



AGE AND PALEOENVIRONMENTAL SIGNIFICANCE OF
MEGA-INVERTEBRATES FROM THE “SAN PEDRO”
FORMATION IN THE COYOTE HILLS, FULLERTON AND
BUENA PARK, ORANGE COUNTY, SOUTHERN
CALIFORNIA

By

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U.S. DEPARTMENT OF THE INTERIOR
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ABSTRACT

The "San Pedro" Formation in the Coyote Hills contains an invertebrate fossil assemblage of 184 taxa from 158 localities. The fauna consists of two annelids, 174 mollusks (80 bivalves, 94 gastropods, and three scaphopods), five arthropods, and three echinoids, along with other minor constituents recognized by not specifically identified during the present study. These fossils are divided into three assemblages; 1) a lower, Pliocene assemblage (which may not differ ecologically from the middle fauna), 2) a middle, cool water assemblage, and 3) an upper, temperate to warm water. These fossils suggest a probably late Pliocene to early Pleistocene age for outcrops of the "San Pedro" Formation in the Coyote Hills. A fourth assemblage with a limited, restricted marine fauna occurs in the overlying Coyote Hills Formation.

The occurrence of *Solamen columbianum* (Dall) (Mollusca: Bivalvia) in the "San Pedro" Formation of the Coyote Hills marks its first occurrence as a fossil. The oldest fossil occurrence of the gastropods *Tegula pulligo* (Gmelin), questionably *Haliotis cracherodii* Leach, and the crustacean *Randallia ornata* (Randell) occurs in the "San Pedro" Formation in the Coyote Hills.

INTRODUCTION

Paleontologically, late Pliocene to early Pleistocene outcrops in the Los Angeles Basin are little studied. Outcrops in and around the Coyote Hills in Orange County (Figure 1) are examined here for the purpose of developing a chronostratigraphy for the Quaternary of southern California based on successive molluscan faunas. A chronostratigraphy has already been partially completed for the later Quaternary (Powell, Lajoie, and Ponti, in press) but few studies have been undertaken on early Quaternary deposits in the Los Angeles Basin.

The "San Pedro" Formation in the Coyote Hills, Orange County, contains a molluscan assemblage of 174 taxa (80 bivalves, 94 gastropods, and three scaphopods; Table 1; Appendix 2) collected from 158 localities. In addition foraminifers, annelid worms, bryozoans, echinoids, arthropods, and vertebrates are known from these collections. Fossils from the "San Pedro" Formation are divided into two main faunas: an upper, temperate to warm-water fauna and a middle, cool-water fauna. A third fauna may be present which is similar to the middle fauna but is presumably older. Likewise the Formation is divided into two informal members, but these members are not coincident with the two, or possibly 3, faunal assemblages. Exposures of the "San Pedro" Formation occur fairly extensively in the West Coyote Hills (including Ralph Clark Regional Park) reaching a maximum thickness of nearly 100 m. In the East Coyote Hills, the formation thins, reaching a maximum thickness of only 20 m.

The upper, temperate, faunal assemblage is not well dated, but contains *Chlamys anapleus* Woodring which suggests a middle Pleistocene age, and *Pecten bellus* (Conrad) which suggests a late Pliocene to early Pleistocene age. The data presented below suggests for an age range extension for *C. anapleus* Woodring to the early Pleistocene. The upper fauna contains two extra-limital southern taxa, which do not currently occur north of Baja California Norte, Mexico [i.e., *Argopecten ventricosus* (Sowerby) and *Trachycardium panamense* (Sowerby)]. In addition to the extra-limital taxa, the bivalve mollusks *Chione* spp., *Donax californicus* Conrad, *Gari fucata* (Hinds), and the gastropods *Bursa californica* (Hinds), *Crucibulum spinosum* (Sowerby), *Nassarius* sp., cf. *N. cerritensis* (Arnold), and *Terebra pedroana* Dall suggest warmer water conditions than the cool faunal assemblage

recognized elsewhere in the Coyote Hills. This warm water fauna has been recognized only in the West Coyote Hills.

The middle, cool, faunal assemblage contains several extinct taxa, which suggest early Pleistocene, or possibly late Pliocene age. The fauna also contains two cooler water taxa which do not occur today south of about 36°N along the central California coast [i.e., *Patinopecten caurinus* (Gould) and *Pandora wardiana* Adams]. The cool-water nature of this fauna might correlate with a sea-level lowstand during the early part of the Pleistocene. This fauna is characterized by the occurrence of the bivalve mollusks *Cyclocardia* sp., cf. *C. occidentalis* (Conrad), *Panope abrupta* (Conrad), *Patinopecten caurinus* (Gould), *Pecten bellus* (Conrad), the gastropods *Crassispira zizyphus* Berry, and *Crepidula princeps* (Conrad), and the echinoid *Dendraster venturaensis* Kew. This fauna includes the oldest record of the gastropod *Tegula pulligo* (Gmelin), the crustacean *Randellia ornata* (Randell), and possibly the gastropod *Haliotis cracherodii* Leach.

A possible lower fauna was recovered from one collection from the East Coyote Hills. It does not appear to differ ecologically from the middle fauna except that it lacks extra-limital cool water taxa. It does, however contain several extinct taxa which suggest a late Pliocene age.

The following abbreviations are used in the text below:

F	Cited in Yerkes (1972) Some of these collections are from Hoskins (1954).
LACMIP	Los Angeles County Museum of Natural History, Invertebrate Paleontology section, Los Angeles, California.
PC	Claremont Graduate School (formerly Pomona College), Claremont, California. Hoskins (1954) collections.
RBCRP	Ralph B. Clark Regional Park, Buena Park, California.
RMW	RMW Pale Associates, Inc., Mission Viejo, California.
UCR	University of California at Riverside.

STRATIGRAPHY OF THE "SAN PEDRO" FORMATION

General

Dall (1898) first used the name "San Pedro beds" for sediments in the vicinity of the town of San Pedro. However it is unclear if he was referring to what is now known as the San Pedro Sands, Palos Verdes Sands, or both (*vide* Woodring and others, 1946). The San Pedro Sands of Woodring and others (1946) [=lower "San Pedro" Formation of Arnold and Arnold (1902) and Arnold (1903)] was described from sections on Deadman Island with supplemental outcrops along the San Pedro waterfront. Woodring and others (1946) regarded the entire San Pedro area as the type section probably because Deadman Island had been destroyed in 1928 and both Deadman Island and the San Pedro waterfront are referred to by Arnold and Arnold (1902). Kew (1923) follows the usage of Arnold (1903) referring to an upper and lower member of the San Pedro Formation separated by an unconformity. Woodring and others (1946) define the San Pedro Sands as occurring between the underlying Timms Point Silt and Lomita Marl and the overlying Palos Verdes Sands, although recent work by Ponti (1989) suggest that the three lower formations (Timms Point Silt, Lomita Marl, and San Pedro Sands) are approximately coeval and lie, in part, adjacent to one another. These formations, with the exception of the Palos Verdes Sands, were considered early Pleistocene by Woodring and others (1946), but recent work

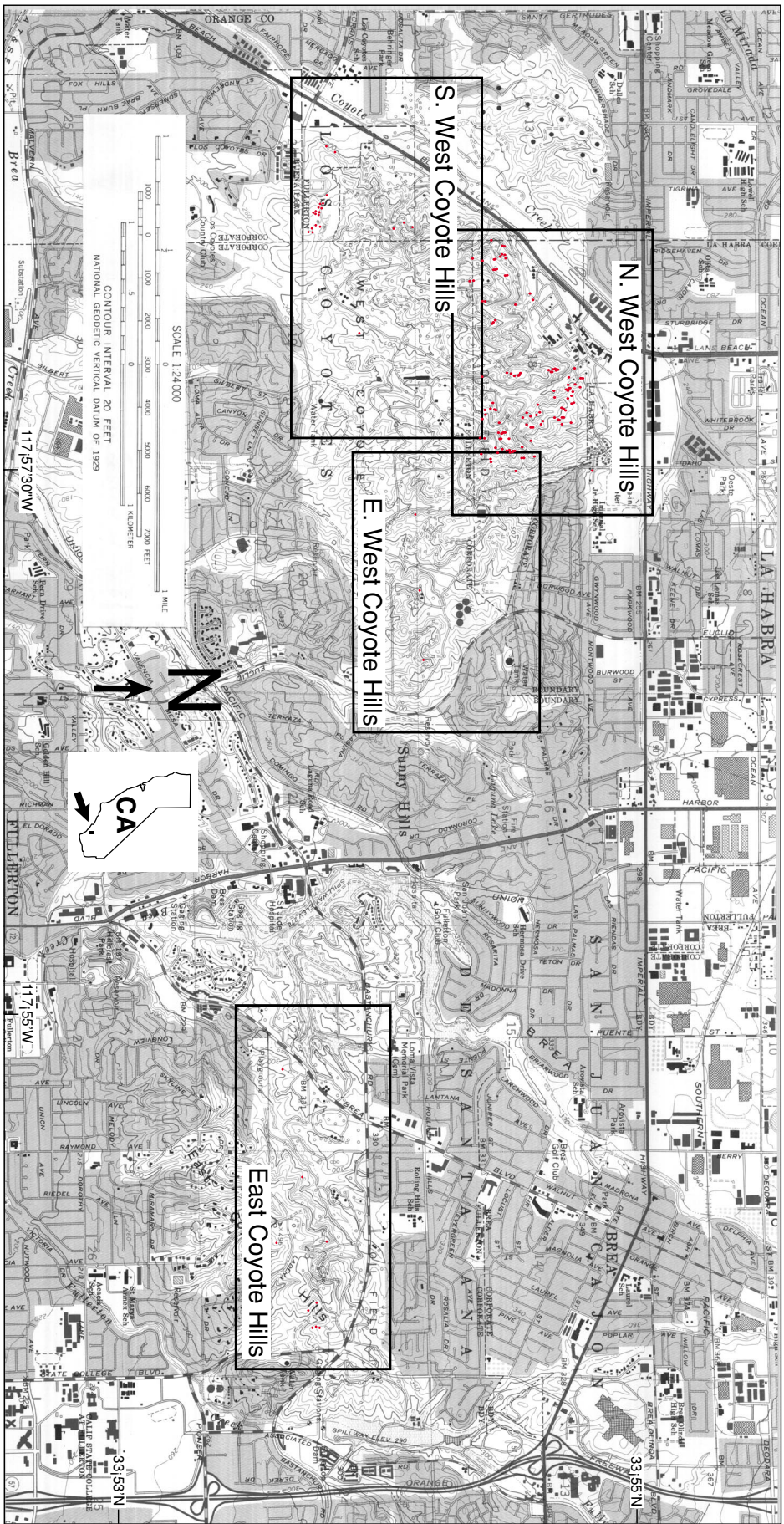


Fig.--1.—Index map of outcrops areas of the “San Pedro” Formation in the Coyote Hills, Orange County, California. Includes location for Figures 6 (northern West Coyote Hills), 7 (southern West Coyote Hills), 8 (east West Coyote Hills), and 9 (East Coyote Hills). The map covers approximately the lower third of the USGS La Habra 7.5' quadrangle (1964 ed., 1981 photorevised).

by Ponti (1989) and Lajoie and others (1991) in the San Pedro area suggest an age range of between 500 ka and 200 ka (middle Pleistocene) for the Lomita Marl, Timms Point Silt, and San Pedro Sands.

Poland and others (1956) redefined the San Pedro Formation in the subsurface as everything between the Pliocene/Pleistocene Pico Formation and unnamed upper Pleistocene sediments. As suggested by Poland and others (1956) this likely includes strata younger than the type San Pedro Sands and strata which is older. Ponti (1989) has shown that the San Pedro Formation in the Torrance Plain includes strata that are significantly older than the type San Pedro Sands. Unfortunately, Poland and others (1956) usage of the name San Pedro Formation has been applied not only to subsurface strata, but also to surface outcrops around the margins of the Los Angeles Basin by later authors. Herein the term San Pedro Sands is used in the sense of Woodring and others (1946) for surficial outcrops in the San Pedro area while the term "San Pedro" Formation (of Poland and others, 1956) is used for all subsurface deposits and surficial outcrops outside of the type area, until this problem can be adequately resolved.

Physical stratigraphy

West Coyote Hills - Yerkes and others (1965) give a brief description of lower Pleistocene sediments in the Coyote Hills stating that they attaining a thickness of about 100 m (325 ft) in the West Coyote Hills oil field. Yerkes (1972) referred these strata to the "San Pedro" Formation following Hoskins (1954) and described them as follows "...consists of an upper light-colored sand about 170 ft (52 m) thick and a lower dark-colored silty sandstone about 155 ft (47 m) thick." Maurer and Conkling (written communication, 1998) report 224 m of "San Pedro" Formation in the western Coyote Hills, but they report fossils from only the upper 120 m. The section they measured is in the bluffs north of Rosecrans Blvd. across from Ralph B. Clark Regional Park headquarters. Near the base, this section is cut by two faults, creating an up-thrown horst. It is unclear if this block belongs to the "San Pedro" Formation or some underlying unit. But a single fossil locality within this part of the section contains *Crepidula princeps* (Conrad) which restricts the age to late Miocene to middle Pleistocene and is common elsewhere in the "San Pedro" Formation of the Coyote Hills. The sediments are similar to those described by Yerkes (1972) for the lower member of the "San Pedro" Formation in the Coyote Hills, but they could also be attributed to the Fernando Formation as described by Yerkes (1972).

Still observable at Ralph B. Clark Regional Park and described by Yerkes (1972), the upper sand is composed of light gray to pale yellow brown, massive, friable to loose, very coarse grained to pebbly, very poorly sorted, angular grains of quartz, feldspar, and biotite with rust colored clayey matrix and locally abundant mollusks. The upper part of the upper sandstone contains sandy conglomerate beds up to 4.5 m (15 ft) thick (Yerkes, 1972), which contains abundant well-rounded flat ellipsoidal pebbles that are somewhat better sorted and more friable than the lower part, and continues into the overlying Coyote Hills Formation.

The lower sandstone is dark yellow gray to olive gray, silty to fine grained, massive, locally well graded or cross laminated sandstone, which contains loadcasts and deformed siltstone clasts in some place (Yerkes, 1972). The upper third is less silty and more friable and contains abundant finely interspersed biotite. The base of this unit is not observable in outcrop, but is characterized in the subsurface as conformable with no lithologic break [W. H. Holman (1959), *in lit.* in Yerkes (1972)]. Fossils in this unit generally occur in small widely scattered, possibly current accumulated, concentrations and as individual speci-

mens.

In the northern West Coyote Hills RMW Paleo Associates monitored development (RMW Paleo Associates, 1996a) and made fossil collections. These collections and collections from development of Ralph B. Clark Regional Park were examined during the present study and make up the bulk of the samples studied for the West Coyote Hills. Some, perhaps most, of the specimens collected and studied by Hoskins (1954) were also examined for this study.

A composite stratigraphic section for the northern West Coyote Hills with fossil occurrences is presented in Figure 2. A similar stratigraphic section with fossil occurrences for Ralph C. Clark Regional Park (southern West Coyote Hills) is presented in Figure 3a and 3b.

East Coyote Hills - Yerkes (1972) describes the upper part of the "San Pedro" Formation in the East Coyote Hills as only about 14 m (45 ft) thick with the base not exposed and consisting of light yellow-gray, massive, medium- to coarse-grained, pebbly sandstone that contains a single bed of well-preserved mollusks. Recent grading on the north side of the East Coyote Hills for a golf course and homes showed the "San Pedro" Formation in this area to be up to 20 m thick and generally composed of massive siltstone underlying interbedded sand and siltstone (D. Stevens, field observations, 1997). RMW Paleo Associates monitored development of this area (RMW Paleo Associates, 1996) and their fossil collections were examined during the present study. No other collections from the East Coyote Hills could not be located. A stratigraphic section for the East Coyote Hills with fossil occurrences is presented in Figure 4.

PREVIOUS PALEONTOLOGICAL STUDIES OF THE "SAN PEDRO" FORMATION IN THE COYOTE HILLS

Few studies have been done on invertebrate megafossils from the "San Pedro" Formation in the Coyote Hills and the ones that have been done are mainly unpublished [Hoskins (1954); Maurer and Conkling (written communication, 1998)]. Invertebrate megafossils from the Coyote Hills have been mentioned as part of other studies related to the Pleistocene of California (Valentine, 1961), or as part of the general geology of the western Puente Hills (Yerkes, 1972). The occurrence of the "San Pedro" Formation in the Coyote Hills has also been discussed as part of regional studies without mentioning of fossil occurrences [Poland and others (1956), Yerkes and others (1965)]. Studies incorporating invertebrate megafossils from the western Coyote Hills are discussed below.

In a master's thesis, Hoskins (1954) discusses the geology and paleontology of the West Coyote Hills. He recognized two distinct faunas and accompanying rocks that correlate with the two faunas recognized here. His upper formation, "San Pedro Sands(?)," consisted of sands and gravels containing a large, but poorly preserved fauna suggesting shallow water depths and marine conditions possibly warmer than along the adjacent coast today. This unit correlates with the upper, warm water fauna reported here. His lower formation, "Coyote Silt," consists of massively bedded tan to brown silt with occasional sand lenses. Within this unit he reports a cooler, deeper water fauna which correlates with the lower, cool water fauna described below. Both these units are referred to the "San Pedro" Formation here. Hoskins (1954) also reported a brackish water fauna from high in his section with correlates with the fauna reported from the Coyote Hills Formation, below.

Using fauna lists from Hoskins (1954) Valentine (1961) interprets the fauna from the upper part of the "San Pedro" Formation in the western Coyote Hills as dominated by his

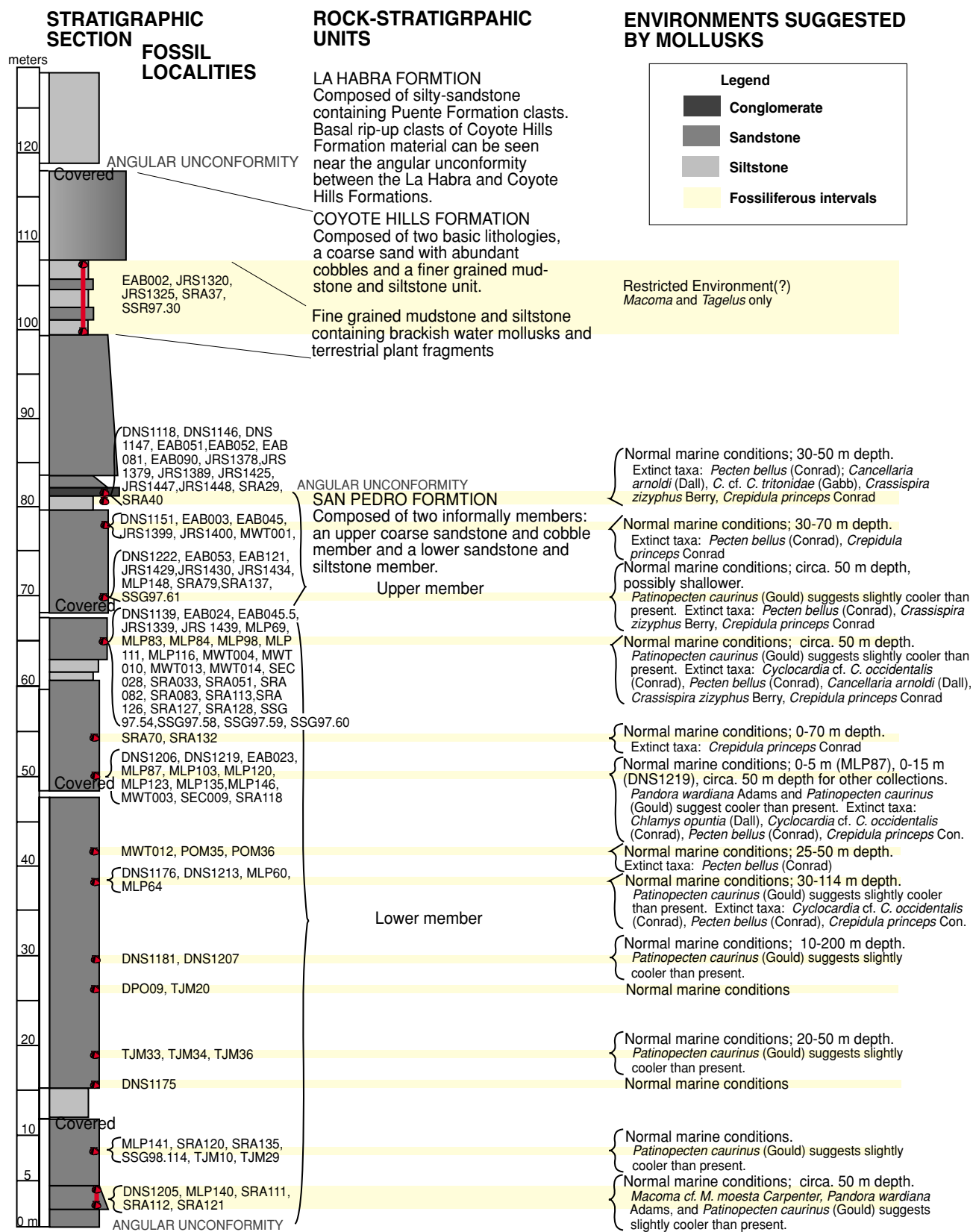


Fig. 2.—Composite stratigraphic section for the northern West Coyote Hills with fossil localities and environmental interpretations.

STRATIGRAPHIC SECTION
FOSSIL LOCALITIES

ROCK-STRATIGRAPHIC UNITS

ENVIRONMENTS SUGGESTED BY MOLLUSKS

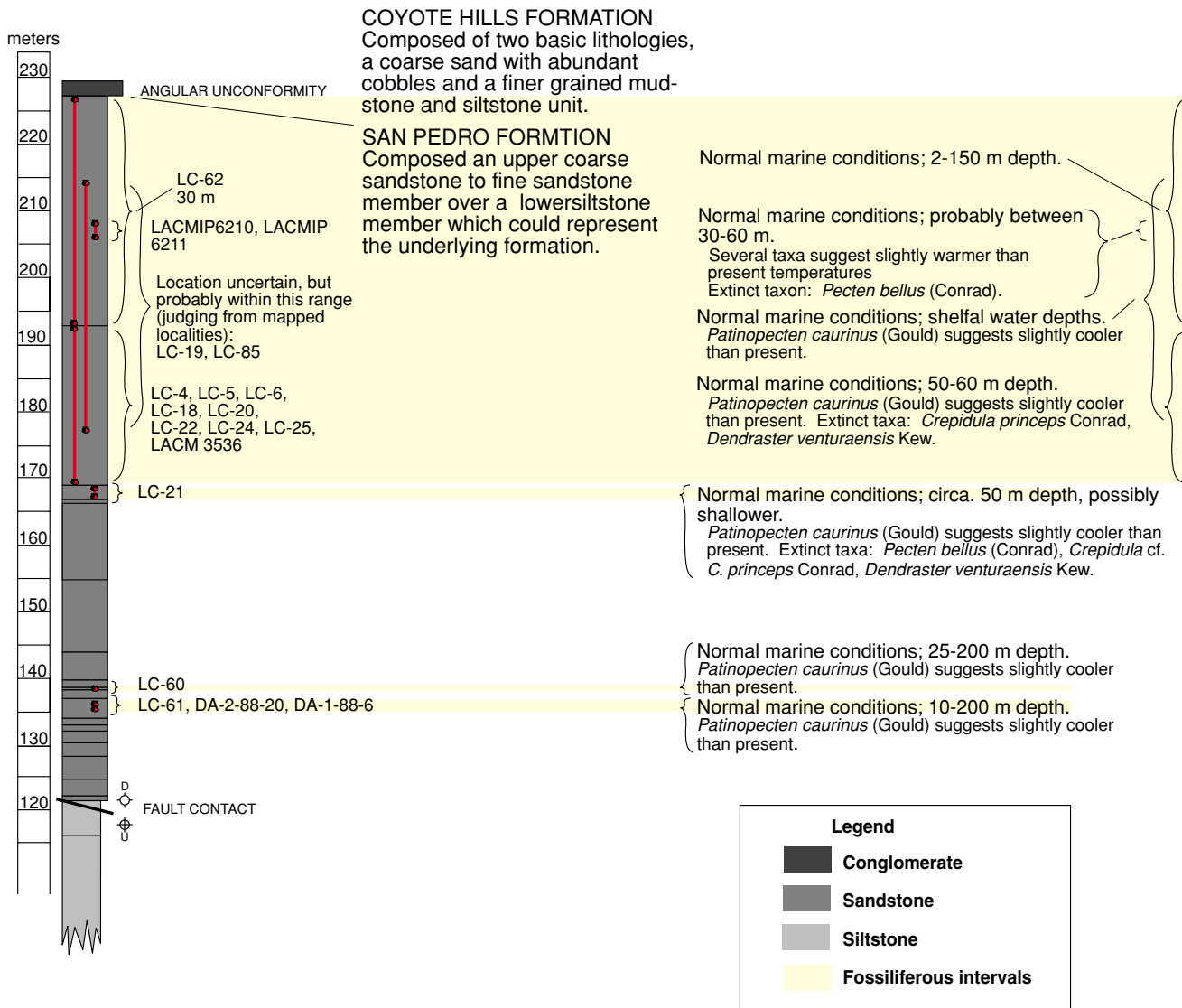


Fig. 3a.—Composite stratigraphic section of approximately the top half (some overlap) for the Ralph C. Clark Regional Park (southern West Coyote Hills) with rock stratigraphic units, fossil localities, and environmental interpretations from mollusks.

