foram. Res., v. 2, p. 60, pl. 9, figs. 1a-c. - - Finger, 1990, Cushman Lab. Foram. Res., Spec. Pub., no. 28, p. 252-253, plate-figs. 1-9.
RANGE: Middle Miocene to Holocene (Finger, 1990)
ECOLOGY: The upper depth limit of *Valvulineria californica* is in the upper middle bathyal biofacies (Ingle, 1980).
OCCURRENCE: Balcom Canyon, Wheeler Canyon (Natland, 1952)

Valvulineria inflata (d'Orbigny)

Valvulina inflata d'Orbigny, 1839, Voyage dans l'Amerique Meridionale; Foraminiferes, v. 5, p. 48, pl. 7, figs. 7-9.
Valvulineria inflata (d'Orbigny) - - Natland, 1952, unpub. Ph.D. Diss., Univ. of Calif., Los Angeles, p. 139, pl. 13, fig. 9a,b,c. - - Crouch and Poag, 1987, Jour. Foram. Res., v. 17, p. 173-174.
OCCURRENCE: Wheeler Canyon (Natland, 1952)

Valvulineria spp.

COMMENTS: Specimens are too poorly preserved to identify to species.

OCCURRENCE: Balcom Canyon

Appendix 3 Chart numbers and taxonomic designations of Natland (1952) synonomized with the taxonomic designation used in this paper.

Chart No.	Taxa (Natland, 1952)	
7	Ammodiscus sp. (minutum)	Ammodiscus sp.
8	Ammodiscus pacificus	Ammodiscus incertus
9	Angulogerina semitrigonia	Uvigerina semitrigonia
10	Angulogerina carinata	Trifarina carinata
11	Angulogerina occidentalis	Trifarina occidentalis
12	Anomalina schmitti	Cibicides fletcheri
13	Bolivina pisciformis	Bolivina pisciformis
14	Bolivina advena var striatella	Bolivina striatella
15	Bolivina vaughani	Bolivina vaughani
16	Bolivina interjuncta	Bolivina interjuncta
17	Bolivina argentea	Bolivina argentea
18	Bolivina minuta	Bolivinita minuta
19	Bolivina subadvena	Bolivina subadvena
20	Bolivina spp.	Bolivina spp.
21	Bolivina spissa	Bolivina spissa
22	Bolivina seminuda	Bolivina seminuda
23	Bolivina humilis	Bolivina humilis
24	Bolivina punctata	Bolivina punctata
25	Bolivina sinuata	Bolivina sinuata
26	Bolivina beyrichi	Bolivina beyrichi
27	Bolivina pseudobeyrichi	Loxostomum pseudobeyrichi
28	Bolivina panamensis/B. acuminata	Bolivina acuminata
29	Bolivinita angelina	Bolivinita quadilatera
30	Bathysiphon arenaria	Bathysiphon arenaria
31	Bulimina pagoda	Bulimina pagoda
32	Bulimina ovata	Praeglobobulimina ovata
33	Bulimina subacuminata	Bulimina subacuminata
34	Bulimina affinis	Praeglobobulimina affinis
35	Bulimina inflata/B. subcalva	Bulimina inflata
36	Bulimina ovula	Praeglobobulimina ovula
37	Bulimina pulchella/B. marginata	Bulimina pulchella
38	Bulimina spinifera	Globobulimina spinifera
39	Bulimina fossa	Bulimina rostrata
40	Buliminella curta	Buliminella curta
41	Buliminella elegantissima	Buliminella elegantissima
42	Buliminella subfusiformis	Buliminella subfusiformis
43	Cassidulina limbata	Cassidulina limbata
44	Cassdiulina tortuosa/	Cassidulina tortuosa
	C. reflexsa	Cassidulina spp.
45	Cassidulina corbyi	Cassidulina corbyi
46	Cassdiulina tumida	Cassidulina tumida
47	Cassidulina cushmani	Cassidulina cushmani
48	Cassidulina oblonga	Cassidulina oblonga

49	Cassidulina parisi ms	Cassidulina delicata
50	Cassidulina spiralis	
51	Cassidulina transluscens	Cassidulina transluscens
52	Cassidulina laevigata	Cassidulina laevigata
53	Cassidulina pacifica ms	Cassidulina spp.
54	Cassidulina spira ms	Cassidulina spp.
55	Cassidulina spira var ms	Cassidulina spp.
56	Cassidulina crassaformis	Cassidulina spp.
57	Cassidulina s.n.q. subglobosa (C. var. quadrata)	Globocassidulina subglobosa
58	[blank]	
59	Cassidulina californica	Cassidulina californica
60	Chilostomella oolina	Chilostomella oolina
61	Cassidulina lomitensis	Cassidulina lomitensis
62	Cassidulinella pliocenica	Cassidulinella pliocenica
63	Cassidulinoides bradyi	Cassidulinoides bradyi
64	Cassidulinoides cornuta	Fursenkoina cornuta
65	Cibicides basiloba	Hanzawaia nitidula
66	Cibicides cf. basiloba	Hanzawaia nitidula
67	Cibicides mckannai	Cibicides mckannai
68	Cibicides concideus	Cibicides/Cibicidoides spp.
69	Cibicides cicatricosa/ C. mckannai var. depressa	Cibicides cf. C. mckannai
70	Cibicides repettensis	Cibicides/Cibicidoides spp.
71	Cibicides spiralis	Cibicidoides spiralis
72	Cyclammina cancellata	Cyclammina cancellata
73	Clavulina communis	Martinottiella communis
74	Clavulina pallida	Martinottiella pallida
75	Ehrenbergina bradyi/E. compressa	Ehrenbergina brady
76	Elphidium acutum ms	Elphidium spp.
77	Epistomina elegans	Hoeglundina elegans
78	Elphidium articulatum	Elphidium articulatum
79	Eponides healdi	Eponides healdi
80	Elphidium crispum	Elphidium crispum
81	Eponides pecki (patagonica)	
82	Elphidium hannai	Elphidiella hannai
83	Eponides tenera	Oridorsalis umbonatus
84	Eponides poeyanum	Elphidium transluscens
85	Eponides subtenera	Oridorsalis subtenera
86	Elphidium hughesi	Elphidium tumidum
87	Eponides sp. 5/ Eponides cf. rosaformis	Eponides spp.
88	Eponides mansfieldi	Buccella frigida
89	Eponides ornata/E. cf. frigidus	Buccella tenerrima
90	Discorbis rosaceus	Rotorbinella versiformis
91	Frondicularia advena	Plectofrondicularia advena
92	Haplophragmoides scitulum	Alveolophragmium scitulum
93	Pseudoglandulina laevigata	Glandulina laevigata
94	Planktic foraminifers	
95	Planktic foraminifers	

96	Planktic foraminifers	
97	Planktic foraminifers	
98	Planktic foraminifers	
99	Planktic foraminifers	
100	Gyroidina soldanii	Gyroidina soldanii
101	Gyroidina soldanii var. altiformis	Gyroidina altiformis
102	Gaudryina arenaria	Gaudryina arenaria
103	Guttulina quinquecosta	Guttulina quinquecosta
104	Karreriella grammostomata	Karreriella grammostomata
105	Gyroidina soldanii var. rotundimargo	Gyroidina rotundimargo
106	Leibusella pliocenica	Leibusella pliocenica
107	Lagena	Lagena spp
108	Dentalina lawndelensis	Dentalina spp.
109	Laticarinina pauperata	Laticarinina pauperata
110	Nodosaria limbosa	
111	Karreriella milleri	
112	Nodosaria cf emaciata	
113	Nodogenerina lepidula	Stilostomella lepidula
114	Nodogenerina advena	Stilostomella advena
115	Nodosaria arundinea	Nodosaria longiscata
116	Nodosaria soluta	Dentalina soluta
117	Ellipsonodosaria verneuili	Siphonodosaria verneuili
118	Nodosaria tympaniplectriformis	Nodosaria tympaniplectriformis
119	Ellipsonodosaria insecta	Siphonodosaria insecta of Haller (1980)
120	Nodosaria pliocenica	Siphonodosaria spp.
121	Nodosaria raphanistrum	?Siphogenerina spp.
122	Nodosaria pliocenica v. spinosa	Nodosaria hispida
123	Nodosaria tosta	Nodosaria lamellata
124	Nodosaria (robusta) moniliformis	Nodosaria anomala
125	Nonion pacificum	Melonis barleeanus
126	Planktic foraminifers	
127	Nonion pompilioides (umbilicatula)	Melonis pompilioides
128	[blank]	
129	Nonion grateloupe/N. scaphum	
130	Nonionella miocenica v. stella	Nonionella stella
131	Nonion auris/ N. pizarrense basispinatum	Nonionella basispinata
132	Nonion stelligera	Astrononion stellatum
133	Planktic foraminifers	
134	[blank]	
135	Planulina ornata	Planulina ornata
136	Planulina cf. ariminensis	Planulina ariminensis
137	Plectofrondicularia californica	Plectofrondicularia californica
138	[blank]	
139	Virgulina nodosa	Fursenkoina nodosa
140	Triloculina triserialis	Triloculina spp.
141	Pullenia salisburyi	Pullenia salisburyi
142	Pullenia quinqueloba	Pullenia quinqueloba
143	Pullenia bulloides	Pullenia bulloides

