Group	Genus	Species	Shell Oil Calif. San Joaquin Type No.	Range	Optimum	SM43	SM102	SM122	SM131	SM132	Neaves Elkhorn No.3 104.2-122.5 m	SM34	SM35	CR13	CR14	SS12	H612	M7868	M7870	M7869	H564	H661	H662	Mf6385	Mf6387	Mf6386	M7898	H549	H603	H605	H607	H608	SM5	SM12	SM14	Sandy Creek XVI	Shell Perris No.1A 1866.6-1867.5 m	M5A	M7	M8	P8	CCMO No.14 1089.7-1092.7 m	CCMO No.16 643.1-640.1 m 754.4-755.3 m	CCMO No.25-1 823.3-824.2 m 960.7-962.3 m 1026.3-1038.8 m	62-1	62-2	SM159	SM176	SM181	H567	V311	A918	K17	K20	S5	S6	S7
FOSSILS				BATHYMETRY, IN METERS		WEST SIDE OF TEMBLOR RANGE																											RANGE CREST			EAST SIDE OF TEMBLOR RANGE																					
						Shale and sandstone member[1]						Santa Margarita Formation															Bitterwater Creek Shale	Unnamed marine and nonmarine sedimentary rocks (samples from Panorama Hills Formation of Dibblee, 1968)					Santa Margarita Formation			McLure Shale Member[1] (upper part)									Belridge Diatomite Member[1] and Santa Margarita Formation, undivided								McLure Shale Member[1] (lower part)				
																																				Williams sandstone of local usage	Republic sandstone of local usage																					
Foraminifers	Ammobaculites	sp.		0-9144	18-610									VR		RR																		VR																							
	Angulogerina	angulosa	2	0-1829	30-610																															RC	RC			VR	RC	C	RC	RC												VR	
	Bolivina	argentea	2B	183-1829	274-610																															R	A	C	A	R	RC	A	RC	VA	R												
	B.	californica	4	61-3658	91-914																																																				
	B.	costata	15B	18-1829	122-914																															R																				VA	RR
	B.	interjuncta	43	61- 914	183-610																															VR	A	VR	R		R		RC	RC													
	B.	pacifica	3A	46-1829	61-1219																														VR																						
	B.	pseudostriatella	44	30-457	91-274																															C	RR				C	RC	RC	RC													
	B.	punctata	19A	0-1829	61-183																															V^2A					A		RC	C													
	B.	sinoata	26	91-1829	183-914																																				R		C	C													
	B.	seminuda	19	91-1829	274-914	R					C																									VR	VA			VR	C		C										RR		V^2A	V^3A	VA
	B.	timida	22	183-1981	610-1219						A																																														
	B.	vaughani	14A	18-1829	10-274	R																																			V^2A	VA	RR		R												
	Bulimina	sp.									RR																																														
	B.	ovata	3	9-1829	91-274	R					RC																									C							A										R		A	A	A
	Buliminella	curta	3A	0-1829	69-762						RR					VR																					RR					RR		R										A	A	VA	VA
	B.	elegantissima	2	0-1829	18-91																																RR				VA		R	RC													
	B.	subfusiformis	1	18-1524	69-762	R																														RC	C				A	R	A	RR				RR									C
	Cassidulina	californica	3	0-1219	91-610																																RR																				
	C.	carinata	1?																																		R																				
	C.	cushmani	5	46-2743	366-1829																															R					RC																
	C.	laevegata	2	46-488	274-366											R																												VR													
	C.	margareta	4	18-1829	91-457	VR		VR																																VR	RC	RC		C										A	A		A
	C.	monicana	6	46-3658	122-457																																																			VR	
	C.	pulchella	7	0-3658	183-914																																																		C		
	Cibicides	conoideus	26A	0-1829	18-122									VR	R	A																			VR	VA	RR			VR	C	RC	R	A													
	C.	fletcheri	28B	0-610	18-91									VR		RC																			R	RC	RR		VR		C	RR	RC	RC											RR		
	Cyclammina	sp.		0-9144	152-610					VR																								C																							
	C.	constrictionargo	1	3-1219	91-610																												C																								
	Discorbinella	concentricus	2	3-366	30-183																																																		VR		
	Discorbis	isabelleanus	1	0-1829	0-46										VR																					RR						VR		RC													
	D.	versiformis	6	0-1829	0-76					VR				R																							RR				RC	RR	RC	C													
	Dorthea	sp.		0-9144	30-914					VR																																															
	Elphidium	advenum	5	0-1829	0-91									RC																					C	RR			R	R	VR	R															
	E.	crispum (fax)	9	0-1829	0-91									RR		RR																			RC									C													
	E.	hannai	2	0-1829	0-91																																		VR					RR													
	E.	microgranulosum	4	0-1829	0-183			RR																													RR		R			RR		A													
	Epistominella	gyroidinaformis	5	30-2103	152-914	C					C																																					R						RR	A	VA	A
	E.	pacifica	10	274-2103	91-914	RR					VR																																R					RC									RR
