MIOCENE MACROFAUNA ALONG SESPE CREEK, VENTURA COUNTY, CALIFORNIA

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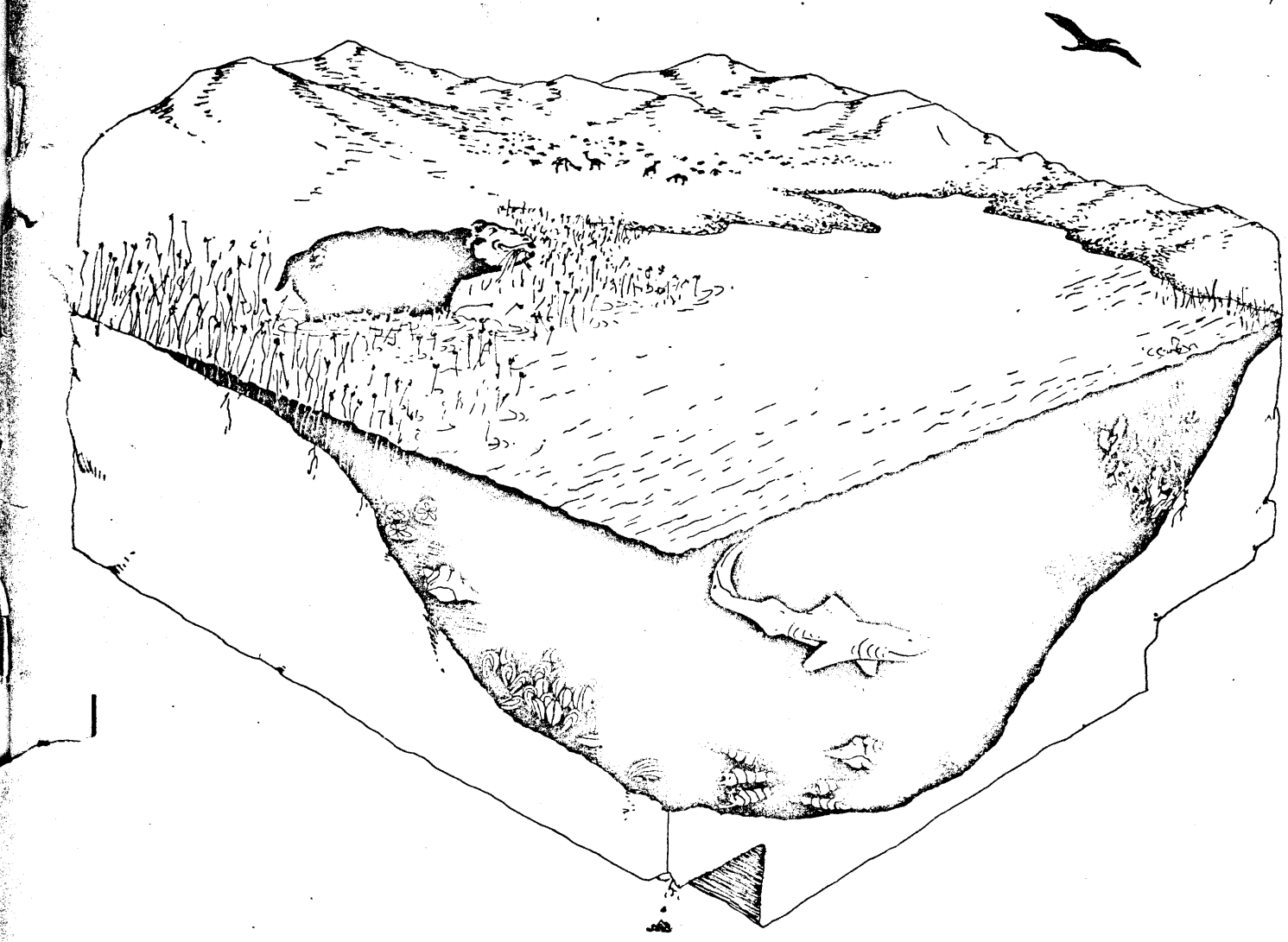
INTRODUCTION

and photographic record of the Sespe Creek Miocene

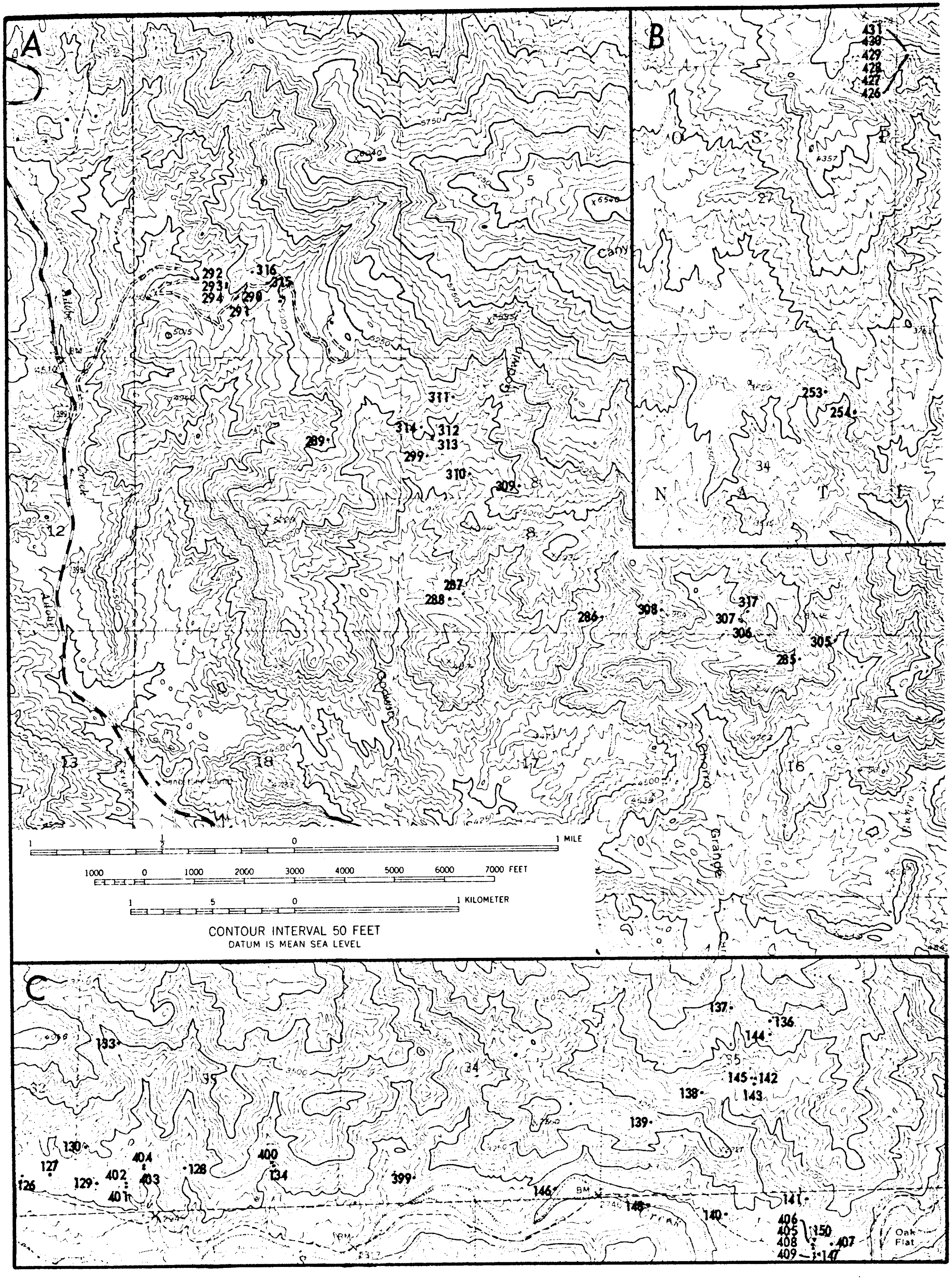
Squires & Fritsche 1978

Pacific Coast Paleogeography Field Guide 3

Squires & Fritsche
1978



DEPOSITIONAL ENVIRO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Goodwin
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409
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Oak Flat
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