144	[blank]	
145	Pulvinulinella pacifica	Epistominella pacifica
146	[blank]	
147	Pulvinulinella bradyana	Epistominella bradyana
148	Pulvinulinella smithi	Epistominella smithi
149	Pulvinulinella umbilicatula ms	Epsitominella exiqua
150	Pulvinulinella subperuviana	Epistominella subperuviana
151	Pyrgo	Pyrgo spp.
152	[blank]	
153	Quinqueloculina akneriana/	Quinqueloculina akneriana
	Q. seminulum	Quinqueloculina seminulum
154	Robulus flexuosa	Lenticulina spp.
155	Robulus cushmani (calcar)	Lenticulina cushmani
156	[blank]	
157	Rotalia peruviana/R. beccarii	Ammonia beccarii
158	[blank]	
159	Sigmoilina tenuis	Sigmoilina tenuis
160	[blank]	
161	Sphaeroidina bulloides	Sphaeroidina bulloides
162	Sphaeroidina cyclindroides	Sphaeroidina spp.
163	Spiroloculina sp. A	
164	Suggrunda eckisi	Suggrunda eckisi
165	Textularia cf. abbreviata/	
	T. crassisepta	Textularia spp.
166	[blank]	
167	Textularia flintii	Siphotextularia flintii
168	Uvigerina auberiana	Uvigerina auberiana
169	Uvigerina peregrina	Uvigerina peregrina
170	Globobulimina pacifica	Globobulimina pacifica
171	Uvigerina senticosa	Uvigerina senticosa
172	Uvigerina hispida	Uvigerina hispida
173	Uvigerina canariensis/	
	U. hootsi	Uvigerina hootsi
174	Hopkinsina nodosa	
175	Uvigerina pygmeae	Uvigerina rustica
176	[blank]	
177	Uvigerina tenuistriata/	
	U. juncea	Uvigerina juncea
178	Uvigerina gigantea	Uvigerina spp.
179	Uvigerina ampullacea	Uvigerina proboscidea
180	Uvigerina attenuata/	
	U. microcostata	Uvigerina excellens
181	Valvulineria araucana/	Valvulineria araucana
	V. californica	Valvulineria californica
182	Valvulineria inaequalis	Valvulineria inaequalis
183	Valvulinera inflata	Valvulineria inflata
184	Virgulina schreibersiana	Fursenkoina schreibersiana
185	Rotalia garveyensis	Rotalia garveyensis

Table 1 Distribution and abundance of benthic foraminifers in the Balcom Canyon Section. Abundance of each species is a percentage of the total benthic foraminiferal assemblage in a split containing approximately 300 specimens. Foraminiferal number is the number of specimens actually picked from the split and diversity is the number of species per sample.

Taxa	Sample number														
	84-75	84-74	84-73	84-72	84-71	84-70	84-69	84-68	84-67	84-66	84-65	84-84	84-63	84-62	84-61
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	3.9	1.2	-	-
Bulliminella basispinata Stewart and Stewart	-	-	-	19.7	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	28.9	-	-	-	-	-	-	-	-	0.6	-	-
Bolivina argentea Cushman	-	-	-	-	1.2	9.7	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	-	-	-	0.3	-	3.2	-	-	7.1	-	7.5	0.7	2.4	-	1.8
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
B. sinuata Galloway and Wissler	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	0.3	-	-	-	0.6	-	-	2.7	-	-	5.0	2.0	0.9	-	2.6
B. spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	0.7	-	0.6	0.3
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
Buccella frigida (Cushman)	0.8	-	-	1.1	-	-	-	-	-	-	-	6.5	4.6	6.2	0.6
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	3.8	2.3	4.3	7.0	-	-	-	-	-	-	-	-	-	-	-
B pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	2.5	1.3	0.4	0.8	1.2	6.5	12.5	2.7	-	-	2.5	1.3	2.8	4.4	1.2
C. cushmani Stewart and Stewart	-	-	-	-	-	3.2	-	-	-	4.0	5.0	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata d'Orbigny	-	0.3	-	-	-	-	-	-	-	4.0	2.5	11.1	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	3.2	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. obicnga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	1.4	-	1.6	-	2.4	6.5	-	-	14.3	-	-	-	8.3	27.5	9.4
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9
C cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	8.1	-	-	2.5	26.1	6.1	15.6	-
C. mckannai Galloway and Wissler	-	-	-	0.3	0.6	6.5	-	-	-	12.0	5.0	2.0	-	5.6	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	0.3	-	-	-	-	-	-	-	-	0.6	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	0.4	0.5	-	6.5	-	-	7.1	8.0	-	1.3	1.5	1.2	-
Epistominella bradyana (Cushman)	-	0.3	-	-	-	-	-	-	-	8.0	-	-	-	-	-
E. pacifica (Cushman)	-	-	-	0.5	3.0	6.5	-	-	21.4	-	5.0	-	-	-	-

Appendix 4 Distribution and abundance of benthic foraminifers in the Balcom Canyon Section. Abundance of each species is a percentage of the total benthic foraminiferal assemblage in a split containing approximately 300 specimens. Foraminiferal number is the number of specimens actually picked from the split and diversity is the number of species per sample.

Taxa	Sample number														
	84-75	84-74	84-73	84-72	84-71	84-70	84-69	84-68	84-67	84-66	84-65	84-64	84-63	84-62	84-61
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.3
F. obecurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	0.3	1.6	-	0.6	-	-	-	-	-	-	-	0.9	1.9	1.8
Globobulimina pacifica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	14.3	-	-	-	0.3	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
L. flatulenta Loeblich and Tappan	0.8	-	-	-	0.6	-	-	-	7.1	-	-	-	-	-	0.3
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	0.3	-	-	-	-	-	-	-	-	-	-	0.3	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	0.5	-	-	-	-	-	-	5.4	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	3.2	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	52.9	45.8	39.4	3.5	36.3	-	-	-	14.3	48.0	32.5	4.6	4.0	-	0.3
N. costifera (Cushman)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	3.5	25.7	37.5	9.7	50.0	64.9	-	-	-	-	-	5.6	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	2.4	5.4	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-
Oridorsalis m[illegible]iseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	84-75	84-74	84-73	84-72	84-71	84-70	84-69	84-68	84-67	84-66	84-65	84-64	84-63	84-62	84-61
Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	14.4	45.5	14.2	-	8.9	16.1	-	13.5	-	-	-	-	3.4	11.9	1.5
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. salisburyi Stewart and Stewart	-	-	-	0.5	-	-	-	-	-	-	-	-	-	0.6	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	0.3
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.6	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	2.2	-	-	-	-	-	-	-	1.3	1.5	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Trifarina angulosa (Williamson)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	0.3	-	-	-	-	6.5	25.0	2.7	-	12.0	20.0	31.4	41.6	10.6	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	19.9	2.7	31.1	-	-	12.9	-	-	-	-	-	-	15.3	-	62.6
U. peregrina Cushman	0.8	0.3	-	2.2	3.0	-	12.5	-	14.3	-	10.0	3.3	-	1.2	1.2
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	0.7	0.3	1.2	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	4.1
U. semitrigonia Galloway and Wissler	-	-	-	1.1	1.8	-	-	-	-	4.0	-	2.0	-	-	7.4
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-
Foraminiferal number	367	299	254	370	168	31	8	37	14	25	40	153	327	160	340
Diversity	17	12	12	17	16	14	4	7	6	8	12	18	26	19	21

Taxa	Sample number														
	84-60	84-59	84-58	84-57	84-56	84-55	84-54	84-53	84-52	84-51	84-50	84-49	84-48	84-47	84-46
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	0.9	1.8	-	-	-	11.8	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	3.8	3.5	-	2.4	3.6	12.2	0.4	-	1.7	0.3	5.9	17.9	-	-	-
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	3.6	17.4	-	1.2	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	0.9	1.2	-	2.4	-	-	0.4	-	-	-	11.8	8.9	2.0	0.8	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	0.9	-	-	-	10.7	-	-	0.4	-	-	-	1.8	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	0.9	2.3	-	-	-	-	-	-	1.7	-	-	-	-	-	-
B. parkerae Andersen	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	1.3	-	-	-	10.7	7.0	0.4	-	0.9	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	5.4	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	4.7	4.7	-	-	-	0.9	3.5	3.3	-	0.3	-	1.8	4.9	0.4	0.4
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata d'Orbigny	0.4	4.7	-	-	-	-	19.4	58.2	-	-	-	3.6	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	5.2	33.0	19.7	13.7	47.0	-	-	68.4	40.7	54.1
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	-	-	0.4	-	-	-	-	3.6	-	0.8	0.4
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	0.4	0.8	5.1	29.9	-	-	-	-	-
C. mckannai Galloway and Wissler	0.4	3.5	14.3	-	7.1	0.9	-	-	0.9	-	5.9	3.6	-	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	0.4
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	0.9	1.3	-	-	-	11.8	1.8	-	-	-
E. translucens Natland	-	1.2	-	-	-	-	-	-	-	-	5.9	3.6	-	-	-
E. tumidum Natland	0.4	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	-	-	-	-	-	-	-	0.8	-	-	23.5	12.5	3.0	0.4	-

Taxa	Sample number														
	84-60	84-59	84-58	84-57	84-56	84-55	84-54	84-53	84-52	84-51	84-50	84-49	84-48	84-47	84-46
Epistominella subperuviana (Cushman)	-	-	-	-	7.1	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	14.3	-	-	3.5	0.9	0.4	-	2.8	-	-	-	-	0.4
Globobulimina pacifica Cushman	-	-	-	-	3.6	-	-	-	-	-	-	-	-	-	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multiloculs Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multiloculs Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
L. scalariformis Williamson	-	1.2	-	-	-	-	-	-	-	0.3	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	1.7	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	8.8	1.2	-	-	-	1.7	-	2.0	0.9	-	-	1.8	0.3	0.4	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	0.9	-	0.4	2.6	0.3	-	1.8	-	-	0.7
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	5.9	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	1.2	-	-	-	-	-	-	-	0.3	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	84-60	84-59	84-58	84-57	84-56	84-55	84-54	84-53	84-52	84-51	84-50	84-49	84-48	84-47	84-46
Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	8.1	10.5	-	-	-	7.0	0.4	1.6	8.8	5.3	-	1.8	2.0	23.6	2.6
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. salisburyi Stewart and Stewart	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7
Q. spp.	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	0.9	-	-	-	3.6	0.9	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	1.2	-	-	-	-	-	-	0.9	1.6	-	1.6	-	-	-
Saccammina sp.	-	-	-	-	-	7.8	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	1.3	-	-	-	-	-	0.4	-	1.7	0.3	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	3.6	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	14.3	-	-	-	9.7	1.6	4.3	1.6	-	-	1.3	1.5	3.0
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	3.5	-	-	-	-	-	-	-	-	-	5.4	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	1.7	-	-	5.4	0.7	0.4	1.1
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	60.0	58.1	-	85.7	35.7	26.1	23.3	7.0	56.4	10.0	5.9	-	16.4	31.2	35.2
U. peregrina Cushman	2.6	-	57.1	-	-	-	-	-	-	-	11.6	12.5	0.3	-	-
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	10.7	-	0.9	1.6	0.9	-	-	-	0.7	-	0.7
U. semitrigonia Galloway and Wissler	3.0	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	1.8	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	235	86	7	42	28	115	227	244	117	321	17	56	304	263	270
Diversity	22	16	4	6	11	19	20	16	15	13	10	21	11	10	13