	E.	parva	12	46-1219	76-274											VR																					R																				
	E.	reliaiana	4	18-1829	366-914	VR																																			RC																
	E.	subperuviana	6	18-1829	91-914						RR																									RC					C	C		RC				RC							VA		RR
	Eponides	blancoensis	1B	0-1219	18-274																														VR									C													
	E.	frigidus	1A	0-1829	0-91										RC																				A																						
	E.	hannai	6B	0-1829	0-91											VA																			C																						
	E.	regularis	6	0-914	3-91	RR		RR			VR				C																				RR	C	RC		C	R	A	RR	RR	VA													C
	Fissurina	laevegata	1A	46-1829	61-122																																VR				RC	R															
	F.	orbignyana	2A	46-914	46-274																																					VR															
	Frondicularia	vaughani	3	91-1829	183-914																																																			RR	
	Gaudryina	stavenensis	1	37-213	55-76																																RC							R													
	Globigerina	sp.		46-3658	183-1829																																				V^2A	A	RR	V^2A	C										A	R	
	G.	bulloides	1	46-4572	183-1829																																																				
	G.	pseudobulloides	4	46-2743+	183-1829						C																									VA	C																				
	G.	triloculinoides	1A	40-2743+	183-1829																															A																					
	Gyroidina	montereyana	2	152-3658	183-1219																																																	RC	RR		
	G.	rotundimargo	2B	146-2377																																	RR						C	RC													
	Haplophragmoides	sp.		0-9144	30-1219		VR		VR	VR																								R																							
	Lagena	acuticostata	1	3-1829	61-914																															RC	R				RC			RR											RR		R
	L.	hexagona	2	46-1829	46-914																																				RC	VR	R														
	Loxostroma	plicatella	2	91-1829	183-914																																																		RC	A	A
	Nodogenerina	advena	1	0-2743	183-1829											VR																																									
	N.	lepidula	2	274-1981																																	VR																				
	Nodosaria	parexilis	1	0-2743	183-610																																				R																
	Nonion	cf. atlanticum	8A	3-610	3-122																															RR																					
	N.	costifera	2	3-366	30-183	RC																																																	RC	RR	RC
	N.	scapha	9	3-366	46-152											VR																				VR					VR			VR													
	Nonionella	cf. miocenica	2	12-76	55-73																																						RR														
	N.	miocenica	1	3-1829	18-274																																				R																
	Planulina	ornata	1B	18-1829	61-457																															VR																		RR			
	Robulus	orbicularis	9	0-1829	122-366											VR																									VR			RR													
	Spiroplectammina	gracilis	1	0-1829	46-183																													RC																							
	Textularia	conica	3	23-1021	34-101																																							VR													
	Trochammina	sp.		0-2743	0-305					VR																																															
	T.	parva	3	0-2743	0-305		A		A			VA	C																				A																								
	Uvigerina	hootsi	6	61-3658	183-914	R																													VR							R												A	RC	VA	VA
	U.	joaquinensis	4	113-2743	183-914						RC																																										RR	A			RR
	U.	subperegrina	5A	34-1981	91-914																															RR	A	VR			R		A	VA	C	A											
	Valvulineria	grandis	13	122-1981	122-488						C																										VR							RR										RC			VA
	V.	ornata	5								VR																																														
	Virgulina	californica	3	3-914	46-183	RC					RC																																					RC							RR	VA	A
	V.	nodosa	9	3-914	46-183																																R				RC		RC	RR													
Diatoms	Actinocyclus	ehrenbergii																																											C		RR		VA								
	A.	pyrotechnicus																																											RC		RR		A								
	Actinoptychus	glabratus																																											RR												
	A.	perplexus																																											C				A								
	A.	splendens																																													RC		VR								
	A.	thumii																																													VR										
	A.	undulatus																																											A		RR		A								
	A.	vulgaris v. monicae																																											A				R								
	Arachnoidiscus	decorus																																											RC		C		RR								
	A.	ehrenbergii																																											C		C		RR								
	A.	manni																																											RC		RR		RR								
	A.	ornatus monterianus																																											VR	VR											
	Asterionella	sp.																																											R												