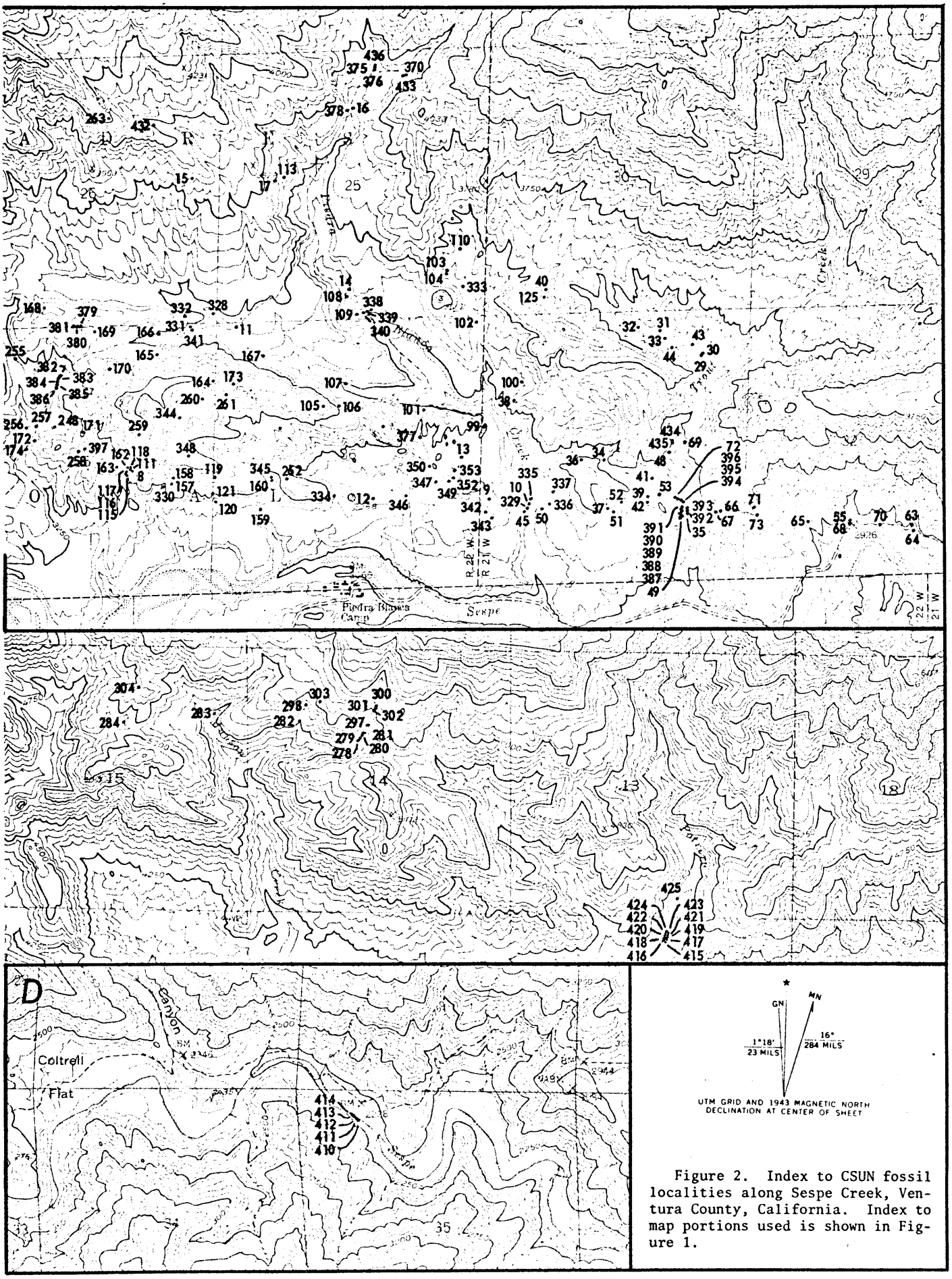


Figure 2. Index to CSUN fossil localities along Sespe Creek, Ventura County, California. Index to map portions used is shown in Figure 1.

Table 1. Checklist of macrofauna from the lower member of the Vaqueros Formation.

SPECIES	CSUN LOCALITIES																																								
	10	14	30	31	33	35	37	42	43	45	49	50	51 (16350)	64	65	66	67	68	73	108	110	115	116	117	126	128	142	144	145	147	159	163	168	169	174	253	254	255	328	329	330	331
BRYOZOA																																										
unidentified bryozoan																												R									R					
GASTROPODA																																										
Potamides sespeensis																												A			C											
Rapana vaquerosensis				F		C			R			C	A		F	F	C	R	R	F	F	A		R	C	F		R	R	R	R		F			C				A	R	
Turritella inezana s.l.							R												F							C		r														
T. inezana bicarina			F					A																					R													
T. inezana pervulgata	F		A		A										A	A		A												A	C	A		A	F						A	A
Turritella s.p.				R									R																											R		
unidentified gastropods	r					R									R									R				R							f							
unidentified naticid															R																											
PELECYPODA																																										
Anomia vaquerosensis						F						A	A				A		R					A	A	A		C			A	A	F			C	A			A	A	
Clementia sp.																															R											
?Eucrassatella granti		F																																								
Macoma arctata						R																																R				
Mytilus sp.	R											R																					C									
Ostrea howelli			R									a																														
pholadid borings																																										
?Saxidomus vaquerosensis	F	F																															C					C				
unidentified bivalves				C		F				R			F				r	r													F		C					C	C			
unidentified mytilid						F										R	R											R														
unidentified pectinid	r																R							R	R							r								R		
unidentified solenid										R																					R		R							R		
Vertipecten nevadanus																																									R	
Zirfaea sp.																																										
CIRRIPEDIA																																										
Balanus sp.	A			A	R	C			R	F		C	A					R		F	C			C	C			F			C	C	f		C	C	c			A	A	
BRACHYURA																																										
crab parts																																			R							
ECHINOIDEA																																										
Kewia fairbanksi		R		C		C	F		F	R	F		F						R		a		A	F			R	F			R	C										
VERTEBRATA																																										
cetacean vertebrae	F													F																				F								
Galeocerdo sp.																																										
unident. myliobatoid teeth																																										
unident. shark teeth						R																													r							
unident. vertebrate bones																									f																	
TRACE FOSSILS																																										
unidentified burrows																	F							R																		

Symbols defined in "Introduction" section.

and upper members as used in this report is the same as that described by Fritsche and Shmitka (this guidebook), but is different from the three-way division made by Reid (this guidebook).

Fossils from the Vaqueros Formation are presented on Tables 1, 2, and 3, fossils from the Rincon Shale on Table 4, and those from the Santa Margarita Formation on Table 5.

Abundance symbols used on the tables indicate the relative number of specimens that occurred at the locality in the field, not the number collected. Capital letters indicate that specimens are in the collection at CSUN; lower case letters indicate that the fossils were present in the field, but not collected. "R" means that only one or two specimens were found, "F" indicates about three to ten specimens, "C" means that there were more than most people would want to collect, and "A" means that there were enough for a whole S.E.P.M. field trip.

This study was greatly facilitated by the help and cooperation of several people. The authors are indebted to the students at CSUN who helped over the past 15 years in the assembly of this large collection, especially to D. R. Thor and S. A. Reid. Bruce Welton, of the Los Angeles Museum of Natural History, kindly identified the vertebrate fossils. Louella Saul and Takeo Susuki shared their knowledge of Tertiary mollusks and allowed access to the University of California, Los Angeles paleontology collections. Warren Addicott shared his knowledge on the taxonomy of Miocene mollusks. Steve Grupp assisted in the photography of the fossils and in drafting. Theresa Dunn and Patricia Cournoyer typed the manuscript and the tables. Some financial assistance for this project was provided by the CSUN Geosciences Department.

The figured specimens are stored in the Univer-

Table 1. Continued - Checklist of macrofauna from the lower member of the Vaqueros Formation.

CSUN LOCALITIES

332	333	343	370	375	376	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	400	401	402	405	406	408	409	410	411	412	413	414	415	416	417	418	426	427	428	433	436	SPECIES
																																										BRYOZOA
											R																															unidentified bryozoan
																																										GASTROPODA
					A						A										A	A		A				A					A	A		A			C	A	A	*Potamides sespeensis*
						R					R					C	F	A	F	C	R									R									R			*Rapana vaquerosensis*
																																										Turritella inezana s.l.
																																										T. inezana bicarina
	C																																									*T. inezana pervulgata*
			A																				A																			*Turritella* s.p.
					R	R																																				unidentified gastropods
																																										unidentified naticid
																																										PELECYPODA
a		a				A				A	C			A	A	A	A	R			c				C	c				R												*Anomia vaquerosensis*
																																R										*Clementia* sp.
																																										?Eucrassatella granti
																					R														R							*Macoma arctata*
																														R												*Mytilus* sp.
	A																																									*Ostrea howelli*
R																																										pholadid borings
												R															R															*?Saxidomus vaquerosensis*
					F			R	C			R			R				R		R								R		R				F		R	R				unidentified bivalves
																																										unidentified mytilid
																		R																								unidentified pectinid
																																										unidentified solenid
																																										Vertipecten nevadanus
												R																														*Zirfaea* sp.
																																										CIRRIPEDIA
C		C			R		R			R	R	R			R	A		R	R	F	R																					*Balanus* sp.
																																										BRACHYURA
								A													R																			R		crab parts
																																										ECHINOIDEA
										R			R																													*Kewia fairbankski*
																																										VERTEBRATA
			R	R																																						cetacean vertebrae
																																								R		*Galeocerdo* sp.
																										R																unident. myliobatoid teeth
																																										unident. shark teeth
						R																																				unident. vertebrate bones
																																										TRACE FOSSILS
																																										unidentified burrows

sity of California, Los Angeles (UCLA) invertebrate paleontology collection. The remaining specimens are part of the CSUN invertebrate paleontology collection.

SYSTEMATIC PALEONTOLOGY

No attempt has been made to write synonymies for the taxa discussed herein. The original reference is given for each species and, where the original reference is inadequate, a supplementary reference is presented which adds pertinent information.

Representative specimens of many of the species from Sespe Creek are figured in Plates 1 through 4 of this article. Species not figured are those for which the specimens were too poorly preserved to allow informative photographs or those that have been figured by others in numerous publications.

Taxonomic classification and arrangement of the brachiopods, cirripeds, and echinoids is based on the systems used in the "Treatise on Invertebrate Paleontology" edited by R. C. Moore. The classification scheme used for the molluscan groups is based on the system used by Keen and Coan (1974). Other groups and their respective classification formats are: desmostylid (Reinhart, 1959), elasmobranch (Phillips and others, 1976), and coralline algae (Bold and Wynne, 1978, p. 464, 499, 508).

Kingdom ANIMALIA

Unidentified fossil fragment

At locality 280, a single specimen was found which consists of a circular depression, 5 mm in diameter, that has shell material around the sides and along the bottom. The shell material along the bottom shows concentric lines.

Table 2. Checklist of macrofauna from the middle member of the Vaqueros Formation.

	CSUN LOCALITIES																																							
	16300					16304	16302	16301				16303	16298																16363											
SPECIES	8	9	11	15	17	29	32	39	40	41	44	52	53	55	63	70	71	72	103	104	107	109	111	113	118	119	120	121	125	127	129	133	134	136	137	138	140	143	146	148
BRYOZOA																																								
unidentified bryozoan															R																									
SCAPHOPODA																																								
unidentified scaphopod										R																														
GASTROPODA																																								
Calyptraea sp.																		R																						
Conus aff. *C. owenianus*																																							R	
Cylichna sp.																																							R	
Ficus ocoyana											R																												R	
Ocenebra dorrancei?																		R																					R	
Sinum scopulosum																																								
Rapana vaquerosensis							R								R																		R							
Turritella inezana s.l.										R								C							A													A		
T. inezana bicarina		A	C	C	A															A	C			C			A							A					C	R
T. inezana pervulgata																A																								
Turritella sp.						c																										f								
unidentified gastropods				R							R																													
unidentified naticid																																							R	
PELECYPODA																																								
Acila sp.																																								
Amussiopecten vanvlecki											R																													
Anomia vaquerosensis																																								
Anadara santana																				R																				
A. cf. *A. microdonta*																		R																						R
Chione cf. *C. richthofeni*			C	F	C													C		A					A		R												F	
Dosinia sp.																																								
Macoma arctata				R							R							F							R															
Ostrea eldridgei ynezana		A											A																											
O. howelli	A			A		A	A	C	C			A		A	A		A		A			A	A	A				A	A	A	A	A	A	A	A	A	A			
Panopea ramonensis				F																																				
Spondylus perrini																													R											
unidentified bivalves			F		R						F							R		C						F													F	
CIRRIPEDIA																																								
Balanus sp.																																								
VERTEBRATA																																								
unidentified shark teeth																																								
unidentified vertebrate bones																																					R			
TRACE FOSSILS																																								
unidentified burrows																																								

Symbols defined in "Introduction" section.