Taxa	Sample number														
	84-45	84-44	84-43	84-42	84-41	84-40	84-39	84-38	84-37	84-36	84-35	84-34	84-33	84-32	84-31
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	0.9	-	2.1	-	0.9	-	5.6	1.5	2.4	-	0.4	-	28.1	62.2	78.6
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	4.0	-	-	-	-	-	-	-	-	-	-	0.7	-
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Mertin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	-	0.3	-	-	5.1	3.9	19.0	5.2	24.0	12.9	-	-	5.7	1.7	1.6
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	0.3	-	-	0.4	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	1.0
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	0.9	2.4	1.5	-	0.9	0.7	2.4	0.3	3.0	4.3	78.3	63.8	3.6	5.8	0.3
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	0.3	-	-	-	8.6	-	1.5	-	-	-	-	-	-
C. laevigata d'Orbigny	37.3	37.6	-	-	6.0	3.0	-	1.5	-	-	1.7	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	3.7	-	-	-	-	13.6	-	-	-	-	0.7	35.6	17.2	5.0
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	-	-	0.3	-	-	0.9	2.1	2.3	-	-	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	3.6	1.2	-	-	-	-	0.3	0.9	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	0.9	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. guntari Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-
E. translucens Natland	1.8	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	6.4	34.3	85.4	-	0.9	3.0	19.6	77.3	12.2	38.8	0.8	3.3	-	-	0.8

Taxa	Sample number														
	84-45	84-44	84-43	84-42	84-41	84-40	84-39	84-38	84-37	84-36	84-35	84-34	84-33	84-32	84-31
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequanza	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	0.3	-	-	-	-	-	-	0.3	-	-	0.3	0.7	0.3
Globobulimina pacifica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	0.9	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.3
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	0.9	-	-	-	0.9	0.7	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	0.3	-	-	-	-	-	-	-	-	-	-	0.6	1.4	2.6
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	2.7	1.3
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	0.6	-	5.6	-	-	-	-	-	0.3	-	0.7	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	0.6	-	-	0.9	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	0.4	0.7	-	-	0.5
Nonion spp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	-	-	-	0.3	-	-	1.7	-	4.5	1.0	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paralissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	0.3	-	-	-	0.6	-	2.7	1.1	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-

Taxa	Sample number														
	84-45	84-44	84-43	84-42	84-41	84-40	84-39	84-38	84-37	84-36	84-35	84-34	84-33	84-32	84-31
Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	15.5	6.7	2.4	91.7	33.3	12.1	0.3	1.8	8.2	5.5	7.1	1.6	3.3	2.1	1.6
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	-	-	-	-	-	-	-	-	-	0.3	1.7	3.9	0.6	-	0.3
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	0.9	0.3	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	3.3	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	1.0	1.0
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	0.9	4.0	-	-	-	-	0.6	0.9	1.2	0.9	0.8	7.2	-	-	0.3
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	1.5	-	-	0.8	8.5	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	1.8	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	10.9	3.1	-	2.8	47.9	4.3	-	-	1.8	4.6	-	-	8.5	2.1	2.6
U. peregrina Cushman	-	-	2.1	-	-	70.5	26.7	8.3	41.6	28.7	1.7	0.7	-	-	-
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
U. senticosa Cushman	10.9	0.6	1.2	-	-	1.3	0.6	-	1.2	0.3	-	-	6.0	1.0	1.0
U. semitrigonia Galloway and Wissler	-	-	-	-	1.7	-	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	0.4	1.6	-	-	0.3
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	110	327	328	36	117	305	337	326	329	348	240	307	331	291	383
Diversity	15	18	11	3	12	11	14	12	11	15	17	17	17	14	21

Taxa	Sample number															
	84-30	84-29	84-28	84-27	84-26	84-25	84-24	84-23	84-22	84-21	84-20	84-19	84-18	84-17	84-16
Astacolus sp.	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	84.0	66.5	54.4	35.4	50.2	74.6	69.8	3.1	17.9	73.2	43.9	56.2	-	54.3	73.1
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
B. sinuata Galloway and Wissler	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	-	0.6	0.6	0.6	5.4	9.4	7.0	1.0	17.2	6.3	8.0	7.2	0.4	6.1	3.2
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpelli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	0.3	4.2	-	-	0.3	0.3	0.3	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	2.9	-	-	-	3.9	0.7	-	1.0	2.6	-	0.9	2.6	21.5	0.3	-
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata d'Orbigny	-	-	-	-	1.8	-	0.3	-	11.9	-	5.4	3.6	12.4	2.5	0.3
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	1.3	16.4	21.1	13.9	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	0.6	-	0.6	1.0	5.3	2.8	4.0	12.9	-	0.3	1.0
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	1.0	-	-	-	-	-	-	-	0.3	-
C. mckannai Galloway and Wissler	-	-	-	-	-	-	0.3	-	-	-	-	-	0.9	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	0.3	1.0	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistomineila bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	3.2	-	4.4	4.5	-	4.0	7.9	14.4	0.7	5.1	8.5	2.1	0.4	6.4	2.3

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	84-30	84-29	84-28	84-27	84-26	84-25	84-24	84-23	84-22	84-21	84-20	84-19	84-18	84-17	84-16
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	9.9	-	-	0.9	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-
F. hodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	0.3	0.9	0.7	-	-	-	0.4	-	-	-	-	-
Globobulimina pacifica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	6.1	10.1	15.2	-	-	-	4.1	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	0.3	-	4.2	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	-	-	-	1.0	1.3	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. latulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	0.6	0.3	0.6	0.9	-	0.9	-	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	3.2	2.9	0.6	0.3	1.2	-	-	-	-	-	-	-	0.4	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	10.3	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multisentus (Koch)	-	-	-	2.7	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	0.3	-	-	-	-	-	3.1	0.7	-	-	-	3.4	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-

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Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	1.0	1.0	-	0.3	0.9	0.3	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	0.6	-	-	-	1.5	0.3	0.3	48.5	22.5	5.5	-	3.6	2.6	-	1.0
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	1.0	-	0.3	1.8	0.3	-	-	2.1	0.7	0.8	-	1.5	5.6	-	-
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	0.6	-	-	-	-	-	-	-	0.4	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	0.9	1.8	0.3	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularis flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	0.6	0.6	1.3	0.9	0.6	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	2.9	0.3	10.4	6.8	7.3	-	-	-	1.3	0.8	1.1	1.0	0.9	-	-
U. peregrina Cushman	-	-	-	-	-	5.4	5.5	4.1	17.2	3.9	27.9	9.3	9.0	29.4	18.8
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina diruptа Todd	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	4.5	-	5.7	3.3	1.3	5.2	1.0	0.7	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	0.6	-	-	0.8	-	-	22.7	-	0.3
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	0.3	-	18.0	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	313	313	318	336	331	299	328	97	151	254	351	194	233	326	309
Diversity	11	16	12	19	20	17	14	18	13	11	9	10	16	9	8

Taxa	Sample number														
	84-15	84-14	84-13	84-12	84-11	84-10	84-9	84-8	84-7	84-6	84-5	86-101	86-100	84-4	86-99
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimineila basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	54.3	45.8	8.0	2.1	7.5	-	0.8	3.6	2.3	5.7	0.4	-	-	-	0.3
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	2.7	5.2	10.2	4.5	4.9	1.0	-	9.8	11.6	19.8	12.3	0.3	0.7	10.8	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebospinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	0.4	-	4.9	-	0.7	7.2	1.2	3.0	-	-	-	-	-	1.1	-
C. cushmani Stewart and Stewart	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	-	-	-	-	0.8	11.2	-	-
C. laevigata d'Orbigny	0.8	0.7	2.7	0.3	0.3	28.3	2.7	-	1.2	12.6	0.4	-	-	3.8	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	0.8	2.3	1.5	4.5	-	1.0	0.8	3.3	-	7.8	6.2	7.0	-	3.8	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	0.7	-	-	-	-	-	-	-	-	0.9	-	-	-	-
C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	4.6	-	0.3
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-
D. spp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	0.4	17.0	37.1	63.9	0.3	4.6	3.5	2.0	5.2	6.3	0.9	2.2	2.0	1.1	4.4

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Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. lucida (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	0.4	-	-	-	0.4	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	0.7	1.1	-	-	-	-	-	-	-	0.9	-	-	0.5	-
Globobulimina pacifica Cushman	-	-	-	-	-	-	-	-	-	-	-	4.2	4.3	-	4.0
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-	-	-	2.1	4.8	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	-	0.3	0.4	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	0.6	0.3	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	-	-	-	-	-	0.8	-	-	-	0.4	0.8	0.7	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	0.3	0.4	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	-	-	0.4	8.5	-	-	13.7	-	0.3	1.1	0.7
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
P. auriculata (Bailey)	2.3	2.3	5.7	-	-	9.5	9.3	3.0	8.1	4.5	13.7	-	-	23.7	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	0.8	0.7	1.9	-	-	3.9	0.4	0.3	3.5	-	-	-	-	1.1	-
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reussella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	0.3	-	-	-	-	-	-	-	-	-	-	0.3	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	0.3	0.4	-	-	0.5	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	0.3
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	1.6	0.8	0.3	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
U. juncea Cushman and Todd	0.8	2.3	6.8	-	-	-	-	-	-	-	-	-	1.0	-	24.5
U. peregrina Cushman	35.9	20.6	15.9	23.0	86.2	40.1	77.0	61.6	66.9	39.9	44.1	84.6	73.9	52.2	64.8
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	0.3	-	1.0	0.6	0.3	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	0.8	0.6	-	1.0	-	-	-	0.3	-	-	-	-	-
U. semitrigonia Galloway and Wissler	0.4	0.3	-	-	-	-	0.4	3.6	-	-	-	-	-	-	-
U. spp.	-	-	-	-		-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	0.3	-	-	-	-	0.4	-	-	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	256	306	264	330	305	304	257	305	172	333	227	357	303	186	298
Diversity	12	17	18	9	6	15	17	12	9	12	15	7	13	12	10