Tellina bodegensis Hinds – *Forreria belcheri* (Hinds) association with mixed *Lucinoma annulata* (Reeve) – *Turcica coffea* Gabb and *Thyasira flexuosa* (Montagu) [= *T. gouldii* (Philippi)] – *Neptunea tabulata* (Baird) community assemblages as minor constituents. Assemblages suggesting deeper-water depths (*Lucinoma annulata* Reeve – *Turcica coffea* Gabb and *Thyasira flexuosa* (Montagu) – *Neptunea tabulata* Baird assemblages) and cold water element of Valentine’s (1961) Oregonian element are present in the underlying silt. These underlying silts yield a smaller assemblage with larger percentages of northern forms. Valentine (1961) suggests that the fauna from the “San Pedro” Formation in the Coyote Hills resembles assemblages from the Pico and Saugus Formations in the Ventura Basin.

STRATIGRAPHIC SECTION

FOSSIL LOCALITIES

ROCK-STRATIGRAPHIC UNITS

ENVIRONMENTS SUGGESTED BY MOLLUSKS

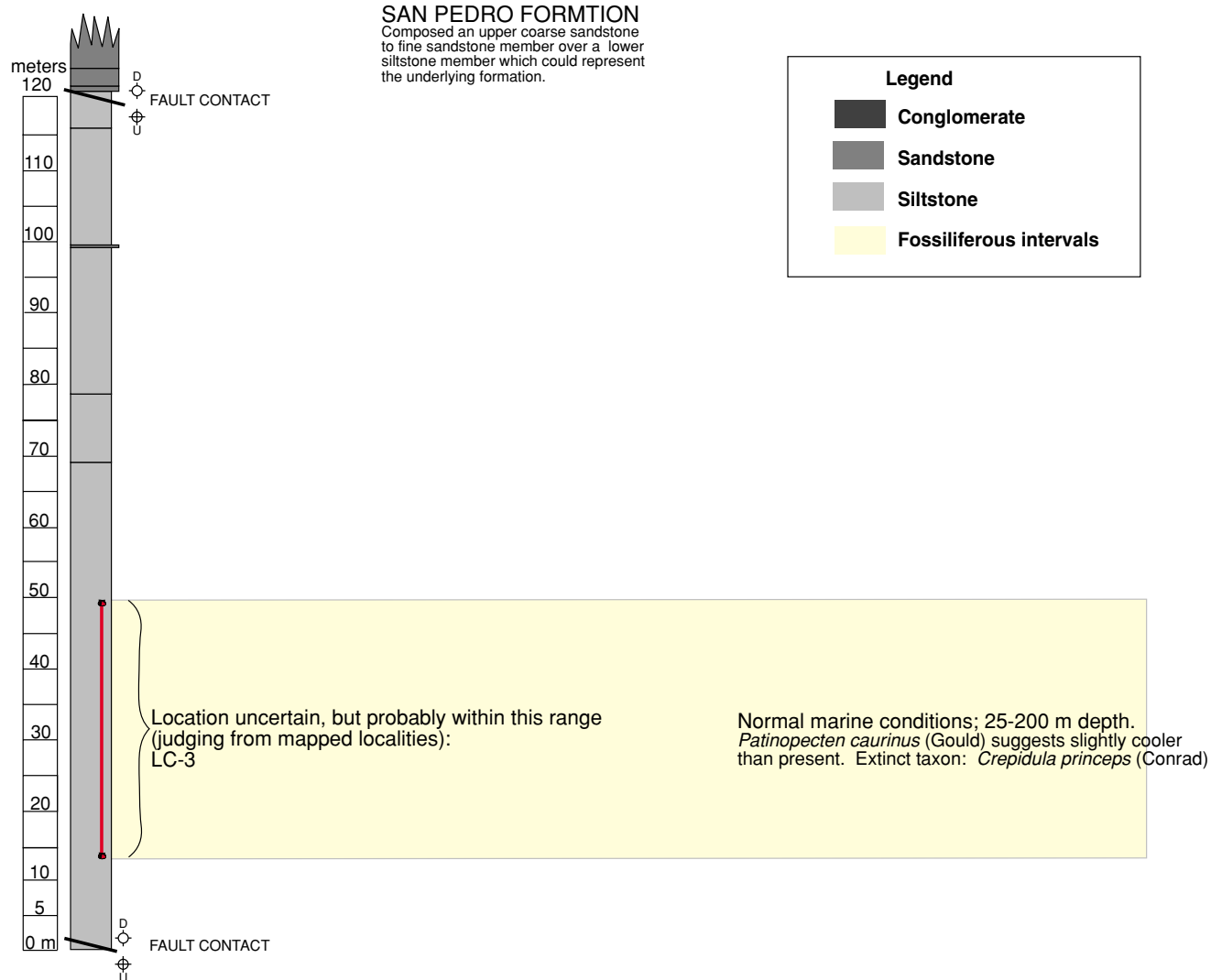


Fig. 3b.—Composite stratigraphic section of approximately the bottom half (some overlap) for the Ralph C. Clark Regional Park (southern West Coyote Hills) with rock stratigraphic units, fossil localities, and environmental interpretations from mollusks.

Yerkes (1972) cites the “San Pedro” Formation in the West Coyote Hills as attaining a thickness of about 52 m (170 ft) and divided into lower and upper units. He also cites a fauna of 115 mollusks, (60 bivalves, 53 gastropods, two scaphopods), two echinoids, and one arthropod. The lower sandstone contains scattered mollusks, while the upper sandstone contains locally abundant mollusks.

A unpublished manuscript on the paleoecology of the “San Pedro” Formation at Ralph B. Clark Regional Park by Maurer and Conkling (MS) reports a fauna of 82 invertebrates (66 mollusks) and 13 vertebrates taxa. They interpret the fauna as occurring on a shallow, protected bottom (approximately 10 m), which deepens, down section, to shallow continental shelf depths (50-100 m). Some of their samples are at the Interpretative Center, Ralph B. Clark Regional Park and were used in this present study. Significant in this report is a strontium isotope age determination of 1.4 ± 0.4 Ma from a *Patinopecten caurinus*

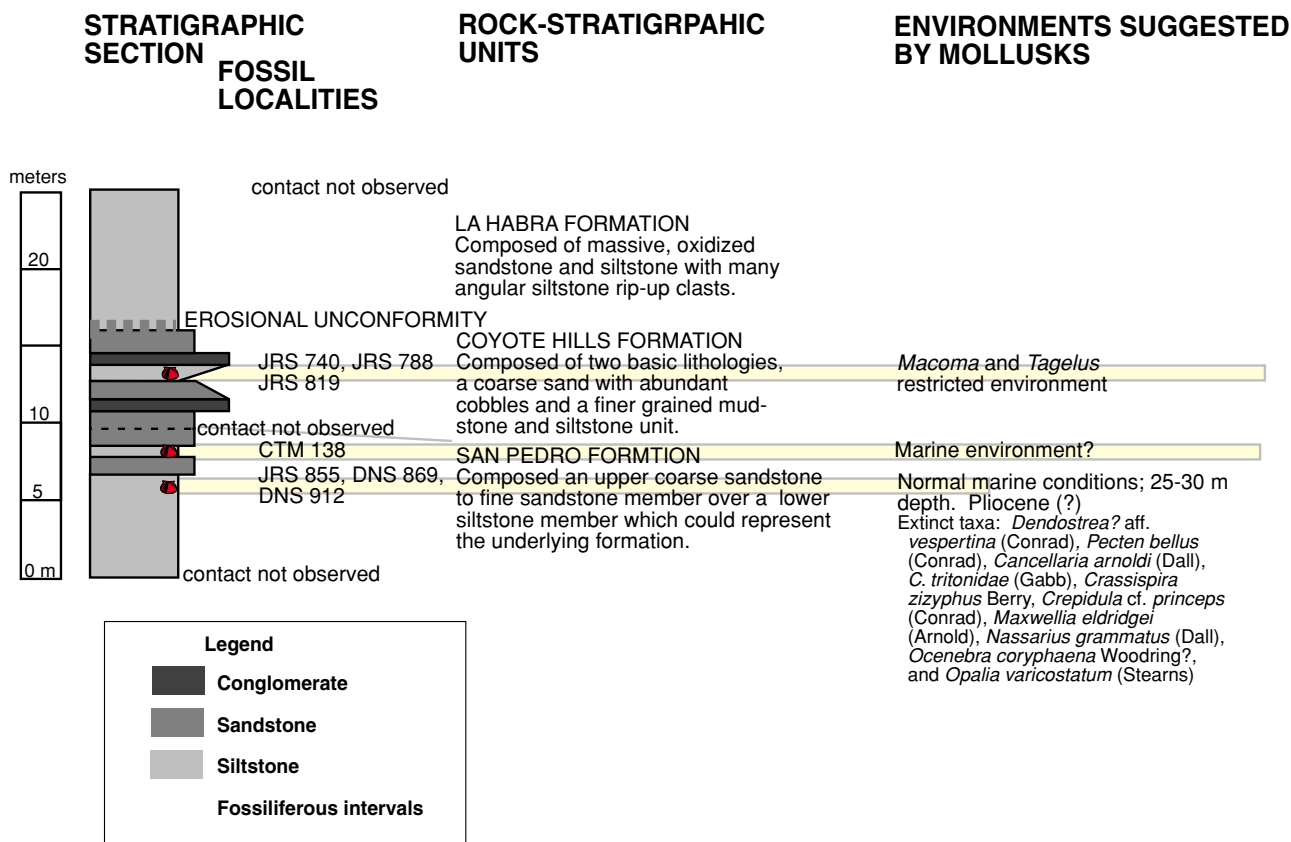


Fig. 4.—Composite stratigraphic section for the East Coyote Hills with rock stratigraphic units, fossil localities, and environmental interpretations from mollusks.

(Gould) (RBCRP LC-60) collected from the lower fauna in the upper part of the “San Pedro” Formation exposed north of Rosecrans Blvd. in the Park.

Welton (written communication, 1998) discuss the paleoecology of a small ichthyofauna from the “San Pedro” Formation west of Ralph B. Clark Regional Park and now buried under a housing track (LACMIP 6210 [=LACMVP 5011], LACMIP 6211 [=LACMVP 5012]) and collected during paleontological monitoring (Weir and Morgan, 1982). They report a fauna of nine elasmobranchs and fourteen teleosts, which are all extant and found today along the adjacent Los Angeles County coast at depths between 15 and 60 m. Associated with the vertebrates is an invertebrate fauna of 55 taxa (52 mollusks, 1 bryozoan, and 2 echinoids) identified by Edward C. Wilson and Phillip G. Owen (both formerly of the LACMIP). The invertebrate part of these collections have also been re-examined during the course of the present study. Welton and others (MS) suggest that although the “San Pedro” Formation is ecologically equivalent to the type San Pedro Sands in San Pedro, it is older.

Recent work by Powell and Stevens (1999; in press) present preliminary results from this study, which are fully documented here.

FAUNAL COMPOSITION AND PALEOECOLOGY

Faunal composition and preservation – The fauna from the “San Pedro” Formation in the Coyote Hills (from 158 localities) consists of 181 taxa; 1% (two) annelids, 96% (174) mollusks [44% (80) bivalves, 52% (94) gastropods, 2% (three) scaphopods], 3%

(five) arthropods, and 2% (three) echinoids, and is presented in Table 1. Preservation is variable between beds, but is generally very good to excellent. A correlation chart between the northern West Coyote Hills, southern West Coyote Hills (Ralph B. Clark Regional Park), and the East Coyote Hills is presented in Figure 5.

Table 1.—Molluscan taxa reported from the “San Pedro” Formation in the Coyote Hills, Orange County, southern California. Occurrences of taxa in the various faunas are shown. Taxa not marked with an “x” could not be referred to a specific fauna with confidence. Taxa with their names underlined have been reported from the Coyote Hills, but were not recognized during the present study and their occurrence in the “San Pedro” Formation in the Coyote Hills needs confirmation.

TAXA/OCCURRENCE	RESTRICTED	UPPER	MIDDLE	PLIOCENE
ANNELIDA	-	-	-	-
POLYCHAETA	-	-	x	-
Cirratulidae, indeterminate	-	-	x	-
Serpulidae, indeterminate	-	-	-	-
MOLLUSCA				
BIVALVIA				
<u>Acila castrensis</u> (Hinds, 1843)	-	-	-	-
<i>Amiantis callosa</i> (Conrad, 1837)	-	x	-	-
<i>Argopecten ventricosus</i> (Sowerby, 1842)	-	x	-	-
Cardiidae, indeterminate	-	x	-	-
<i>Chione californiensis</i> (Broderip in Broderip & Sowerby, 1835)	-	x	-	-
<i>Chione undatella</i> (Sowerby, 1835)	-	x	-	-
<i>Chlmays</i> sp., cf. <i>C. anapleus</i> Woodring, 1946	-	x	-	-
<i>Chlamys beringiana</i> (Middendorff, 1849)	-	-	x	-
<i>Chlamys hastata</i> (Sowerby, 1843)	-	x	x	-
<i>Chlamys opuntia</i> (Dall, 1898)	-	-	x	-
<i>Chlamys rubida</i> (Hinds, 1845)	-	-	-	-
<i>Chlamys</i> sp.	-	x	-	-
<i>Clinocardium</i> sp.	-	-	-	-
<i>Compsonyax subdiaphana</i> (Carpenter, 1864)	-	x	x	-
<i>Crassadoma giganteus</i> (Gray, 1825)	-	x	-	-
<i>Crassinella?</i> sp.	-	-	-	-
<i>Cryptomya californica</i> (Conrad, 1837)	?	-	-	-
<i>Cyathodonta pedroana</i> Dall, 1915	-	x	x	x
<i>Cyclocardia</i> sp., aff. <i>C. occidentalis</i> (Conrad, 1855)	-	-	x	sp.
<i>Dendostrea? vespertina</i> (Conrad, 1854)	-	-	x	x
<i>Diplodonta orbellus</i> (Gould, 1851)	-	x	-	-
<i>Donax californicus</i> Conrad, 1837	-	x	-	-
<i>Donax gouldii</i> Dall, 1921	-	x	-	-
<i>Epilucina californica</i> (Conrad, 1837)	-	-	-	-
<i>Gari fucata</i> (Hinds, 1845)	-	x	-	-
<i>Glycymeris septentrionalis</i> (Middendorff, 1849)	-	x	x	-
<i>Humilaria kennerleyi</i> (Reeve, 1863)	-	-	x	-
<u>Larkinia camuloensis</u> (Osmont, 1905)	-	-	-	-
<i>Leporimetis obesa</i> (Deshayes, 1855)	-	x	-	x
<i>Leptopecten latiauratus</i> (Conrad, 1837)	-	x	-	-
Lithophaginae, indeterminate	-	x	-	-
<i>Lucinisca nuttalli</i> (Conrad, 1837)	-	x	x	-
<i>Lucinoma annulata</i> (Reeve, 1850)	-	x	x	-
Lucinidae, indeterminate	-	-	-	-
<u>Lyropecten cerrosensis</u> (Gabb, 1866)	-	-	-	-
<i>Macoma indentata</i> Carpenter, 1864	-	x	-	-

TAXA/OCCURRENCE	RESTRICTED	UPPER	MIDDLE	PLIOCENE
<i>Macoma</i> sp., cf. <i>M. modesta</i> Carpenter, 1864	-	-	X	-
<i>Macoma nasuta</i> (Conrad, 1837)	-	-	-	-
<i>Macoma secta</i> (Conrad, 1837)	-	X	-	-
<i>Macoma</i> sp.	X	-	-	-
<i>Macromeris catiliformis</i> (Conrad, 1867)	-	X	-	-
<i>Mactromeris hemphilli</i> (Dall, 1894)	-	X	-	-
<i>Mactrotoma californica</i> (Conrad, 1837)	-	X	-	-
<i>Miodontiscus prolongatus</i> (Carpenter, 1864)	-	-	-	-
<i>Modiolus rectus</i> (Conrad, 1837)	-	X	-	-
<i>Mytilus californianus</i> Conrad, 1837	-	-	-	-
<i>Mytilus coalingensis</i> Arnold, 1909	-	-	-	-
<i>Mytilus trossulus</i> Gould, 1850	-	-	X	-
<i>Nuculana taphria</i> (Dall, 1896)	-	X	X	X
<i>Nuculana</i> sp.	-	-	-	-
<i>Nutricula lordi</i> (Baird, 1863)	-	-	-	-
<i>Nutricula tantilla</i> (Gould, 1853)	-	-	-	-
<i>Ostrea conchapila</i> Carpenter, 1857	-	X	-	-
<i>Pandora wardiana</i> Adams, 1860	-	-	X	-
<i>Pandora</i> sp.	-	X	X	-
<i>Panopea abrupta</i> (Conrad, 1849)	-	X	X	X
<i>Parvilucina tenuisculpta</i> (Carpenter, 1864)	-	X	-	-
<i>Patinopecten caruinus</i> (Gould, 1850)	-	-	X	-
<i>Pecten bellus</i> Conrad, 1857	-	X	X	X
Pectinidae, indeterminate	-	-	-	-
<i>Periploma planiusculum</i> Sowerby, 1834	-	X	-	-
<i>Pododesmus macrochisma</i> (Deshayes, 1839)	-	X	X	-
<i>Protothaca tenerrima</i> (Carpenter in Gould & Carpenter, 1857)	-	X	-	-
<i>Protothaca</i> sp.	-	-	-	-
<i>Saxidomus nuttalli</i> Conrad, 1837	-	X	X	-
<i>Semele pulchra</i> (Sowerby, 1832)	-	-	-	-
<i>Semele venusta</i> (Reeve, 1853)	-	-	-	-
<i>Semele?</i> sp.	-	-	-	-
<i>Siliqua</i> sp.	-	-	-	-
<i>Solamen</i> sp., cf. <i>S. columbianum</i> (Dall, 1879)	-	-	X	-
<i>Solen</i> sp., cf. <i>S. sicarius</i> Gould, 1850	-	-	X	-
<i>Spisula</i> sp.	-	-	X	?
<i>Tagelus</i> sp., cf. <i>T. californianus</i> (Conrad, 1837)	-	-	-	-
<i>Tagelus</i> sp., cf. <i>T. subteres</i> (Conrad, 1837)	X	-	-	-
<i>Tellina bodegensis</i> Hinds, 1845	-	-	-	-
<i>Tellina</i> sp., cf. <i>T. moesta</i> (Carpenter, 1864)	-	-	-	-
Tellinidae, indeterminate	-	-	-	-
Teredinidae, indeterminate	-	-	-	-
<i>Thracia trapezoides</i> Conrad, 1849	-	-	X	-
<i>Tivela stultorum</i> (Mawe, 1823)	-	X	-	-
<i>Trachycardium panamense</i> (Sowerby, 1833)	-	X	-	-
<i>Trachycardium quadragenarium</i> (Conrad, 1837)	-	X	X	-
<i>Tresus nuttalli</i> (Conrad, 1837)	-	X	cf.	? sp.
Veneridae, indeterminate	-	-	-	-
GASTROPODA				
<i>Acanthina spirata</i> (Blainville, 1832)	-	X	-	-
<i>Acteocina culcitella</i> (Gould, 1853)	-	-	-	-
<i>Acteocina harpa</i> (Dall, 1871)	-	-	-	-
<i>Acteon</i> sp.	-	X	-	-
<i>Alia carinata</i> (Hinds, 1844)	-	-	-	X
<i>Amphissa reticulata</i> Dall, 1916	-	-	-	-
<i>Astrea gibberosa</i> (Dillwyn, 1817)	-	X	X	-
<i>Astrea undosa</i> (Wood, 1828)	-	X	-	X
<i>Astyris gausapata</i> (Gould, 1850)	-	-	X	-

TAXA/OCCURRENCE	RESTRICTED	UPPER	MIDDLE	PLIOCENE
<i>Boreotrophon</i> sp., cf. <i>B. multicosatus</i> (Eschscholtz, 1829)	-	-	x	-
<i>Boreotrophon pedroana</i> (Arnold, 1903)	-	-	x	-
<i>Bulla gouldiana</i> Pilsbry in Tryon, 1895	-	-	-	x
<i>Bursa californica</i> (Hinds, 1843)	-	x	-	-
<i>Calicantharus fortis</i> (Carpenter, 1866)	-	x	-	sp.
<i>Calliostoma annulatum</i> (Lightfoot, 1786)	-	x	-	-
<i>Calliostoma canaliculatum</i> (Lightfoot, 1786)	-	cf.	-	-
<i>Calliostoma gemmulatum</i> Carpenter, 1864	-	-	-	x
<i>Calliostoma ligatum</i> (Gould, 1849)	-	-	-	cf.
<i>Calliostoma variegatum</i> Carpenter, 1864	-	-	-	-
<i>Calliostoma</i> sp.	-	-	-	x
<i>Calyptreaea spirata</i> (Forbes, 1852)	-	-	sp.	-
<i>Cancellaria arnoldi</i> (Dall, 1909)	-	-	-	x
<i>Cancellaria fergusoni</i> Carson, 1926	-	x	-	sp.
<i>Cancellaria tritonidae</i> (Gabb, 1866)	-	-	-	x
<i>Clathromangelia variegata</i> (Carpenter, 1864)	-	-	-	-
<i>Clathurella</i> sp.	-	-	-	-
<i>Conus californicus</i> Reeve, 1844	-	x	cf.	x
<i>Crassispira semiinflata</i> (Grant and Gale, 1931)	-	-	-	x
<i>Crassispira zizyphus</i> Berry, 1940	-	x	x	x
<i>Crepidula adunca</i> Sowerby, 1825	-	x	-	sp.
<i>Crepidula onyx</i> Sowerby, 1824	-	-	x	cf.
<i>Crepidula princeps</i> (Conrad, 1856)	-	-	x	cf.
<i>Crockerella conradiana</i> (Gabb, 1869)	-	-	-	-
<i>Crucibulum spinosum</i> (Sowerby, 1824)	-	x	-	-
<i>Cryptonatica affinis</i> (Gmelin, 1791)	-	x	-	-
<i>Cylichna attonsa</i> (Carpenter, 1864)	-	-	-	-
<i>Cypraea spadicea</i> Swainson, 1823	-	-	-	x
<i>Cymatosyrix hemphilli</i> (Stearns, 1871)	-	-	-	-
<i>Epitonium bellastrata</i> (Carpenter, 1864)	-	x	-	sp.
<u><i>Epitonium indianorum</i> (Carpenter, 1864)</u>	-	-	-	-
<i>Epitonium sawinae</i> (Dall, 1903)	-	x	-	-
<i>Erato vitellina</i> Hinds, 1844	-	x	-	-
<i>Fusinus</i> sp., cf. <i>F. arnoldi</i> Cossman, 1903	-	sp.	-	sp.
<i>Fusinus barbarensis</i> (Trask, 1855)	-	-	x	-
<i>Haliotis cracherodii</i> Leach, 1814	-	-	-	-
<i>Halistylus pupoideus</i> (Carpenter, 1864)	-	-	-	-
<i>Haminoea vesicula</i> (Gould, 1855)	-	x	-	-
<i>Homalopoma paucicostatum</i> (Dall, 1871)	-	-	-	-
<i>Kelletia kelletii</i> (Forbes, 1852)	-	-	-	x
<i>Lacuna unifasciata</i> Carpenter, 1857	-	x	-	-
<i>Lirobittium lomaensis</i> (Bartsch, 1911)	-	-	sp.	sp.
<i>Lirobittium rugatum</i> (Carpenter, 1864)	-	-	-	-
<i>Littorina scutulata</i> Gould, 1849	-	sp.	-	-
<i>Maxwellia eldridgei</i> (Arnold, 1907)	-	-	-	x
<i>Megasurcula carpenteriana</i> (Gabb, 1865)	-	x	-	x
<i>Mitra idea</i> Melville, 1893	-	x	-	-
<i>Mitrella</i> sp.	-	-	-	x
<i>Nassarius</i> sp., cf. <i>N. cerritensis</i> (Arnold, 1903)	-	x	-	sp.
<i>Nassarius fossatus</i> (Gould, 1849)	-	x	x	-
<i>Nassarius</i> sp., cf. <i>N. grammatus</i> (Dall, 1917)	-	-	-	x
<i>Nassarius insculpta</i> (Carpenter, 1864)	-	cf.	-	-
<i>Nassarius mendicus</i> (Gould, 1849)	-	x	-	x
<i>Nassarius perpinguis</i> (Hinds, 1844)	-	x	-	-
<i>Nassarius tegula</i> (Reeve, 1853)	-	-	-	-
Naticidae, indeterminate	-	x	-	x
<i>Neptunea tabulata</i> (Baird, 1863)	-	x	x	-
<i>Neverita reclusiana</i> (Deshayes, 1839)	-	x	x	x

TAXA/OCCURRENCE	RESTRICTED	UPPER	MIDDLE	PLIOCENE
<i>Nucella lamellosa</i> (Gmelin, 1791)	-	-	-	cf.
<i>Ocenebra coryphaena</i> Woodring in Woodring and others, 1946	-	-	-	x
<i>Ocenebra foveolata</i> (Hinds, 1844)	-	x	cf.	sp.
<i>Olivella baetica</i> Carpenter, 1864	-	x	cf.	cf.
<i>Olivella biplicata</i> (Sowerby, 1825)	-	x	x	x
<i>Olivella</i> sp.	-	-	-	-
<i>Opalia borealis</i> Keep, 1881	-	-	-	-
<i>Opalia</i> sp., cf. <i>O. varicostatum</i> (Stearns, 1875)	-	-	-	x
<u><i>Ophiodermella mercedensis</i> (Martin, 1914)</u>	-	-	-	-
<i>Ophiodermella inermis</i> (Reeve, 1843)	-	sp.	-	x
<i>Polinices draconis</i> (Dall, 1903)	-	-	-	-
<i>Polinices lewisii</i> (Gould, 1847)	-	-	x	x
<i>Polygireulima rutila</i> (Carpenter, 1864)	-	-	-	-
<i>Pseudomelatoma</i> sp., cf. <i>P. pencillata</i> (Carpenter, 1864)	-	-	-	-
<i>Scabrotrophon</i> sp., cf. <i>S. lasius</i> Dall, 1919	-	-	-	-
<i>Seila montereyensis</i> Bartsch, 1907	-	-	-	x
<i>Sinum scopulosum</i> (Conrad, 1849)	-	-	-	x
<i>Tegula</i> sp., cf. <i>T. funebris</i> (Adams, 1855)	-	-	-	x
<i>Tegula pulligo</i> (Gmelin, 1791)	-	-	x	-
<i>Terebra danai</i> Berry, 1958	-	x	-	-
<i>Turbonilla</i> sp.	-	-	-	-
Turridae, indeterminate	-	-	-	-
<i>Turritella cooperi</i> Carpenter, 1864	-	-	-	x
<i>Volvarina?</i> sp.	-	x	-	x
<i>Volvulella cylindrica</i> (Carpenter, 1864)	-	-	-	-
SCAPHOPODA				
<i>Dentalium neohexamun</i> Sharp and Pilsbry, 1897	-	x	-	-
<i>Dentalium pretiosum</i> Sowerby, 1860	-	-	x	-
<i>Dentalium</i> sp.	-	x	-	-
ARTHROPODA				
CRUSTACEA				
<i>Balanus?</i> sp. (barnacle)	-	x	-	-
<i>Cancer</i> sp. (crab)	-	-	x	-
<i>Coronula?</i> sp. (whale barnacle)	-	-	-	-
<i>Randallia ornata</i> (Randell, 1839)	-	-	-	-
Indeterminate crab fragments	-	-	-	-
ECHINODERMATA				
ECHINOIDEA				
Clypeasteroid, indeterminate	-	-	-	-
<i>Dendraster venturaensis</i> Kew, 1920	-	sp.	x	-
Indeterminate echinoid spines	-	-	-	-

In comparison, a fauna reported by Groves (1991) from the Pliocene – Pleistocene Saugus Formation appears to have been deposited in a similar environment and during the same period of time (near the Pliocene – Pleistocene boundary), but from considerably fewer localities (15). It contains 100 significant taxa of which 5% (five) are brachiopods, 92% (92) mollusks [43% (43) bivalves, 49% (49) gastropods, 1% (one) scaphopod], 2% (two) barnacles, and 1% (one) echinoid. These percentages compare favorably with those from the “San Pedro” Formation in the Coyote Hills with 90+% of the Coyote Hills fauna composed of mollusks, somewhat equally divided between bivalves and gastropods, with annelids, scaphopods, arthropods, and echinoderms as minor constituents.