Phylum BRYOZOA

Unidentified bryozoan

Bryozoa are rare, but occur as encrusting forms on *Anomia vaquerosensis* or *Rapana vaquerosensis*.

Phylum BRACHIOPODA
Class ARTICULATA
Order TEREBRATULIDA

Unidentified terebratulid
Pl. 4, fig. 5

Most specimens are incomplete and/or crushed, but are articulated and have the shell material still intact. Average length of the uncrushed specimens is 2.5 cm.

Phylum MOLLUSCA
Class SCAPHOPODA

Unidentified scaphopod

Preservation of the single 2-cm-long, tapered tube that was found was too poor to allow generic determination.

Class GASTROPODA

Unidentified gastropods

The unidentified gastropods occur as molds or as crushed and/or replaced shell fragments. Internal molds at locality 298 have been phosphatized.

Table 2. Continued - Checklist of macrofauna from the middle member of the Vaqueros Formation.

CSUN LOCALITIES																																						SPECIES
150	157	158	162	165	166	167	170	171	172	248	256	257	258	334	335	336	337	338	339	340	341	342	394	395	396	397	399	403	404	407	419	420	421	422	423	424	429	430	431	
																																								BRYOZOA unidentified bryozoan
																																								SCAPHOPODA unidentified scaphopod
																																								GASTROPODA
																																								Calyptraea sp.
																																								Conus aff. *C. owenianus*
																																								Cylichna sp.
																																								Ficus ocoyana
																												R												*Ocenebra dorrancei*?
		R																																						*Sinum scopulosum*
																										R														*Rapana vaquerosensis*
			F									A		R		A			R							F				C					C				*Turritella inezana* s.l.
		A						A	C											A	R		A					C					C		C			C	*T. inezana bicarina*
											A							F																					*T. inezana pervulgata*
f																											C			C			c		C				*Turritella* sp.
								R										F									R												unidentified gastropods
																																								unidentified naticid
																R																								PELECYPODA
																																								Acila sp.
																																								Amussiopecten vanvlecki
																																r				R				*Anomia vaquerosensis*
																			R													C	C	c			c	C	*Anadara santana*
R		A	C																A						F	F	R	C						C	C			C		*A.* cf. *A. microdonta*
																											R													*Chione* cf. *C. richthofeni*
		A																A								R	C		A				c	C				*Dosinia* sp.
				A		C	A										A																						*Macoma arctata*
	A		A		A				A	A				C	A						A	A		C						C					C			*Ostrea eldridgei ynezana*
		R																C																				*O. howelli*
																																								Panopea ramonensis
																																								Spondylus perrini
								R										R		F					R		R	R					c	R			R		unidentified bivalves
																										R														CIRRIPEDIA
		R																							R														*Balanus* sp.
																													R											VERTEBRATA unidentified shark teeth
		R											R																											unidentified vertebrate bones
														r																								R			TRACE FOSSILS unidentified burrows

Subclass PROSOBRANCHIA
Order ARCHAEOGASTROPODA
Family Turritellidae

Genus *Turritella* Lamarck, 1799

Four taxonomic categories are used for *Turritella* specimens from this area. The category *Turritella inezana* s.l. is used for those specimens that show the two prominent spiral lines of the *T. inezana* group, but which are not preserved well enough to allow subspecies determination. The designation *T. inezana bicarina* is used for those specimens that have two, equally spaced primary spiral lines of equal strength. In better specimens, one or several minor spiral lines occur between these two primaries, and in a few specimens, an anterior sutural spiral line is also present, but is less prominent than the primaries. The *T. inezana pervulgata* category is for those specimens which have a very strong posterior primary and less strong anterior and anterior sutural spirals. In the better preserved specimens, several minor spiral lines occur between the posterior and anterior spirals.

As noted by Loel and Corey (1932), some of the larger *T. inezana pervulgata* specimens have *T. inezana bicarina* ornamentation on the juvenile whorls. For identification purposes, therefore, it was necessary to consider only the larger sized specimens at any one locality. At a few locations large sized specimens of both subspecies were found. Loel and Corey (1932) believed that *T. inezana bicarina* ornamentation was the ancestral form of the *T. inezana* group and was retained in the other subspecies. In this study, however, *T. inezana pervulgata* seems to be the more ancestral subspecies because it is the most common of the two in the lower member and *T. inezana bicarina* is the most common in the middle

Table 3. Checklist of macrofauna from the upper member of the Vaqueros Formation.

SPECIES	CSUN LOCALITIES																																								
	12	16	34	36	38	48	69	99	100	101	102	105	106	130	139	141	160	164	173	259	260	261	262	263	344	345	346	347	348	349	350	351	377	378	425	432	434	435
PELECYPODA																																									
Amussiopecten vanvlecki					R																R				F															
Chlamys sespeensis			F	F																																				
Lyropecten magnolia																								C											F					
Ostrea eldridgei	C	f	C	C		F	A		A	C		A	C	C		C	R		r	C				a		A	C		C							R		
pholadid borings																								R																
unidentified pelecypods		F									R																								A					
unidentified pectinid													R					R		R									R					A		C			
Vertipecten nevadanus																						R		R																
CIRRIPEDIA																																									
Balanus sp.																																		R		R				
ECHINOIDEA																																								
unidentified spatangoid?		R																																						
unidentified echinoid parts																				C				a																
VERTEBRATA																																								
Carcharodon angustidens									R																				R										
Carcharodon sp.									R																															
Desmostylus sp.								R																																
Galeocerdo sp.									R																															
Isurus sp.								C	F			F				R				R		C						C		R		R								
Odontaspis sp,									R																						R									
unidentified shark teeth																			R										r				R						R	
unident. vertebrate bones			F																																				r	

Symbols defined in "Introduction" section.

member.

The category *Turritella* sp. is used for those specimens which were very poorly preserved or for those localities where *Turritella* specimens were seen but not collected.

Turritella inezana Conrad s.l.

Turritella inezana Conrad, 1857c, p. 195, pl. 8, fig. 4. Merriam, 1941, p. 105-107, pl. 23, figs. 1-4; pl. 24, figs. 1, 8-12; pl. 26, fig. 6.

All specimens of *Turritella inezana* s.l. are incomplete and most consist of adult whorls which are heavily coated with well indurated matrix or are partial internal molds. At localities 118 and 143, *T. inezana* s.l. is abundant enough to form distinct beds, and at locality 257, the specimens are oriented.

Table 4. Checklist of macrofauna from the Rincon Shale.

SPECIES	CSUN LOCALITIES			
	13	352	353	
BRACHIOPODA				
unidentified terebratulid		C		
VERTEBRATA				
cetacean vertebrae			F	
Isurus sp.	C		R	

Symbols defined in "Introduction" section.

Turritella inezana bicarina Loel and Corey

Turritella inezana bicarina Loel and Corey, 1932, p. 257-258, pl. 58, figs. 1-5; pl. 59, figs. 1, 3a, 3b, 4-7. Merriam, 1941, p. 110-111, pl. 25, figs. 1, 2.

Most specimens of *Turritella inezana bicarina* are fragmentary adult shells that average 5 cm in length and 2 cm in diameter; no complete specimens were found. Preservation generally is poor to fair; well preserved specimens are rare. At localities 17, 107, 120, and 394, specimens are abundant enough to form distinct beds.

Turritella inezana pervulgata Merriam

Turritella inezana pervulgata Merriam, 1941, p. 108-109, pl. 25, figs. 7, 11.

Most specimens of *Turritella inezana pervulgata* are fragments of adult whorls, 3 to 5 cm in length; one nearly complete specimen, 13 cm in length, was found. Preservation is generally poor to fair; a few specimens are well preserved. At localities 30, 65, and 147, specimens are abundant and form distinct beds. At localities 33, 256, and 331, *T. inezana pervulgata* fragments form coquinoid beds.

Turritella sp.

Specimens of *Turritella* sp. show only the turritellid form and in many cases only a cross-sectional view is present.

Table 5. Checklist of macrofauna from the Santa Margarita Formation.

SPECIES	CSUN LOCALITIES																																						
	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	1497 306	307	308	309	310	311	312	313	314	315	316	317
GASTROPODA																																								
Calyptrea sp.																															A									
Crepidula sp.																												C											
Scaphander sp.																															R									
Vermetus? sp.																								C																
unidentified gastropods		R																			F						R	C				R				F	R	R		
PELECYPODA																																								
Aequipecten discus	C						C			F		A				C		F	A																					
Anadara sp.		A				C				F							C																							
Crassostrea titan				c								A	A			C										a	C								C	A	F	A		A	
Dosinia sp.								R																																
Lyropecten crassicardo																											C								C		C			
ostreid coquina																														A										
pholadid borings						·					A																													
unidentified pectinid		R		R																																				
unidentified solenid																												F												
unidentified tellinid										F											F																			
unidentified pelecypods		F		R					A	C		R		F			C	R		C	A	c	A				R	C			A	F		C		A				
CIRRIPEDIA																																								
Balanus sp.																		F									F										F	F	F	
ECHINOIDEA																																								
Astrodapsis antiselli														A	A			A					C			C	C							C							
VERTEBRATA																																								
Isurus sp.																													R											
marine mammal bones				C		A				A																														
unident. vertebrate bones		R									F																													
TRACE FOSSILS																																								
unidentified burrows										A															A									A						F
UNIDENT. FOSSIL FRAGMENTS			R																																				
RHODOPHYCEAE																																								
Corallinaceae																																				A				
FACIES	A																			B			C																	

Symbols defined in "Introduction" section.