	Astrolampra	darwinii																																											A				VR								
	A.	dubius																																											VR												
	Aulacodiscus	decorus																																											RR		A		RC								
	A.	oreganus																																															VR								
	Auliscus	albidus																																															VR								
	A.	caelatus																																											RC		RR		C								
	A.	grunowii																																													RR		RR								
	A.	mirabilis																																											RR		VR		VR								
	A.	punctatus																																											RC	VR	A		RR								
	A.	stockhardtii																																															VR								
	Biddulphia	aurita																																											VR												
	B.	pulchella																																															RR								
	B.	tourneyi																																											A		RR		C								
	Campylodiscus	coronilla																																											VR				RR								
	C.	monterianus																																											VR												
	Ceratulus	johnsonianus																																											R												
	Chaetoceras	sp.																																											RR				RC								
	Cocconeis	ambigua																																											R												
	C.	antiquua																																											RC		VR		VR								
	C.	dirupta																																															VR								
	C.	distans																																															VR								
	C.	notabilis																																											C												
	C.	pennata																																											RC				RR								
	C.	triumphis																																											RR												
	C.	vitrea																																											RR				VR								
	Coscinodiscus	apiculatus																																															A								
	C.	asteromphalus																																											C				C								
	C.	curvulatus																																											A	C			C								
	C.	elegans																																											RR		RR		VR								
	C.	excentricus																																															V^2A								
	C.	herculus																																													R										
	C.	lineatus																																											RR		VR		C								
	C.	marginatus																																											VA	C	V^2A		VA								
	C.	masoni																																															RC								
	C.	obscurus																																											A		R		A								
	C.	oculus-iridis																																											C		VA		VA								
	C.	radiatus																																											A	VR			C								
	C.	subtilis																																											RR												
	C.	vetustissimus																																													RR		RR								
	Craspydodiscus	rhombicus																																											VR												
	Diploneis	exemta																																													R		C								
	D.	major																																															VR								
	D.	taschenbergeri																																											VR												
	Entopyla	gigantea																																											C		VR		R								
	Eupodiscus	oculatus																																											RR				R								
	Glyphodiscus	stellatus																																											VR												
	Goniothecum	rogersii																																											R												
	Grammatophora	marina																																											RC		R		RR								
	G.	merleta																																											RC		R		RR								
	Hemidiscus	simplicissimus																																													RR		VR								
	Hyalodiscus	reticulatus																																											RC												
	H.	valens																																											C				C								
	Isthmia	nervosa																																											RC		RR		RC								
	Lithodesmium	californicum																																											R												
	L.	miniscutum																																															RR								
	Ludugeria	janischii																																											R												
	Melosira	clavigera																																											RC		RC		R								
	M.	sulcata																																											A	VR	A		A								
	Navicula	angelorum																																															R								
	N.	aspera																																															R								
	N.	densistriata																																											VR												
	N.	hennedyi																																															R								
	N.	longa																																											R												
	N.	lyra																																											A		RR		A								
	N.	madrae																																											VR												