Paleoecology – An ecologically restricted (marginally marine) fauna is found in the Coyote Hills Formation above all the other fauna and is represented by several collections. Two distinct faunules are recognized in the upper member of the “San Pedro” Formation of

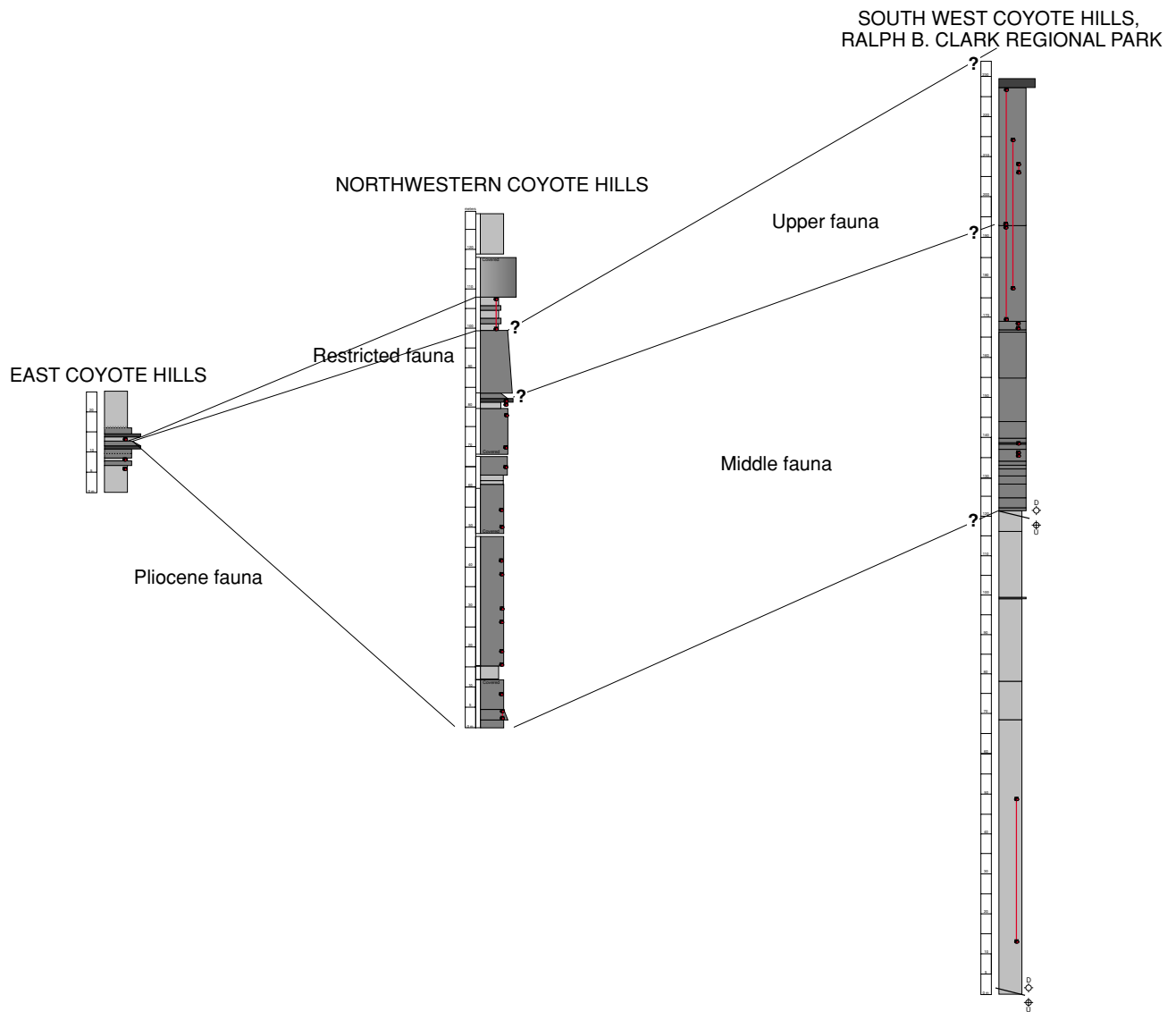


Fig. 5.—Correlation chart of stratigraphic sections in the northern West Coyote Hills, southern West Coyote Hills (Ralph C. Clark Regional Park), and East Coyote Hills. See individual stratigraphic section for details. From youngest to oldest the faunas are 1) the restricted fauna, which is exposed in the East Coyote Hills and northern West Coyote Hills; 2) the upper “warm water” fauna which is only recognized in the southern West Coyote Hills; 3) the middle “cool water” fauna which is recognized in the northern and southern West Coyote Hills; and 4) the lower “Pliocene” fauna which is known with certainty from only one site in the East Coyote Hills.

Yerkes (1972) from collections at LACMIP, RBCRP and RMW Paleo Associates. The upper fauna is recognized only from a few collections from Ralph Clark Regional Park and west of the Park, and possibly in the northern West Coyote Hills. The lower fauna occurs widely in the “San Pedro” Formation in the Coyote Hills and extends from the upper member down into the lower member of Yerkes (1972). Exact stratigraphic data for some collections is imprecise or lacking, but the collections generally show a shallow, warmer water taxa overlying a deeper, cool water fauna, followed by a Pliocene fauna. The latter is questionably separated from the cool water fauna and is recognized only from a single collection in

the East Coyote Hills.

Restricted fauna.—In the Coyote Hills, an unusual marine fauna exists in the Coyote Hills Formation, overlying the “San Pedro” Formation. It only contains the bivalve mollusks *Tagelus* sp., cf. *T. subteres* (Conrad), indeterminate *Macoma*, and unidentified bivalve fragments. Hoskins (1954) and Yerkes (1972) also report plant remains and the bivalve mollusk *Cryptomya californica* (Conrad) from the Coyote Hills Formation, but it has not been recognized in collections examined. This fauna occurs in highly fractured, fine grays, siltstone to mudstone, and is found in isolated blocks (D. Stevens, pers. comm., 1998). It is underlain by wood which has been radiocarbon dated at > 40,000 ka (Shinn, 1999). Because this age is nearly at the limit of radiocarbon dating, it suggests a minimum age for this fauna (> 40,000 ka). The few taxa present in this fauna suggest a restricted marine environment and are dissimilar to anything encountered in the “San Pedro” Formation in the Coyote Hills. Based on its stratigraphic position, this is the youngest marine fauna occurring in the Coyote Hills, but an accurate age for these collections has not been determined.

Upper fauna.—Molluscan taxa from this fauna, referred to as the warm-water fauna, suggests temperatures similar to those occurring off the Los Angeles/Orange County coast today, or slightly warmer as suggested by two extra-limital southern taxa: *Argopecten ventricosus* (Sowerby) and *Trachycardium panamense* (Sowerby). These taxa do not occur today north of about 32°N (northern Baja California, Mexico). This fauna also contains several mollusks, which do not occur today north of the latitude of the fossil locality (circa. 34° N) [data from Bernard (1983) for the bivalves and McLean (1978) for the gastropod]. These taxa include the bivalves *Chione californiensis* (Broderip in Broderip & Sowerby), *Chione undatella* (Sowerby), *Donax californicus* Conrad, *Gari fucata* (Hinds), *Leporimetis obesa* (Deshayes), and the gastropod *Terebra pedroana* Dall. This fauna represents Valentine’s (1961) *Tellina bodegensis* Hinds – *Forreria belcheri* (Hinds) community and suggests shallow inner sublittoral water depths (about 9 to 20 m). This fauna has been recognized only in a few collections from the West Coyote Hills (LACMIP 477, LACMIP 6010, questionably RMW/JRS1379, and PC264).

Middle fauna.—Stratigraphically below the warm water fauna in the upper to lower members of the “San Pedro” Formation is a cool water fauna with northern extra-limital taxa that do not exist along the Orange County/Los Angeles County coast today. It is characterized by the occurrence of the bivalves *Lucinoma annulata* (Reeve), *Panope abrupta* (Conrad), *Patinopecten caurinus* (Gould), and/or the gastropods *Crepidula princeps* (Conrad) and *Neptunea tabulata* (Baird). Other cool water extra-limital taxa which are also associated with the fauna include the bivalve *Pandora wardiana* Adams, and the gastropod *Boreotrophon* sp., cf. *B. multicostatus* (Eschscholtz). Reconstruction of the depth of deposition of faunas containing *Patinopecten caurinus* (Gould) suggests water depths greater than 20 m and probably less than 60 m, although many collections are not well constrained. This fauna represents mixed *Lucinoma annulata* (Reeve) – *Turcica coffea* Gabb and *Thyasira flexuosa* (Montagu) [= *T. gouldii* (Philippi)] – *Neptunea tabulata* (Baird) communities of Valentine (1961) and is supplemented by some of his cold water Oregonian elements. In the Ralph Clark Regional Park section it is possible that this fauna both underlies and overlies the “warm-water fauna.” This is based on collections containing the cold water taxon *Patinopecten caurinus* (Gould) which possibly overlie LACMIP 6210, a sample containing taxa which could represent water temperatures similar to those present along the

adjacent coastline. But the collections containing *P. caurinus* (Gould) are poorly located stratigraphically and could entirely underlie the upper, “warm water, fauna.” This said, I think it likely that the “warm-water fauna” completely overlies the “cool-water fauna.”

Pliocene fauna.—A single collection (RMW/JRS 855) in the East Coyote Hills contains several extinct mollusks which suggest a Pliocene age. Ecologically, the fauna suggests water temperatures similar to off the adjacent Orange County coast today at water depths between 25 m and 30 m, but otherwise does not look different than the cool water fauna above.

AGE

The following definitions are used here: late Pleistocene, approximately 140 ka to 12 ka; middle Pleistocene, approximately 720 ka to 140 ka; early Pleistocene, the Pliocene/Pleistocene boundary at about 1.8 Ma to about 720 ka.

Paleontologic Age

Restricted fauna.—This fauna contains no age significant taxa. Based on stratigraphic position alone it is probably middle Pleistocene or younger in age. Future amino-acid studies should help resolve this problem.

Upper fauna.—Extinct taxa and their ranges are presented in Table 2. The questionable identification of *Chlamys anapleus* Woodring at PC264, which has previously been reported only from the Lomita Marl and San Pedro Sands in the San Pedro area, Los Angeles County (Woodring and others, 1946), suggests a middle Pleistocene age. The occurrence of *Pecten bellus* (Conrad) at LACMIP 6211 argues for a late Pliocene to early Pleistocene age for this fauna. *Mytilus coalingensis* Arnold, *Crepidula princeps* Conrad and *Chione* sp. are questionably identified in the associated collection (PC 265). If the identifications of *Mytilus coalingensis* Arnold and *Crepidula princeps* Conrad prove correct and they are part of the warm water fauna, then their presence suggests, either 1) a early to middle Pleistocene age for the upper fauna, 2) a stratigraphic range extension to early Pleistocene for *C. anapleus* Woodring, or 3) a stratigraphic range extension to middle Pleistocene for *P. bellus* (Conrad). I would favor case 1 above as there is no other evidence for extending the stratigraphic range of either taxa at this time.

Table 2.—Stratigraphic ranges of extinct taxa recovered from the upper, warm water, fauna in the West Coyote Hills, Orange County, California.

TAXA/AGE	late Miocene	early Pliocene	late Pliocene	early Pleistocene
Mollusca				
Bivalvia				
<i>Chlamys anapleus</i> Woodring	-	-	-	-
<i>Mytilus coalingensis</i> Arnold	X	X	X	?
<i>Pecten bellus</i> (Conrad)	-	X	X	X
Gastropoda				
<i>Calicantharus fortis</i> (Carpenter)	X	X	X	X
<i>Cancellaria fergusonii</i> Carson	-	-	X	X
<i>Crassispira zizyphus</i> Berry	-	-	X	X
<i>Crepidula princeps</i> Conrad	X	X	X	X

Middle fauna.—Seven extinct taxa are recorded here from the middle fauna in the “San Pedro” Formation in the Coyote Hills (Table 3). The age ranges of some of these taxa has changed over recent years as have the ages of the formations which contain them (see Appendix 1 for a complete stratigraphic discussion). Taken together extinct taxa from this fauna suggest an age of late Pliocene to early Pleistocene for the “San Pedro” Formation in the Coyote Hills.

Table 3.—Stratigraphic ranges of extinct taxa from the middle, cool water, fauna in the Coyote Hills, Orange County, California.

TAXA/AGE	late Miocene	early Pliocene	late Pliocene	early Pleistocene
Mollusca				
Bivalvia				
<i>Chlamys opuntia</i> (Dall)	-	-	X	X
<i>Cyclocardia occidentalis</i> (Conrad)	-	-	X	X
<i>Pecten bellus</i> (Conrad)	-	X	X	X
Gastropoda				
<i>Calicantharus humerosus</i> (Gabb)	-	X	X	X
<i>Crassispira zizyphus</i> Berry	-	-	X	X
<i>Crepidula princeps</i> Conrad	X	X	X	X
Echinodermata				
Echinoidea				
<i>Dendraster venturaensis</i> Kew	-	-	X	X

Pliocene fauna.—As with the middle fauna, the age ranges of some of the taxa presented in Table 4 has changed over recent years as have the ages of the formations which contain them, so the age significance of these taxa is discussed in Appendix 1.

Significant in this fauna is *Ocenebra coryphaena* Woodring which has not been reported from rocks older than middle Pleistocene. This taxon is rare, so its stratigraphic occurrence is presumably not as well known as the other extinct taxa. It is represented in collections from the Coyote Hills by a single, questionably identified individual, which otherwise suggests a late Pliocene age. If properly identified, the stratigraphic range of *O. coryphaena* Woodring needs to be extended into the late Pliocene.

Another interesting taxon from this collection is *Maxwellia eldridgei* (Arnold), first described from an oil company well near Newhall, Los Angeles County. Other occurrences, listed by Grant and Gale (1931), are from the same area and were assigned to the early (lower) Pliocene. It is also known from the Niguel Formation in the San Joaquin Hills, southern Orange County (LACMIP collections). Valentine (1961) mentions *Maxwellia eldridgei* (Arnold) occurring in the Lomita Marl but does not cite reference, locality, or collection. With the exception of its occurrence in San Pedro, which needs to be confirmed, it appears to have a Pliocene age range.

Table 4.—Stratigraphic ranges of extinct mollusks from the lower (Pliocene) fauna in the East Coyote Hills, Orange County, California

TAXA/AGE	late Miocene	early Pliocene	late Pliocene	early Pleistocene
Mollusca				
Bivalvia				
<i>Dendostrea? vespertina</i> (Conrad)	X	X	X	-
<i>Pecten bellus</i> (Conrad)	-	X	X	X
Gastropoda				
<i>Cancellaria arnoldi</i> (Dall)	-	-	X	X
<i>Cancellaria tritonidae</i> (Gabb)	X	X	X	X
<i>Crassispira zizyphus</i> Berry	-	-	X	X
<i>Crepidula princeps</i> Conrad	X	X	X	X
<i>Maxwellia eldridgei</i> (Arnold)	-	X	X	-
<i>Nassarius grammatus</i> (Dall)	-	X	X	-
<i>Ocenebra coryphaena</i> Woodring	-	-	-	-
<i>Opalia varicostatum</i> (Stearns)	-	X	X	-

Radiometric dating

Middle fauna - Maurer and Conkling (written communication, 1998) reported a strontium age determination of 1.4 ± 0.4 Ma from a *Patinopecten caurinus* (Gould) collected from the upper part of the "San Pedro" Formation section in the bluffs on the north side of Rosecrans Blvd., Ralph B. Clark Regional Park (LC-60). This determination is in general agreement with the age suggested by the extinct mollusks discussed above (i.e., early Pleistocene).

CONCLUSIONS

The "San Pedro" Formation in the Coyote Hills contains a fauna of 184 taxa which have been divided into three stratigraphically distinct faunas. The upper fauna represents warm water conditions, probably similar to off the Orange/Los Angeles Counties coast today, or possibly warmer as suggested by several extra-limital southern taxa. It may correlate to warmer part(s) of the Lomita Marl and San Pedro Sands in the San Pedro area, Los Angeles County suggesting a middle Pleistocene age. The middle fauna contains *Patinopecten caurinus* (Gould) suggests much cooler water conditions than exist locally today; temperatures equivalent to the central California coast today (circa. 36°N) at moderate water depths (circa. 30-60 m). It also contains several extinct taxa which suggest an early Pleistocene, or possibly late Pliocene, age. The biostratigraphic age determination is supported by a Sr-isotope age of 1.4 Ma from *Patinopecten caurinus* (Gould) from this fauna. The lower, Pliocene fauna, is represented by one collection low in the section in the East Coyote Hills. It is ecologically similar to the middle fauna but lacks the extra-limital northern taxa. It contains several extinct taxa which suggest a Pliocene age and is correlated with the Saugus Formation in the Ventura Basin and the San Diego Formation in San Diego County, California. Above the "San Pedro" Formation in the Coyote Hills Formation is a small fauna suggesting a restricted marine environment.

We conclude that several ecologically distinct faunas exist in the "San Pedro" Formation in the Coyote Hills which represent faunal response to sea-level fluctuations during

the Quaternary and possibly latest Tertiary. Overlying this is the Coyote Hills Formation, with a few mollusk taxa which possibly represent a restricted marine environment. These fauna suggest at least three sea-level events in the Coyote Hills: from a possibly lowstand for the middle and possibly lower fauna, to a highstand for the upper fauna, and another highstand for the restricted marine fauna in the Coyote Hills Formation. Whether the Pliocene fauna is part of the lower fauna, or represents another lowstand or intermediate conditions, is unclear.

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Appendix 1: Selected faunal notes

Discussed here are taxonomic, stratigraphic, and/or environmentally significant taxa either reported or recovered from the "San Pedro" Formation in the Coyote Hills, Orange County, California.

Phylum ANNELIDA Class POLYCHAETA

Family CIRRATULIDAE

Two distinct worms are recognized from the "San Pedro" Formation in the Coyote Hills. The first is composed of small, closed spaced calcareous tubes, which were identified by Reish (1952) as *Dodecaceria fistulicola* Ehlers. In California, this species has a fossil record from the late Miocene (Santa Margarita Formation) to middle Pleistocene (unspecified formation on Deadman Island in San Pedro; this restricts it to the Lomita Marl, Timms Point Silt, or San Pedro Formation, all of middle Pleistocene age). The later taxon is discussed under the family Serpulidae(?).

Family SERPULIDAE(?)

Large calcareous tubes up to 1+ cm diameter and 10 cm long have been collected from the "San Pedro" Formation in the Coyote Hills and are questionably placed in the worm family Serpulidae. There are no diagnostic features for a specific determination. It is not even clear if these specimens belong in the Phylum Annelida or Mollusca. Specimens similar to these have also been found in the Pliocene Niguel and Santa Barbara formations, questionably from the Sisquoc Formation (as an indeterminate Vermetid mollusk; Woodring and Bramblett, 1950), and from the Pleistocene Lomita Marl (Woodring and others, 1946; as indeterminate Vermetid mollusks).

Phylum MOLLUSCA Class BIVALVIA

Family NUCULIDAE

Yerkes (1972) reported *Acila castrensis* (Hinds) from his locality F12 in the West Coyote Hills. This locality appears to correlate with Hoskins (1954) locality F6 which was not given a Pomona College number. Examination of specimens at Pomona College with Hoskins (1954) F6 field number did not include *Acila castrensis* (Hinds) so its occurrence in the "San Pedro" Formation in the Coyote Hills, although likely, needs confirmation. For this reason, it is not used for age and/or environmental interpretations.

Family ARCIDAE

Larkinia camuloensis (Osmont) [as *Anadara camuloensis* (Osmont)] has been reported from the "San Pedro" Formation in the West Coyote Hills by Yerkes (1972) from his locality F5. Yerkes' (1972) specimens could not be located and no other specimens of this taxon are in collections from the Coyote Hills, so its occurrence there, although possible, needs confirmation. For this reason it is not used for age and/or environmental interpretations.

Family MYTILIDAE

Five Mytilids are reported from the "San Pedro" Formation in the Coyote Hills: *Solamen columbianum* (Dall), *Mytilus californicus* Conrad, *M. coalingensis* Arnold, *M. trossulus* Gould [as *M. edulis* Linnaeus], and *Modiolus rectus* (Conrad). Three of these taxa are significant and are discussed below.

The report of *Solamen columbianum* (Dall) from the "San Pedro" Formation in the Coyote Hills (Hoskins, 1954) is the first reported fossil occurrence of this taxa and the specimen was verified during this study. *Mytilus coalingensis* Arnold has a restricted stratigraphic range in rocks from

southern and central California from the late Miocene to late Pliocene, possibly early Pleistocene age (Moore, 1983). Lastly, *Modiolus rectus* (Conrad) as recognized by Bernard (1983) occurs mostly south of the fossil locality today (5°S to 35°N), but recently Coan and Scott (1997) synonymized it with *M. flabellatus* (Gould) under the former name. If this synonymy is accepted the range of this taxon would be extended, from 35°N to 54°N, eliminating it as an ecologically significant taxon.

Family OSTREIDAE

Dendostrea? vespertina (Conrad) *s.l.* occurs in Miocene to Pliocene rocks in Baja California, as well as southern and central California. It was described from the Imperial Formation in eastern San Diego County and western Imperial County from deposits associated with the ancestral Gulf of California. Specimens referred to this species from coastal California are generally larger and rounder in outline than the typical form but in all other features are very similar to Imperial Formation specimens. In my opinion these specimens are referable to a different taxon, but separating the two species is beyond the scope of this paper.

Family PECTINIDAE

Argopecten ventricosus (Sowerby) [syn. *A. circularis* (Sowerby); syn. *A. aequisulcatus* (Carpenter, 1864)] has been reported from Elkhorn Slough, Monterey Bay, California, south to Païta, Peru, including the Galapagos Islands (Grau, 1959). McLean (1978) reported its [as *A. aequisulcatus* (Carpenter)] northern end point as the Santa Barbara Islands. Bernard (1983), studying only live collected specimens in various West Coast museum reports its northernmost occurrence at 30°N [as *A. circularis* (Sowerby)]. I (Powell) have occasionally seen specimens living in bay and lagoons in Orange and San Diego Counties, but reproducing populations of this taxon probably do not occur north of Baja California, Mexico. Therefore, we follow Bernard (1983) and designate *A. ventricosus* (Sowerby) as an extra-limital southern taxon.

Chlamys anapleus Woodring has previously been reported only from the Lomita Marl and San Pedro Sands in the San Pedro area, Los Angeles County (Woodring and others, 1946). It is questionable reported from the Coyote Hills from Hoskins locality PC264 examined during this study but was not reported by Hoskins (1954). This collection contains warm water taxa and is referred to the upper, warm water, fauna herein. If this identification proves correct, then it suggests either 1) an age range extension to the early Pleistocene for this taxon, or 2) the warm water fauna in the Coyote Hills is probably middle Pleistocene.

Coan and Scott (1997) suggested that *Chlamys islandica* (Gmelin) does not occur in the eastern Pacific or Alaskan waters and that all specimens previously attributed to this species in the eastern Pacific should be referred to *C. beringiana* (Middendorff). This suggestion is followed here. They also suggest that *Chlamys rubida* (Hinds) and *C. jordani* (Arnold) are synonymous under the former name and that suggestion is also followed.