Taxa	Sample number														
	84-3	86-98	86-97	84-2	86-96	86-95	84-1	86-106	84-76	86-107	86-108	84-77	86-109	86-1	84-78
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	-	-	34.8	-	80.0	70.1	57.1	54.6	43.2	52.8	58.9	-	58.5	51.2	84.6
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	2.1	-	0.6	-	-	-	0.6	0.9	4.1	1.8	1.4	-	1.5	1.8	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	3.4	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	1.0	0.9	0.6	-	-	-	-	-	0.3	0.3	-	-	-	-	-
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	0.2	1.9	-	1.9	-	-	0.6	-	0.9	-	-
C. laevigata d'Orbigny	3.1	-	-	-	-	-	2.4	-	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	0.3	-	-	-	-	-	-	0.3	0.3	-	0.6	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	0.3	-	-	-	-	3.9	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	9.4	7.0	9.8	1.3	-	0.2	0.3	0.3	0.3	0.3	-	-	1.5	-	1.4
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
C. mckannai Galloway and Wissler	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	0.8
C. cf. C. mckannsi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	1.0	-	1.2	18.2	-	-	0.9	-	1.8	-	0.6	-	-	-	0.5

Taxa	Sample number														
	84-3	86-98	86-97	84-2	86-96	86-95	84-1	86-106	84-76	86-107	86-108	84-77	86-109	86-1	84-78
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	0.9	-	0.3	-	-	-	0.3	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	-	2.3	1.5	-	-	-	-	0.3	-	0.3	-	-	0.3	0.9	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	1.4	0.3	1.3	-	-	-	0.3	0.3	0.3	0.3	-	-	0.3	0.3
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	9.3	4.8	3.1	-	-	-	0.6	-	-	-	-	0.3	0.9	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paralissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	2.1	-	-	1.3	-	-	0.9	-	2.1	-	-	96.6	-	-	0.5
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenis miocenica Kleinpell	-	4.2	0.9	7.5	-	-	-	-	-	-	-	-	-	0.3	-
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaris Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Reuseila sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	0.6	-	-	-	-	-	0.6	-
U. juncea Cushman and Todd	-	-	2.4	-	-	1.7	-	1.2	0.9	1.2	0.3	-	-	-	-
U. peregrina Cushman	78.1	65.4	40.2	59.7	19.8	25.5	37.7	38.3	44.4	40.7	37.8	-	35.5	38.9	10.7
U. cf. U. peregrina Cushman	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	1.0	4.7	2.4	5.7	-	-	-	-	1.2	0.3	-	-	0.6	0.3	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	96	214	336	159	420	411	329	324	338	339	360	29	330	334	364
Diversity	10	11	14	10	3	7	7	11	13	13	8	2	10	13	11

Taxa	Sample number														
	86-110	86-111	86-112	84-79	86-2	84-80	86-113	86-3	86-4	86-5	86-6	86-7	86-8	86-9	86-10
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	2.9	0.6	0.2	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	27.3	50.3	51.8	84.6	-	92.1	70.4	90.2	87.1	90.6	90.0	86.5	93.7	83.8	83.2
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	0.6	0.6	0.2	-	-	-	0.7	0.3	0.3	-	-	-	-	-	0.5
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	0.9	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	4.6	1.7	1.4	0.3	-	-	1.2	1.0	0.9	1.3	0.9	0.3	-	0.5	0.7
B. spp.	-	-	-	-	1.8	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	0.6	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	-	0.3	0.2	0.9	-	0.3	0.2	-	0.9	-	-	-	-	-	-
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	3.2	0.6	0.2	-	-	-	0.2	-	-	-	-	-	-	-	-
C. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-
C. minuta Cushman	3.7	1.4	6 8	-	-	-	0.2	-	-	-	-	-	-	-	-
C. oblonga Reues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	1.2	-	1.9	-	0.3	0.3	2.6	-	0.6	-	0.3	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	6.0	0.6	-	2.9	-	-	1.7	0.6	4.7	1.3	-	1.0	-	-	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	0.3	-	-	-	-	-	0.3	-
C. mckannai Galloway and Wissler	-	1.4	5.2	-	-	-	0.5	-	-	-	-	-	-	0.3	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	1.4	-	1.2	0.9	-	0.6	1.0	0.6	0.3	0.3	2.1	0.3	0.6	1.6	4.4

Taxa	Sample number														
	86-110	86-111	86-112	84-79	86-2	84-80	86-113	86-3	86-4	86-5	86-6	86-7	86-8	86-9	86-10
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	0.7	-	-	-	0.2	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	-	-	-	-	83.6	-	-	1.0	0.3	0.3	1.2	3.2	2.4	8.1	6.6
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	1.7	-	-	-	-	-	-	-	-	0.6	0.3	0.3	-	0.5	0.2
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	0.5	-	-	-	0.2	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williameon)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	0.6	0.2	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	3.6	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ooiina melo d'Orbigny	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	0.3	-	0.2	-	-	-	-	-	-	-	-	-	-	-	0.2
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	86-110	86-111	86-112	84-79	86-2	84-80	86-113	86-3	86-4	86-5	86-6	86-7	86-8	86-9	86-10
Plectofrondicularia advena (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	9.1	-	-	-	-	-	-	-	-	-	0.7
P. auriculata (Bailey)	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	0.6	-	-	-	-	-	-	-	-	-	-	-	0.2	0.8	0.5
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveyensis Natland	0.3	0.8	0.7	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	1.1	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trilarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	1.4	0.3	1.4	-	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-
U. peregrina Cushman	40.5	40.0	26.5	8.4	-	4.4	22.4	5.4	5.0	2.9	4.5	7.7	2.2	2.6	2.2
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	0.6	-	0.4	-	0.2
U. aff. U. peregrina Cushman	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	1.8	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	1.1	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	348	360	423	344	55	318	406	315	317	310	331	311	494	383	410
Diversity	20	15	24	9	5	7	13	10	9	8	8	8	8	15	12

Taxa	Sample number														
	86-11	86-12	86-13	86-14	86-15	86-16	86-17	86-18	86-19	86-20	86-21	86-22	86-23	86-24	86-25
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	5.2	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	1.2	0.2	-	0.3	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	81.4	24.8	7.6	15.3	3.9	39.7	49.6	66.5	10.1	-	-	62.6	74.2	62.1	1.6
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	0.9	3.7	3.6	0.4	1.7	1.4	0.8	0.3	1.3	5.1	-	1.5	2.5	-	0.8
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-
B. spissa Cushman	2.4	16.4	15.1	11.8	16.8	12.7	9.2	1.0	9.4	14.1	3.1	6.9	6.5	0.6	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	0.3	-	0.3	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	-	-	-	-	-	-	-	-	-	0.3	-	0.6	-	-	-
C. cushmani Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	1.0	-	-	-	-	1.2
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	0.3	-	-	-	-	-	5.7	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	3.6	-	-	-	-	0.3	10.4	-	-	-	-	-	1.2
C. minuta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-
C. translucens Cushman and Hughes	-	-	-	0.2	-	0.8	-	-	18.2	0.3	-	-	0.2	0.6	0.4
C. cf. C. translucens Cushman and Hughes	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-
Cibicides fletcheri Galloway and Wissler	0.3	-	1.2	-	0.6	0.6	-	-	-	0.6	0.6	-	-	0.3	1.6
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	-	-	0.3	-	-	-	-	-	-	2.9	2.2	-	-	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
E. pacifica (Cushman)	-	39.3	32.6	41.9	61.7	24.5	19.4	15.6	1.6	2.3	1.6	10.8	8.4	-	1.6

Taxa	Sample number														
	86-11	86-12	86-13	86-14	86-15	86-16	86-17	86-18	86-19	86-20	86-21	86-22	86-23	86-24	86-25
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.3	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	-	-	-	-	-	-	1.0	-	-	-	0.3	2.0
Globobulimina pacifica Cushman	6.8	6.1	-	-	0.3	0.6	1.0	-	-	-	-	0.9	1.0	0.3	6.5
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	2.4	-	-	-	-	-	-	5.5	1.6	-	1.0	-	1.2
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	8.7	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	1.9	1.2	2.7	0.5	0.3	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	0.4
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	0.4
L. striata (d'Orbigny)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	0.4
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.3	1.6
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.4
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	0.3	-	-	-	-	-	-	-	-	3.2	0.3	-	0.2	1.8	4.1
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	86-11	86-12	86-13	86-14	86-15	86-16	86-17	86-18	86-19	86-20	86-21	86-22	86-23	86-24	86-25
Plectofrondicularia advena (Cushman)	0.6	-	0.6	0.2	-	-	-	-	-	-	0.6	-	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	0.3	1.8	-	-	-	-	-	-	-	-	-	1.2	-	-
P. auriculata (Bailey)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	0.6	0.3	1.8	-	-	-	-	-	-	2.9	0.6	-	0.7	2.4	6.5
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	1.2	-	0.3	-	-	-	-	-	-	-	-	-	-	0.3	0.4
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	0.6	0.3	-	-	-	0.8
R. cf. R. garveyensis Natland	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	1.6
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia ilintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	2.4
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	1.3	0.6	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	0.3	1.2	-	-	-	-	-	-	-	-	-	-	-	1.2
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	0.6	2.2	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	2.4
U. curticosta (Cushman)	-	-	2.4	-	-	-	-	-	4.2	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	-	-	-	-	-	-	-	1.0	-	-	-	0.3	0.2	-	-
U. peregrina Cushman	5.3	9.2	20.5	21.0	14.0	18.3	19.2	15.3	36.4	48.2	83.5	7.5	2.0	7.3	54.1
U. cf. U. peregrina Cushman	-	-	-	-	0.8	0.3	0.3	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	0.3	0.3	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	0.3	-	-	-	1.2	-	-	0.3	1.2
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	338	379	331	561	358	355	391	385	385	311	322	334	403	330	246
Diversity	11	11	25	10	9	13	9	7	11	23	15	11	18	22	31