Family Vermetidae

Genus *Vermetus* Daudin, 1800

Vermetus? sp.

Specimens of *Vermetus?* sp. occur as closely packed, small tubes whose morphologic details are mostly obliterated by replacement. No spires were seen although the tubes are up to 2.5 cm in length.

Family Potamididae

Genus *Potamides* Brongniart, 1810

Potamides sespeensis Loel and Corey
Pl. 1, fig. 1

Potamides sespeensis Loel and Corey, 1932, p. 253, pl. 46, figs. 16, 17.

At most localities where *Potamides sespeensis* occurs, specimens are so abundant that they form distinct, thin beds that contain very few other associated species. Specimens are mostly complete and, at some localities, growth series are present. Preservation commonly is poor, but a few specimens show the axial nodes.

Family Calyptraeidae

Genus *Calyptraea* Lamarck, 1799

Calyptraea sp.

Specimens of *Calyptraea* sp. from both the Vaqueros and Santa Margarita Formations are internal molds. Most are small and uncrushed.

Genus *Crepidula* Lamarck, 1799

Crepidula sp.
Pl. 4, fig. 6

All of the specimens are internal molds. Most are partial individual specimens, but a few are stacked one atop the other in the living position.

Family Naticidae

Genus *Sinum* Röding, 1798

Sinum scopulosum (Conrad)

Sigaretus scopulosus Conrad, 1849, p. 727, pl. 19, figs. 6, 6a.

Sinum scopulosum (Conrad). Marincovich, 1977, p. 350-354, pl. 33, figs. 13, 14; pl. 34, figs. 1-5.

Only a single, moderately preserved specimen of *Sinum scopulosum* was found. Loel and Corey (1932) also reported only a single specimen of this gastropod from the Sespe Creek region.

Unidentified naticid

Three specimens of unidentified naticids were found, all poorly preserved and crushed.

Family Ficidae

Genus *Ficus* Röding, 1798

Ficus ocoyana (Conrad)

Sycotopus ocoyanus Conrad, 1855, p. 19.

Ficus (Trophosycon) ocoyana (Conrad). Grant and Gale, 1931, p. 743-746, pl. 30, figs. 3, 7, 8a, 8b, 11.

Only two moderately well preserved juvenile specimens of *Ficus ocoyana* were found. Loel and Corey (1932) reported that *F. ocoyana* is rare in the Vaqueros horizon, with only a questionable occurrence in the Ventura-Ojai area and no occurrences in the Sespe Creek region.

Order NEOGASTROPODA
Family Muricidae

Genus *Ocenebra* Gray, 1847

Ocenebra dorrancei? (Loel and Corey)

Tritonalia dorrancei Loel and Corey, 1932, p. 247-248, pl. 47, figs. 17a, 17b, 18a, 18b.

Most of the few specimens of *Ocenebra dorrancei?* are very small and fragmental, but a single large specimen, 2 cm in height, was found at locality 403. Preservation is poor to fair. If the identification is correct, this represents the first recorded occurrence of the species from the Sespe Creek region.

Family Rapanidae

Genus *Rapana* Schumard, 1817

Rapana vaquerosensis (Arnold)
Pl. 1, figs. 2-6

Purpura vaquerosensis Arnold, 1907b, p. 426, pl. 52, figs. 1a, 1b.

Rapana vaquerosensis (Arnold). Loel and Corey, 1932, p. 244-245, pl. 50, figs. 1, 2, 3a, 3b; pl. 51, figs. 2, 3.

Many of the specimens of *Rapana vaquerosensis* are complete or nearly complete and preservation is fair to good. Locally, as at localities 115, 391, and 393, specimens are abundant enough to form *Rapana* beds. At localities 35, 50, 51, 391, and 393, growth series were collected. Typical well developed node ornamentation of *R. vaquerosensis* is shown in all specimens at localities 35, 50, and 51 (Pl. 1, fig.6). At localities 391 (Pl. 1, fig. 4) and 393, the juvenile specimens are smaller than at the other localities and those less than 2.5 cm in height could be classified as *Solenosteira venturana* Loel and Corey, whereas the adult forms are definitely *R. vaquerosensis*. Loel and Corey (1932) noted that juvenile forms of *R. vaquerosensis* are practically indistinguishable from the *Solenosteira* form, so in this report no attempt has been made to differentiate between these two taxonomic groups.

Plate 1. Fossils from the lower member of the Vaqueros Formation. (Figures are natural size except where noted.)

Figure 1--*Potamides sespeensis* Loel and Corey, hypotype UCLA 58223, CSUN loc. 401; 2--*Rapana vaquerosensis* (Arnold), hypotype UCLA 58218, CSUN loc. 384; 3--*R. vaquerosensis* (Arnold), hypotype UCLA 58219, CSUN loc. 391; 4--*R. vaquerosensis* (Arnold), hypotype UCLA 58221, CSUN loc. 392; 5--*R. vaquerosensis* (Arnold), hypotype UCLA 58201, CSUN loc. 51; 6--*R. vaquerosensis* (Arnold), hypotype UCLA 58200, CSUN loc. 51; 7--*Mytilus* sp., exterior of right valve, catalogued specimen UCLA 58224, CSUN loc. 412; 8--*Anomia vaquerosensis* Loel and Corey, exterior of left (upper) valve, hypotype UCLA 58217, CSUN loc. 383; 9--*Balanus* sp., catalogued specimen UCLA 58220, CSUN loc. 392; 10--Unidentified crab cheliped, catalogued specimen UCLA 58222, CSUN loc. 400; 11--*Kewia fairbanksi* (Arnold), hypotype UCLA 58206, CSUN loc. 142.

Family Conidae

Genus *Conus* Linnaeus, 1758

Conus aff. *C. owenianus* Anderson

Conus oweniana Anderson, 1905, p. 201-202, pl. 15, figs. 58, 59.

Conus (Chelyconus) owenianus Anderson. Addicott, 1970, p. 122-123, pl. 17, figs. 1-8, 32, 37.

Only three excellently preserved spires of *Conus owenianus* were found, all from the same locality. These spires are similar to the stout, low-spired forms recognized by Addicott (1970).

Subclass OPISTHOBRANCHIA
Order CEPHALASPIDEA
Family Scaphandridae

Genus *Cylichna* Lovén, 1846

Cylichna sp.

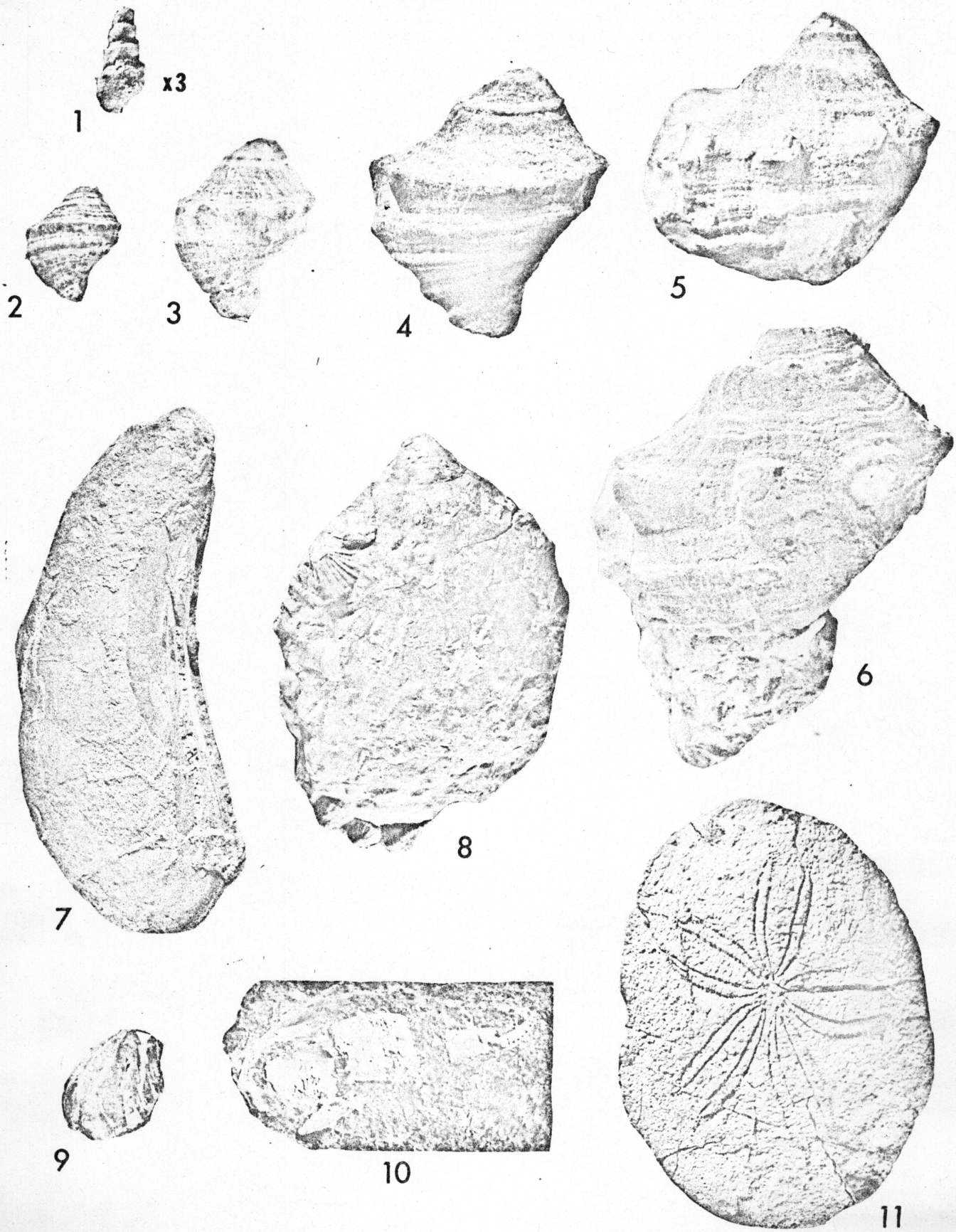
Although only a few poorly preserved, but complete, specimens of *Cylichna* sp. were found, all from the same locality, *Cylichna* aff. *C. alba* was reported by Loel and Corey (1932) from the Sespe Creek region.