The Miocene age reported for *Chlamys opuntia* (Dall), *Flabellipecten stearnsii* (Dall) and *Pecten bellus* (Conrad) by Moore (1984) is based on these taxa occurring in the Purisima Formation (Arnold, 1906). But Arnold was referring to Purisima-age faunas, not to the Purisima Formation *s.s.* These taxa do not exist in collections from the Purisima Formation (collections examined include: California Academy of Sciences; Los Angeles County Museum of Natural History, University of California, Berkeley, Museum of Paleontology; and U.S. Geological Survey; see also Powell, 1998). Otherwise *Chlamys opuntia* (Dall) occurs in probably Pliocene to early Pleistocene rocks in central and southern California, *Flabellipecten stearnsii* (Dall) occurs in late(?) Pliocene to middle Pleistocene sediments in southern California and Baja California, Mexico, and *Pecten bellus* (Conrad) occurs in late Pliocene to early Pleistocene sediments in southern California and Baja California, Mexico (Moore, 1984). It is generally thought that *Pecten bellus* (Conrad) has a first occurrence at about the Pliocene – Pleistocene boundary and its last occurrence in the middle Pleistocene (see occurrences in Moore, 1984). In most collections in the Coyote Hills it is associ-

ated with the cool water fauna, but Welton and others (MS) report it occurring with a neutral to possibly warm water fauna near the top of the San Pedro Formation at Ralph Clark Regional Park.

Other significant Pectinids include *Lyropecten cerrosensis* (Gabb) and *Patinopecten caurinus* (Gould). *Lyropecten cerrosensis* (Gabb) is reported from a single collection by Hoskins (1954) in the West Coyote Hills. Its occurrence has not been verified so it is not included in age interpretations. *Patinopecten caurinus* (Gould) is extant and has a modern occurrence from central California (36°N) to the Gulf of Alaska (59°N) in water from 10 to 200 m deep (Bernard, 1983). It suggests cooler water conditions than exists along the Orange County coast today.

Family CARDITIDAE

Cyclocardia from the "San Pedro" Formation in the Coyote Hills are all attributed to *Cyclocardia* sp., aff. *C. occidentalis* (Conrad) of Woodring and others (1946). Woodring and others (1946) report this taxon as common in the Lomita Marl and Timms Point Silt, uncommon in the San Pedro Sand, and rare in the Palos Verdes Sand. They do not state how it differs from specimens of *C. occidentalis* (Conrad) from the type locality in the Santa Barbara Formation (late Pliocene to early Pleistocene). Based on its occurrence in the San Pedro area (Woodring and others, 1946) and in the Coyote Hills, it probably ranges in age from near the Pliocene/Pleistocene boundary to middle Pleistocene (Powell and others, MS). It is common in some collections in the San Pedro area where it is associated with taxa representing offshore conditions equivalent to the *Lucinoma annulata* – *Turcica coffea* and *Thyasira gouldi* – *Neptunea tabulata* communities of Valentine (1961). Valentine reports the *Lucinoma annulata* – *Turcica coffea* community as representing deep inner sublittoral water depths (18-23 to 46 m) and the *Thyasira gouldi* – *Neptunea taubulata* community representing shallow outer sublittoral water depths (46-90 m). This is in accordance with the depth range suggested by other taxa associated with *Cyclocardia* sp., aff. *C. occidentalis* (Conrad) of Woodring and others (1946) in the Coyote Hills.

Family TELLINIDAE

Leporimetis obesa (Deshayes) is extant and has a modern occurrence from Point Conception, California (35°N) to Magdalena Bay, Baja California Sur, Mexico (25°N) (McLean, 1978) in water depths from the intertidal zone to 50 m (Bernard, 1983). It is reported from the upper fauna here and suggests water temperatures equal to, or perhaps slightly warmer, than exists along the Orange County coast today.

Family DONACIDAE

Both the *Donax* species reported here occur only in the upper fauna. *Donax californicus* Conrad is extant and ranges from Santa Barbara, through the Gulf of California, and south to Puerto Pizarro, Tumbes Province, Peru (Coan, 1983). This geographic range suggests water temperatures equal to, or possibly higher than exists along the Orange County coast today. *Donax gouldii* Dall has a modern occurrence from Santa Cruz County, central California south to southern Baja California, but is sporadic north of Point Conception (McLean, 1978). In the southern California Pleistocene it is found associated with taxa suggesting water temperatures the same or warmer than those occurring off the adjacent coast today, and is part of the upper fauna in the Coyote Hills.

Family CARDIIDAE

Despite its name *Trachycardium panamense* (Sowerby) is an extra-limital southern taxon with a modern range from Baja California south to only Costa Rica (Keen, 1971). It is common in warmer water faunas in southern California and is herein included in the upper, warm water, fauna of the Coyote Hills. The species was collected at only one locality (LACM 477).

Family VENERIDAE

The genus *Chione*, although not extra-limital, has a geographic range mainly south of the

fossil locality, suggesting water temperatures as warm or possibly warmer than those existing along the Orange County/Los Angeles County coast today. McLean (1978) reported *Chione californiensis* (Broderip in Broderip & Sowerby) from Carpinteria, California, to Panama, and *Chione undatella* (Sowerby) from Goleta, California to Peru. Both of these taxa are reported from the upper fauna.

Both Hoskins (1954) and Yerkes (1972) report *Nutricula lordi* (Baird) from the West Coyote Hills. Specimens available for study at Pomona College and LACMIP appear to be referable to *N. tantilla* (Gould). Until specimens referable to *N. lordi* (Baird) are located, its occurrence in the "San Pedro" Formation in the Coyote Hills is questioned. Therefore it is not used for environmental interpretations here.

Family MACTRIDAE

The family Mactridae has recently been reviewed by Moore (1999) and her recommendations for generic assignment are applied in this study. Three Mactrids have been reported from the "San Pedro" Formation in the Coyote Hills, but only one is possibly ecologically significant. *Mactromeris hemphilli* (Dall) has a modern range from Santa Barbara south to Ensenada, Baja California Norte, Mexico (McLean, 1978). This taxon occurs only in the upper fauna of the Coyote Hills and suggests water temperatures similar to today or possibly slightly warmer. The specimen illustrated by Hoskins (1954) does not show the posterior ridge characteristic of this species and may be referable to some other taxon, but this species was observed in collections at Pomona College.

Family THRACIIDAE

Work by Coan (1990) suggests that *Cyathodonta* species recorded from the California Pleistocene are probably referable to *Cyathodonta pedroana* Dall. *Cyathodonta pedroana* Dall is the only eastern Pacific taxon in this genus, which has a modern range extending into California. It is possible that *C. undulata* Conrad and/or *C. dubiosa* Dall are present in the California Pleistocene as some outcrops represent significantly warmer water temperatures than occur along with adjacent coast today, but this must await confirmation. All specimens identifiable to species during the current study are referred to *C. pedroana* Dall.

Family PANDORIDAE

Bernard (1983) cites the range of *Pandora wardiana* Adams as 47°N (Washington) to 57°N (Gulf of Alaska) in water depths from 40 m to 200 m, making this another cool water, northern extralimital taxon.

Class GASTROPODA

Family HALIOTIDAE

A small fragment attributed with some confidence to *Haliotis cracherodii* Leach is present in collections at Ralph B. Clark Regional Park. If this specimen is referable to *H. cracherodii* Leach, then the "San Pedro" Formation in the Coyote Hills may represent the oldest fossil occurrence of this taxon. Unfortunately, the field number from which the specimen was collected lacks locality data and therefore it cannot be placed with confidence into the stratigraphic succession at Ralph B. Clark Regional Park. Previously, the oldest occurrences of *H. cracherodii* Leach are from the 735' terrace on San Nicolas Island (Vedder and Norris, 1963), which is probably less than 1 million years old (D. Muhs, written commun., 1998), and from the 13th terrace on the Palos Verdes Peninsula (Woodring and others, 1946) which Ponti (1989) suggests is middle Pleistocene (<720 ka) in age.

Family TROCHIDAE

Tegula pulligo (Gmelin) has a modern range from Sitka, Alaska, to Baja California. It is uncommon on low intertidal rocks inshore of kelp beds but more common subtidally on large algae

in kelp forests (Morris and others, 1980). It has rarely been reported as a fossil and apparently only in late Pleistocene deposits in southern California: Orange County (Bruff, 1946), San Diego County (Webb, 1937), and Los Angeles County (Arnold, 1903; Willett, 1937). This makes its occurrence here the oldest record of this taxon.

Family EPITONIIDAE

Five Epitonids have been reported from the "San Pedro" Formation in the Coyote Hills: *E. bellastrata* (Carpenter), *E. indianorum* (Carpenter), *E. sawinae* (Dall), *Opalia borealis* Keep, and *O. varicostatum* (Stearns) (questionably identified here). Only *E. indianorum* (Carpenter) and *O. varicostatum* (Stearns) are discussed below.

Epitonium indianorum (Carpenter) has been reported from Forrester Island, Alaska south to Bahia Todos Santos, Baja California Sur, Mexico (DuShane, 1979) in water depths from the intertidal zone to 120 m (McLean and Grosliner, 1996). It is reported from the "San Pedro" Formation in the Coyote Hills by Hoskins (1954) and Yerkes (1972) but the specimens on which these occurrences are based were only identified as indeterminate species during the present study. Therefore, the occurrence of *E. indianorum* (Carpenter) in the "San Pedro" Formation of the Coyote Hills, Orange County must await confirmation. Previous records of *O. varicostatum* (Stearns) are from the Pliocene of southern California; thus its occurrence in the "San Pedro" Formation of the Coyote Hills suggests a Pliocene age for the part of the Formation in which it was collected.

Family CREPIDULIDAE

Crepidula princeps (Conrad) ranges in age from late Miocene to middle Pleistocene. The middle Pleistocene age is based on its occurrence in the Timms Point Silt (Clark, 1931), which according to Lajoie and others (1991), is middle Pleistocene in age. Late Pleistocene occurrences, such as at Newport Bay (Kanakoff and Emerson, 1959), represent reworked specimens judging by their preservation and color.

Family CALYPTRAEIDAE

Much confusion exists, especially in the fossil record, between *Calyptraea spirata* (Forbes) and *C. trochiformis* (Born). According to Keen (1971) these two taxa are separable on several counts including size, color, sculpture, and distribution. *Calyptraea spirata* (Forbes) has a modern occurrence from Mazatlán, Mexico south to the Gulf of Tehuantepec, Mexico, while *C. trochiformis* (Born) occurs from Manta, Ecuador south to Valparaiso, Chile. The name *C. trochiformis* (Born) has been used for Neogene fossils in southern and central California by Grant and Gale (1931) and followed by later authors. Based on modern occurrence alone, fossil specimens from southern California are probably better referred to *C. spirata* (Forbes) *s.l.* It is likely, however, that *C. spirata* (Forbes) in the Tertiary of southern California represents a species complex of several taxa because of the wide stratigraphic range and variability exhibited by individual specimens associated with this species name. Fossil occurrence of taxa assigned to, and similar to, *C. spirata* (Forbes) in California include: *C. costellata* (Conrad) and *C. costellata panzana* Loel and Corey from the Ladera Sandstone (Arnold, 1908a *fide* Powell, 1998), the Vaqueros and Temblor formations (Loel and Corey, 1932), the Topanga Formation (Arnold, 1907), and questionably from the Jewett Sand in Kern County [Loel and Corey, 1932; Addicott, 1970 as *C. sp.*, cf. *C. spirata* (Forbes)]; *C. diabloensis* Clark from the lower San Pablo Group (Clark, 1915); *C. martini* Clark the upper San Pablo Group in Contra Costa County and the Santa Margarita Formation north of Coalinga, Kings County (Clark, 1915; Grant and Gale, 1931), and the Orinda Formation of Contra Costa County (Richey, 1943 as "cf."); *C. radians* (Lamarck) from the Purisima Formation (Martin, 1916), Foxen Mudstone [Fugler Point (=Waldrof) asphalt mine (Arnold, 1908b; Grant and Gale, 1931), the Cebada Member of the Carega Sandstone (Woodring and Bramlette, 1950) both in Santa Barbara County, the "Fernando" Formation near Newhall (English, 1914), the Fernando Formation in downtown Los Angeles (Moody, 1916), and the Pico Formation in the Puente Hills (Carson, 1926), all in Los Angeles

County; *C. spirata* (Forbes) from the Santa Margarita Formation (Addicott and others, 1978); *C. trochiformis* (Born) from the Topanga Formation (Arnold, 1907; Grant and Gale, 1931), and the Fernando Formation of Newport Bay (Zinsmeister, 1970). These taxa show overlapping stratigraphic and geographic ranges which can only be resolved with further study.

The only other Calyptraeid from the "San Pedro" Formation in the Coyote Hills is *Crucibulum spinosum* (Sowerby). McLean (1978) reports its modern occurrence as San Pedro, Los Angeles County, California south to Chile. Its occurrence here is from the upper "warm water" fauna and supports the warm water temperature interpretation of this fauna.

Family MURICIDAE

Four muricids of note are present in collections from the "San Pedro" Formation in the Coyote Hills. *Boreotrophon multicostatus* (Eschscholtz) is here considered a cold-water faunal element in that its range is mostly north of the fossil locality. McLean and Gosliner (1996) report it from Laguna Beach, Orange County, California (33.5°N) north to Kenai Peninsula, Alaska (59°N). They also reported the depth range of this taxon as intertidal to 100 m, with specimens from southern California as being submerged below 40 m. *Boreotrophon pedroana* (Arnold) described from the Pleistocene of the San Pedro area was recently shown to be extant from Santa Rosa Island (34°N) to Isla Todos Santos, Baja California Norte, Mexico (32°N) in water depths from 40 to 270 m (McLean and Gosliner, 1996). *Ocenebra coryphaena* Woodring is present in one collection from the east Coyote Hills (RMW/JRS 855). Previously this taxon was only reported from the Lomita Marl in San Pedro (Woodring and others, 1946) suggesting a middle Pleistocene age for its occurrence. But other taxa associated with it in the Coyote Hills, including the next taxon, suggest a Pliocene age. This suggests a chronologic range extension for this taxon. The last is *Maxwellia eldridgei* (Arnold) which was described from an oil company well near Newhall, Los Angeles County. Other occurrences listed by Grant and Gale (1931) are from the same area, and all occurrences were assigned to the early (lower) Pliocene (Grant and Gale, 1931). *Maxwellia eldridgei* (Arnold) is also known from the Niguel Formation in the San Joaquin Hills, southern Orange County (LACMIP collections). Valentine (1961) mentions *Maxwellia eldridgei* (Arnold) occurring in the Lomita Marl but does not cite reference, locality, or collection. Since I can find no other record of this taxon from the Lomita Marl and have not observed it there myself, its occurrence in the Lomita Marl is questioned. Discounting Valentine's reference, the species' occurrence in the "San Pedro" Formation of the Coyote Hills (as does its occurrence in the Niguel Formation) extends its stratigraphic range from possibly late Pliocene to early Pleistocene.

Here I follow McLean (1978) in considering *Ocenebra squamulifera* Carpenter and *O. fusconotata* Dall synonymous with *O. foveolata* (Hinds).

Family BUCCININAE

Neptunea tabulata (Baird) has a modern occurrence from Dixon Entrance, north of Queen Charlotte Island, British Columbia, southward to the Gulf of Santa Catalina, and off San Diego, California, in water depths between 90 m and 250 m (Nelson, 1978). This taxon suggests cooler water conditions than present in shallow water along the adjacent coast today.

Family PISANIINAE

Two extinct *Calicantharus* are found in the "San Pedro" Formation in the Coyote Hills. *Calicantharus fortis* (Carpenter) is found questionably in the upper, warm water, fauna and has been reported in rocks of late Miocene [Castaic Formation (Stanton, 1966)] to late Pleistocene [Palos Verdes Sands and San Pedro Formation (Woodring and others, 1946)] from southern and central California. *Calicantharus humerosus* (Gabb) (questionably identified here) is found presumably in the middle, cool water, fauna (based on stratigraphic position) and has been previously reported from early Pliocene Pancho Rico Formation (Durham and Addicott, 1965) to the late

Pliocene to Pleistocene Saugus Formation (Hetherington, 1957).

Family NASSARIIDAE

Keen (1971) reports *Nassarius cerritensis* (Arnold) as living along the "Outer coast of Baja California through the Gulf of California to Bahia San Luis Gonzaga and Guaymas, in depths of 35 to 55 m," and is here considered an extra-limital southern taxon. It is a common warm water indicator taxon in the Pleistocene of southern California and here occurs in the upper fauna.

Nassarius grammatus (Dall) has been recognized from the "San Pedro" Formation in the Coyote Hills in collections at Pomona College. According to Addicott (1965) this species is "one of the more widespread and characteristic mollusks which occur in formations generally considered to be Pliocene in the standard Pacific coast provincial classification...."

Family OLIVIDAE

Olivella pedroana (Arnold) has been reported from the "San Pedro" Formation in the Coyote Hills by Hoskins (1954) and Yerkes (1972). Specimens in the collections at Pomona College are here identified as *O. baetica* Carpenter and *O. biplicata* (Sowerby) so the occurrence of *O. pedroana* (Arnold) is in doubt and must await confirmation.

Family CANCELLARIIDAE

Three extinct Cancellarids occurs in the "San Pedro" Formation of the Coyote Hills: *Cancellaria arnoldi* (Dall), *C. fergusonii* Carson, and *C. tritonidae* (Gabb). According to Powell (1998) *C. arnoldi* (Dall) is found in late Pliocene to possibly early Pleistocene formations from central California to southern California. *Cancellaria fergusonii* Carson (syn. *C. sanctae-mariae* Carson) also has a restricted stratigraphic range from late Pliocene to early Pleistocene from the Careaga Sandstone of Santa Barbara County, and the Saugus Formation at Barlow's Ranch, Ventura County (Carson, 1926). It is also found in the Niguel Formation in Orange County (LACMIP and UCR collections) and San Diego Formation in San Diego County (LACMIP collections). *Cancellaria tritonidae* (Gabb) s.l. occurs in rocks from early (?) Pliocene to late Pleistocene (Grant and Gale, 1931; Powell, unpublished data) in southern California and Baja California Norte.

Family TURRIDAE

Twelve turrids have been reported from the "San Pedro" Formation in the Coyote Hills: *Clathromangelia variegata* (Carpenter), *Clathurella* sp., "*Crassispira montereyensis*" (Stearns), *C. semiinflata* (Grant and Gale), *C. zizyphus* Berry, *Crockerella conradiana* (Gabb), *Cymatosyrinx hemphilli* (Stearns), *Megasurcula carpenteriana* (Gabb), *Ophiodermella mercedensis* (Martin), *O. inermis* (Reeve), *Pseudomelatoma* sp. cf. *P. pencillata* (Carpenter) and indeterminate specimens referable to the family Turridae. Judging from a photograph in Hoskins (1954) [and followed by Yerkes (1972)] *Crassispira montereyensis* (Stearns) is actually *C. zizyphus* Berry. *Crassispira zizyphus* Berry is an extinct taxon described from the Lomita Marl in the San Pedro area, and also known from the Pico Formation in the Whittier Hills, Los Angeles County (Pomona College loc. 136, *vide* USGS report on referred fossils by W. Addicott, O-68-9M; 3/1968), the Fernando Formation at Newport Bay, Orange County (LACMIP and UCR collections), and the Niguel Formation in the San Joaquin Hills, Orange County (LACMIP collections). These occurrences suggest a late Pliocene to middle Pleistocene age range for this taxon. *Crassispira semiinflata* (Grant and Gale) was reported and illustrated from the "San Pedro" Formation in the Coyote Hills by RMW Paleo Associates (1996) but was not found in any collections examined. Based on the illustration this species is expected in the "San Pedro" Formation in this area, but its occurrence needs to be verified. *Ophiodermella mercedensis* (Martin) was reported from the "San Pedro" Formation in the Coyote Hills by Hoskins (1954) and Yerkes (1972). Woodring and Bramblett (1950) considered *Ophiodermella mercedensis* (Martin) to be a replacement name for *O. graciosa* (Arnold, 1907), but both are distinct taxa and forms a stratigraphic succession (Yancey, 1978) in central California. The occurrence of *O.*

mercedensis (Martin) in the "San Pedro" Formation in the Coyote Hills is south of its known geographic range and specimen(s) could not be located in collections. One specimen attributed to this species in the collections at Pomona College was identifiable only to genus. Therefore, its occurrence in the "San Pedro" Formation is questioned until better specimens can be examined, and it is not used for age or environmental interpretations.

Family TEREBRIDAE

Examination of collections at Pomona College indicated that Hoskins' (1954) specimens of *Terebra pedroana* Dall are referable to *T. danai* Berry which was described a few years after Hoskins' (1954) thesis.

Family ACTEONIDAE

A single internal mold identified by Hoskins (1954) as *Acteon traski* Stearns is herein referred to *Acteon?* sp. indeterminate.

Phylum ARTHROPODA Class CRUSTACEA

Family LEUCOSIIDAE

Randallia ornata (Randall, 1839) has been reported from late Pleistocene deposits in southern California (Rathbun, 1926) at Potrero Canyon and Long Wharf in Santa Monica, Nob Hill (lumber yard) and Deadman Island in San Pedro, Signal Hill in Long Beach, and Spanish Bight in San Diego Bay. The specimen reported here records the oldest occurrence of this taxon. Also of interest is that of the two specimens collected as float from the western Coyote Hills one represents a male the other has yet to be determined.

Phylum ECHINODERMATA Class ECHINOIDEA

Family DENDRASTERIDAE

According to Grant and Hertlein (1938) *Dendraster venturaensis* Kew has been reported from the Pliocene of northern Los Angeles County and Ventura County [Santa Clara Valley, north of San Fernando Valley, Las Posas Hills (Kew, 1920), and "Ventura 'Saugus'" and "Kalorama horizon" (Pressler, 1929)]. It is interesting that Grant and Hertlein (1938) cite this species as co-occurring with *Patinopecten caurinus* Gould and stratigraphically above outcrops containing *Pecten bellus* (Conrad), as it occurs with both taxa in the Coyote Hills. Although this taxon appears to have a restricted stratigraphic range, some modern specimens of *D. excentricus* Eschscholtz are indistinguishable from this taxon and it is likely to be placed in synonymy at a later date (R. Mooi, personal communication, 1998).

As discussed above, specimens herein referred to *Dendraster venturaensis* Kew fall within the range of variability of modern *Dendraster excentricus* Eschscholtz, so the occurrence of specimens questionably referred to the latter are expected. The specimen illustrated by Hoskins (1954) as *D. cf. D. excentricus* Eschscholtz is here referred to *D. venturaensis* Kew.

Appendix 2: Fossil localities and faunal list

Because of the large number of fossil localities and taxa present in the “San Pedro” Formation of the Coyote Hills the occurrence data is present here as a list. An oversize table, nearly 2 m long and 1 wide, of the occurrence data can be obtained by contacting the lead author.

Unfortunately nearly all fossil sites with the exception of those in the Ralph C. Clark Regional Park have been lost to development. Fossil localities are illustrated for the north West Coyote Hills in Figure 6, the southern West Coyote Hills, including Ralph C. Clark Regional Park in Figure 7, the eastern West Coyote Hills in Figure 8, and for the East Coyote Hills in Figure 9. The stratigraphic occurrence of fossil localities is presented for the northern West Coyote Hills in Figure 2, for the southern West Coyote Hills, including Ralph C. Clark Regional Park in Figure 3, and the East Coyote Hills in Figure 4.

All specimens were identified by C. Powell, II unless otherwise noted.

Los Angeles County Museum of Natural History

LACMIP 477. Pleistocene invertebrate fossils collected by Mr. Ojeda from a locality described on the accession data sheet as “Excavations on top of hill at the extension of Rosecrans Ave. after it crossing the Beach Blvd., at the LA-Orange County borderline.” Locality further detailed by Paul Langenwalter as “... N side of Rosecrans, 500-600’ E of Buena Park underground reservoir and 500-600’ N of Rosecrans. Barrow pit used by California Division of Highways; now Los Coyotes Regional Park...” Collected by Mr. Ojeda. Upper fauna.

Mollusca

Bivalvia

Amiantis callosa (Conrad)
Argopecten ventricosus (Sowerby)
Chione undatella (Sowerby)
Leporimetis obesa (Deshayes)
Mactra californica Conrad
Ostrea conchaphila Carpenter
Tivela stultorum (Mawe)
Trachycardium panamense (Sowerby)
Tresus nuttallii (Conrad)

Gastropoda

Bursa californica (Hinds)
Conus californicus Reeve
Crucibulum spinosum (Sowerby)
Terebra sp.

LACMIP 4560. Label reads “... at bottom of Coyote Creek, E of Highway 39 [Beach Blvd.], N of Rosecranz Ave., near LA-Orange Co. line. Collected G. L. Paul, 2/10/65.” Middle fauna.

Mollusca

Bivalvia

Patinopecten caurinus (Gould)

LACMIP 6210. (=LACMV 5011). Elevation between 64 m (210’) and 65.6 m (215’) in a 25-cm thick, poorly sorted, silty to medium-grained arkosic to subarkosic, biotitic, very friable sandstone. Located approximately 4-5 m stratigraphically below LACMIP 6211 (=LACMV 5012) and approximately 17 m stratigraphically below the base of the overlying Coyote Hills Formation. NE1/4, SE1/4, NW1/4, SW1/4, NE1/4 of section 24, T. 3 S., R. 11 W. La Habra 7.5’ Quadrangle. Fullerton, Orange County, CA. Diana Weir and Marilyn Morgan, collectors. Upper fauna.