	N.	praetexta																																											R		VR		R								
	N.	splendida																																											RR												
	Nitzschia	sp.																																											R												
	Orthoneis	splendida																																											RR		VR		R								
	Plagiogramma	antillarium																																											VR												
	Rutilaria	epsilon																																											RR												
	Rouxia	californica																																															A								
	Stephenoptyxis	appendiculata																																													VR		C								
	S.	corona																																											RR				VR								
	S.	lineata																																											RR												
	S.	turris																																											C				C								
	Stictodiscus	californicus																																											RR		RR		RR								
	Triceratium	arcticum																																											RC				R								
	T.	elegans																																											R		VR		C								
	T.	inelegans																																											R				A								
	T.	montereyi																																															VR								
	T.	thumii																																															VR								
	Xanthiopyxis	sp. D																																											R		VR		RR								
	X.	diaphana																																															VR								
	X.	lacera																																											RC												
	X.	oblonga																																											VR												
	X.	unbonata																																											RR		VR										
Silicoflagellates	Cannopilis	binoculus																																															R								
	Dictyocha	fibula																																															A								
	D.	staurodon																																															R								
	Distephanus	crux																																											R		VR		RC								
	D.	speculum																																											R		R		A								
	Mesocena	diadon																																											VR				VR								
	M.	hexagona																																											VR				VR								
	Paradictyocha	polyactis																																											V^2A	R			RR								
Miscellaneous microfossils	Arenaceous forams					VR						V^5A	V^2A																				VA	V^3A																							
	Diatoms unident.											VR																					R				A									VA											
	Echinoid spines													VA	V^3A																				VA									R													
	Fish remains											C																					C	C	VR	RR		VR	VR						C	A								R	R	R	R
	Lompoquia	culveri (bass)																																												R											
	L.	retropes (bass)																																											R												
	Plant fragments																							+	+	+																															
	Pseudoseriola	sp. (yellowtail)																																												R											
	Sorda	stockii (bonita)																																												R											
	Ostracods								VR			C	C													+								C	VR		RC	RR	RR		RR			RC														
	Sponge spicules																																																								
	Statoliths								VR			V^3A	V^2A	VR																			V^3A																									
	Radiolaria			46-9144	610-3658				VR	VR		RC	RC																					RC				V^3A	V^3A		V^2A												V^2A	VA	VA	VA	VA
	Worm tubes																							+																																	
Macrofossils (Arthropods, echinoids, mollusks, and vertebrates)	? Antiplanes	sp.																													+																									
	Arca	sp.																													+																									
	Astrodapsus	sp.																												+																										
	A.	margaritanus																+																																							
	Balanus	sp.																																	+																+							
	Borophagus	litteralis																																																		+						
	Calyptraea	sp.																											+																												
	Cancellaria	sp.																													+																									
	Cryptomya	sp.																												+																										
	C.	californica Conrad																										+																													
	C.	cf. quadrata Arnold																													+																									
	C.	quadrata Arnold																										+	+			+																									
	Fissuridea	sp.																													+																									
	Forreria	magister (Nomland)																											+	+		+																									
	Macoma	cf. secta Conrad																										+																													
	Marcia	cf. oregonensis Conrad																																																	+							
	Mitrella	sp.																													+																									