Genus *Scaphander* Montfort, 1810

Scaphander sp.

Only a single, uncrushed, internal mold, 1.5 cm in height, was found.

Plate 1



Class PELECYPODA

Unidentified pelecypods

Most of the unidentified pelecypods are molds, although some bear traces of shell material. Molds of paired valves are especially common in the Santa Margarita Formation. At locality 298, the molds have been phosphatized.

Subclass CRYPTODONTA
Order NUCULOIDA
Family Nuculidae

Genus *Acila* H. and A. Adams, 1858

Acila sp.

Only a single, poorly preserved, unbroken valve of *Acila* sp. was found. The genus *Acila* was not reported from the Vaqueros Formation by Loel and Corey (1932).

Subclass PTERIOMORPHA
Order ARCOIDA
Family Arcidae

Genus *Anadara* Gray, 1847

Anadara santana Loel and Corey
Pl. 3, fig. 1

Anadara santana Loel and Corey, 1932, p. 185, pl. 8, figs. 1a-1c, 2, 3a, 3b.

Nearly all specimens of *Anadara santana* are poorly preserved, broken, single valves, but one exceptional articulated specimen (Pl. 3, fig. 1) shows details of the surface sculpture. *A. santana* was not reported by Loel and Corey (1932) as occurring in the Sespe Creek region.

Anadara cf. *A. microdonta* (Conrad)
Pl. 3, fig. 2

Arca microdonta Conrad, 1855, p. 13.

Anadara (Anadara?) microdonta (Conrad). Reinhart, 1943, p. 46-47, pl. 6, figs. 9, 10.

Of the four specimens found, three are fragments of valves and the other is articulated, but has shell material on only one of the valves. Although preservation is poor, tentative assignment to *Anadara microdonta* is based on the size, anterior position of the beaks, and the lack of grooves on the 26 ribs. The only specimen known to Reinhart (1943) was the holotype, which was supposedly collected from California.

Anadara sp.

Most of the specimens consist of molds which show impressions of the radial ribbing. Although species identification is not possible, some specimens at localities 287 and 294 show impressions of ribs that are longitudinally grooved.

Order MYTILOIDA
Family Mytilidae

Unidentified mytilid

Unidentified mytilid specimens are mostly internal molds, but a few have small patches of shell material; a few are crushed and the others are fragments of single or paired valves.

Genus *Mytilus* Linnaeus, 1758

Mytilus sp.
Pl. 1, fig. 7

At localities 10, 50, and 412, specimens of *Mytilus* sp. are internal molds of paired valves, the largest being the figured specimen. At locality 168, specimens are internal molds of single, mostly broken valves. Preservation of the distinctive beak areas is good enough in these specimens to allow identification as *Mytilus* rather than *Modiolus*.

Order PTERIOIDA
Family Ostreidae

Genus *Crassostrea* Sacco, 1897

Crassostrea titan (Conrad)

Ostrea titan Conrad, 1853, p. 199-200.

Ostrea (Crassostrea) titan Conrad. Dall, 1909, p. 111.

Crassostrea titan typically occurs in distinct beds up to 1 m thick in which many specimens are articulated and in vertically oriented *in situ* clusters. Less closely spaced *in situ* specimens and disarticulated valves in horizontal position also occur. *C. titan* valves commonly bear attached *Balanus* sp. specimens.

Genus *Ostrea* Linneaus, 1758

The following three species of *Ostrea* seem to represent an evolutionary lineage in the Sespe Creek area. *Ostrea howelli* occurs only in the lower and lower middle members of the Vaqueros Formation. *O eldridgei ynezana* occurs in a few places in association with *O. howelli* in the lower middle member, but alone in the upper middle member. *O. eldridgei* is restricted to the upper member of the Vaqueros. Whether this apparent evolutionary line is truly biological or whether separate and already existing species were introduced as the environment changed is unknown.

Shells of the genera *Ostrea* and *Crassostrea* are not easily distinguished. One of the easier methods is by the respective presence or absence of chomata. Many specimens of *O. howelli* have the chomata (Pl. 3, figs. 3, 4) and are correctly

Plate 2. *Ostrea howelli* Wiedey from the middle member of the Vaqueros Formation. Plate illustrates variation in the species. (Figures are x0.7 natural size.)

Figure 1--Exterior of left (lower) valve, showing many, prominent, elevated ribs, hypotype UCLA 58198, CSUN loc. 39; 2--Exterior of left valve, hypotype UCLA 58193, CSUN loc. 32; 3--Exterior of left valve, showing few, prominent, elevated ribs, hypotype UCLA 58192, CSUN loc. 29; 4--Exterior of left valve, showing many, prominent, elevated ribs, hypotype UCLA 58195, CSUN loc. 32; 5--Exterior of right (upper) valve, showing few, low, broadly rounded ribs, hypotype UCLA 58202, CSUN loc. 52; 6--Exterior of left valve, showing few, prominent, elevated ribs, hypotype UCLA 58194, CSUN loc. 32.

Plate 2

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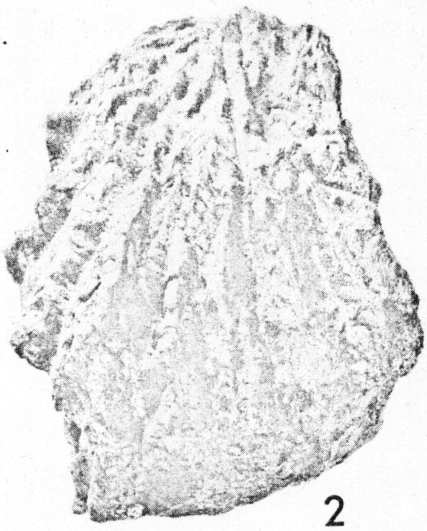

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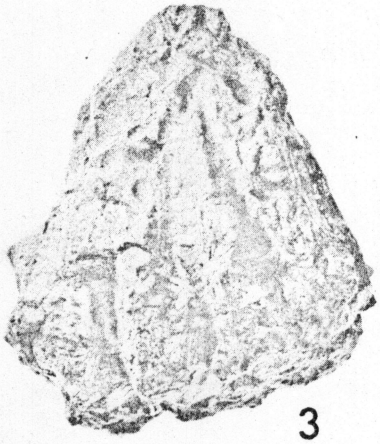

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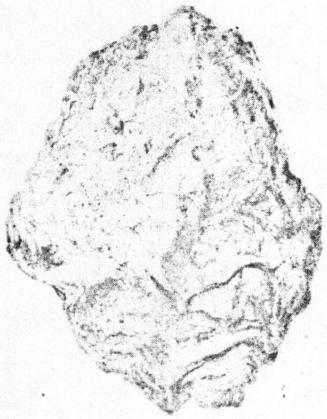

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assigned to the genus *Ostrea*. Chomata have not been found on either *O. eldridgei or O. eldridgei ynezana* and the assignment to the genus *Ostrea* is based only on the apparent evolutionary relationship with *O. howelli*.

Ostrea howelli Wiedey
Pl. 2, figs. 1-6; Pl. 3, figs. 3, 4

Ostrea Veatchii Gabb. Yates, 1903, p. 87-88, pl. 7, fig. 6; p. 89-90, pl. 8, figs. 18-20.

(non) *Ostrea Veatchii* Gabb, 1866, p. 34-35, pl. 11, fig. 59. (=*Ostrea vespertina, fide* Arnold, 1910, p. 77.)

Ostrea howelli Wiedey, 1928, p. 135-136, pl. 15, figs. 1, 2.

Ostrea loeli Hertlein, 1928, p. 144-146, pl. 22, figs. 2, 3.

Ostrea wiedeyi Hertlein, 1928, p. 147-148, pl. 23, fig. 1, 10.

Ostrea vespertina (Conrad) *loeli* (Hertlein). Loel and Corey, 1932, p. 193-194, pl. 16, figs. 1a, 1b, 2; pl. 17, figs. 1a, 1b, 2a, 2b, 3.

Loel and Corey (1932) synonymized *Ostrea wiedeyi* with *O. loeli*, but did not note their similarity with *O. howelli*. *O. loeli* was distinguished by a few, low, broadly rounded ribs, *O. wiedeyi* by many, prominent, elevated ribs, and *O. howelli* by a few, prominent, elevated ribs. At localities where specimens are abundant, however, all three forms occur together and are clearly variants of a single species. Plate 2 illustrates individuals collected from the oyster bed near the bottom of the middle member. The name *O. howelli* has priority over the other two names because it was published two months earlier.

Ostrea howelli is found only in lower Miocene rocks, whereas *O. vespertina* occurs in rocks from Pliocene to Holocene, and questionably in the upper Miocene. The shell of *O. howelli* is thicker, the hinge is thicker and stronger, and the ligament area longer than in *O. vespertina*. Because no continuous chronological or morphological gradation exists between the two species and because *O. howelli* in this area seems to have evolved into *O. eldridgei*, *O. howelli* is retained at full specific rank.

Ostrea howelli is the most abundant fossil in the lower member of the Vaqueros Formation. It occurs commonly in the form of well-preserved, paired valves in nonresistant siltstone beds that are 0.5 to 1.0 m thick. Growth series are not evident. Average height of the shells is 8 to 10 cm.

Ostrea eldridgei Arnold
Pl. 4, fig. 1

Ostrea eldridgei Arnold, 1907a, p. 528, pl. 42, figs. 2, 2a.

Ostrea eldridgei most commonly occurs in distinct lenses near the base of the upper member of the Vaqueros Formation, but scattered valves also occur in the remainder of the member. Most specimens are moderately preserved, unbroken, single valves which show some wear. Articulated specimens occur, but not as commonly as with the other two oyster species. The species is differentiated from *O. eldridgei ynezana* by its lack of sculpture.

Plate 3. Fossils from the middle member of the Vaqueros Formation. (Figures are natural size except where noted.)