Taxa	Sample number														
	86-26	86-27	86-28	86-29	86-30	86-31	86-32	86-33	86-34	86-35	86-36	86-37	86-38	86-39	86-40
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	10.2	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	2.8	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	-	0.5	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	30.4	86.7	0.6	13.6	0.3	9.4	21.7	25.6	60.8	3.3	83.3	79.2	83.5	90.2	90.7
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	2.6	-	-	1.3	3.3	2.1	6.5	2.0	-	2.1	0.3	-	0.6	0.8	0.8
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	0.3	0.6	-	-	-	-	15.0	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	11.3	2.3	5.3	1.6	15.4	34.0	31.1	0.4	13.4	5.1	1.5	0.8	4.1	4.4	5.9
B. spp.	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpelli	-	-	-	-	-	-	-	19.1	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	-	-	-	-	-	-	-	-	-	2.4	-	-	-	-	-
C. cushmani Stewart and Stewart	0.2	-	-	-	-	-	-	-	2.0	4.2	6.6	9.8	5.3	0.8	0.3
C. delicata Cushman	-	2.3	-	0.3	-	-	-	1.2	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	0.2	-	-	-	0.3	-	-	2.8	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	-	-	-	-	-	-	1.6	2.3	28.9	0.9	-	0.3	0.8	0.5
C. laevigata d'Orbigny	-	-	10.9	-	30.8	-	-	6.5	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-
C. obionga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	0.4	-	-	0.3	-	-	-	0.4	0.3	-	-	-	-	0.3	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	0.4	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	0.2	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
E. pacifica (Cushman)	1.5	5.2	1.2	0.3	4.7	36.1	22.0	7.7	5.6	7.4	3.9	2.7	0.3	1.6	0.5

Taxa	Sample number														
	86-26	86-27	86-28	86-29	86-30	86-31	86-32	86-33	86-34	86-35	86-36	86-37	86-38	86-39	86-40
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina cornuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	0.4	-	-	-	-	-	-	-	-	-	-	3.8	1.2	-	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	0.4	-	6.5	25.4	1.0	-	-	2.0	1.3	-	-	-	-	0.3	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	0.2	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	0.2	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	0.2	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	4.0	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	0.9	-	0.9	1.1	1.7	-	-	-	-	-	-	-	-	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	86-26	86-27	86-28	86-29	86-30	86-31	86-32	86-33	86-34	86-35	86-36	86-37	86-38	86-39	86-40
Plectofrondicularia advena (Cushman)	1.9	-	0.3	1.3	1.3	0.6	0.3	-	-	-	-	-	-	0.3	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	1.3	-	2.7	-	-	-	-
Pullenia miocenica Kleinpell	4.3	-	-	3.5	4.0	-	-	-	-	-	-	-	-	-	-
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveyensis Natland	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-
S. tortа (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. beggi Galloway and Wissler	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	0.3	-	-	-	12.4	-	-	-	-	0.5	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. juncea Cushman and Todd	-	-	13.4	-	-	-	3.7	-	-	-	-	-	-	-	-
U. peregrina Cushman	43.0	2.6	48.3	47.1	15.4	17.9	14.3	0.4	-	46.7	0.9	2.3	4.4	-	1.3
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	0.9	-	-	-	-	0.4	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	2.2	1.1	16.1	-	-	-	-	-	-	-	-	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	467	384	321	374	299	341	322	248	306	336	335	264	339	366	376
Diversity	22	7	27	15	16	6	8	20	11	8	8	9	9	10	7

Taxa	Sample number														
	86-41	86-42	86-43	86-44	86-45	86-46	86-47	86-48	86-49	86-50	86-51	86-52	86-53	86-54	86-55
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. girardensis Rankin	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	60.0	7.0	75.1	1.0	0.6	-	24.3	56.8	66.1	55.7	75.3	32.6	57.2	2.0	-
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	1.6	1.5	0.8	5.0	0.9	4.8	1.1	0.4	-	-	0.3	-	-	8.2	0.5
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	-	-	-	-	-	0.2	0.8	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	18.9	2.9	0.5	29.0	20.8	16.0	11.5	0.2	0.6	-	0.5	-	9.3	33.0	3.2
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. vaughani Natland	-	0.6	0.3	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpelli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	1.1
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	0.2	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cushmani Stewart and Stewart	11.0	0.3	-	-	-	-	-	-	5.3	10.2	3.1	34.8	0.3	-	3.2
C. delicata Cushman	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	1.2	0.5	0.7	0.9	-	4.5	25.3	15.6	23.1	17.8	24.0	31.3	-	6.5
C. laevigata d'Orbigny	-	-	-	8.3	-	-	6.8	-	-	-	-	-	-	4.1	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	7.3	-	-	0.3	-	-	0.2	-	-	-	-	-	0.7	3.2
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	5.3	0.5	0.3	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	-	0.3	-	0.7	3.8	1.0	-	0.2	0.2	1.3	-	0.2	-	1.4	0.5
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	7.5	4.7	17.4	2.7	6.9	-	15.5	10.2	4.9	3.1	0.5	4.2	0.3	6.8	70.8

Taxa	Sample number														
	86-41	86-42	86-43	86-44	86-45	86-46	86-47	86-48	86-49	86-50	86-51	86-52	86-53	86-54	86-55
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	7.3	-	-	1.5	-	-	0.6	-	27.2	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	0.5	4.1	-	-	0.3	1.9	0.9	0.2	0.2	0.4	0.3	-	-	0.3	-
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	2.9	0.8	0.3	0.9	-	-	-	-	-	-	-	-	0.3	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-
Melonis barleeanus (Williamson)	-	0.3	-	0.7	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	0.3	0.3	-	-	-	-	-	0.4	-	-	-	-	-	0.5
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	4.0	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	0.9	-	5.3	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	0.6	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	0.6	-	0.7	-	-	-	-	-	-	-	0.2	-	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	86-41	86-42	86-43	86-44	86-45	86-46	86-47	86-48	86-49	86-50	86-51	86-52	86-53	86-54	86-55
Plectofrondicularia advena (Cushman)	-	0.3	-	4.7	0.9	1.6	-	-	-	-	-	-	-	5.1	0.5
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	-	17.5	0.5	6.3	-	0.3	-	-	-	-	-	0.2	-	-	0.5
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	13.2	0.3	1.3	7.2	-	-	-	-	-	-	-	-	-	1.1
U. juncea Cushman and Todd	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-
U. peregrina Cushman	1.8	8.8	1.6	20.7	56.6	66.5	33.3	6.5	5.1	4.2	0.5	1.2	1.5	9.5	5.4
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	8.5	-	1.0	-	0.6	-	-	-	1.3	0.8	2.0	-	-	1.1
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fotaminiferal number	438	342	386	300	346	313	445	521	469	451	393	500	332	294	185
Diversity	10	38	17	25	12	9	9	9	10	11	11	10	6	15	16

Taxa	Sample number														
	86-56	86-57	86-58	86-59	86-60	86-61	86-62	86-63	86-64	86-65	86-66	86-90	86-67	86-92	86-69
Astacolus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-	-	-	-	-	19.4	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. interjuncta Cushman	-	21.0	-	-	-	1.4	-	-	-	5.2	84.1	-	33.2	-	-
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pseudoespissa Kleinpell	-	-	-	0.3	0.3	-	-	-	-	-	-	-	1.8	-	-
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	-	-	1.6	-	0.2	-	-	-	-	-	-
B. seminuda Cushman	-	-	-	-	10.7	13.8	-	-	-	-	0.5	0.5	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spissa Cushman	-	-	3.3	10.5	3.1	-	-	-	-	-	-	-	-	-	3.2
B. spp.	-	-	-	-	0.1	-	-	-	-	-	-	0.2	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	-	1.8	-	0.9	0.7	-	-	-	-	0.3	-	-	0.5	-	-
C. cushmani Stewart and Stewart	-	13.8	13.4	-	5.2	20.0	44.1	6.2	24.8	7.3	0.2	-	29.0	41.8	-
C. delicata Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	-	5.4	-	-	-	-	3.3	-	-	1.0	-	54.9	18.9	33.6	-
C. laevigata d'Orbigny	0.3	-	26.8	-	0.4	0.7	-	-	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	26.9	0.5	-	-	-	-	1.0	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. minuta Cushman	-	2.7	2.2	-	-	9.0	0.2	-	-	-	-	-	0.5	-	-
C. oblonga Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	-	6.2	0.4	0.3	0.3	-	-	-	-	0.3	-	-	0.5	-	-
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-
C. wuellerstorffi (Schwager)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cibicides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyclammina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
D. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discorbis sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. pacifica (Cushman)	46.5	29.5	-	57.6	0.7	-	-	71.9	0.7	7.0	-	-	-	3.6	-