Mollusca

Bivalvia

Cardiidae, indeterminate
Chlamys hastata (Sowerby)
Chlamys sp.
Cryptomya californica (Conrad)
Cyathodonta pedroana Dall

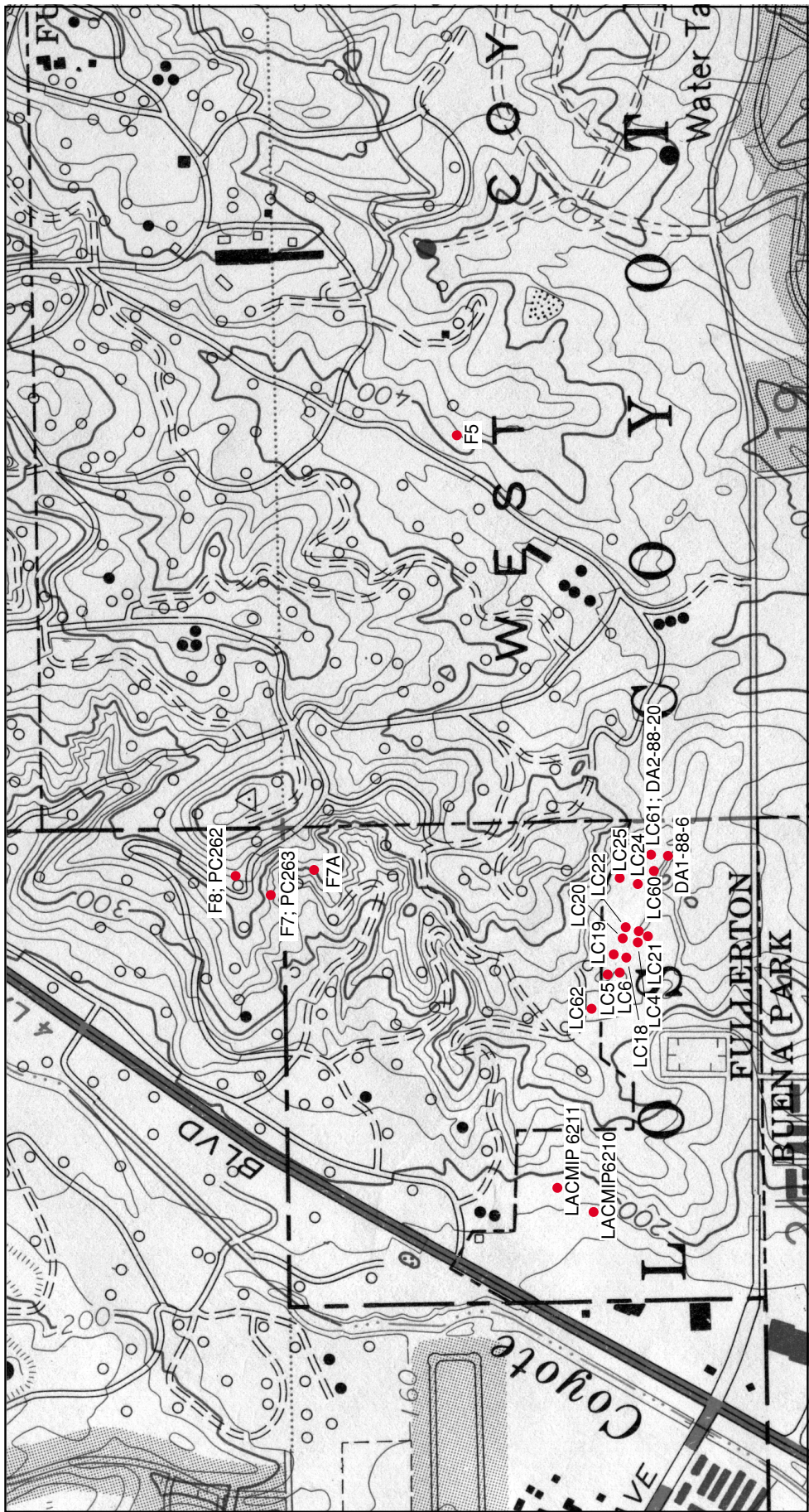


Fig. 7.—Fossil localities in the southern West Coyote Hills (including Ralph C. Clark Regional Park), La Habra 7.5' USGS quad-range, southern California.

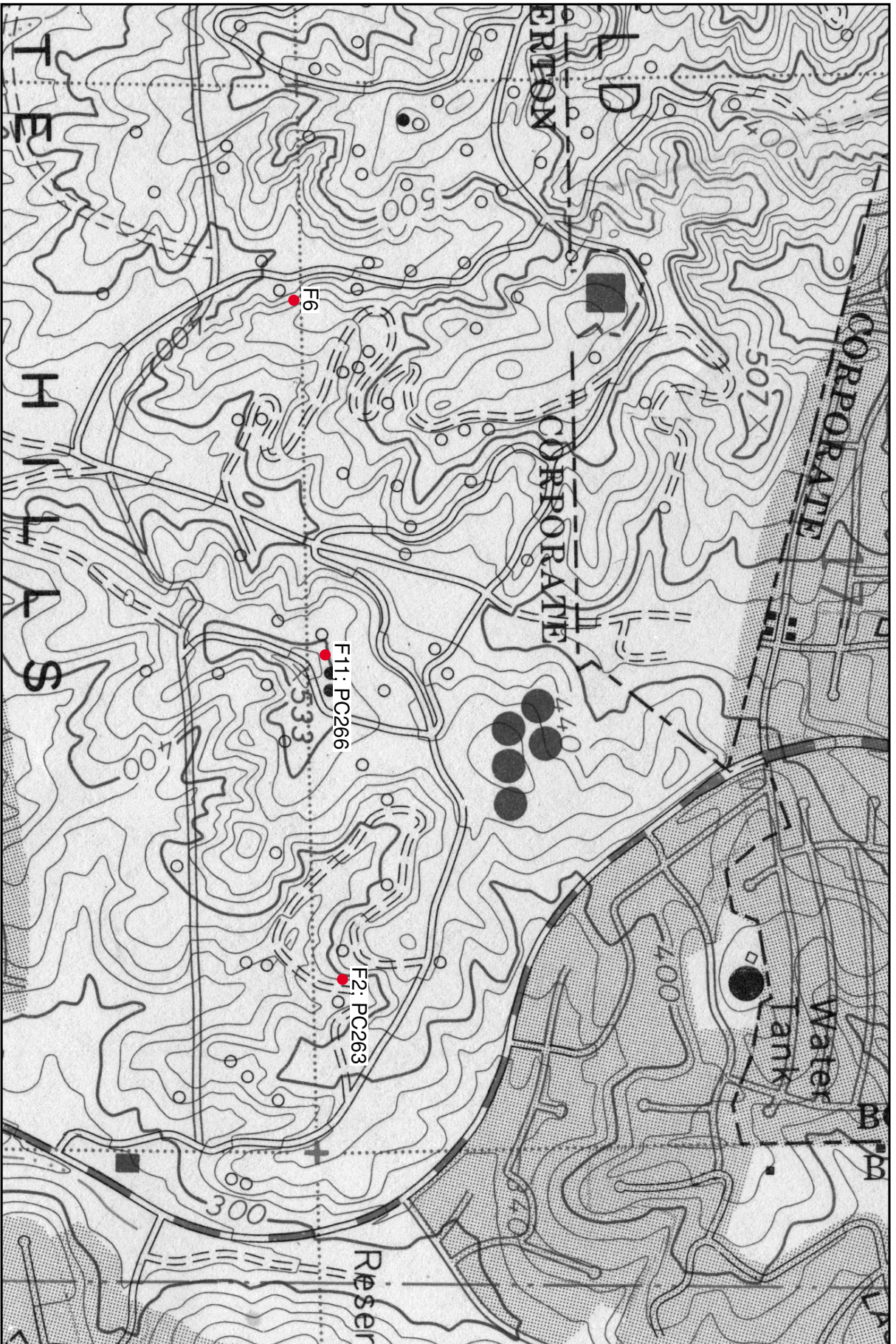


Fig. 8.—Fossil localities in the east West Coyote Hills, La Habra 7.5' USGS quadrangle, southern California..

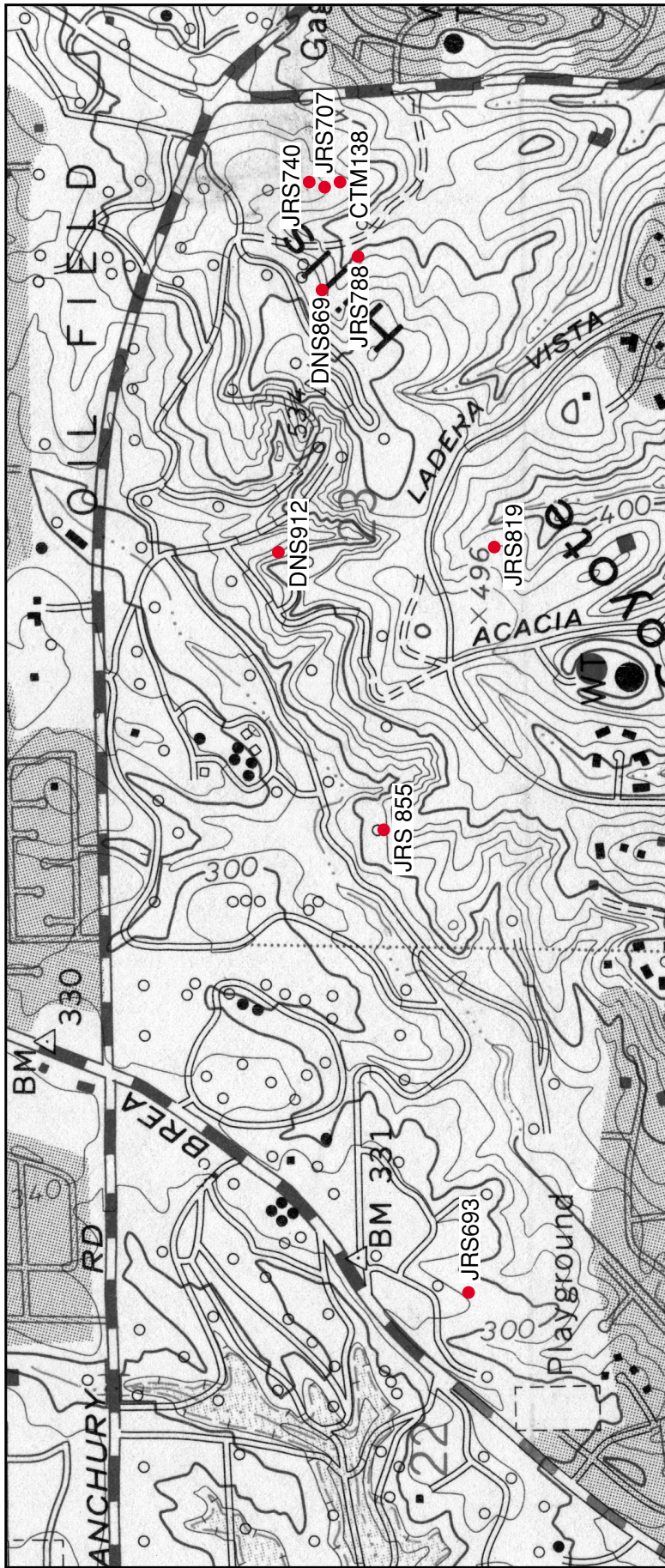


Fig. 9.—Fossil localities in the East Coyote Hills, La Habra 7.5' USGS quadrangle, southern California.

Diplodonta orbellus (Gould)
Doxax californicus (Conrad)
Gari edentula (Gabb)
Leporimetis obesa (Deshayes)
Lucinisca nuttalli (Conrad)
Lucinoma annulata (Reeve)
Modiolus rectus (Conrad)
Nuculana taphria (Dall)
Panope abrupta (Conrad)
Pododesmus macrochisma (Deshayes)
Saxidomus sp., cf. *S. nuttalli* Conrad
Trachycardium quadragenarium (Conrad)

Gastropoda

Astrea gibberosa (Dillwyn)
Astrea undosa (Wood)
Calliostoma annulatum (Lightfoot)
Calicantharus fortis (Carpenter)
Crassispira zizyphus Berry
Crepidula adunca Sowerby
Crucibulum? sp.
Epitonium bellastrata (Carpenter)
Fusinus sp.
Haminoea vesicula (Gould)
Megasurcula carpenteriana (Gabb)
Mitra idea Melvill
Nassarius fossatus (Gould)
Nassarius mendicus (Gould)
Nassarius perpinguis (Hinds)
 Naticidae, indeterminate
Neverita reclusiana (Deshayes)
Ocenebra foveolata (Hinds)
Olivella baetica Carpenter
Olivella biplicata (Sowerby)
Ophiodermella sp.

Scaphopoda

Dentalium neohexagonum Pilsbry & Sharp
Dentalium sp.

Arthropoda

Crustacea

Balanus? sp.
 Indeterminate crab parts

Echinodermata

Echinoidea

Dendraster sp.

LACMIP 6211 (=LACMV 5012). Situated at an elevation between 68 m (222') and 73 m (240') above sea level is a 0.6 m (2-foot) thick, poorly sorted, pebble conglomerate with numerous articulated, disarticulated and fragmented mollusk shells, about 12 m to 13 m below the base of the overlying Coyote Hills Formation. NE1/4, SE1/4, NW1/4, SW1/4, NE1/4 of section 24, T. 3 S., R. 11 W. La Habra 7.5' Quadrangle. Fullerton, Orange County, CA. Diana Weir and Marilyn Morgan, collectors. Upper fauna (?).

Mollusca

Bivalvia

Cardiidae, indeterminate
Chlamys hastata (Sowerby)
Chlamys sp.
Compsomyx subdiaphana (Carpenter)?
Crassadoma giganteus (Gray)
Leporimetis? sp.
Leptopecten latiauratus (Conrad)
 Lithophagidae, indeterminate
Lucinisca nuttalli (Conrad)
 Lucinidae, indeterminate

Nuculana taphria (Dall)
Panope abrupta (Conrad)
Pecten bellus (Conrad)
Pododesmus macrochisma (Deshayes)
Tellinidae, indeterminate
Trachycardium quadragenarium (Conrad)

Gastropoda

Asperiscala bellastrata (Carpenter)
Astyris gausapata (Gould)
Bittium sp.
Calliostoma annulatum (Lightfoot)
Calliostoma sp., cf. *C. canaliculatum* (Lightfoot)
Calliostoma sp.
Crepidula sp.
Epitonium sawinae (Dall)
Megasurcula carpenteriana (Gabb)
Nassarius sp.
Naticidae, indeterminate
Olivella sp., cf. *O. baetica* Carpenter

Scaphopoda

Dentalium neohexagonum Pilsbry & Sharp

Echinodermata

Echinoidea

Dendraster sp.

Arthropoda

Crustacea

Cancer sp.
Indeterminate crab parts

Ralph B. Clark Regional Park

Field No.: LC-1. Stratigraphic position uncertain; but sample probably collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Gastropoda
Astrea sp.

Field No.: LC-4. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna.

Mollusca
Bivalvia
Cardiidae, indeterminate
Lucinisca nuttalli (Conrad)
Lucinoma annulata (Reeve)
Macoma secta (Conrad)
Panope sp.
Patinopecten caurinus (Gould)
Spisula sp.

Gastropoda

Astrea gibberosa (Dillwyn)
Conus sp., cf. *C. californicus* Reeve
Crepidula princeps (Conrad)
Nassarius sp.
Naticidae, indeterminate

Arthropoda

Crustacea

Cancer sp.
indeterminate leg fragments

Field No.: LC-5. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Echinodermata
Echinoidea
Dendraster venturaensis Kew

Field No.: LC-6. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Modiolus? sp.
Gastropoda
Neptunea tabulata (Baird)
Arthropoda
Crustacea
Cancer sp.

Field No.: LC-18. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Cardiidae, indeterminate
Mytilus californianus Conrad
Tresus nuttalli (Conrad)
Gastropoda
Calliostoma sp. cf. *C. variegatum* Carpenter
Arthropoda
Balanus sp.

Field No.: LC-19. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Echinodermata
Echinoidea
Dendraster venturaensis Kew

Field No.: LC-20. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Identified by C. Powell, II

Mollusca
Bivalvia
Lucinidae, indeterminate
Pododesmus macrochisma (Deshayes)
Gastropoda
Calicantharus sp., cf. *C. humerosus* (Gabb)
Fusinus? sp.
Nassarius sp., cf. *N. grammatus* (Dall)
Naticidae indeterminate
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Echinodermata
Echinoidea
Dendraster venturaensis Kew

Field No.: LC-21. Sample collected between 52 m and 54 m below Coyote Hills Formation and "San Pedro" Formation boundary in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Upper fauna (?).

Mollusca

Bivalvia

Cardiidae, indeterminate
Chlamys hastata (Sowerby)
Crassinella? sp.
Lucinisca nuttalli (Conrad)
Lucinoma annulata (Reeve)
Macoma nasuta (Conrad)
Macoma secta (Conrad)
Macoma sp.
Modiolus rectus (Conrad)
Nuculana taphria (Dall)
Nuculana sp.
Nutricula tantilla (Gould)?
Ostrea conchaphila Carpenter
Panope abrupta Conrad
Protothaca? sp.
Solen sp.
Teredinidae, indeterminate
Tresus nuttalli (Conrad)

Gastropoda

Acteocina sp., cf. *culcitella* (Gould)
Acteocina sp.
Astrea sp.
Astyris gausapata (Gould)
Boreotrophon? sp.
Calliostoma sp.
Calliostoma sp. cf. *C. variegatum* Carpenter
Conus californicus Reeve
Crepidula sp., cf. *C. adunca* Sowerby
Crepidula sp., cf. *C. princeps* (Conrad)
Crockerella? sp.
Epitonium sawinae (Dall)
Fusinus? sp.
Homalopoma paucicostatum (Dall)
Lacuna sp., cf. *L. unifasciata* Carpenter
Lirobittium sp., cf. *L. lomaense* (Bartsch)
Nassarius sp., cf. *N. grammatus* (Dall)
Nassarius sp.
Naticidae indeterminate
Neptunea tabulata (Baird)
Neverita reclusiana (Deshayes)?
Ocenebra sp., cf. *O. foveolata* (Hinds)
Olivella sp., cf. *O. baetica* Carpenter
Olivella sp., cf. *O. biplicata* (Sowerby)
Opalia borealis Keep
Polinices lewisii (Gould)
Turbonilla sp.
Turridae, indeterminate

Scaphopoda

Dentalium neohexagonum Pilsbry & Sharp
Dentalium sp.

Arthropoda

Crustacea

Cancer sp.
crab leg fragments
Coronulidae, indeterminate (whale barnacles)

Echinodermata

Echinoidea
Dendraster venturaensis Kew
Indeterminate echinoid spines

Field No.: LC-22. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Chlamys sp., cf. *C. hastata* (Sowerby)
Chlamys sp., cf. *C. rubida* (Hinds)
Chlamys sp.
Pododesmus macrochisma (Deshayes)
Gastropoda
Cantharus sp.
Conus sp., cf. *C. californicus* Reeve
Nassarius sp.
Naticidae indeterminate
Neptunea tabulata (Baird)
Olivella sp.

Field No.: LC-24. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Chlamys rubida (Hinds)
Pododesmus? sp.

Field No.: LC-25. Located 30 m to 52 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Pododesmus sp.

Field No.: LC-60. Sample collected between 78.5 m and 78.85 m below Coyote Hills Formation and "San Pedro" Formation boundary in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: LC-62. Located 2 m to 32 m below contact between Coyote Hills Formation and "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Chlamys sp., cf. *C. hastata* (Sowerby)

Field No.: LC-68. Stratigraphic position uncertain, but sample probably collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Gastropoda
Haliotis sp., cf. *H. cracherodii* Leach

Field No.: LC-83. Stratigraphic position uncertain, but sample probably collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna (?).

Mollusca
Bivalvia
Patinopecten sp.

Field No.: LC-84. Stratigraphic position uncertain, but sample probably collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Pododesmus sp.
Echinodermata
Echinoidea
Dendraster venturaensis Kew

Field No.: LC-85. Stratigraphic position uncertain, but sample probably in the upper 50 m of "San Pedro" Formation in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: DA-1-88-6. Sample collected between 82.35 m and 83.35 m below Coyote Hills Formation and "San Pedro" Formation boundary in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Scaphopoda
Dentalium sp.

Field No.: DA-2-88-20 Sample collected between 79.85 m and 82.35 m below Coyote Hills Formation and "San Pedro" Formation boundary in lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: ULH 88-2. Stratigraphic position uncertain, but sample probably collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown. Middle fauna (?)

Mollusca
Bivalvia
Cardiidae, indeterminate
Chlamys sp.
Lucinoma annulata (Reeve)
Luciniscia nuttalli (Conrad)
Macoma nasuta (Conrad)?
Macoma secta (Conrad)
Nuculana sp.
Pandora sp.
Patinopecten sp.
Gastropoda
Astyris gausapata (Gould)

Bittium sp.
Conus californicus Reeve?
Euspira pallida (Broderip & Sowerby) (operculum)
Lacuna sp., cf. *L. unifasciata* Carpenter
Lirularia sp.
Nassarius sp., cf. *N. grammatus* (Dall)
Olivella baetica Carpenter
Olivella biplicata (Sowerby)
Sinum scopulosum (Conrad)
Turbonilla sp.
 Turridae, indeterminate
Volvulella cylindrica (Carpenter)
 Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp

Field No.: Float. Stratigraphic position uncertain, but sample collected from lower bluff behind baseball diamonds across Rosecrans Blvd. from Ralph B. Clark Regional Park headquarters, 8800 Rosecrans Blvd., Buena Park, Orange County, CA. Collector unknown.

Arthropoda
 Crustacea
 Randallia ornata (Randall)

Claremont College, Department of Geology [Also referred to as Pomona College. These are the collections from Hoskins (1954) thesis. Unfortunately when examined in the summer of 1999, several boxes appear to be missing. The boxes present were numbered 4 to 9].

PC 262. Locality description from Hoskins (1954). "10,000' north and 7,200' E of intersection of 118°00' W longitude and 33°52' 30" N latitude at an elevation of 375'. Coyote Hills silt in cut for Emery #79", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 1. Middle fauna.

Mollusca
 Bivalvia
 Chlamys hastata (Sowerby)
 Compsomyax subdiaphana (Carpenter)
 Cyathodonta sp., cf. *C. pedroana* Dall
 Cyclocardia sp., aff. *C. occidentalis* (Conrad) of Woodring and others
 Mytilus trossulus Gould
 Pandora wardiana Adams
 Saxidomus nuttalli Conrad
 Solamen sp., cf. *S. columbianum* (Dall)
 Solen sp., cf. *S. sicarius* Gould
 Thracia sp.
 Gastropoda
 Lirobittium sp.
 Neptunea tabulata (Baird)
 Olivella biplicata (Sowerby)

PC 263. Locality description from Hoskins (1954). "About 250' SW of F1 and about 40' higher in cut for Emery #65. In transition zone," Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 2. Middle fauna.

Mollusca
 Bivalvia
 Lucinoma annulata (Reeve)
 Mytilus trossulus Gould
 Nutricula sp.
 Pandora sp.
 Panope sp.
 Patinopecten caurinus (Gould)
 Solen sp.
 Thracia sp.
 Trachycardium quadragenarium (Conrad)
 Gastropoda
 Crepidula princeps Conrad

PC 264. Locality description from Hoskins (1954). "14,100' N and 12,750' E of same reference point at an elevation of about 285'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 3. Upper fauna.

Mollusca

Bivalvia

Argopecten sp.
Chione sp., cf. *C. californiensis* (Broderip)
Chlamys sp., cf. *C. anapleus* Woodring
Cryptomya californica (Conrad)
Donax gouldii Dall
Glycymeris septentrionalis Middendorff
Leporimetis obesa (Deshayes)
Leptopecten latiauratus (Conrad)
Lucinisca nuttalli Conrad
Macoma indentata Carpenter
Macoma secta (Conrad)
Mactromeris hemphillii (Dall)
Modiolus sp.
Ostrea conchaphila (Carpenter)
Pandora sp., cf. *P. punctata* Conrad
Panope abrupta (Conrad)
Parvilucina sp., cf. *P. approximata* (Dall)
Periploma planiusculum Sowerby
Protothaca tenerrima (Carpenter)
Spisula sp., cf. *S. catilliformis* Conrad
Tivela stultorum (Mawe)
Trachycardium quadragenarium (Conrad)
Tresus nuttallii (Conrad)

Gastropoda

Acanthina spirata (Blainville)
Acteocina sp.
Alia carinata (Hinds)
Balcis sp.
Bursa californica (Hinds)
Cancellaria fergusonii Carson
Conus californicus Reeve
Crassispira zizyphus Berry
Crepidula sp.
Crucibulum spinosum (Sowerby)
Cryptonatica affinis (Gmelin)
Epitonium sp.
Erato vitellina Hinds
Globodrilla hemphilli (Stearns)
Lacuna unifasciana Carpenter
Littorina sp.
Mitrella sp.
Nassarius sp., cf. *N. cerritensis* (Arnold)
Nassarius fossatus (Gould)
Nassarius sp., cf. *N. insculpta* (Carpenter)
Nassarius sp., cf. *N. mendicus* (Gould)
Naticidae, indeterminate
Neptunea tabulata (Baird)
Neverita reclusiana (Deshayes)
Olivella baetica Carpenter
Olivella biplicata (Sowerby)
Ophiodermella? sp.
Terebra danai Berry
Turridae, indeterminate
Volvarina? sp.

Scaphopoda

Dentalium neohexagonum (Pilsbry & Sharp)
Dentalium sp.

Arthropoda
 Crustacea
 Balanus? sp.
Echinodermata
 Echinoidea
 Dendraster sp.

PC 265. Locality description from Hoskins (1954). "11,950' N and 12,450' E of reference point at an elevation of 430'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 4. Upper fauna (?).