Figure 1--*Anadara santana* Loel and Corey, exterior of right valve, hypotype UCLA 58225, UCLA loc. 4268; 2--*Anadara* cf. *A. microdonta* (Conrad), exterior of left valve, hypotype UCLA 58207, CSUN loc. 148; 3--*Ostrea howelli* Wiedey, dorso-posterior interior ligament margin of left (lower) valve showing chomata, hypotype UCLA 58190, CSUN loc. 8; 4--*O. howelli* Wiedey, dorso-posterior interior ligament margin of right valve showing anachomata, hypotype UCLA 58209 = CSUN loc. 162; 5--*Ostrea eldridgei ynezana* Loel and Corey, exterior of left valve, hypotype UCLA 58203, = CSUN loc. 53; 6--*Spondylus perrini* Wiedey, exterior of right valve, hypotype UCLA 58205, CSUN loc. 125; 7--*Chione* cf. *C. richthofeni* Hertlein and Jordan, exterior of right valve, hypotype UCLA 58208, CSUN loc. 150; 8--*Macoma arctata* (Conrad), exterior of left valve, hypotype UCLA 58214, CSUN loc. 338; 9--*Panopea ramonensis* Clark, exterior of left valve, hypotype UCLA 58215, CSUN loc. 338.

Ostrea eldridgei ynezana Loel and Corey
Pl. 3, fig. 5

Ostrea eldridgei ynezana Loel and Corey, 1932, p. 189-190, pl. 11, fig. 3; pl. 12, figs. 1a-1c; pl. 13, figs. 1, 2a, 2b.

Ostrea eldridgei ynezana, like *O. howelli*, occurs in nonresistant siltstone beds in which the valves are commonly articulated and moderately to well preserved. Beds of *O. eldridgei ynezana* occur in the upper part of the middle member of the Vaqueros Formation, well above the beds of *O. howelli*, although individual specimens referable to *O. eldridgei ynezana* occur in a few places in the lower *O. howelli* beds. The species is differentiated from *O. howelli* by the presence of low, fluted corrugations on the shell, in place of the larger, higher, more angular ribs of *O. howelli*.

Ostreid coquina

At locality 307, and commonly near the top of Thor's (this guidebook) facies C of the Santa Margarita Formation, is an ostreid coquina that consists of fragments of oysters other than *Crassostrea titan*. The fragments are 0.5 to 2 cm long, very thin, and make up over 95 percent of the coquina.

Family Pectinidae

Unidentified pectinid

All unidentified pectinids from the Vaqueros Formation are poorly preserved, broken valves. Specimens from the Santa Margarita Formation are internal molds of incomplete valves.

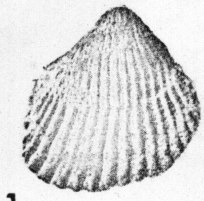
Genus *Chlamys* Röding, 1798

Chlamys sespeensis Arnold
Pl. 4, fig. 2

Pecten (Chlamys) sespeensis Arnold, 1906, p. 69, pl. 8, figs. 2, 2a, 3.

All specimens of *Chlamys sespeensis* are single valves with only parts of the auricles present. Preservation of the surface sculpture generally is fair.

Plate 3



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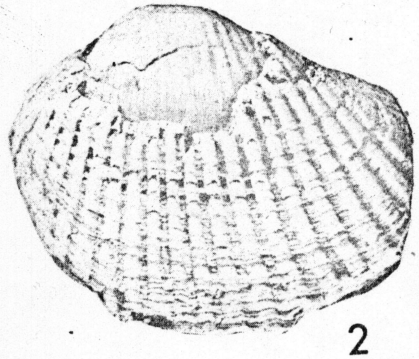

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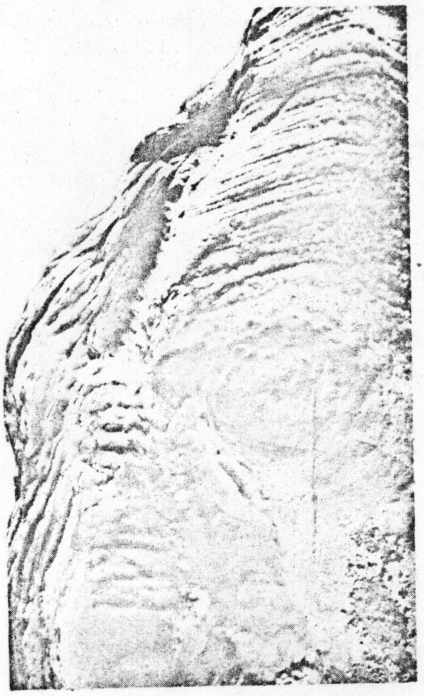

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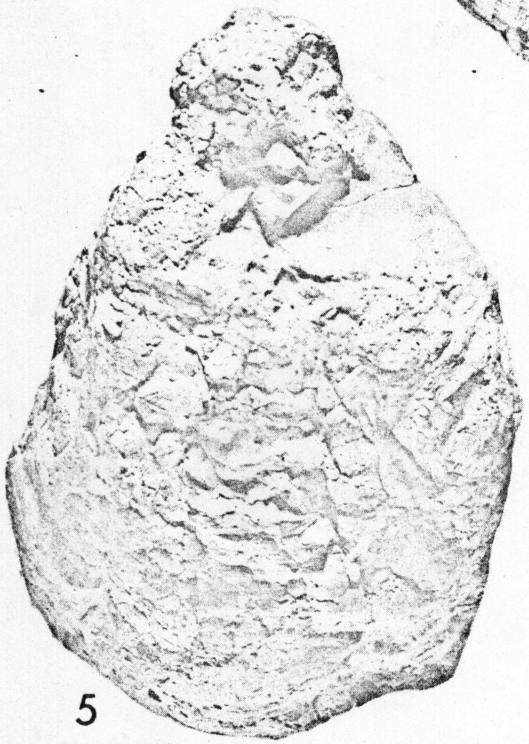

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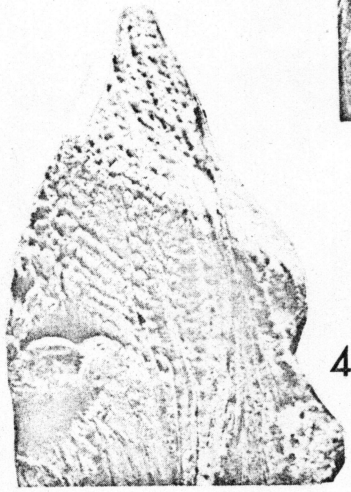

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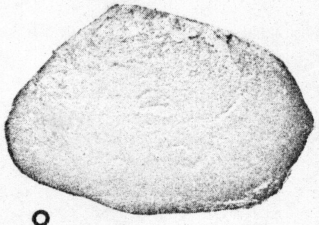

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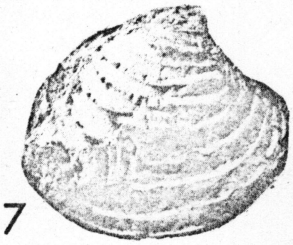

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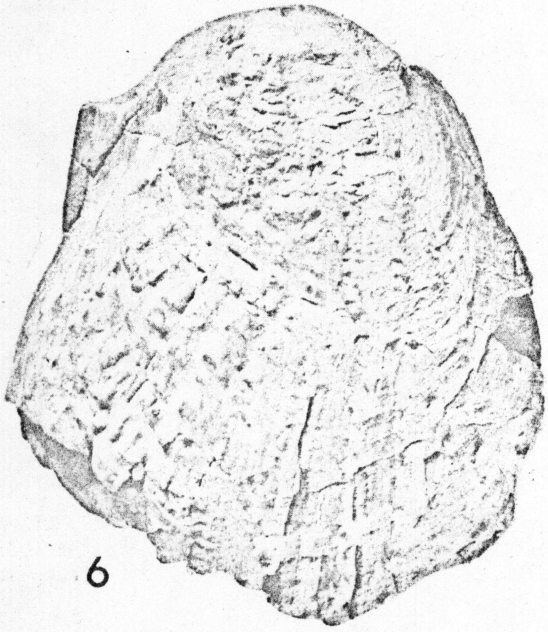

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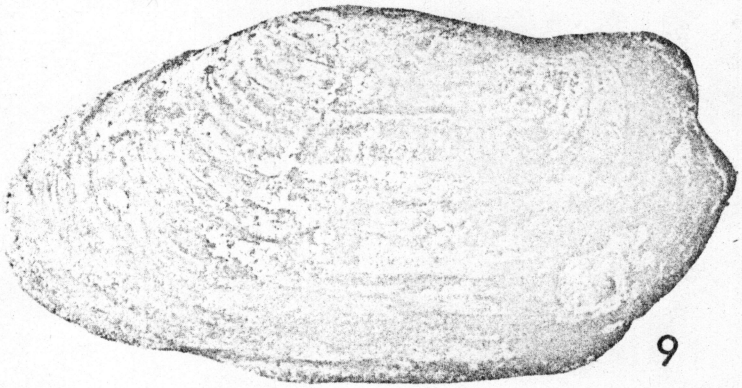

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Genus *Aequipecten* Fischer, 1886

Aequipecten discus (Conrad)
Pl. 4, fig. 7

Pecten discus Conrad, 1857c, p. 190, fig. 1.

Pecten (Plagioctenium) discus Conrad. Arnold, 1906, p. 86-87, pl. 27, figs. 1, 1a, 2-4.

Specimens of *Aequipecten discus* are mostly molds of single valves, although a few still have traces of shell material. At locality 289, valves are abundant enough to constitute a coquina.

Genus *Lyropecten* Conrad, 1862

Lyropecten crassicardo (Conrad)

Pallium crassicardo Conrad, 1857a, p. 313.

Pecten (Lyropecten) crassicardo Conrad. Arnold, 1906, p. 71-73, pl. 16, figs. 1, 1a; pl. 17, figs. 1, 1a, 1b; pl. 18, figs. 1, 2, 2a.

Lyropecten crassicardo occurs as fragments of single valves which show poor to fair preservation. The largest partial specimens is 10 cm in height.

Lyropecten magnolia (Conrad)

Pecten magnolia Conrad, 1857c, p. 191, pl. 1, fig. 2.

Pecten (Lyropecten) magnolia Conrad. Arnold, 1906, p. 77-79, pl. 24, figs. 1, 2.

Specimens of this distinctive species are mostly large, broken, single valves, up to 8 cm in height. Preservation of the surfaces of the fragments generally is good. At locality 263, several valves of *Lyropecten magnolia* are closely packed together in a single hand sample with a single valve of *Vertipecten nevadanus*.