Taxa	Sample number														
	86-56	86-57	86-58	86-59	86-60	86-61	86-62	86-63	86-64	86-65	86-66	86-90	86-67	86-92	86-69
Epistominella subperuviana (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E. smithi (Stewart and Stewart)	24.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. marginata (Montagu)	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	-	-	-	-	0.3	-	-	0.5	-	-	-	1.7	-	-	-
G. pyrula (d'Orbigny)	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-	-	-	-	-	19.4	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. costata (Williamson)	-	0.9	-	0.3	0.1	-	-	-	-	-	-	-	-	-	-
L. elongata (Ehrenberg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. striata (d'Orbigny)	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	2.1	-	0.5	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	-	-	-	-	0.5	-	4.3	-	-	1.2	-	1.8	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Taxa	Sample number														
	86-56	86-57	86-58	86-59	86-60	86-61	86-62	86-63	86-64	86-65	86-66	86-90	86-67	86-92	86-69
Plectofrondicularia advena (Cushman)	1.2	-	-	0.6	0.4	-	3.0	-	-	-	-	0.7	-	-	-
P. miocenica Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. auriculata (Bailey)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	1.5	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-
P. salisburyi Stewart and Stewart	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	7.6	-	-	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	0.4	-	-	-	-	-	-	-	-	-	-	0.5	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	1.1	-	-	-	-	-	-	-	-	0.2	-	-	-
U. juncea Cushman and Todd	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	4.8
U. peregrina Cushman	22.6	15.2	52.8	28.4	77.7	17.9	46.4	20.8	70.0	78.9	15.2	-	15.2	15.5	91.9
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	-	-	-	-	-	-	-	-	-	1.8	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Foraminiferal number	340	224	269	342	764	145	576	192	420	384	427	408	217	110	62
Diversity	9	13	7	12	13	10	10	5	5	7	4	12	9	7	3

Taxa	Sample number						
	86-70	86-71	86-93	86-72	86-73	86-74	86-76
Astacolus sp.	-	-	-	-	-	-	-
Astrononion sp.	-	-	-	-	0.3	-	-
A. stellatum Cushman and Edwards	-	-	-	-	-	-	-
Buliminella basispinata Stewart and Stewart	-	-	-	-	-	-	-
B. curta Cushman	-	-	-	-	-	-	-
B. elegantissima (d'Orbigny)	-	-	-	-	-	-	-
B. subfusiformis Cushman	-	-	-	-	-	-	-
Bolivina argentea Cushman	-	-	-	-	-	-	-
B. girardensis Rankin	-	-	-	-	-	-	-
B. interjuncta Cushman	-	-	-	-	1.1	0.2	3.3
B. cf. B. interjuncta Cushman	-	-	-	-	-	-	-
B. marginata Cushman	-	-	-	-	-	-	-
B. pseudospissa Kleinpell	-	-	-	-	-	-	-
B. sinuata Galloway and Wissler	-	-	-	-	-	-	-
B. semiperforata Martin	-	-	-	-	1.3	-	2.5
B. seminuda Cushman	-	-	-	-	-	-	-
B. aff. B. seminuda	-	-	-	-	-	-	-
B. spissa Cushman	1.6	2.8	1.2	4.3	-	-	-
B. spp.	-	-	-	-	-	-	-
B. vaughani Natland	-	-	-	-	-	-	-
B. woodringi Kleinpell	-	-	-	-	-	-	-
Buccella frigida (Cushman)	-	-	-	-	-	-	-
B. parkerae Andersen	-	-	-	-	-	-	-
B. tenerrima Bandy	-	-	-	-	-	-	-
Bulimina denudata Cushman and Parker	-	-	-	-	-	-	-
B. pagoda hebespinata Stewart and Stewart	-	-	-	-	-	-	-
B. rostrata Brady	-	-	-	-	-	-	-
B. aff. B. rostrata Brady	-	-	-	-	-	-	-
B. subaccuminata Cushman and Parker	-	-	-	-	-	-	-
B. spp.	-	-	-	-	-	-	-
Cassidulina californica Cushman and Hughes	0.5	0.3	-	5.1	12.3	0.6	2.5
C. cushmani Stewart and Stewart	-	-	-	3.6	-	-	-
C. delicata Cushman	-	-	-	-	-	-	-
C. depressa Asano and Nakamura	-	-	-	-	-	-	-
C. laevigata carinata Silvestri	1.6	0.9	27.8	5.1	5.9	0.2	23.2
C. laevigata d'Orbigny	-	-	-	-	-	-	-
C. limbata Cushman and Hughes	-	-	-	-	-	-	-
Cassidulinella pliocenica Natland	-	-	-	-	-	-	-
Cassidulina lomitensis Galloway and Wissler	-	-	-	-	-	-	-
C. minuta Cushman	-	-	-	-	-	-	-
C. oblonga Reuss	-	-	-	-	-	-	-
Cassidulinoides tenuis Phleger and Parker	-	-	-	-	-	-	-
Cassidulina spp.	-	-	-	-	-	-	-
C. tortuosa Cushman and Hughes	-	-	-	-	-	-	-
C. transluscens Cushman and Hughes	-	-	-	-	-	-	-
C. cf. C. transluscens Cushman and Hughes	-	-	-	-	-	-	-
Chilostomella oolina Schwager	-	-	-	-	-	-	-
Cibicides fletcheri Galloway and Wissler	-	-	-	-	1.9	-	-
C. cf. C. fletcheri Galloway and Wissler	-	-	-	-	-	-	-
C. lobatulus (Walker and Jacob)	-	-	-	-	-	-	-
C. mckannai Galloway and Wissler	0.5	2.2	3.7	1.3	0.5	1.2	1.4
C. cf. C. mckannai Galloway and Wissler	-	-	-	-	-	-	-
Cibicidoides bradyi (Trauth)	-	-	-	-	-	-	-
C. wuellerstorffi (Schwager)	-	-	-	1.3	0.8	1.8	34.8
Cibicides spp.	-	-	-	-	0.5	-	1.9
Cyclammina spp.	-	-	-	-	-	-	-
Dentalina baggi Galloway and Wissler	-	1.2	-	0.3	-	0.4	-
D. spp.	-	-	-	-	-	0.2	0.3
Discorbis sp.	-	-	-	-	-	-	-
Dyocibicides perforatus Cushman and Valentine	-	-	-	-	-	-	-
Ehrenbergina bradyi Cushman	-	-	-	0.3	-	-	-
Elphidiella hannai (Cushman and Grant)	-	-	-	-	-	-	-
Elphidium frigidum Cushman	-	-	-	-	-	-	-
E. gunteri Cole	-	-	-	-	-	-	-
E. cf. E. gunteri Cole	-	-	-	-	-	-	-
E. sp.	-	-	-	-	-	-	-
E. translucens Natland	-	-	-	-	-	-	-
E. tumidum Natland	-	-	-	-	-	-	-
Epistominella bradyana (Cushman)	-	-	-	-	-	-	1.7
E. pacifica (Cushman)	-	-	-	11.4	5.3	-	1.7

Taxa	Sample number						
	86-70	86-71	86-93	86-72	86-73	86-74	86-76
Epistominella subperuviana (Cushman)	-	-	-	-	0.8	-	-
E. smithi (Stewart and Stewart)	-	-	-	-	-	-	-
Fissurina alveolata (Brady)	-	-	-	-	-	-	-
F. bodjonegoroensis (Boomaart)	-	-	-	-	-	-	-
F. kugleri (Cushman and Stainforth)	-	-	-	-	-	-	-
F. marginata (Montagu)	-	-	-	-	0.3	-	-
F. obscurocostata Galloway and Wissler	-	-	-	-	-	-	-
F. orbignyana Sequenza	-	-	-	-	-	-	-
F. spp.	-	-	0.6	-	0.5	-	-
Fursenkoina comuta (Cushman)	-	-	-	-	-	-	-
F. schreibersiana (Czjzek)	-	-	-	-	-	-	-
F. spp.	-	-	-	-	0.3	-	-
Gaudryina arenaria Galloway and Wissler	-	-	-	-	-	-	-
Globobulimina pacifica Cushman	-	-	-	-	-	-	0.3
G. pyrula (d'Orbigny)	-	-	-	-	-	-	-
Globocassidulina subglobosa (Brady)	-	-	-	-	-	-	-
Glandulina laevigata (d'Orbigny)	-	-	-	-	-	-	-
Gyroidina altiformis Stewart and Stewart	-	-	-	-	-	90.7	4.4
G. condoni (Cushman and Schenck)	-	-	-	-	-	-	0.3
G. multilocula Coryell and Mossman	-	-	-	-	-	-	-
G. cf. G. multilocula Coryell and Mossman	-	-	-	-	-	-	-
G. soldanii d'Orbigny	-	-	-	-	-	-	-
G. spp.	-	-	-	-	-	-	0.6
Hanzawaia illingi (Nuttall)	-	-	-	-	-	-	-
H. nitidula (Bandy)	-	-	-	-	-	-	-
Haplophragmoides spp.	-	-	-	-	-	-	-
Hoeglundina elegans (d'Orbigny)	-	-	-	-	-	-	-
Lagena acuticosta Reuss	-	-	-	-	-	-	-
L. amphora Reuss	-	-	-	-	-	-	-
L. costata (Williamson)	-	-	-	-	0.8	-	0.6
L. elongata (Ehrenberg)	-	-	-	-	-	-	-
L. flatulenta Loeblich and Tappan	-	-	-	-	-	-	-
L. hexagona (Williamson)	-	-	-	-	1.1	-	-
L. laevis (Montagu)	-	-	-	-	-	-	-
L. scalariformis Williamson	-	-	-	-	-	-	-
L. setigera Millett	-	-	-	-	0.3	-	-
L. sulcata laevicosta Cushman and Gray	-	-	-	-	-	-	-
L. semistriata Williamson	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	0.3
L. striata (d'Orbigny)	-	-	-	-	0.3	-	0.6
L. sulcata (Walker and Jacob)	-	-	-	-	-	-	-
L. vulgaris Williamson	-	-	-	-	-	-	-
L. williamsoni (Alcock)	-	-	-	-	-	-	-
Lenticulina cushmani (Galloway and Wissler)	-	-	-	-	-	-	-
L. spp.	-	-	-	-	-	-	0.6
Loxostomum pseudobeyrichi (Cushman)	-	-	-	-	-	-	-
Melonis barleeanus (Williamson)	-	-	-	-	0.3	-	-
M. cf. M. pompilioides (Fitchel and Moll)	-	-	-	-	-	-	-
Miliammina fusca (Brady)	-	-	-	-	-	-	-
Nonionella auricula Heron-Allen and Earland	-	-	-	-	-	-	-
N. basispinata (Cushman and Moyer)	-	-	-	-	-	-	-
N. costifera (Cushman)	-	-	-	-	-	-	-
N. miocenica Cushman	-	-	-	-	-	-	-
N. spp.	-	-	-	-	-	-	-
N. stella Cushman and Moyer	-	-	-	-	-	-	-
Nodosaria anomala Reuss	-	-	-	-	-	-	-
N. lamellata Cushman and Stainforth	-	-	-	-	-	-	-
N. longiscata d'Orbigny	-	-	-	-	0.3	-	-
N. spp.	-	-	-	-	-	-	-
Nonion spp.	-	-	-	-	-	-	-
Oolina melo d'Orbigny	-	-	-	-	1.3	-	0.3
Oridorsalis multiseptus (Koch)	-	-	-	-	-	-	-
O. umbonatus (Reuss)	-	-	-	-	9.9	-	6.1
Orthomorphina aff. O. rohri (Cushman & Stainforth	-	-	-	-	-	-	-
O. spp.	-	-	-	-	-	-	-
Parafissurina spp.	-	-	-	-	-	-	-
Planulina ariminensis d'Orbigny	-	-	60.5	-	-	-	-
P. exorna Phleger and Parker	-	-	-	-	-	-	-
P. ornata (d'Orbigny)	-	-	-	-	-	-	-
P. cf. P. ornata d'Orbigny	-	-	-	-	-	-	-