Mollusca
 Bivalvia
 Chione? sp.
 Cyathodonta sp., cf. *C. pedroana* Dall
 Lucinidae, indeterminate
 Lucinoma annulata (Reeve)
 Macoma indentata Carpenter
 Macoma secta (Conrad)
 Macoma? sp.
 Miodontiscus prolongatus (Carpenter)
 Mytilus sp., cf. *M. californianus* Conrad
 Mytilus sp., cf. *M. coalingensis* Arnold
 Nuculana taphria (Dall)
 Panope abrupta (Conrad)
 Pecten bellus (Conrad)
 Semele incongrua Carpenter
 Semele sp.
 Thracia sp., cf. *T. trapezoides* Conrad
 Trachycardium quadragenarium (Conrad)
 Gastropoda
 Boreotrophon? sp.
 Calliostoma gemmulatum Carpenter
 Calliostoma sp.
 Calyptraea sp.
 Crepidula sp., cf. *C. onyx* Sowerby
 Crepidula sp. cf. *C. princeps* Conrad
 Crockerella sp., cf. *C. conradiana* (Gabb)
 Cylichnella attonsa Carpenter
 Epitonium sp.
 Halistylus pupoideus (Carpenter)
 Lirobittium sp.
 Nassarius sp.
 Naticidae, indeterminate
 Neptunea tabulata (Baird)
 Neverita reclusiana (Deshayes)
 Ocenebra foveolata (Hinds)
 Olivella biplicata (Sowerby)
 Olivella pedroana Conrad
 Scaphopoda
 Dentalium neohexagonum (Pilsbry & Sharp)
 Dentalium sp.
Arthropoda
 Crustacea
 Indeterminate crab parts
Echinodermata
 Echinoidea
 Dendraster sp.

PC 266. Locality description from Hoskins (1954). "10,150' N and 15,500' E of reference point at an elevation of 500'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 5.

Mollusca
Bivalvia
Gari sp.
Lucinidae, indeterminate
Macoma sp., cf. *M. secta* (Conrad)
Pecten bellus (Conrad)
Pododesmus macrochisma (Deshayes)
Siliqua sp.
Tellina sp., cf. *T. bodegensis* Hinds
Gastropoda
Acteon? sp.
Calliostoma sp.
Cancellaria? sp.
Conus sp.
Fusinus sp., cf. *F. arnoldi* Cossman
Nassarius sp., cf. *N. fossatus* (Gould)
Nassarius sp., cf. *N. grammatus* (Dall)
Nassarius sp.
Naticidae, indeterminate
Ocenebra sp.

No PC number. Locality description from Hoskins (1954). "13,000' N and 11,250' E of reference point at an elevation of 400'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 6.

Mollusca
Bivalvia
Mytilus sp., cf. *M. trossulus* Gould
Panope sp.
Pecten bellus (Conrad)
Pododesmus macrochisma (Deshayes)
Saxidomus? sp.
Solen sp.
Trachycardium sp.
Tresus? sp.
Gastropoda
Calliostoma sp.
Conus californicus Reeve
Crepidula princeps Conrad
Megasurcula carpenteriana (Gabb)

No PC number. Locality description from Hoskins' (1954) thesis. "10,250' N and 17,100' E of reference point at an elevation of 380'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 7.

Mollusca
Bivalvia
Macoma? sp.
Indeterminate fragments

PC 267. Locality description from Hoskins (1954). "11,300' N and 8,900' E of reference point at an elevation of 500'. In San Pedro Sand (?)", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field no. 8. Middle fauna.

Mollusca
Bivalvia
Chlamys sp., cf. *C. behringiana* (Middendorff)
Compsomyax subdiaphana (Carpenter)
Cyclocardia sp., aff. *C. occidentalis* (Conrad) of Woodring and others

Glycymeris septentrionalis Middendorff
Humilaria kennerleyi (Reeve)
Nutricula sp.
Pandora sp., cf. *P. wardiana* Adams
Patinopecten caurinus (Gould)
Pododesmus macrochisma (Deshayes)
Gastropoda
Nassarius sp., cf. *N. fossatus* (Gould)

PC 268. Locality description from Hoskins (1954). "11,800' N and 11,250' E of reference point at an elevation of 475'. In San Pedro Sand (?) about 300' W of F4", Coyote Hills, Orange County, CA. Collected by Cortez Hoskins, circa. early 1950's, field No. F10.

Mollusca
Bivalvia
Veneridae, indeterminate
Gastropoda
Crepidula princeps Conrad
Fusinus sp., cf. *F. arnoldi* Cossman
Turritella sp.

RMW Paleo Associates RMW Paleo Associates fossil localities can be located on Figure 6 for the north West Coyote Hills and Figure 9 for the East Coyote Hills.

Map measurements are ± 0.4 km; section measurements are ± 2 m.

Field No.: RMW/CTM 138. "Fine grained silt. Coyote Hills Formation. Location: Grisalli cut, south and below restaurant on ridge, elevation 395' [120 m]." Locality located in former oil field about 0.24 km SW of intersection of State College Blvd. and Bastanchury Rd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Chris Morgan, 6/10/94.

Mollusca
Bivalvia
Indeterminate bivalve

Field No.: RMW/DNS 869. "Sandstone concretion. San Pedro Formation. Location: large cut facing State College, elevation 442'." Locality located in former oil field about 0.36 km SW of intersection of State College Blvd. and Bastanchury Rd. and 0.14 km ESE of triangulation station 543, East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 6 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 7/12/94. Lower fauna (?).

Annelida
Polychaeta
Serpulid, indeterminate
Mollusca
Bivalvia
Dendostrea? sp., aff. *D? vespertina* (Conrad)
Pectinidae indeterminate
"Ostrea" sp.
Gastropoda
Astyris gausapata (Gould)
Olivella sp., cf. *O. baetica* Carpenter

Field No.: RMW/DNS 1118. "Tan oxidized siltstone and sand. San Pedro Formation. Location: next to well MC259, elevation 345' [105 m]." Locality located in former oil field about 0.96 km S of Imperial Highway 0.71 km E of its intersection with Beach Blvd. and 1.18 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation and within a few meters of the Coyote Hills contact. Collected by David Stevens, 4/1/97.

Mollusca
Bivalvia
Pecten bellus (Conrad)

Field No.: RMW/DNS 1139. "Friable white fine sand. San Pedro Formation. Location: old school site in main canyon, elevation 420' [130 m]." Locality located in former oil field about 0.54 km S of Imperial Highway 0.34 km E of its intersection with Beach Blvd. and 0.62 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 65 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 6/11/97.

Mollusca
Bivalvia
 Pecten bellus (Conrad)
Gastropoda
 Nassarius sp.
 Naticidae, indeterminate
 Olivella biplicata (Sowerby)

Field No.: RMW/DNS 1146. "Gray pebbly sandstone. San Pedro Formation. Location: buttress by crib wall, elevation 430' [130 m]." Locality located in former oil field about 0.98 km S of Imperial Highway 0.57 km E of its intersection with Beach Blvd. and 1.14 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 7/1/1997.

Mollusca
Bivalvia
 Pecten bellus (Conrad)
 Tresus nuttalli (Conrad)
Gastropoda
 Fusinus sp., cf. *F. barbarensis* (Trask)
 Nassarius sp., cf. *N. perpinguis* (Hinds)
 Naticidae, indeterminate
 Olivella biplicata (Sowerby)
Echinodermata
Echinoidea
 Dendraster sp.

**Field No.: RMW/DNS 1147 [= RMW/DNS 1146]. "Gray pebbly sandstone. San Pedro Formation. Location: buttress by crib wall, elevation 430' [130 m]." Locality located in former oil field about 0.98 km S of Imperial Highway 0.57 km E of its intersection with Beach Blvd. and 1.14 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 7/1/1997.

Mollusca
Bivalvia
 Macoma? sp.
 Pectinidae, indeterminate
Gastropoda
 Astyris gausapata (Gould)
 Conus californicus Reeve
 Nassarius mendicus (Gould)
 Nassarius sp., cf. *N. perpinguis* (Hinds)
 Naticidae, indeterminate
 Ocenebra sp., cf. *O. foveolata* (Hinds)
 Olivella biplicata (Sowerby)
Echinodermata
Echinoidea
 Dendraster sp.

Field No.: RMW/DNS 1151. "Hard shelly sand. San Pedro Formation. Location: key cut 1/2 way down main ridge, elevation 365' [111 m]." Locality located in former oil field about 0.71 km S of Imperial Highway 0.48 km E of its intersection with Beach Blvd. and 0.85 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 77 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 7/16/97.

Mollusca
Bivalvia
 Cardiidae, indeterminate

Cyathodonta pedroana Dall
Lucinoma annulata (Reeve)
Panope abrupta (Conrad)
Pecten bellus (Conrad)
 Tellinid, indeterminate
 Gastropoda
Astyris gausapata (Gould)
Conus californicus Reeve
Crepidula princeps Conrad
Nassarius mendicus (Gould)
 Naticidae, indeterminate
Olivella biplicata (Sowerby)
Ophiodermella sp.
Turritella cooperi Carpenter
 Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
 Arthropoda
 Crustacea
 Indeterminate crab parts

Field No.: RMW/DNS 1175. "Tan siltstone. San Pedro Formation. Location: West end of site, elevation 370' [110 m]." Locality located in former oil field about 1.15 km S of Imperial Highway 0.52 km E of its intersection with Beach Blvd. and 1.29 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 16 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 11/20/97.

Annelida
 Polychaeta
 Serpulidae, indeterminate
 Mollusca
 Bivalvia
 Cardiidae, indeterminate

Field No.: RMW/DNS 1176. "Gray to tan siltstone. San Pedro Formation. Location: ridge between Canyons 3 and 4, elevation 335' [102 m]." Locality located in former oil field about 0.61 km S of Imperial Highway 0.14 km E of its intersection with Beach Blvd. and 0.64 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 37 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 11/20/97.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Macoma? sp.
 Gastropoda
 Crepidula princeps Conrad

Field No.: RMW/DNS 1181. "Tan to gray siltstone and mudstone. San Pedro Formation. Location: key at southwest end of Canyon 7, elevation 345' [105 m]." Locality located in former oil field about 0.97 km S of Imperial Highway 0.55 km W of its intersection with Beach Blvd. and 1.12 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 29 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 12/15/97. Middle fauna.

Annelida
 Polychaeta
 Serpulid, indeterminate
 Mollusca
 Bivalvia
 Patinopecten caurinus (Gould)

Field No.: RMW/DNS 1205. "Gray to tan mudstone and sand. San Pedro Formation. Location: Canyon 6." Locality located in former oil field about 1.05 km S of Imperial Highway 0.63 km W of its intersection with Beach Blvd. and 1.22 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 4 m above base of exposed "San Pedro" Forma-

tion. Collected by David Stevens, 3/12/98. Middle fauna.

Mollusca
Bivalvia
Macoma sp.
Nuculana taphria (Dall)
Nutricula sp.
Pandora sp. (small)
Patinopecten caurinus (Gould)
Gastropoda
Astyris gausapata (Gould)
Bittium sp.
Boreotrophon pedroana (Arnold)
Crepidula onyx Sowerby
Neptunea tabulata (Baird)
Neverita reclusiana (Deshayes)
Ocenebra sp., cf. *O. foveolata* (Hinds)
Olivella sp., cf. *O. baetica* Carpenter
Olivella biplicata (Sowerby)
Ophiidermella sp.
Scaphopoda
Dentalium pretiosum Sowerby
Echinodermata
Echinoidea
Dendraster venturaensis Kew

Field No.: RMW/DNS 1206. "Tan siltstone. San Pedro Formation. Location: Canyon 6 slide." Locality located in former oil field about 1.19 km S of Imperial Highway 0.59 km E of its intersection with Beach Blvd. and 1.31 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 51 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 3/16/98. Middle fauna.

Mollusca
Bivalvia
Chlamys opuntia (Dall)
Patinopecten caurinus (Gould)
Pecten bellus (Conrad)
Pododesmus macrochisma (Deshayes)
Veneridae, indeterminate

Field No.: RMW/DNS 1207. "Tan mudstone. San Pedro Formation. Location: Canyon 7, elevation 265' [80 m]." Locality located in former oil field about 1.20 km S of Imperial Highway 0.67 km E of its intersection with Beach Blvd. and 1.28 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 29 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 3/16/1998. Middle fauna.

Mollusca
Bivalvia
Patinopecten sp., cf. *P. caurinus* (Gould)

**Field No.: RMW/DNS 1213. "Gray siltstone. Sand Pedro Formation. Location: ridge between Canyon 3 and 4, elevation 335' [102 m]." Locality located in former oil field about 0.61 km S of Imperial Highway 0.61 km E of its intersection with Beach Blvd. and 1.2 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 37 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 4/17/97. Middle fauna.

Mollusca
Bivalvia
Cardiidae, indeterminate
Chlamys sp.
Clinocardium sp.
Cyclocardia sp., cf. *C. occidentalis* (Conrad)
Lucinoma annulata (Reeve)
Patinopecten caurinus (Gould)

Indeterminate bivalve
Gastropoda
Crepidula princeps Conrad
Polinices sp., cf. *P. lewisii* (Gould)

Field No.: RMW/DNS 1219. "Fine silt and sand. San Pedro Formation. Location: Pad 135 between Canyon 5 and 6., elevation 380' [120 m]." Locality located in former oil field about 1.07 km S of Imperial Highway 0.50 km E of its intersection with Beach Blvd. and 1.15 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 51 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 4/23/98.

Mollusca
Bivalvia
Modiolus rectus (Conrad)
Panope abrupta (Conrad)
Pododesmus macrochisma (Deshayes)

Field No.: RMW/DNS 1222. "Tan sand. San Pedro Formation. Location: toe of ridge between Canyons 2 and 3, elevation 263' [80 m]." Locality located in former oil field about 0.45 km S of Imperial Highway 0.25 km E of its intersection with Beach Blvd. and 0.50 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 71 m above base of exposed "San Pedro" Formation. Collected by David Stevens, 4/29/98.

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Modiolus rectus (Conrad)
Pecten bellus (Conrad)
Pododesmus macrochisma (Deshayes)
Gastropoda
Calliostoma sp.
Conus californicus Reeve
Crassispira zizyphus Berry
Crepidula princeps Conrad
Epitonium sp.
Fusinus sp., cf. *F. barborensis* (Trask)
Megasurcula carpenteriana (Gabb)
Nassarius sp.
Neverita reclusiana (Deshayes)
Olivella baetica Carpenter
Olivella biplicata (Sowerby)
Turritella cooperi Carpenter
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Echinodermata
Echinoidea
Dendraster sp.

Field No.: RMW/DPO 9. "Dark gray siltstone to mudstone. San Pedro Formation. Location: 100 yards [91 m] SW of well 232, elevation 250' [76 m]." Locality located in former oil field about 1.05 km S of Imperial Highway 0.63 km W of its intersection with Beach Blvd. and 1.22 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 27 m above base of exposed "San Pedro" Formation. Collected by Dan Orris, 6/24/98.

Mollusca
Gastropoda
Naticidae, indeterminate

Field No.: RMW/EAB 002. "Black silt. Coyote Hills Formation. Location: near slide, Canyon 3, elevation 500' [150 m]." Locality located in former oil field about 1.07 km S of Imperial Highway 0.38 km E of its intersection with Beach Blvd. and 1.12 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically from 98 to 107 m above base of exposed "San Pedro" Formation in Coyote Hills Formation. Collected by Edwin Bragado, 6/4/97.

Mollusca
 Bivalvia
 Macoma sp.
 Tagelus sp.

Field No.: RMW/EAB 003. "Coarse sand. San Pedro Formation. Location: Well MC96." Locality located in former oil field about 1.03 km S of Imperial Highway 0.60 km E of its intersection with Beach Blvd. and 1.16 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 6/4/97.

Mollusca
 Bivalvia
 Pecten bellus (Conrad)
 Gastropoda
 Nassaridae, indeterminate
 Naticidae, indeterminate
 Turritella cooperi Carpenter
 Scaphopoda
 Dentalium neohexagonum Pilsbry & Sowerby

Field No.: RMW/EAB 023. "Coarse sand. San Pedro Formation. Location: west of Well MC322." Locality located in former oil field about 1.08 km S of Imperial Highway 0.40 km E of its intersection with Beach Blvd. and 1.14 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 6/23/97.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Modiolus sp.
 Gastropoda
 Calliostoma sp.
 Neptunea tabulata (Baird)
 Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/EAB 024. "7976 m 1202; elevation 382' [116 m]. Sand. San Pedro Formation." Locality located in former oil field about 0.78 km S of Imperial Highway 0.74 km E of its intersection with Beach Blvd. and 1.07 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 6/24/97.

Mollusca
 Gastropoda
 Astyris gausapata (Gould)
 Conus californicus Reeve
 Nassarius mendicus (Gould)
 Nassarius perpinguis (Hinds)
 Olivella biplicata (Sowerby)
 Scaphopoda
 Dentalium sp.

Field No.: RMW/EAB 045 (= RMW EAB 045.5). "Near Idaho St. Sand and sandstone. San Pedro Formation." Locality located in former oil field about 0.73 km S of Imperial Highway 0.50 km E of its intersection with Beach Blvd. and 0.88 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 7/18/97.

Mollusca
 Bivalvia
 Clinocardium? sp.

Pecten bellus (Conrad)
Tresus? sp.
 Gastropoda
 Calliostoma sp.
 Nassarius sp.
 Naticidae, indeterminate
 Turritella cooperi Carpenter
 Scaphopoda
 Dentalium neohexagonum Pilsbry & Sharp
 Arthropoda
 Crustacea
 Indeterminate crab parts

Field No.: RMW/EAB 051. "Concretions. San Pedro Formation. Location: near Well MC96." Locality located in former oil field about 0.96 km S of Imperial Highway 0.59 km E of its intersection with Beach Blvd. and 1.12 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 7/23/97.

Mollusca
 Gastropoda
 Crepidula princeps Conrad

Field No.: RMW/EAB 052. "Sandstone and sand. San Pedro Formation. Location: far right side of slide." Locality located in former oil field about 1.02 km S of Imperial Highway 0.50 km E of its intersection with Beach Blvd. and 1.13 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 7/23/97.

Mollusca
 Gastropoda
 Astiris gausapata (Gould)
 Conus californicus Reeve
 Nassarius mendicus (Gould)
 Nassarius sp.
 Naticidae, indeterminate
 Ocenebra sp., cf. *O. foveolata* (Hinds)
 Olivella biplicata (Sowerby)
 Turbonilla sp.
 Scaphopoda
 Dentalium sp.
 Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/EAB 053. "Sand. San Pedro Formation. Location: near golf course hole 16." Locality located in former oil field about 1.04 km S of Imperial Highway 0.6 km E of its intersection with Beach Blvd. and 1.17 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 7/23/97.

Mollusca
 Bivalvia
 Pecten bellus (Conrad)
 Gastropoda
 Astiris gausapata (Gould)
 Conus californicus Reeve
 Crepidula sp., cf. *C. princeps* Conrad
 Nassarius sp., cf. *N. perpinguis* (Hinds)
 Olivella biplicata (Sowerby)
 Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/EAB 081. "Sandy bed with conglomerate and concretions. San Pedro Formation. Location: near Well MC96." Locality located in former oil field about 0.96 km S of Imperial Highway 0.59 km E of its intersection with Beach Blvd. and 1.12 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 8/13/97.

Mollusca
 Bivalvia
 Tresus sp.
 Gastropoda
 Kelletia sp.

Field No.: RMW/EAB 090. "Sand. San Pedro Formation. Location: near Well MC239." Locality located in former oil field about 0.92 km S of Imperial Highway 0.63 km E of its intersection with Beach Blvd. and 1.13 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 8/26/97.

Annelida
 Polychaeta
 Serpulidae, indeterminate
Mollusca
 Gastropoda
 Crepidula princeps Conrad
Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/EAB 121. "Silt with mud. San Pedro Formation. Location: front of Chevron facility." Locality located in former oil field about 0.50 km S of Imperial Highway 0.29 km E of its intersection with Beach Blvd. and 0.57 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Edwin Bragado, 12/29/97. Middle fauna.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Compsomyax? sp.
 Modiolus sp.
 Panope? sp.
 Patinopecten caurinus (Gould)
 Tresus? sp.
 Gastropoda
 Crepidula princeps Conrad
 Tegula pulligo (Gmelin)

Field No.: RMW/JRS 693. "Medium to fine silt and clay. Coyote Hills Formation. Location: cut below house on Skyline Dr., elevation 295'." Locality located in former oil field about 2.04 km SSW of intersection of State College Blvd. and Bastanchury Rd. and 0.69 km SW of intersection of Bastanchury Rd. and Brea Blvd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 13 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn. Restricted fauna (?)

Mollusca
 Bivalvia
 Macoma sp.

Field No.: RMW/JRS 707. "Medium to coarse sand. San Pedro Formation. Location: cut below native plant park." Locality located in former oil field about 0.27 km SW of intersection of State College Blvd. and Bastanchury Rd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 6 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 5/2/94.

Mollusca
 Bivalvia
 Dendostrea? vespertina (Conrad)

Field No.: RMW/JRS 740. "Fine grained silt with sand. Coyote Hills Formation. Location: cut below restaurant off State College Blvd., elevation 398'." Locality located in former oil field about 0.25 km SW of intersection of State College Blvd. and Bastanchury Rd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 13 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 6/9/94. Restricted fauna.

Mollusca

Bivalvia

Macoma sp.

Tagelus sp., cf. *T. subteres* (Conrad)

Field No.: RMW/JRS 788. "Coyote Hills Formation. Location: large hill cut next to native habitat area, elevation 350'." Locality located in former oil field about 0.37 km SW of intersection of State College Blvd. and Bastanchury Rd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 13 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 8/25/94. Restricted fauna.

Mollusca

Bivalvia

Macoma sp.

Field No.: RMW/JRS 819. "Fine grain blocky siltstone. Coyote Hills Formation. Location: old trailer hill next to Bastanchury." Locality located in former oil field about 0.87 km SW of intersection of State College Blvd. and Bastanchury Rd. and 0.11 km WSW of Hill 496 ESE of intersection of Acacia Dr. and Ladera Vista Dr., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 13 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 11/7/94. Restricted fauna.

Mollusca

Bivalvia

Tagelus sp., cf. *T. subteres* (Conrad)

Tellinidae, indeterminate

Field No.: RMW/JRS 855. Locality located in former oil field about 1.25 km SW of intersection of State College Blvd. and Bastanchury Rd. and about 0.69 km E of BM 331 on Brea Blvd., East Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 6 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn. Lower fauna.

Mollusca

Bivalvia

Cyathodonta pedroana Dall

Cyclocardia sp.

Dendostrea? sp., aff. *D? vespertina* (Conrad)

Leporimetis obesa (Deshayes)

Nuculana taphria (Dall)

Panope abrupta (Conrad)

Pecten bellus (Conrad)

Spisula? sp.

Tresus? sp.

Gastropoda

Alia carinata (Hinds)

Astrea sp., cf. *A. undosa* (Wood)

Bulla gouldiana Pilsbry

Calicantharus sp.

Calliostoma gemmulatum Carpenter

Calliostoma sp., cf. *C. ligatum* (Gould)

Calliostoma sp.

Cancellaria arnoldi (Dall)

Cancellaria tritonidae (Gabb)

Cancellaria sp.

Conus californicus Reeve

Crassispira semiinflata (Grant and Gale)

Crassispira zizyphus Berry

Crepidula sp., cf. *C. onyx* Sowerby

Crepidula sp., cf. *C. princeps* (Conrad)

Crepidula sp.
Crepidatella? sp.
Cypraea spadicea Swainson
Epitonium sp.
Fusinus sp.
Haliotis? sp.
Kelletia kelletii (Forbes)
Lirobittium sp.
Maxwellia eldridgei (Arnold)
Megasurcula carpenteriana (Gabb)
Mitrella sp.
Nassarius mendicus (Gould)
Nassarius sp., cf. *N. grammatus* (Dall)
Nassarius sp.
 Naticidae, indeterminate
Neverita reclusiana (Deshayes)
Nucella sp., cf. *N. lamellosa* (Gmelin)
Ocenebra coryphaena Woodring
Ocenebra sp.
Olivella sp., cf. *O. baetica* Carpenter
Olivella biplicata (Sowerby)
Opalia sp., cf. *O. varicostatum* (Stearns)
Ophiodermella sp., cf. *O. inermis* (Reeve)
Polinices lewisii (Gould)
Seila montereyensis Bartsch
Sinum scopulosum (Conrad)
Tegula sp., cf. *T. funebris* (Adams)
Turritella cooperi Carpenter
Volvulella? sp.

Field No.: RMW/JRS 1320. "Gray to green fine silt. Coyote Hills Formation. Location: 40' key cut." Locality located in former oil field about 0.94 km S of Imperial Highway 0.58 km E of its intersection with Beach Blvd. and 1.12 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically from 98 to 107 m above base of exposed "San Pedro" Formation in Coyote Hills Formation. Collected by Juanita Shinn, 4/21/97. Restricted fauna.

Mollusca
 Bivalvia
 Macoma sp.
 Tagelus sp.
 Indeterminate bivalves

Field No.: RMW/JRS 1325. "Green clay. Coyote Hills Formation. Location: cut opposite park next to Idaho Street, elevation 411' [125 m]." Locality located in former oil field about 0.95 km S of Imperial Highway 0.59 km E of its intersection with Beach Blvd. and 1.12 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically from 98 to 107 m above base of exposed "San Pedro" Formation in the Coyote Hills Formation. Collected by Juanita Shinn, 4/23/97. Restricted fauna.

Mollusca
 Bivalvia
 Macoma sp.
 Modiolus? sp.

Field No.: RMW/JRS 1339. "Fine sand. San Pedro Formation. Location: cut above 40' [12 m] buttress, elevation 460' [140 m]." Locality located in former oil field about 0.97 km S of Imperial Highway 0.58 km E of its intersection with Beach Blvd. and 1.14 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 5/7/97. Upper fauna.

Mollusca
 Bivalvia
 Argopecten? sp.