Genus *Vertipecten* Grant and Gale, 1931

Vertipecten nevadanus (Conrad)

Pecten nevadanus Conrad, 1855, p. 19.

Pecten (Vertipecten) nevadanus Conrad. Grant and Gale, 1931, p. 189-190, pl. 7, figs. 2a-2c.

Only a few, poorly preserved, single valves of *Vertipecten nevadanus* were found. Except for the large specimen found with *Lyropecten magnolia* at locality 263, all the specimens are broken.

Genus *Amussiopecten* Sacco, 1897

Amussiopecten vanvlecki (Arnold)

Pecten (Pecten) vanvlecki Arnold, 1907, p. 428, pl. 53, figs. 1, 2.

Amussiopecten vanvlecki (Arnold). Addicott, 1974, p. 180-194.

Specimens of *Amussiopecten vanvlecki* are mostly broken, single valves with shell material still present. Although preservation generally is only fair, both external and internal ribbing is clearly visible on various of the specimens.

Plate 4. Fossils from the Vaqueros, Rincon, and Santa Margarita Formations. (All figures are natural size.)

Figure 1--*Ostrea eldridgei* Arnold, exterior of right (upper) valve, hypotype UCLA 58199, CSUN loc. 48 upper member of Vaqueros Formation; 2--*Chlamys sespeensis* Arnold, exterior of right valve, hypotype UCLA 58197, CSUN loc. 36, upper member of Vaqueros Formation; 3--*Carcharodon angustidens* L. Agassiz, hypotype UCLA 58204, CSUN loc. 100, upper member of Vaqueros Formation; 4--Unidentified spataganoid?, catalogued specimen UCLA 58191, CSUN loc. 16, upper member of Vaqueros Formation; 5--Unidentified terebratulid, catalogued specimen UCLA 58216, CSUN loc. 352, Rincon Shale; 6--*Crepidula* sp., catalogued specimen UCLA 58212, CSUN loc. 305, Santa Margarita Formation; 7--*Aequipecten discus* (Conrad), exterior of right valve, hypotype UCLA 58210, CSUN loc. 287, Santa Margarita Formation; 8--*Isurus* sp., catalogued specimen UCLA 58213, CSUN loc. 306, Santa Margarita Formation; 9--*Astrodapsis antiselli* Conrad, hypotype UCLA 58211, CSUN loc. 300, Santa Margarita Formation.

Family Spondylidae

Genus *Spondylus* Linnaeus, 1758

Spondylus perrini Wiedey
Pl. 3, fig. 6

Spondylus perrini Wiedey, 1928, p. 138, pl. 17, figs. 6, 7.

Only a single, articulated, but incomplete specimen of *Spondylus perrini* was found. The right valve is well preserved; the left valve poorly preserved.

Family Anomiidae

Genus *Anomia* Linnaeus, 1758

Anomia vaquerosensis Loel and Corey
Pl. 1, fig. 8

Anomia vaquerosensis Loel and Corey, 1932, p. 203-204, pl. 33, figs. 1a, 1b, 2a, 2b, 3, 4.

Anomia vaquerosensis is one of the more abundant faunal elements of the lower member of the Vaqueros Formation. Specimens occur in distinct, thin beds made mostly of crushed and broken, disarticulated valves. The few good specimens are of left (upper) valves whose average height is about 5 cm. Barnacle or bryozoan encrustations occur on a few of the specimens.

Order VENEROIDA
Family Crassatellidae

Genus *Eucrassatella* Iredale, 1924

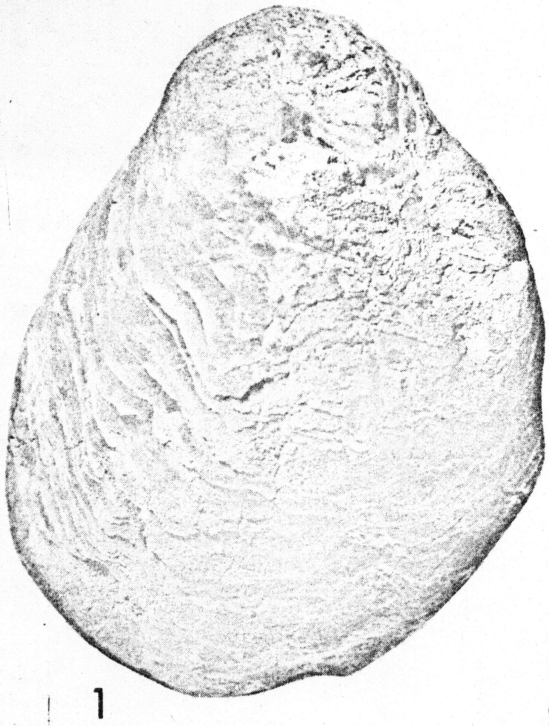
?*Eucrassatella granti* (Wiedey)

Spisula granti Wiedey, 1928, p. 152, pl. 20, figs. 2, 3.

Crassatellites granti (Wiedey). Loel and Corey, 1932, p. 207-208, pl. 35, figs. 1a, 1b. 2, 3a, 3b; pl. 36, fig. 2.

Only four specimens (up to 6 cm in height) of internal molds of paired valves of ?*Eucrassatella granti* were found. Many of the unidentified pelecypods, however, may belong to this species.

Plate 4



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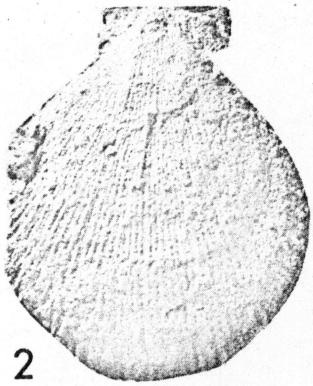

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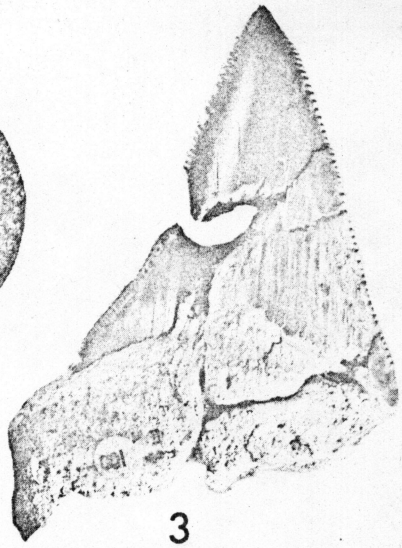

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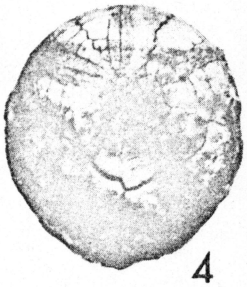

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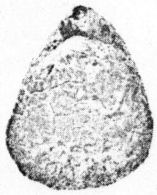

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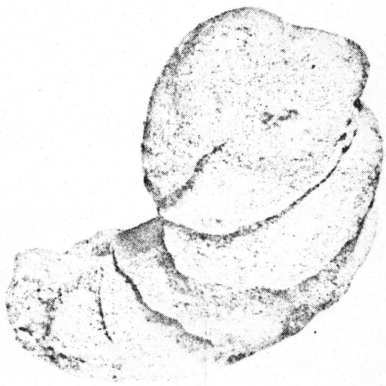

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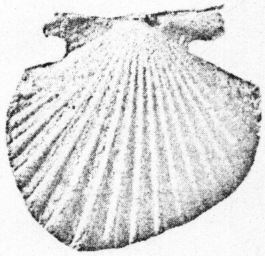

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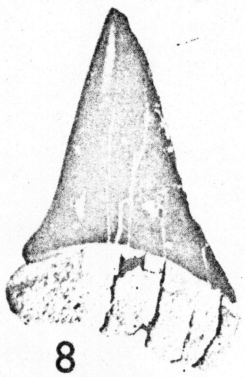

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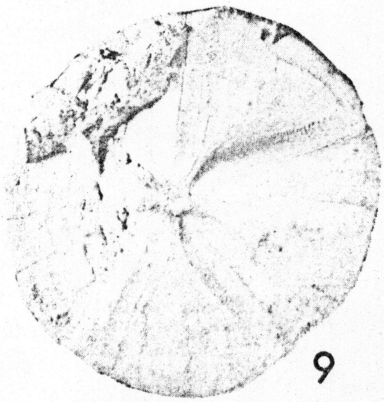

9

Family Veneridae

Genus *Dosinia* Scopoli, 1777

Dosinia sp.

Only two specimens of *Dosinia* sp. were found, one each in the Vaqueros and Santa Margarita Formations. Both specimens are broken valves in which shell material has been replaced and surface ornamentation obliterated.

Genus *Saxidomus* Conrad, 1837

?*Saxidomus vaquerosensis* Arnold

Saxidomus vaquerosensis Arnold, 1910, p. 56, pl. 7, fig. 7.

All specimens of ?*Saxidomus vaquerosensis* occur as internal molds of paired valves up to 7 cm in height. At locality 255 there is a growth series.

Genus *Clementia* Gray, 1842

Clementia sp.

Two broken, internal molds of *Clementia* sp. were found, one articulated and the other a single valve.

Genus *Chione* Megerle von Muhlfeld, 1811

Chione cf. *C. richthofeni* Hertlein and Jordan
Pl. 3, fig. 7

Chione richthofeni Hertlein and Jordan, 1927, p. 619, pl. 17, figs. 4, 7, 8.

Most specimens of *Chione* cf. *C richthofeni* consist of paired valves that have the shell material missing, except along the widely spaced concentric ribs. A few of the better preserved specimens show faint radial striae between the concentric ribs. The species is common in the Sespe Creek area, although most individuals are crushed and hinge line details are not visible.

Loel and Corey (1932) reported a *Chione* in the Sespe Creek region which they called *C. temblorensis subtemblorensis*. Their material was too poorly preserved for figuring, but they suggested that some of the individuals might belong to the species that they called *C.* aff. *richthofeni*. Their *C.* aff. *richthofeni* was not reported as occurring in the Sespe Creek area, and according to their text was not figured. A figure labeled *Chione* aff. *richthofeni* (Loel and Corey, 1932, pl. 42, fig. 4), however, is very unlike the figure of the holotype of *C. richthofeni* in Hertlein and Jordan (1927).