Taxa	Sample number						
	86-70	86-71	86-93	86-72	86-73	86-74	86-76
Plectofrondicularia advena (Cushman)	-	1.2	-	-	2.9	0.4	1.9
P. miocenica Cushman	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-
Praeglobobulimina affinis (d'Orbigny)	-	-	-	-	-	-	-
P. auriculata (Bailey)	-	-	-	-	-	-	-
P. pupoides (d'Orbigny)	-	-	-	-	-	-	-
Pullenia miocenica Kleinpell	-	-	-	-	-	-	-
P. salisburyi Stewart and Stewart	-	-	-	-	0.5	-	-
P. subcarinata d'Orbigny	-	-	-	-	-	1.0	-
P. spp.	-	-	-	-	-	-	-
Pyrgo rotalaria Loeblich and Tappan	-	-	-	-	-	-	-
P. spp.	-	-	-	-	-	-	-
Quinqueloculina akneriana d'Orbigny	-	-	-	-	-	-	-
Q. laevigata d'Orbigny	-	-	-	-	-	-	-
Q. spp.	-	-	-	-	-	-	-
Reusella sp.	-	-	-	-	-	-	-
Rhabdammina sp.	-	-	-	-	-	-	-
Rosalina cf. R. columbiensis (Cushman)	-	-	-	-	-	-	-
R. sp.	-	-	-	-	-	-	-
Rotalia garveynsis Natland	-	-	-	-	0.3	-	-
R. cf. R. garveyensis Natland	-	-	-	-	-	-	-
R. sp.	-	-	-	-	0.3	-	-
Rotorbinella lomaensis (Bandy)	-	-	-	-	-	-	-
R. versiformis (Bandy)	-	-	-	-	-	-	-
Saccammina sp.	-	-	-	-	-	-	-
Sigmoilina tenuis (Czjeck)	-	-	-	-	-	-	-
S. torta (Galloway and Wissler)	-	-	-	-	-	-	-
Siphotextularia flintii (Cushman)	-	-	-	-	-	-	-
Sphaeroidina bulloides d'Orbigny	-	-	-	-	-	-	-
Spiroplectammina sp.	-	-	-	-	-	-	-
Stainforthia concava (Hoeglund)	-	-	-	-	-	-	-
Stilostomella adolphina (d'Orbigny)	-	-	-	-	-	-	0.6
S. spp.	-	-	-	-	-	-	-
Suggrunda spp.	-	-	-	-	-	-	-
Trifarina angulosa (Williamson)	-	-	-	-	0.5	-	-
T. carinata (Cushman)	-	-	-	-	-	-	-
T. cf. T. carinata (Cushman)	-	-	-	-	-	-	-
T. hughesi (Galloway and Wissler)	-	-	-	-	-	-	-
T. occidentalis (Cushman)	-	-	-	-	-	-	-
Triloculina spp.	-	-	-	-	-	-	-
Uvigerina auberiana d'Orbigny	-	-	-	-	-	-	-
U. baggi Galloway and Wissler	-	-	-	-	0.8	-	-
U. curticosta (Cushman)	-	-	-	-	-	-	-
U. hispidocostata Cushman and Todd	-	-	-	-	-	-	-
U. hispida Schwager	-	-	-	-	-	-	-
U. hootsi Rankin	-	-	-	-	1.1	0.2	-
U. juncea Cushman and Todd	-	-	-	-	-	-	-
U. peregrina Cushman	95.6	91.3	6.2	67.5	46.4	3.0	8.3
U. cf. U. peregrina Cushman	-	-	-	-	-	-	-
U. aff. U. peregrina Cushman	-	-	-	-	-	-	-
U. peregrina dirupta Todd	-	-	-	-	1.1	-	2.2
U. rustica Cushman and Edwards	-	-	-	-	-	-	-
U. cf. U. rustica Cushman and Edwards	-	-	-	-	-	-	-
U. senticosa Cushman	-	-	-	-	-	-	-
U. semitrigonia Galloway and Wissler	-	-	-	-	-	-	-
U. spp.	-	-	-	-	-	-	-
U. striata d'Orbigny	-	-	-	-	-	-	-
Valvulineria araucana (d'Orbigny)	-	-	-	-	0.3	-	-
V. californica Cushman (s.s.)	-	-	-	-	-	-	-
V. spp.	-	-	-	-	-	-	-
Foraminiferal number	366	322	162	394	375	497	362
Diversity	5	7	6	10	32	12	24

Appendix 5 Distribution and abundance of planktic foraminifers in the Balcom Canyon Section. Abundance of each species is a percentage of the total planktic foraminiferal assemblage. Planktic foraminiferal number is the number of specimens picked and diversity is the number of species per sample.

Table 3 Distribution and abundance of planktic foraminifers in the Balcom Canyon Section. Abundance of each species is a percentage of the total planktic foraminiferal assemblage. Planktic foraminiferal number is the number of specimens picked and diversity is the number of species per sample.

Taxa	Sample number							
	84-75	84-71	84-66	84-65	84-64	84-63	84-61	84-60
Globigerina bulloides d'Orbigny	30.2	45.2	27.3	43.8	54.4	16.1	48.6	73.8
G. quinqueloba Natland	20.4	26.0	30.3	37.5	33.3	17.0	8.4	7.2
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	1.2	1.0	6.1	-	0.9	1.8	-	0.3
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	7.7	-	-	-	-	-	0.3
G. scitula (Brady)	2.5	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	1.9	-	-	-	-	-	2.5	-
N. pachyderma (Ehrenberg), left	22.2	-	12.1	6.2	3.5	53.6	35.9	16.2
N. pachyderma (Ehrenberg), right	21.6	17.3	21.2	-	7.9	1.8	4.0	1.2
N. sp.	-	-	-	-	-	-	-	-
Orbulina universa d'Orbigny	-	1.0	-	-	-	-	0.3	-
indeterminate planktic foraminifers	-	1.9	3.0	12.5	-	9.8	0.3	0.9
Foraminiferal number	162	104	33	16	114	112	323	321
Diversity	7	7	6	4	5	6	7	7

Taxa	Sample number							
	84-59	84-58	84-56	84-55	84-54	84-53	84-52	84-51
Globigerina bulloides d'Orbigny	49.9	40.1	38.4	32.3	59.2	24.2	50.2	36.8
G. quinqueloba Natland	2.3	17.6	14.4	26.3	12.5	11.8	17.4	17.1
G. umbilicata Orr and Zaitzeff	-	0.3	-	-	-	-	0.6	-
Globigerinita glutinata (Egger)	-	0.7	0.3	0.3	-	0.7	1.6	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	7.2	0.9	3.6	2.9	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	2.5	4.2	2.8	0.6	5.0	27.8	3.5	-
N. pachyderma (Ehrenberg), right	45.0	36.8	44.1	32.3	22.3	31.4	23.2	45.9
N. sp.	-	-	-	-	-	-	-	-
Orbulina universa d'Orbigny	-	-	-	0.6	-	-	-	-
indeterminate planktic foraminifers	0.3	0.3	-	0.3	-	0.7	0.6	0.3
Foraminiferal number	353	307	320	319	319	306	311	340
Diversity	5	7	5	8	5	7	8	4

Taxa	Sample number							
	84-50	84-49	84-48	84-47	84-46	84-45	84-44	84-42
Globigerina bulloides d'Orbigny	25.6	45.2	56.4	31.5	42.2	51.3	62.7	-
G. quinqueloba Natland	10.6	10.0	-	6.1	2.2	-	4.0	-
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	0.5	-	-
Globigerinita glutinata (Egger)	0.7	-	-	-	-	0.5	-	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	2.7	0.7	-	-	1.3	1.0	0.7	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	1.8	-	1.9	0.5	-	-
N. pachyderma (Ehrenberg), left	1.7	1.0	38.2	47.3	18.8	13.0	28.3	20.0
N. pachyderma (Ehrenberg), right	52.2	41.9	3.6	14.5	31.9	32.1	0.7	80.0
N. sp.	-	-	-	-	-	-	-	-
Orbulina universa d'Orbigny	-	0.3	-	-	-	-	-	-
indeterminate planktic foraminifers	6.5	1.0	-	0.6	1.6	1.0	3.6	-
Foraminiferal number	293	301	55	165	313	193	276	5
Diversity	7	7	4	5	7	8	6	2