	Mya	cf. truncata Linne																										+																													
	Nassarius	sp.																													+																									
	N.	californianus ? var. Arnold																											+																											
	N.	coalingensis ? var. Arnold																																																							
	Neverita	sp.																										+				+																									
	N.	recluziana (Deshayes)																											+																											
	Ostrea	sp.														+	+					+	+												+																	+	+					
	O.	titan Conrad																																																	+							
	Ponape	generosa Gould																																																	+							
	Pecten	sp.																														+			+																						
	P.	crassicardo Conrad														+	+				+	+	+				+																								+							
	P. (Lyropecten)	cerrosensis Gabb																																																								
	P. (Lyropecten)	estrellanus Conrad														+		+	+	+		+																													+	+	+					
	P.	pabloensis (?) Conrad																																																	+							
	P.	pedroanus Trask																																																	+							
	P.	raymondi Clark															+				+		+																												+							
	Phacoides	annulatus Reeve																										+			+																				+							
	Psephidia	sp.																																	+																						
	Scutella	sp.																										+																													
	? Searlsia	sp.																																																							
	Solen	sp.																														+																									
	S.	cf. perrini Clark																										+			+																										
	S.	perrini Clark																																																	+							
	Spisula	sp.																										+																													
	Tamiosoma	cf. gregaria Conrad																											+																												
	Thais	sp.																												+		+																									
	T.	cf. kettlemanensis Arnold																											+																												
	Turritella	cf. cooperi Carpenter																													+																									
	T.	cooperi Carpenter																											+																												
Age	p--Pliocene; lm--late Miocene. Shell Oil Company informal age designation: IV-early Mohnian; III-late Mohnian; a-h (subdivisions of late Mohnian--a, youngest; h, oldest)					lm IV	lm	lm IV	lm	lm	lm IV	lm	lm	lm	lm	lm	lm	lm	lm	lm	lm	lm	lm				p? or lm	lm	lm	lm	lm	lm	lm	lm	lm	lm III g-h	lm III g-h?	lm III b	lm III b	lm III b	lm III g-h	lm III g	lm III g	lm III g	lm III a	lm III a	lm III a	lm III a*	lm III a				lm IV	lm IV	lm IV	lm IV	lm IV
	Provincial Molluscan Stage															"Margaritan" Provincial Molluscan Stage (SS12 to H662)												"Jacalitos" Provincial Molluscan Stage (H549 to H608)																														
Bathymetry	Bathymetric data were primarily obtained from the Shell Oil Company, Pacific Coast Area, *Paleontology Data Processing Dictionary* (unpublished, 1970)					Outer neritic-upper bathyal	Outer neritic-upper bathyal	Neritic-upper bathyal	Upper bathyal	Upper bathyal	Outer neritic-upper bathyal	Upper bathyal	Upper bathyal	Middle neritic	Middle neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic					Inner neritic	Inner neritic	Inner neritic	Inner neritic	Inner neritic	Neritic-upper bathyal	Upper bathyal	Middle neritic	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Upper bathyal	Neritic-upper bathyal	Inner neritic			Upper bathyal	Upper bathyal	Middle-upper bathyal	Upper bathyal	Upper bathyal

Code for abundance of microfossils and macrofossils

VR- 1
R- 2 to 4
RR- 5 to 10
RC- 11 to 20
C- 21 to 50
A- 51 to 100
VA- 101 to 200
V^2A- 201 to 300
V^3A- 301 to 400
V^5A- 501 to 600
+- present

[1]Members of Monterey Shale

* Dominated by reworked lmIV fauna

CHART LISTING THE NAME, AGE, AND BATHYMETRY OF FOSSILS COLLECTED FROM THE SANTA MARGARITA FORMATION, MONTEREY SHALE, AND ASSOCIATED UNITS

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1989

Paleontology of the Santa Margarita Formation, Monterey Shale, and associated units by U.S. Armstrong (diatoms and silicoflagellates), Alex Clark (macrofossils), G.C. Lutz (foraminifers), Kristin McDougall (miscellaneous microfossils), E.J. Moore (macrofossils), R.E. Steinert (foraminifers), and E.H. Stinemeyer (foraminifers and macrofossils). Macrofossils from localities V311 and A918 were identified by Vander Hoof (1931) and Barbat and Weymouth (1931). Macrofossils similar to those collected at localities H549, H603, H605, H607, and H608 (Panorama Hills Formation of Dibblee, 1968) and S512, H564, H612, H661, H662, M7868, M7869, and M7870 (Santa Margarita Formation) have been identified by Addicott (1972).