The CSUN specimens from the middle member of the Vaqueros Formation are very similar to *C. richthofeni* and definitely not similar to *C. temblorensis subtemblorensis*. Fritsche and Squires (1978) reported that this *Chione* might possibly be a new species, but until specimens that show hinge line details are found, such a designation cannot be made with certainty.

Family Tellinidae

Unidentified tellinid

A single internal mold of paired valves, 4 cm in height, was found.

Genus *Macoma* Leach in Ross, 1911

Macoma arctata (Conrad)
Pl. 3, fig. 8

Tellina arctata Conrad, 1849, p. 725, pl. 18, figs. 3, 3a.

Macoma arctata (Conrad). Moore, 1963, p. 81, pl. 28, figs. 6, 7, 10, 11, 13; pl. 29, fig. 8.

Most specimens of *Macoma arctata* are internal molds of paired valves which have been deformed by compaction. A few specimens which have part of the shell wall intact show faint concentric ridges. Growth series are not apparent.

Family Solenidae

Unidentified solenid

A few fragmentary internal molds of paired valves of unidentified solenids were found in both the Vaqueros and the Santa Margarita Formations. Two of the largest are 5 cm in length. Solenids are previously unreported from the Sespe Creek region (Loel and Corey, 1932).

Order MYOIDA
Family Hiatellidae

Genus *Panopea* Menard, 1807

Panopea ramonensis Clark
Pl. 3, fig. 9

Panope ramonensis Clark, 1925, p. 106, pl. 10, figs. 2, 3.

Most of the specimens of *Panopea ramonensis* are articulated, and preservation generally is good. None was found in living position, but at locality 338 the specimens make up a growth series. Loel and Corey (1932) did not report *Panopea* as occurring in the Sespe Creek region.

Family Pholadidae

Genus *Zirfaea* Gray, 1842

Zirfaea sp.

Only a poorly preserved, single? valve of a rather large *Zirfaea* was found. *Zirfaea* is previously unreported from the Sespe Creek region (Loel and Corey, 1932).

Pholadid borings

Pholadid borings at locality 263 average 6 mm in diameter and occur within two irregular siltstone clasts, the largest being 8 cm in length. The bored clasts are sandwiched between broken valves of *Lyropecten magnolia* and *Vertipecten nevadanus*.

At locality 332, 12 oblong casts of pholadid borings averaging 3 cm in length and 8 mm in diameter were found. Most occur in a single, connected cluster.

Pholadid borings from locality 288 are up to 1 cm in diameter and occur in basal Santa Margarita clasts of fine-grained Monterey Formation.

Phylum ARTHROPODA
Class CIRRIPEDIA
Order THORACICA
Family Balanidae

Genus *Balanus* da Costa, 1778

Balanus sp.
Pl. 1, fig. 9

Most *Balanus* from the Vaqueros Formation are complete except for the opercular plates and preservation generally is fair to good. Specimens occur either as isolated individuals or as single or clustered encrustations on *Anomia vaquerosensis, Rapana vaquerosensis,* other shell fragments, or other *Balanus* specimens. Locally, as at locality 330, individuals are abundant enough to form *Balanus* beds. Some specimens have walls with prominent longitudinal ribs on the outer surfaces, such ribbing perhaps the result of preservation. The largest specimen is 3.5 cm in height.

Specimens from the Santa Margarita Formation are mostly complete and attached to *Crassostrea titan* valves. Preservation of such barnacles is usually poor.

Class MALACOSTRACA
Order DECAPODA
Infraorder BRACHYURA

Crab parts
Pl. 1, fig. 10

Most of the crab parts are from locality 381, where they occur as scattered, but abundant, remains in a bed that has horizontal burrows at the base. The poorly preserved claws average about 7 mm in length.

At locality 400, a cheliped (Pl. 1, fig. 10) was found within a borrow.

Phylum ECHINODERMATA
Class ECHINOIDEA

Unidentified echinoid parts

At locality 259, scattered fragments of poorly preserved echinoid spines, up to 8 mm in length, occur in a coarse-grained sandstone.

Order CLYPEASTEROIDA
Family Echinarachniidae

Genus *Astrodapsis* Conrad, 1857

Astrodapsis antiselli Conrad
Pl. 4, fig. 9

Astrodapsis antiselli Conrad, 1857a, p. 315. Hall, 1962, p. 71-73, pl. 15, figs. 1-7; pl. 16, figs. 1-8; pl. 17, figs. 1-8; pl. 18, figs. 1-8, pl. 19, figs. 1-10; pl. 30, figs. 1, 1a, 2, 2a.

Complete and fragmentary specimens of *Astrodapsis antiselli* are commonly mixed and occur in distinct beds. Specimens in the CSUN collection are complete and show fair to excellent preservation.

Genus *Kewia* Nisiyama, 1935

Kewia fairbanksi (Arnold)
Pl. 1, fig. 11

Scutella fairbanksi Arnold, 1907a, p. 542, pl. 42, fig. 3; pl. 43, fig. 3. Kew, 1920, p. 66-68, pl. 11, figs. 2a-2c.

Durham (1955) concluded that *Scutella fairbanksi* seems to be referable to the genus *Kewia*. Complete and fragmentary specimens of *Kewia fairbanksi* are usually mixed together in resistant limestone beds, although isolated individuals do occur. The CSUN specimens are complete to nearly complete, preservation is good to excellent, and average size is about 4.5 cm in diameter.

Order SPATANGOIDA

Unidentified spatangoid?
Pl. 4, fig. 4

One uncrushed and fairly well preserved specimen of an unidentified spatangoid? was found. The oral surface is encased in rock matrix, but much of the aboral surface plate arrangment is visible. Based on the shape and size of the test, as well as the lack of an anterior sulcus, the specimen resembles *Brissus kewi* Grant and Hertlein. The specimen differs from *B. kewi* in that 1) the two middle petals point anteriorly, 2) the petals extend over the sides of the test nearly to the oral surface, and 3) the petals are not sunken. *Megapetalus* Clark has these three features, but the petal areas are much larger and increase in size toward the margin.

Fritsche and Squires (1978) referred to this specimen as *Brissus kewi*, but it is more likely that it represents a new taxon. Preservation, however, is not good enough to allow a more definitive conclusion.

Phylum CHORDATA

Unidentified vertebrate bones

Unidentified vertebrate bone material usually consists of fragments which could be cetacean in origin. At locality 258, the material is possibly a fragment of a reptile jawbone, and at locality 288, the material is probably fish vertebrae.

Class CHONDRICHTHYES

Unidentified shark teeth

At a few localities, shark tooth fragments are so poorly preserved that differentiation between *Isurus, Odontaspis,* or some other genus is not possible.

Order MYLIOBATIFORMES

Unidentified myliobatoid teeth

A single, 2-cm-long specimen of myliobatoid (ray) teeth was found. Myliobatoids are previously unreported from the Vaqueros Formation in the Sespe Creek region (Loel and Corey, 1932).

Order LAMNIFORMES
Family Odontaspididae

Genus *Odontaspis* Agassiz, 1838

Odontaspis sp.

Two nearly complete and well preserved specimens of *Odontaspis* sp. (sand tiger shark) were found. The largest specimen is 2.2 cm in length.

Family Lamnidae

Genus *Isurus* Rafinesque, 1809

Isurus sp.
Pl. 4, fig. 8

Isurus sp. (mako shark) teeth are the most common shark teeth in the Sespe Creek area. Most are moderately well preserved, nearly complete or complete, and not rounded by abrasion. Average length of complete specimens is about 1.5 cm; larger fragments are about 2.5 cm in length.

Genus *Carcharodon* Smith *in* Müller and Henle, 1838

Carcharodon angustidens L. Agassiz
Pl. 4, fig. 3

Carcharodon angustidens L. Agassiz, 1843, p. 255, pl. 28, figs. 20-25. Leriche, p. 13-14, pl. 11, figs. 8, 8a, 8b.

The figured specimen (Pl. 4, fig. 3) of *Carcharodon angustidens* (great white shark) is a 6-cm-long tooth. Other specimens found include only a few fragments. Remains of *Carcharodon* are previously unreported from the Vaqueros Formation in the Sespe Creek region (Loel and Corey, 1932).

Carcharodon sp.

A single, small fragment of a tooth from locality 100 that shows serrations along the cutting edge is too poorly preserved for specific identification.

Family Carcharhinidae

Genus *Galeocerdo* Müller and Henle, 1837

Galeocerdo sp.

One nearly complete, well preserved, 6-mm-long tooth and one tooth fragment of *Galeocerdo* sp. (tiger shark) were found.

Class MAMMALIA

Marine mammal bones

Specimens of unidentified marine mammal bones consist of permineralized fragments that range in width from 1.5 to 7 cm.

Order DESMOSTYLIA
Family Desmostylidae

Genus *Desmostylus* Marsh, 1888

Desmostylus sp.

Two fragments of *Desmostylus* cheek teeth were found. The best is 2.5 cm long and has been rounded by abrasion. *Desmostylus* was not reported from the Vaqueros Formation by Loel and Corey (1932), but has since been found in the Vaqueros in San Luis Obispo County, California (Mitchell and Repenning, 1963).

Order CETACEA

Cetacean vertebrae

Permineralized whale vertebrae occur at several localities. The best specimens, from localities 10 and 64, were found in nearly articulated condition.

TRACE FOSSILS

Unidentified burrows

The few unidentified burrows collected from the Vaqueros Formation are about 9 cm long and about 1.5 cm in diameter. Burrows are more abundant in the Santa Margarita Formation, where the most common type is vertical, 1 to 3 cm in diameter, and straight to slightly curving. Some forms are branching, and at locality 287, some resemble *Ophiomorpha*.

Kingdom PLANTAE
Division RHODOPHYCOPHYTA
Class RHODOPHYCEAE
Order CRYPTONEMIALES

Family Corallinaceae

Abundant whole and fragmented specimens of an unidentified coralline alga occur in a thin bed at locality 313. Small hemispherical colonies up to 2.5 cm in height were collected, but most of the specimens are scattered fragments separated by medium-grained sandstone.

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