Lucinisca nuttalli (Conrad)
Pecten bellus Conrad
 Gastropoda
 Naticidae indeterminate
 Scaphopoda
 Dentalium neohexagonum Pilsbry & Sharp

Field No.: RMW/JRS 1378. "Medium to coarse sand and conglomerate. San Pedro Formation. Location: cut below slide, elevation 140' [40 m]." Locality located in former oil field about 0.98 km S of Imperial Highway 0.57 km E of its intersection with Beach Blvd. and 1.14 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 6/20/97.

Mollusca
 Bivalvia
 Tellinidae, indeterminate
 Gastropoda
 Nassarius sp.
 Olivella biplicata (Sowerby)
 Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/JRS 1379. "Medium to coarse sand. San Pedro Formation. Location: cut below slide, elevation 140' [43 m]." Locality located in former oil field about 0.99 km S of Imperial Highway 0.57 km E of its intersection with Beach Blvd. and 1.15 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 6/30/97.

Mollusca
 Bivalvia
 Clinocardium? sp.
 Compsomyax? sp.
 Macoma sp.
 Siliqua sp.
 Tellina bodegensis Hinds
 Tresus nuttalli (Conrad)
 Gastropoda
 Astyris gausapata (Gould)
 Crepidula onyx Sowerby
 Nassarius sp., cf. *N. perpinguis* (Hinds)
 Nassarius sp.
 Naticidae, indeterminate
 Olivella biplicata (Sowerby)
 Polinices lewisii (Gould)
 Arthropoda
 Crustacea
 Cancer sp.

Field No.: RMW/JRS 1389. "Fine sand. San Pedro Formation. Location: Well 371, elevation 290' [88 m]." Locality located in former oil field about 0.62 km S of Imperial Highway 0.45 km E of its intersection with Beach Blvd. and 0.77 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 7/14/97.

Mollusca
 Bivalvia
 Lucinoma annulata (Reeve)
 Pecten bellus Conrad
 Gastropoda
 Acteocina culcitella (Gould)
 Astyris gausapata (Gould)
 Bittium sp.

Clathurella? sp.
Conus californicus Reeve
Epitonium sp.
Nassarius mendicus (Gould)
Nassarius sp., cf. *N. perpinguis* (Hinds)
Naticidae, indeterminate
Neverita sp., cf. *N. reclusiana* (Deshayes)
Ocenebra foveolata (Hinds)
Olivella sp., cf. *O. baetica* Carpenter
Olivella biplicata (Sowerby)
Olivella sp.
Ophiodermella inermis (Reeve)
Turbonilla sp.
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Arthropoda
Crustacea
Cancer sp.
Indeterminate crab parts
Echinodermata
Echinoidea
Dendraster sp.

Field No.: RMW/JRS 1399. "Canyon 1; elevation 542' [165 m]. Fine grained sand with concretions. San Pedro Formation." Locality located in former oil field about 1.04 km S of Imperial Highway 0.68 km E of its intersection with Beach Blvd. and 1.23 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 7/31/97.

Mollusca
Bivalvia
Teredidae, indet

Field No.: RMW/JRS 1400. "Fine sand. San Pedro Formation. Location: road cut below concrete wall, elevation 520' [160 m]." Locality located in former oil field about 1.16 km S of Imperial Highway 0.69 km E of its intersection with Beach Blvd. and 1.35 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 7/31/97.

Mollusca
Bivalvia
Cardiidae, indeterminate

Field No.: RMW/JRS 1425. "Fine gray sand with concretions. San Pedro Formation. Location: Well 214, elevation 369' [112 m]." Locality located in former oil field about 0.84 km S of Imperial Highway 0.43 km E of its intersection with Beach Blvd. and 0.94 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 9/3/97.

Mollusca
Bivalvia
Cyathodonta pedroana Dall
Gari? sp.
Lucinoma annulata (Reeve)
Modiolus sp.
Nuculana sp.
Panope abrupta (Conrad)
Solen sp.
Gastropoda
Calliostoma sp.
Conus californicus Reeve
Megasurcula carpenteriana (Gabb)
Neverita reclusiana (Deshayes)

Turritella cooperi Carpenter
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp

Field No.: RMW/JRS 1429. "Fine beige silt. San Pedro Formation. Location: Canyon 3, elevation 310' [94 m]." Locality located in former oil field about 0.51 km S of Imperial Highway 0.37 km E of its intersection with Beach Blvd. and 0.61 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 9/8/97.

Mollusca
Bivalvia
Nuculana taphria (Dall)
Pecten bellus Conrad
Gastropoda
Conus californicus Reeve
Crassispira zizyphus Berry
Crepidula princeps Conrad
Nassarius mendicus (Gould)
Nassarius sp., cf. *N. perpinguis* (Hinds)
Neverita sp., cf. *N. reclusiana* (Deshayes)
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Arthropoda
Crustacea
Indeterminate crab parts

Field No.: RMW/JRS 1430. "Fine white sand with concretions. San Pedro Formation. Location: Canyon 3, elevation 303' [92 m]." Locality located in former oil field about 0.64 km S of Imperial Highway 0.28 km E of its intersection with Beach Blvd. and 0.69 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 9/8/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Cyathodonta pedroana Dall
Gastropoda
Olivella biplicata (Sowerby)

Field No.: RMW/JRS 1434. "Canyon 3; elevation 400' [120 m]. Coarse grain concrete sandstone. San Pedro Formation." Locality located in former oil field about 0.55 km S of Imperial Highway 0.28 km E of its intersection with Beach Blvd. and 0.62 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 9/16/97.

Echinodermata
Echinoidea
Dendraster venturensis Kew

Field No.: RMW/JRS 1439. "Fine grain sand becoming concreted. San Pedro Formation. Location: Cut above 40' buttress, elevation 460' [140 m]." Locality located in former oil field about 0.53 km S of Imperial Highway 0.23 km E of its intersection with Beach Blvd. and 0.58 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn, 5/7/97.

Mollusca
Bivalvia
Panope abrupta (Conrad)
Pecten bellus Conrad
Gastropoda
Calliostoma sp.
Crassispira zizyphus Berry
Nassarius mendicus (Gould)

Nassarius sp.
 Naticidae, indeterminate
 Scaphopoda
 Dentalium neohexagonum Pilsbry & Sharp
 Arthropoda
 Crustacea
 Indeterminate crab parts
 Echinodermata
 Echinoidea
 Dendraster sp.

Field No.: RMW/JRS 1447. "Silt below Coyote Hills contact. San Pedro Formation. Location: Northern boundary, canyon 3, elevation about 300'." Locality located in former oil field about 0.73 km S of Imperial Highway 0.43 km E of its intersection with Beach Blvd. and 0.85 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Lucinoma annulata (Reeve)
 Macoma sp.
 Pecten bellus Conrad
 Gastropoda
 Astyris gausapata (Gould)
 Amphissa sp., cf. *A. reticulata* Dall
 Bittium sp.
 Cancellaria arnoldi (Dall)
 Cancellaria sp., cf. *C. tritonidae* (Gabb)
 Conus californicus Reeve
 Crassispira zizyphus Berry
 Crepidula princeps Conrad
 Epitonium sp.
 Fusinus? sp.
 Megasurcula carpenteriana (Gabb)
 Nassarius mendicus (Gould)
 Naticidae, indeterminate
 Ocenebra foveolata (Hinds)
 Turbonilla sp.
 Turridae, indeterminate
 Turritella cooperi Carpenter
 Scaphopoda
 Dentalium neohexagonum Pilsbry & Sharp
 Dentalium sp.
 Arthropoda
 Crustacea
 Indeterminate crab parts
 Echinodermata
 Echinoidea
 Indeterminate spines

Field No.: RMW/JRS 1448 (~ RMW/JRS 1447). "Silt below Coyote Hills contact. San Pedro Formation. Location: Northern boundary, canyon 3, elevation about 300'." Locality located in former oil field about 0.73 km S of Imperial Highway 0.43 km E of its intersection with Beach Blvd. and 0.85 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 82 m above base of exposed "San Pedro" Formation. Collected by Juanita Shinn.

Mollusca
 Bivalvia
 Lucinoma annulata (Reeve)
 Gastropoda
 Conus californicus Reeve
 Nassarius mendicus (Gould)

Olivella biplicata (Sowerby)
Scaphopoda
Dentalium sp.

Field No.: RMW/MLP 60. "Medium to coarse reddish sand. San Pedro Formation. Location: central cut between fill and cut borrow." Locality located in former oil field about 0.86 km S of Imperial Highway 0.73 km E of its intersection with Beach Blvd. and 1.13 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 37 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 3/14/97.

Mollusca
Bivalvia
Ostrea? sp.
Pecten bellus Conrad
Gastropoda
Crepidula? sp.

Field No.: RMW/MLP 64. "Conglomerate with fine to medium sand, sandstone and siltstone. San Pedro Formation. Location: central cut." Locality located in former oil field about 0.88 km S of Imperial Highway 0.73 km E of its intersection with Beach Blvd. and 1.14 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 37 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 3/21/97.

Mollusca
Bivalvia
Cyathodonta pedroana Dall
Ostrea? sp.
Pecten bellus Conrad

Field No.: RMW/MLP 69. "Medium to fine sand. San Pedro Formation. Location: lower cut on edge of fill below buttress." Locality located in former oil field about 0.80 km S of Imperial Highway 0.73 km E of its intersection with Beach Blvd. and 1.08 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 4/24/97.

Mollusca
Bivalvia
Cardiidae, indeterminate

Field No.: RMW/MLP 83. "Sand and silt. San Pedro Formation. Location: side of slope by Canyon 2." Locality located in former oil field about 0.67 km S of Imperial Highway 0.47 km E of its intersection with Beach Blvd. and 0.82 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 7/17/97.

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Pecten bellus Conrad
Tresus sp.
Gastropoda
Bittium? sp.
Cancellaria arnoldi Dall
Epitonium sp.
Nassarius sp.
Olivella sp., cf. *O. baetica* Carpenter
Turritella cooperi Carpenter
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Arthropoda
Crustacea
Indeterminate crab parts

Field No.: RMW/MLP 84. "Fine sand and conglomerate. San Pedro Formation. Location: top of central ridge." Locality located in former oil field about 0.85 km S of Imperial Highway 0.45 km E of its intersection with Beach Blvd. and 0.98 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 6/18/97.

Echinodermata
Echinoidea
Dendraster sp.

Field No.: RMW/MLP 87. "Black petroleum sand. San Pedro Formation. Location: Top below black shale layer." Locality located in former oil field about 1.12 km S of Imperial Highway 0.39 km E of its intersection with Beach Blvd. and 1.17 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 6/26/97.

Mollusca
Bivalvia
Clinocardium? sp.
Macoma secta (Conrad)
Macoma sp.
Saxidomus nuttalli Conrad
Tresus nuttallii (Conrad)
Gastropoda
Crepidula princeps Conrad
Nassarius sp.
Neverita reclusiana (Deshayes)?
Olivella biplicata (Sowerby)
Arthropoda
Crustacea
Cancer sp.
Echinodermata
Echinoidea
Dendraster sp.

Field No.: RMW/MLP 98. "Concretion layer in medium to fine grained, brownish sand. San Pedro Formation. Location: slot cut." Locality located in former oil field about 0.80 km S of Imperial Highway 0.45 km E of its intersection with Beach Blvd. and 0.93 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 9/11/97.

Mollusca
Gastropoda
Crepidula princeps Conrad
Naticidae, indeterminate

Field No.: RMW/MLP 103. "Medium sand and siltstone. San Pedro Formation. Location: base of main buttress." Locality located in former oil field about 1.05 km S of Imperial Highway 0.39 km E of its intersection with Beach Blvd. and 1.12 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 10/2/97.

Annelida
Polychaeta
Dodecaceria fistulicola Ehlers?
Mollusca
Bivalvia
Pecten bellus (Conrad)
Teredidae, indeterminate
Arthropoda
Crustacea
Indeterminate crab parts

Field No.: RMW/MLP 111. "Black and gray siltstone and sandstone. San Pedro Formation. Location: toe of third ridge." Locality located in former oil field about 0.87 km S of Imperial Highway 0.13 km E of its intersection with Beach Blvd. and 0.88 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 10/28/97.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Gastropoda
 Crepidula princeps Conrad

Field No.: RMW/MLP 116. "Medium sand. San Pedro Formation. Location: Ridge 3, middle." Locality located in former oil field about 0.96 km S of Imperial Highway 0.15 km E of its intersection with Beach Blvd. and 0.97 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 11/21/97.

Mollusca
 Bivalvia
 Lucinoma annulata (Reeve)
 Tresus sp., cf. *T. nuttalli* (Conrad)

Field No.: RMW/MLP 120. "Gray to reddish medium sand. San Pedro Formation. Location: base of ridge to right of Canyon 3." Locality located in former oil field about 0.94 km S of Imperial Highway 0.13 km E of its intersection with Beach Blvd. and 0.96 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 12/16/97. Middle fauna.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Chlamys sp., cf. *C. hastata* (Sowerby)
 Cyclocardia sp., cf. *C. occidentalis* (Conrad)
 Lucinidae, indeterminate
 Pandora wardiana Adams
 Patinopecten caurinus (Gould)
 Pododesmus macrochisma (Deshayes)
 Saxidomus nuttalli? (Conrad)
 Gastropoda
 Crepidula princeps Conrad
 Naticidae, indeterminate

Field No.: RMW/MLP 123. "Medium to fine sand. San Pedro Formation. Location: right of Canyon 3." Locality located in former oil field about 0.94 km S of Imperial Highway 0.12 km E of its intersection with Beach Blvd. and 0.95 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 1/8/98.

Mollusca
 Bivalvia
 Cardiidae, indeterminate
 Compsomyax? sp.
 Cyclocardia sp., cf. *C. occidentalis* (Conrad)
 Tresus sp., cf. *T. nuttalli* (Conrad)
 Gastropoda
 Crepidula sp., cf. *C. princeps* Conrad

Field No.: RMW/MLP 135. "Reddish siltstone. La Habra Formation. Location: above main cut." Locality located in former oil field about 1.13 km S of Imperial Highway 0.38 km W of its intersection with Beach Blvd. and 1.18 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 3/3/98.

Mollusca
 Bivalvia
 Chlamys hastata (Sowerby)
 Chlamys opuntia (Dall)
 Modiolus sp.
 Pododesmus macrochisma (Deshayes)

Field No.: RMW/MLP 140. "Siltstone and reddish sand. San Pedro Formation. Location: Canyon 6, left side of main platen, elevation 300' [91 m]." Locality located in former oil field about 0.97 km S of Imperial Highway 0.18 km W of its intersection with Beach Blvd. and 1.00 km SW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 2 to 4 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 3/18-19/98. Middle fauna.

Annelida
 Polychaeta
 Serpulidae, indeterminate
Mollusca
 Bivalvia
 Chlamys sp.
 Glycymeris septentrionalis (Middendorff)
 Macoma sp., cf. *M. moesta* Carpenter
 Nuculana taphria (Dall)
 Nutricula sp.
 Ostrea? sp.
 Pandora wardiana Adams
 Panope abrupta (Conrad)?
 Patinopecten caurinus (Gould)
 Pododesmus macrochisma (Deshayes)
Gastropoda
 Astyris gausapata (Gould)
 Bittium sp.
 Boreotrophon sp., cf. *B. pedroana* (Arnold)
 Calyptrea sp. (flat)
 Crepidula princeps Conrad
 Epitonium sp.
 Lacuna? sp.
 Nassarius fossatus (Gould)
 Nassarius mendicus (Gould)
 Nassarius perpinguis (Hinds)
 Neptunea tabulata (Baird)
 Neverita reclusiana (Deshayes)
 Ocenebra foveolata (Hinds)
 Olivella baetica Carpenter
 Olivella biplicata (Sowerby)
 Ophiodermella inermis (Reeve)
Scaphopoda
 Dentalium pretiosum Sowerby
Echinodermata
 Echinoidea
 Dendroaster venturensis Kew

Field No.: RMW/MLP 141. "Gray siltstone and fine sand. San Pedro Formation. Location: Canyon 7." Locality located in former oil field about 0.96 km S of Imperial Highway 0.54 km W of its intersection with Beach Blvd. and 1.12 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 4/8/98.

Arthropoda
Crustacea
Coronula? sp.

Field No.: RMW/MLP 146. "Sandstone overlying siltstone. San Pedro Formation. Location: above Ridge 6." Locality located in former oil field about 1.12 km S of Imperial Highway 0.35 km W of its intersection with Beach Blvd. and 1.18 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 5/5/98. Middle fauna.

Annelida
Polychaeta
Serpulidae, indeterminate
Mollusca
Bivalvia
Cardiidae, indeterminate
Cyclocardia sp., cf. *C. occidentalis* (Conrad)
Glycymeris septentrionalis (Middendorff)
Humilaria kennerleyi (Reeve)
Pandora wardiana Adams
Panope sp.
Pododesmus macrochisma (Deshayes)
Thracia? sp.
Gastropoda
Crepidula princeps Conrad
Olivella biplicata (Sowerby)
Scaphopoda
Dentalium pretiosum Sowerby

Field No.: RMW/MLP 148. "Medium to fine sand. San Pedro Formation. Location: at toe of Ridge 2 on finished slope." Locality located in former oil field about 0.51 km S of Imperial Highway 0.31 km E of its intersection with Beach Blvd. and 0.60 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Matthew Phillips, 5/20/98.

Mollusca
Bivalvia
Glycymeris septentrionalis (Middendorff)
Lucinoma annulata (Reeve)
Pecten bellus (Conrad)
Gastropoda
Crepidula princeps Conrad
Fusinus sp., cf. *F. barborensis* (Trask)
Olivella baetica Carpenter
Olivella biplicata (Sowerby)
Nassarius sp.
Naticidae, indeterminate
Turritella cooperi Carpenter
Scaphopoda
Dentalium neohexagonum Pilsbry & Sharp
Dentalium sp.
Echinodermata
Echinoidea
Dendraster sp.

Field No.: RMW/MWT 001. "White sand. San Pedro Formation. Location: east end of Idaho Street, elevation 170' [50 m]." Locality located in former oil field about 1.13 km S of Imperial Highway 0.61 km E of its

intersection with Beach Blvd. and 1.30 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 5/28/98.

Mollusca
Bivalvia
Thracia? sp.
Tresus sp., cf. *T. nuttallii* (Conrad)
Gastropoda
Crepidula princeps Conrad

Field No.: RMW/MWT 003. "White sand. San Pedro Formation. Location: near water tower, elevation 450' [140 m]." Locality located in former oil field about 0.94 km S of Imperial Highway 0.14 km E of its intersection with Beach Blvd. and 0.96 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 6/4/98.

Mollusca
Bivalvia
Pecten bellus Conrad
Tresus nuttallii (Conrad)
Gastropoda
Crepidula princeps Conrad
Fusinus sp., cf. *F. barborensis* (Trask)
Megasurcula carpenteriana (Gabb)

Field No.: RMW/MWT 004. "White sand. San Pedro Formation. Location: near golf course, elevation 300' – 450' [90 – 140 m]." Locality located in former oil field about 0.54 km S of Imperial Highway 0.27 km E of its intersection with Beach Blvd. and 0.60 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 6/11-15/98. Middle fauna.

Mollusca
Bivalvia
Cardiidae, indeterminate
Lucinoma annulata (Reeve)
Patinopecten caurinus (Gould)
Pecten bellus Conrad
Tellinidae?, indeterminate
Tresus sp., cf. *T. nuttallii* (Conrad)
Gastropoda
Crepidula princeps Conrad
Naticidae, indeterminate
Neptunea tabulata (Baird)
Olivella biplicata (Sowerby)
Ophiodermella inermis (Reeve)
Echinodermata
Echinodea
Dendraster sp.

Field No.: RMW/MWT 010. "Tan to white siltstone and sandstone. San Pedro Formation. Location: Canyon 1, 2, 3, and 5, elevation 400' [120 m]." Locality located in former oil field about 0.57 km S of Imperial Highway 0.42 km E of its intersection with Beach Blvd. and 0.70 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 6/26/98.

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Patinopecten sp.
Pecten bellus Conrad
Gastropoda
Boreotrophon sp., cf. *B. multicostatus* (Eschscholtz)
Crepidula princeps Conrad

Fusinus sp., cf. *F. barbarentis* (Trask)
Naticidae, indeterminate
Olivella biplicata (Sowerby)

Field No.: RMW/MWT 012. "Sandstone and siltstone. San Pedro Formation. Location: Canyons 1, 2, and 3, elevation 400' [120 m]." Locality located in former oil field about 0.58 km S of Imperial Highway 0.46 km E of its intersection with Beach Blvd. and 0.73 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 41 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 7/10/98.

Mollusca

Bivalvia

Lucinoma annulata (Reeve)
Pecten bellus Conrad
Thracia? sp.

Gastropoda

Conus californicus Reeve
Neverita reclusiana (Deshayes)
Olivella biplicata (Sowerby)

Field No.: RMW/MWT 013. "Sandstone. San Pedro Formation. Location: Canyon 2, elevation 450'." Locality located in former oil field about 0.60 km S of Imperial Highway 0.48 km E of its intersection with Beach Blvd. and 0.80 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 7/15/98.

Mollusca

Bivalvia

Lucinoma annulata (Reeve)
Pecten bellus Conrad

Gastropoda

Conus californicus Reeve
Crepidula princeps Conrad
Fusinus sp., cf. *F. barbarentis* (Trask)
Naticidae, indeterminate
Olivella biplicata (Sowerby)
Turritella cooperi Carpenter

Field No.: RMW/MWT 014. "Tan sandstone. San Pedro Formation. Location: Canyon 2, elevation 450' [140 m]." Locality located in former oil field about 0.59 km S of Imperial Highway 0.47 km E of its intersection with Beach Blvd. and 0.77 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Michael Thompson, 7/20/98.

Mollusca

Bivalvia

Lucinoma annulata (Reeve)

Field No.: RMW/POM 035. "Sand. San Pedro Formation. Location: along Idaho Street, north of bridge." Locality located in former oil field about 0.93 km S of Imperial Highway 0.69 km E of its intersection with Beach Blvd. and 1.17 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Patrick Maxon, 3/11/97.

Mollusca

Bivalvia

Pecten bellus Conrad

Field No.: RMW/POM 036. "Beige sand and sandstone. San Pedro Formation. Location: west of Idaho Street in Canyon 1." Locality located in former oil field about 0.92 km S of Imperial Highway 0.85 km E of its intersection with Beach Blvd. and 1.24 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 41 m above base of exposed "San

Pedro" Formation. Collected by Patrick Maxon, 3/18/97.

Mollusca
Bivalvia
Clinocardium? sp.

Field No.: RMW/SEC 009. "Coquina and loose sand with pebbles. San Pedro Formation. Location: below pads 64 and 65 in key cut, elevation 300' [90 m]." Locality located in former oil field about 1.17 km S of Imperial Highway 0.22 km W of its intersection with Beach Blvd. and 1.19 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Formation. Collected by Skip Clay, 9/5/97.

Mollusca
Bivalvia
Pecten bellus Conrad
Gastropoda
Crepidula sp., cf. *C. princeps* Conrad

Field No.: RMW/SEC 028. "Gray-blue siltstone. San Pedro Formation. Location: club house, elevation 330' [100 m]." Locality located in former oil field about 0.47 km S of Imperial Highway 0.11 km E of its intersection with Beach Blvd. and 0.48 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Skip Clay, 11/5/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Cyclocardia sp., cf. *C. occidentalis* (Conrad)
Gastropoda
Crepidula princeps Conrad
Polinices lewisii (Gould)?

Field No.: RMW/SRA 029. "Medium grain sandstone. San Pedro Formation. Location: Ridge 1, elevation 430' [130 m]." Locality located in former oil field about 1.02 km S of Imperial Highway 0.57 km E of its intersection with Beach Blvd. and 1.18 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 3/26/97.

Mollusca
Bivalvia
Pecten bellus Conrad

Field No.: RMW/SRA 033. "Green silt. San Pedro Formation. Location: Ridge one, elevation 248' [75 m]." Locality located in former oil field about 0.70 km S of Imperial Highway 0.62 km E of its intersection with Beach Blvd. and 0.95 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 5/6/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Cyclocardia sp., cf. *C. occidentalis* (Conrad)
Gastropoda
Astyris gausapata (Gould)
Crepidula sp.
Nassarius sp., cf. *N. mendicus* (Gould)
Olivella biplicata (Sowerby)

Field No.: RMW/SRA 037. "Mudstone with charcoal. Coyote Hills Formation. Location: 100' southwest of Well 335, elevation 495' [150 m]." Locality located in former oil field about 1.15 km S of Imperial Highway 0.48 km E of its intersection with Beach Blvd. and 1.22 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically from 98 to 107 m above

base of exposed "San Pedro" Formation in Coyote Hills Formation. Collected by Scott Armstrong, 5/21/97. Restricted fauna.

Mollusca
 Bivalvia
 Macoma sp.
 Tagelus sp., cf. *T. subteres* (Conrad)

Field No.: RMW/SRA 040. "Concretion in very fine white sand. San Pedro Formation. Location: 100' east of Well MC20, elevation 430' [130 m]." Locality located in former oil field about 1.17 km S of Imperial Highway 0.61 km E of its intersection with Beach Blvd. and 1.30 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 6/2/97.

Mollusca
 Bivalvia
 Cardiidae, indeterminate

Field No.: RMW/SRA 051. "90' N of Well #371; elevation 469' [143 m]. Gray medium sand. San Pedro Formation." Locality located in former oil field about 0.58 km S of Imperial Highway 0.40 km E of its intersection with Beach Blvd. and 0.71 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 7/11/97.