Taxa	Sample number							
	84-39	84-36	84-33	84-30	84-27	84-26	84-24	84-20
Globigerina bulloides d'Orbigny	70.4	86.4	9.4	15.0	16.0	26.9	11.6	22.7
G. quinqueloba Natland	2.4	2.8	1.6	10.6	3.8	-	4.3	1.8
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	-	-	-	0.3	-	0.3	0.3	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	1.9	-	0.3	0.3	-
Globorotalia inflata (d'Orbigny)	2.1	-	-	0.3	-	1.4	0.3	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	0.8	1.2	-	-	1.5	-
N. pachyderma (Ehrenberg), left	11.3	3.5	5.7	1.2	2.5	17.3	63.4	68.7
N. pachyderma (Ehrenberg), right	8.8	4.9	80.3	66.0	76.8	53.4	16.2	6.4
N. sp.	-	-	-	-	-	-	-	-
Orbulina universa d'Orbigny	-	-	-	0.3	-	-	-	-
indeterminate planktic foraminifers	4.9	2.4	2.0	3.1	0.9	0.3	2.1	0.3
Foraminiferal number	328	286	244	321	319	294	328	326
Diversity	6	5	6	10	5	7	9	5

Taxa	Sample number							
	84-17	84-13	84-10	84-7	84-4	84-1	86-1	84-78
Globigerina bulloides d'Orbigny	8.0	51.8	51.6	34.9	18.6	7.7	10.4	3.8
G. quinqueloba Natland	1.7	1.6	3.2	2.7	9.5	5.2	13.6	4.8
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	-	-	-	-	-	-	1.4	0.3
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	0.3	-	-	-	0.4	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	1.3	-	-	-	1.0
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	0.3	-	-	-	-	0.3	-	2.9
N. pachyderma (Ehrenberg), left	84.7	42.1	29.0	55.0	67.7	83.1	73.3	77.1
N. pachyderma (Ehrenberg), right	4.5	2.8	9.7	5.4	1.8	0.3	0.5	0.3
N. sp.	-	-	-	-	-	-	0.5	-
Orbulina universa d'Orbigny	-	-	-	-	-	0.3	-	-
indeterminate planktic foraminifers	0.3	1.6	6.5	0.7	2.1	3.1	0.5	9.8
Foraminiferal number	287	247	31	149	285	326	221	315
Diversity	7	5	5	6	6	7	7	8

Taxa	Sample number							
	84-79	84-80	86-3	86-4	86-5	86-6	86-7	86-8
Globigerina bulloides d'Orbigny	24.3	21.8	18.2	26.9	26.7	34.6	19.3	16.7
G. quinqueloba Natland	3.0	2.5	10.7	21.3	12.0	3.8	26.2	19.0
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	0.7	0.6	0.4	-	-	-	-	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	0.7	-	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	0.6	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	54.3	65.6	68.2	49.0	59.0	61.2	52.4	63.0
N. pachyderma (Ehrenberg), right	-	1.3	1.2	2.0	0.9	-	2.1	1.0
N. sp.	-	-	0.4	-	-	-	-	-
Orbulina universa d'Orbigny	0.3	-	-	-	0.5	-	-	-
indeterminate planktic foraminifers	16.8	7.6	0.8	0.8	0.9	0.4	-	0.3
Foraminiferal number	304	317	242	249	217	260	290	311
Diversity	7	7	7	5	6	4	4	5

Taxa	Sample number							
	86-9	86-10	86-11	86-12	86-13	86-14	86-15	86-16
Globigerina bulloides d'Orbigny	13.4	16.3	36.4	39.8	33.2	14.6	9.9	20.4
G. quinqueloba Natland	19.0	19.6	17.4	15.7	14.3	11.5	10.2	8.4
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	0.3	0.7	-	0.3	-	-	0.3	0.4
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	65.6	62.1	43.7	43.3	51.3	73.6	78.3	69.3
N. pachyderma (Ehrenberg), right	1.3	1.3	0.6	0.6	0.8	-	1.3	1.5
N. sp.	-	-	-	0.3	-	-	-	-
Orbulina universa d'Orbigny	-	-	-	-	-	-	-	-
indeterminate planktic foraminifers	0.3	-	1.9	-	0.4	0.3	-	-
Foraminiferal number	305	306	316	319	265	322	304	274
Diversity	6	5	5	6	5	4	5	5

Taxa	Sample number							
	86-17	86-18	86-19	86-20	86-21	86-23	86-24	86-25
Globigerina bulloides d'Orbigny	37.1	33.2	28.2	20.6	41.6	30.1	28.5	30.2
G. quinqueloba Natland	6.9	10.5	10.3	10.3	7.1	42.1	13.1	12.5
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	-	-	-	0.4	-	-	0.3	0.7
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	53.6	51.6	61.5	61.2	34.0	24.9	54.0	53.4
N. pachyderma (Ehrenberg), right	1.2	3.5	-	1.1	-	1.8	0.9	3.0
N. sp.	1.2	1.2	-	6.0	14.3	0.3	0.3	-
Orbulina universa d'Orbigny	-	-	-	-	-	0.3	-	-
indeterminate planktic foraminifers	-	-	-	0.4	2.9	0.6	3.0	0.3
Foraminiferal number	248	343	39	281	238	342	337	305
Diversity	5	5	3	7	5	7	7	6

Taxa	Sample number							
	86-26	86-27	86-28	86-29	86-30	86-31	86-32	86-33
Globigerina bulloides d'Orbigny	32.0	45.5	25.7	60.4	63.6	35.2	67.8	50.0
G. quinqueloba Natland	11.5	10.1	13.7	7.0	9.1	7.4	6.8	16.7
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	0.9	0.5	-	-	-	-	-	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	52.8	42.6	46.0	16.4	18.2	24.1	1.7	33.3
N. pachyderma (Ehrenberg), right	2.2	1.3	10.7	6.7	9.1	25.9	23.7	-
N. sp.	0.3	-	3.9	9.1	-	7.4	-	-
Orbulina universa d'Orbigny	-	-	-	-	-	-	-	-
indeterminate planktic foraminifers	0.3	-	-	0.3	-	-	-	-
Foraminiferal number	322	376	335	298	11	54	59	6
Diversity	7	5	5	6	4	5	4	3

Taxa	Sample number							
	86-36	86-37	86-38	86-40	86-41	86-54	86-55	86-56
Globigerina bulloides d'Orbigny	-	54.8	68.2	53.9	17.3	70.3	60.0	57.6
G. quinqueloba Natland	14.3	-	-	7.5	7.6	1.4	20.0	0.3
G. umbilicata Orr and Zaitzeff	-	-	-	-	-	-	-	-
Globigerinita glutinata (Egger)	-	-	-	1.0	-	-	-	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	-	-	-	-	-
N. humerosus (Takayanagi and Saito)	-	-	-	-	-	-	-	-
N. pachyderma (Ehrenberg), left	64.3	2.7	-	3.1	2.9	-	-	-
N. pachyderma (Ehrenberg), right	14.3	42.5	22.7	32.5	62.1	24.5	20.0	31.9
N. sp.	7.1	-	9.1	2.0	10.1	-	-	-
Orbulina universa d'Orbigny	-	-	-	-	-	-	-	-
indeterminate planktic foraminifers	-	-	-	-	-	3.8	-	10.1
Foraminiferal number	14	73	22	295	277	286	5	288
Diversity	4	3	3	6	5	4	3	4

Taxa	Sample number							
	86-57	86-58	86-59	86-60	86-61	86-62	86-63	86-64
Globigerina bulloides d'Orbigny	41.3	70.9	34.3	4.2	63.6	69.0	41.6	87.2
G. quinqueloba Natland	13.4	0.6	2.9	-	16.6	20.5	23.4	4.5
G. umbilicata Orr and Zaitzeff	-	-	-	-	0.3	1.3	-	0.6
Globigerinita glutinata (Egger)	-	-	-	-	-	-	-	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	-
Globigerinoides ruber (d'Orbigny)	-	-	2.9	-	0.7	-	-	-
Globorotalia inflata (d'Orbigny)	-	-	-	-	0.3	-	0.5	-
G. scitula (Brady)	-	-	-	-	-	0.4	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	-	12.5	0.7	0.4	4.7	-
N. humerosus (Takayanagi and Saito)	0.7	0.3	-	8.3	0.7	2.2	3.7	-
N. pachyderma (Ehrenberg), left	2.0	-	-	-	-	-	0.9	-
N. pachyderma (Ehrenberg), right	25.2	23.3	20.0	8.3	7.0	6.1	11.7	5.7
N. sp.	-	-	5.7	-	-	-	-	-
Orbulina universa d'Orbigny	-	-	-	-	1.0	-	-	-
indeterminate planktic foraminifers	17.4	4.9	34.3	66.7	9.3	-	13.6	2.0
Foraminiferal number	298	309	35	24	302	229	214	352
Diversity	6	5	6	5	10	7	8	5

Taxa	Sample number							
	86-65	86-66	86-67	86-69	86-70	86-71	86-74	86-76
Globigerina bulloides d'Orbigny	80.0	29.1	62.8	8.3	88.9	30.5	16.4	29.2
G. quinqueloba Natland	-	42.3	8.8	-	-	17.8	5.5	4.2
G. umbilicata Orr and Zaitzeff	-	0.9	-	-	-	-	0.3	-
Globigerinita glutinata (Egger)	-	1.5	-	-	-	-	0.3	-
G. uvula (Ehrenberg)	-	-	-	-	-	-	-	0.7
Globigerinoides ruber (d'Orbigny)	-	-	-	-	-	-	-	-
Globorotalia inflata (d'Orbigny)	-	0.3	-	-	-	-	-	-
G. scitula (Brady)	-	-	-	-	-	-	-	-
Neogloboquadrina asanoi (Maiya, Saito and Sata)	-	-	0.3	50.0	-	23.0	3.5	61.8
N. humerosus (Takayanagi and Saito)	-	0.6	0.6	-	-	-	0.3	-
N. pachyderma (Ehrenberg), left	-	-	19.9	16.7	-	1.7	53.1	1.4
N. pachyderma (Ehrenberg), right	-	25.2	2.3	-	-	14.9	11.6	2.8
N. sp.	-	-	-	-	-	-	-	-
Orbulina universa d'Orbigny	-	-	-	-	-	-	-	-
indeterminate planktic foraminifers	20.0	-	5.3	25.0	11.1	12.1	9.0	-
Foraminiferal number	5	326	341	12	9	174	311	144
Diversity	2	7	7	4	2	6	9	6