Mollusca
 Bivalvia
 Nuculana taphria (Dall)
 Gastropoda
 Astyris gausapata (Gould)
 Conus californicus Reeve
 Fusinus sp., cf. *F. barbarensis* (Trask)
 Nassarius mendicus (Gould)
 Nassarius sp., cf. *N. perpinguis* (Hinds)
 Naticidae, indeterminate
 Olivella biplicata (Sowerby)
 Ophiidermella inermis (Reeve)

Field No.: RMW/SRA 070. "Pad 57; elevation 310' [95 m]. Greenish-gray mudstone. San Pedro Formation." Locality located in former oil field about 0.51 km S of Imperial Highway 0.26 km E of its intersection with Beach Blvd. and 0.56 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 54 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 9/2/97.

Mollusca
 Bivalvia
 Modiolus sp.
 Panope abrupta (Conrad)
 Gastropoda
 Calyptraea sp.
 Crepidula sp.

Field No.: RMW/SRA 079. "Tan medium grain sand. San Pedro Formation. Location: pad 66, elevation 351' [107 m]." Locality located in former oil field about 0.51 km S of Imperial Highway 0.50 km E of its intersection with Beach Blvd. and 0.72 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 6/2/97.

Mollusca
 Bivalvia
 Pecten bellus (Conrad)

Field No.: RMW/SRA 082. "Tan and gray silt. San Pedro Formation. Location: club house parking lot." Locality located in former oil field about 0.61 km S of Imperial Highway 0.12 km E of its intersection with Beach Blvd. and 0.63 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fuller-

ton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 10/27/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Clinocardium? sp.
Lucinoma annulata (Reeve)
Macoma? sp.
Semele? sp.
Tresus? sp.
Gastropoda
Calyptrea sp.
Crepidula sp.
Nassarius sp.

Field No.: RMW/SRA 083. "Concretions in white sand. San Pedro Formation. Location: 30 m north of Well 92." Locality located in former oil field about 0.87 km S of Imperial Highway 0.15 km E of its intersection with Beach Blvd. and 0.88 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 10/29/97.

Mollusca
Bivalvia
Tresus nuttalli (Conrad)

Field No.: RMW/SRA 111. "White and orange sand. San Pedro Formation. Location: Canyon 7 under turbidite (8' stratigraphically)." Locality located in former oil field about 0.97 km S of Imperial Highway 0.71 km W of its intersection with Beach Blvd. and 1.19 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically from 2 to 4 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 3/17/98. Middle fauna.

Mollusca
Bivalvia
Pandora wardiana Adams
Patinopecten caurinus (Gould)

Field No.: RMW/SRA 112. "Tan siltstone. San Pedro Formation. Location: northeast facing slope in back of Canyon 7, elevation 328 [100 m]." Locality located in former oil field about 1.04 km S of Imperial Highway 0.61 km W of its intersection with Beach Blvd. and 1.21 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 2 to 4 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 3/17/98.

Mollusca
Gastropoda
Polinices sp., cf. *P. draconis* (Dall)

Field No.: RMW/SRA 113. "Gray medium sand with concretions. San Pedro Formation. Location: 30 m north of Well MC92." Locality located in former oil field about 0.88 km S of Imperial Highway 0.14 km E of its intersection with Beach Blvd. and 0.90 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 3/17/98.

Mollusca
Bivalvia
Saxidomus nuttalli Conrad
Gastropoda
Conus californicus Reeve

Field No.: RMW/SRA 118. "Tan siltstone. San Pedro Formation. Location: south of Canyon 6 (slide)." Locality located in former oil field about 1.06 km S of Imperial Highway 0.23 km W of its intersection with Beach Blvd. and 1.08 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 50 m above base of exposed "San Pedro" Forma-

tion. Collected by Scott Armstrong, 4/9/98. Middle fauna (?).

Mollusca

Bivalvia

Chlamys sp., cf. *C. hastata* (Sowerby)

Chlamys sp.

Patinopecten sp.

Pododesmus macrochisma (Deshayes)

Field No.: RMW/SRA 120. "Fine brown silt. San Pedro Formation. Location: north facing slope, back of Canyon 7, elevation 285' [87 m]." Locality located in former oil field about 1.06 km S of Imperial Highway 0.23 km W of its intersection with Beach Blvd. and 1.08 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/10/98.

Annelida

Polychaeta

Serpulidae, indeterminate

Field No.: RMW/SRA 121. "Tan silt. San Pedro Formation. Location: south facing slope, back of Canyon 7, elevation 280' [85 m]." Locality located in former oil field about 0.99 km S of Imperial Highway 0.68 km W of its intersection with Beach Blvd. and 1.22 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/10/98.

Arthropoda

Crustacea

Indeterminate crab claw

Field No.: RMW/SRA 126. "Gray silt. San Pedro Formation. Location: club house, ridge 3." Locality located in former oil field about 0.64 km S of Imperial Highway 0.15 km E of its intersection with Beach Blvd. and 0.65 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/16/98.

Mollusca

Gastropoda

Crepidula princeps Conrad

Field No.: RMW/SRA 127. "Gray silt. San Pedro Formation. Location: north end of Ridge 3, elevation 325' [99 m]." Locality located in former oil field about 0.65 km S of Imperial Highway 0.15 km E of its intersection with Beach Blvd. and 0.67 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/16/98. Middle fauna.

Mollusca

Bivalvia

Cardiidae, indeterminate

Cyclocardia sp., cf. *C. occidentalis* (Conrad)

Patinopecten caurinus (Gould)

Pododesmus macrochisma (Deshayes)

Gastropoda

Crassispira zizyphus Berry

Naticidae, indeterminate

Field No.: RMW/SRA 128. "Gray silt. San Pedro Formation. Location: Well 92, elevation 396' [121 m]." Locality located in former oil field about 0.88 km S of Imperial Highway 0.18 km E of its intersection with Beach Blvd. and 0.91 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/21/98.

Mollusca

Bivalvia

Pecten bellus (Conrad)

Field No.: RMW/SRA 132. "Gray silt. San Pedro Formation. Location: Ridge 3, near north end." Locality located in former oil field about 0.62 km S of Imperial Highway 0.13 km E of its intersection with Beach Blvd. and 0.65 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 54 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/27/98.

Mollusca
Gastropoda
Crepidula princeps (Conrad)

Field No.: RMW/SRA 135. "Greenish gray silt. San Pedro Formation. Location: north facing slope far back of Canyon 7, elevation 450' [140 m]." Locality located in former oil field about 1.05 km S of Imperial Highway 0.58 km W of its intersection with Beach Blvd. and 1.21 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 4/29/98. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: RMW/SRA 137. "Tan sand. San Pedro Formation. Location: Ridge 2, elevation 285' [87 m]." Locality located in former oil field about 0.48 km S of Imperial Highway 0.24 km E of its intersection with Beach Blvd. and 0.53 km SSE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Scott Armstrong, 5/1/98.

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Pecten bellus (Conrad)
Gastropoda
Conus californicus Reeve
Crepidula princeps Conrad
Fusinus sp., cf. *F. barbarentis* (Trask)
Megasurcula carpenteriana (Gabb)
Nassarius sp.
Naticidae, indeterminate

Field No.: RMW/SSG 97-18. "Cemented sandstone. San Pedro Formation. Location: near pads 85—86, elevation 475' [145 m]." Locality located in former oil field about 0.81 km S of Imperial Highway 0.53 km E of its intersection with Beach Blvd. and 0.97 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallager, 5/30/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Gastropoda
Nassarius sp.
Turritella sp.

Field No.: RMW/SSG 97-21. "Oxidized sand and sandy mud. San Pedro Formation. Location: Pad 112, elevation 410' [125 m]." Locality located in former oil field about 0.67 km S of Imperial Highway 0.51 km E of its intersection with Beach Blvd. and 0.84 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallager, 6/5/97.

Mollusca
Bivalvia
Pecten bellus (Conrad)
Arthropoda
Crustacea
Indeterminate crab parts

Field No.: RMW/SSG 97-30. "Lot 108; elevation 390' [120 m]. Massive mudstone. Coyote Hills Formation." Locality located in former oil field about 0.58 km S of Imperial Highway 0.39 km E of its intersection with Beach Blvd. and 0.71 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically between 98 and 107 m above base of exposed "San Pedro" Formation in the Coyote Hills Formation. Collected by Sean Gallagher, 7/9/97. Restricted fauna.

Mollusca
Bivalvia
Macoma? sp.
Indeterminate bivalves

Field No.: RMW/SSG 97-41. "Welded sandstone. San Pedro Formation. Location: 100' [30 m] north of pads 55-56, elevation 300' [90 m]." Locality located in former oil field about 0.52 km S of Imperial Highway 0.25 km E of its intersection with Beach Blvd. and 0.60 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 8/20/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Panope abrupta (Conrad)
Gastropoda
Calyptrea sp. (flat)
Nassarius sp.
Olivella biplicata (Sowerby)

Field No.: RMW/SSG 97-47. "Coarse sandstone. San Pedro Formation. Location: 75' [23 m] north of pad 60, elevation 311' [95 m]." Locality located in former oil field about 0.49 km S of Imperial Highway 0.36 km E of its intersection with Beach Blvd. and 0.61 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 9/4/97.

Mollusca
Bivalvia
Pecten bellus (Conrad)
Tresus? sp.
Gastropoda
Nassarius mendicus (Gould)
Olivella biplicata (Sowerby)

Field No.: RMW/SSG 97-54. "Sandstone and unconsolidated sand. San Pedro Formation. Location: 50' [15 m] north of pads 85-86, elevation 460' [140 m]." Locality located in former oil field about 0.83 km S of Imperial Highway 0.50 km E of its intersection with Beach Blvd. and 0.98 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 9/17/97.

Mollusca
Bivalvia
Pecten bellus (Conrad)

Field No.: RMW/SSG 97-58. "Medium sandstone. San Pedro Formation. Location: 9+58 (near hole 11), elevation 290' [90 m]." Locality located in former oil field about 0.42 km S of Imperial Highway 0.18 km E of its intersection with Beach Blvd. and 0.47 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 9/24/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Macoma? sp.
Mytilus? sp.
Gastropoda
Calyptrea sp. (flat)
Naticidae, indeterminate
Olivella biplicata (Sowerby)

Field No.: RMW/SSG 97-59. "Medium sandstone. San Pedro Formation. Location: near hole 11, elevation 290' [90 m]." Locality located in former oil field about 0.44 km S of Imperial Highway 0.18 km E of its intersection with Beach Blvd. and 0.48 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 9/24/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Macoma? sp.
Mytilus? sp.
Gastropoda
Calyptrea sp. (flat)
Nassarius sp., cf. *N. perpinguis* (Hinds)
Olivella sp., cf. *O. baetica* Carpenter

Field No.: RMW/SSG 97-60. "Pad 94; elevation 430' [130 m]. Unconsolidated sand. San Pedro Formation." Locality located in former oil field about 0.78 km S of Imperial Highway 0.58 km E of its intersection with Beach Blvd. and 0.97 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 66 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 9/30/97.

Annelida
Polychaeta
Cirratulidae indeterminate

Field No.: RMW/SSG 97-61. "Unconsolidated sand. San Pedro Formation. Location: near well MC259, elevation 465' [142 m]." Locality located in former oil field about 0.92 km S of Imperial Highway 0.71 km E of its intersection with Beach Blvd. and 1.17 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 69 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 10/1/97.

Mollusca
Bivalvia
Indeterminate bivalves
Gastropoda
Crepidula sp.
Olivella biplicata (Sowerby)

Field No.: RMW/SSG 98-114. "Massive siltstone. San Pedro Formation. Location: Canyon 2, elevation 305' [93 m]." Locality located in former oil field about 0.90 km S of Imperial Highway 0.34 km E of its intersection with Beach Blvd. and 0.97 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Sean Gallagher, 8/20/97.

Mollusca
Bivalvia
Chlamys sp.
Clinocardium? sp.
Compsomyax? sp.
Gastropoda
Naticidae, indeterminate

Field No.: RMW/SW 97-1357. "Sandstone. San Pedro Formation. Location: 500' west of Risner and Idaho Streets, elevation 488'." Locality located in former oil field about 1.18 km S of Imperial Highway 0.77 km E of its intersection with Beach Blvd. and 1.40 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 78 m above base of exposed "San Pedro" Formation. Collected by Steve Wakefield, 4/25/97.

Mollusca
Bivalvia
Cardiidae, indeterminate
Gastropoda
Nassarius sp.

Naticidae, indeterminate
Olivella biplicata (Sowerby)

Field No.: RMW/TJM 10. "Near Well #373; elevation: 370' [110 m]. Gray silt with oxidation. San Pedro Formation." Locality located in former oil field about 0.81 km S of Imperial Highway 0.42 km W of its intersection with Beach Blvd. and 0.92 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Tim Matson, 6/2/98. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: RMW/TJM 20. "Near Well#MC4. San Pedro Formation." Locality located in former oil field about 0.90 km S of Imperial Highway 0.33 km E of its intersection with Beach Blvd. and 0.96 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 26 m above base of exposed "San Pedro" Formation. Collected by T. Matson, 6/8/98.

Mollusca
Bivalvia
Gari sp.
Saxidomus? sp.
Indeterminate bivalve

Field No.: RMW/TJM 29. "Light gray siltstone. San Pedro Formation. Location: cut near edge of property, elevation 319' [97 m]." Locality located in former oil field about 0.90 km S of Imperial Highway 0.33 km W of its intersection with Beach Blvd. and 0.96 km SSW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 8 m above base of exposed "San Pedro" Formation. Collected by Tim Matson, 6/17/98. Middle fauna.

Mollusca
Bivalvia
Patinopecten caurinus (Gould)

Field No.: RMW/TJM 33. "Slope of key cut; elevation 283' [86 m]. Gray mudstone. San Pedro Formation." Locality located in former oil field about 0.97 km S of Imperial Highway 0.74 km W of its intersection with Beach Blvd. and 1.22 km SW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 17 m above base of exposed "San Pedro" Formation. Collected by Tim Matson, 7/1/98. Middle fauna

Mollusca
Bivalvia
Patinopecten caurinus (Gould)
Indeterminate bivalves
Gastropoda
Cryptonatica affinis (Gmelin)
Neverita reclusiana (Deshayes)

Field No.: RMW/TJM 34. "Blue and gray mudstone. San Pedro Formation. Location: key cut adjacent to Hillsborough, elevation 215' [66 m]." Locality located in former oil field about 0.98 km S of Imperial Highway 0.74 km W of its intersection with Beach Blvd. and 1.23 km SW of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 17 m above base of exposed "San Pedro" Formation. Collected by Tim Matson, 7/7/98.

Mollusca
Gastropoda
Polinices draconis (Dall)

Field No.: RMW/TJM 36. "Tan siltstone with gray-blue mudstone. San Pedro Formation. Location: Canyon 7, elevation 295' [90 m]." Locality located in former oil field about 1.08 km S of Imperial Highway 0.80 km E of its intersection with Beach Blvd. and 1.34 km SE of intersection of Beach Blvd and Imperial Highway, West Coyote Hills, Fullerton, Orange County, CA. Site stratigraphically about 17 m above base of exposed "San Pedro" Formation. Collected by Tim Matson, 7/13/1998. Middle fauna.

Mollusca

Bivalvia
Clinocardium? sp.
Patinopecten caurinus (Gould)

Locality descriptions and faunal occurrences from Yerkes (1972). Taxonomic names have been update to conform with modern taxonomic views and adjusted to conform with specimens observed in PC collections and in photographs from Hoskins (1954).

Field No.: F3. Sec. 23, T. 3 S., R. 10 W., artificial cut 2,500' N and 820' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman (Yerkes, 1972, p. C59).

Mollusca
Gastropoda
Crepidula sp.

Field No: F-4. Sec. 23, T. 3 S., R. 10 W., artificial cut 2,450' N and 2,330' W of NW corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman and J. G. Vedder (Yerkes, 1972, p. C59).

Mollusca
Bivalvia
Pecten bellus (Conrad) [= *P. hemphili* Dall of Yerkes, 1972]
Flabellipecten stearnsii (Dall)
Echinodermata
Echinoidea
Dendraster venturensis Kew [? = *D. excentricus* Eschscholtz of Yerkes, 1972]

Field No: F-5. Sec. 19, T. 3 S., R. 10 W., artificial cut 1,440' S and 2,240' E of NW corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman and J. G. Vedder (Yerkes, 1972, p. C59). Upper fauna.

Mollusca
Bivalvia
Argopecten ventricosus (G. B. Sowerby, II) [= *A. circularis* (Sowerby) of Yerkes, 1972]

Field No: F-6. Sec. 20, T. 3 S., R. 10 W., artificial cut 60' S and 1,100' E of NW corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman and J. G. Vedder (Yerkes, 1972, p. C59).

Mollusca
Bivalvia
Cardiidae, indeterminate
Pecten bellus (Conrad) [= *P. hemphili* Dall of Yerkes, 1972]
Solen sp.
Gastropoda
Crepidula princeps Conrad
Nassarius sp.

Field No.: F-7. Sec. 24, T. 3 S., R. 11 W., 350' S and 380' W of NE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca
Bivalvia
Lucinoma annulata (Reeve)
Mytilus sp., cf. *M. californicus* Conrad
Mytilus trossulus (Gould)
Pandora sp.
Panope abrupta (Conrad)
Solen sicarius Gould
Thracia trapezoides Conrad
Trachycardium quadragenarium (Conrad)
Gastropoda
Olivella biplicata (Sowerby)
Echinodermata

Echinoidea
Indeterminate echinoid spines

Field No.: F-7A. Sec. 24, T. 3 S., R. 11 W., artificial cut 550' S and 315' W of NE corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman and J. G. Vedder (Yerkes, 1972, p. C59). Middle fauna.

Mollusca
Bivalvia
Patinopecten caurnus (Gould)

Field No.: F-8. Sec. 24, T. 3 S., R. 11 W., 125' S and 225' W of NE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59). Middle fauna.

Mollusca
Bivalvia
Chlamys hastata (Sowerby)
Chlamys rubida (Hinds) [= *C. hindsii* (Carpenter) of Yerkes, 1972]
Compsomyax subdiaphana (Carpenter)
Cyclocardia sp., aff. *C. occidentalis* (Conrad) [? = *C. ventricosa* (Gould) of Yerkes, 1972]
Megacrenella sp., *M. columbiana* Dall
Pandora wardiana Adams
Patinopecten caurnus (Gould)
Pecten bellus (Conrad)
Saxidomus nuttall (Conrad)
Gastropoda
Crepidula princeps Conrad
Lirobittium sp. [= *L. rugatum* (Carpenter) of Yerkes, 1972]
Neptunea tabulata (Baird)

Field No.: F-9. Sec. 17, T. 3 S., R. 10 W., artificial cut 1,340' S and 60' E of NW corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59). Upper fauna.

Mollusca
Bivalvia
Chione californiensis (Broderip)
Chlamys beringiana (Middendorff)
Cryptomya californica Conrad
Donax gouldii Dall
Gari fucata (Hinds) [= *Gari edentula* (Gabb) of Yerkes, 1972]
Glycymeris septentrionalis (Middendorff)
Leporimetis obesa (Deshayes)
Leptopecten latiauratus (Conrad) [? = *Leptopecten delosi* (Arnold) of Yerkes, 1972]
Macoma indentata Carpenter
Macoma secta (Conrad)
Mactromeris catilliformis Conrad
Mactromeris hemphilli (Dall)
Modiolus rectus (Conrad) [= *Volsella recta flabellata* (Gould) of Yerkes, 1972]
Ostrea conchaphila Carpenter [= *O. lurida* (Carpenter) of Yerkes, 1972]
Pandora sp., [? = *P. punctata* Conrad of Yerkes, 1972]
Panope abrupta (Conrad)
Parvilucina tenuisculpta (Carpenter)
Periploma planiusculum Sowerby
Protothaca tenerrima (Carpenter in Gould and Carpenter)
Tagelus sp., cf. *T. californianus* (Conrad)
Tivela stultorum (Mawe)
Trachycardium quadragenarium (Conrad)
Tresus nuttallii (Conrad)
Gastropoda
Acanthina spirata (Blainville)

Acteocina harpa (Dall)
Astyris gausapata (Gould) [= *Mitrella carinata* (Hinds) of Yerkes, 1972]
Bursa californica (Hinds)
Cancellaria tritonidae (Gabb)
Conus californicus Hinds
Crassispira zizyphus Berry [= *Crassispira montereyensis* (Stearns) of Yerkes, 1972]
Crucibulum spinosum (Sowerby)
Cryptonatica affinis (Gmelin) [= *Cryptonatica clausa* (Broderip & Sowerby) of Yerkes, 1972]
Cymatosyrinx hemphilli (Stearns)
Epitonium indianorum (Carpenter)
Erato vitellina Hinds
Kurtziella variegata Carpenter
Lacuna unifasciata Carpenter
Littorina scutulata Gould
Mitrella tuberosa (Carpenter)
Nassarius sp., cf. *N. cerritensis* (Arnold)
Nassarius mendicus (Gould) [= *N. mendicus cooperi* (Forbes) of Yerkes, 1972]
Nassarius perpinguis (Hinds)
Nassarius tagula (Reeve)
Neptunea tabulata (Baird) [= *Neptunea tabulata colmanis* (Martin) of Yerkes, 1972]
Neverita reclusiana (Deshayes)
Olivella baetica Carpenter [? = *Olivella pedroana* (Conrad) of Yerkes, 1972]
Olivella biplicata (Sowerby)
Ophiodermella mercedensis (Martin)
Polinices lewisii (Gould)
Polygireulima rutila (Carpenter)
Pseudomelatoma sp., cf. *P. pencillata* (Carpenter)
Terebra pedroana Dall
Turbonilla sp.
Volvulella cylindrica Carpenter

Scaphopoda

Dentalium neohexagonum Sharp & Pilsbry
Dentalium pretiosum pretiosum Sowerby

Arthropoda

Crustacea

Balanus sp. [= *B. concavus* Bornn of Yerkes, 1972]

Echinodermata

Echinodea

Dendraster venturensis Kew

Field No.: F-10. Sec. 18, T. 3 S., R. 10 W., 1,800' N and 375' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca

Bivalvia

Cyathodonta pedroana Dall [? = *C. undulata* Conrad of Yerkes, 1972]
Epilucina californica (Conrad)
Lyropecten cerrosensis (Gabb) – not found but if present would suggest upper fauna.
Macoma sp., [= *M. inconspicua* (Broderip & Sowerby) of Yerkes, 1972]
Macoma indentata Carpenter
Macoma secta (Conrad)
Miodontiscus prolongatus (Carpenter)
Mytilus sp., cf. *M. californianus* Conrad
Nuculana taphria (Dall)
Nutricula tantilla (Gould) [= *Nutricula lordi* (Baird) of Yerkes, 1972]
Panope abrupta (Conrad)
Pecten bellus (Conrad)

Semele venusta (Reeve) [= *S. incongrua* Carpenter of Yerkes, 1972]
Thracia trapezoides Conrad
Trachycardium quadragenarium (Conrad)
 Gastropoda
Calliostoma canaliculatum (Lightfoot) [= *C. dolarium* (Hölten) of Yerkes, 1972]
Calliostoma gemmulatum (Carpenter)
Calyptrea spirata (Forbes) [= *C. trochiformis* (Born) of Yerkes, 1972]
Crepidula sp., cf. *C. onyx* Sowerby
Crockerella conradiana (Gabb)
Cylichna attonsa Carpenter
Epitonium indianorum (Carpenter)
Halistylus pupoideus (Carpenter)
Lirobittium rugatum (Carpenter)
Nassarius perpinguis (Hinds)
Neptunea tabulata (Baird)
Neverita reclusianus (Deshayes)
Ocenebra foveolata (Hinds) [= *O. squamulifera* Carpenter of Yerkes, 1972]
Olivella baetica Carpenter [? = *O. pedroana* (Conrad) of Yerkes, 1972]
Olivella biplicata (Sowerby)
Polinices lewisii (Gould)
Scabrotrophon sp., cf. *S. lasius* Dall
 Scaphopoda
Dentalium neohexagonum Sharp & Pilsbry
Dentalium pretiosum Sowerby
 Echinodermata
 Echinoidea
Dendraster venturensis Kew

Field No.: F-11. Sec. 17, T. 3 S., R. 10 W., 55' N and 2,430' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca
 Bivalvia
Compsomyx subdiaphana (Carpenter)
Cyathodonta pedroana Dall [? = *C. undulata* Conrad of Yerkes, 1972]
Gari fucata (Hinds) [= *Gari edentula* (Gabb) of Yerkes, 1972]
Lucinoma annulata (Reeve)
Macoma secta (Conrad)
Pecten bellus (Conrad)
Siliqua sp.
Tellina bodegensis Hinds
 Gastropoda
Acteon sp. [= *Acteon traskii* Stearns of Yerkes, 1972]
Calliostoma sp., cf. *C. ligatum* (Gould)
Conus californicus Hinds
Crepidula princeps Conrad
Fusinus arnoldi (Cossmann)
Nassarius sp., cf. *N. fossatus* (Gould)
Nassarius perpinguis (Hinds)
Ocenebra foveolata (Hinds) [= *O. fusconotata* (Dall) of Yerkes, 1972]
Polinices draconis Dall
Polinices lewisii (Gould)

Field No.: F-12. Sec. 18, T. 3 S., R. 10 W., 1,400' N and 1,360' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca
 Bivalvia
Acila castrensis (Hinds)
Cyathodonta pedroana Dall [? = *C. undulata* Conrad of Yerkes, 1972]
Mytilus trossuslus (Gould)
Panope abrupta (Conrad)

Pecten bellus (Conrad)
Pododesmus macroschisma (Deshayes)
Saxidomus nuttalli (Conrad)
Solen sicarius Gould
 Gastropoda
Calliostoma gemmulatum (Carpenter)
Crepidula princeps Conrad
Megasurcula carpenteriana (Gabb)
Turritella cooperi Carpenter
 Echinodermata
 Echinodea
Dendraster sp., *D. venturaensis* Kew

Field No.: F-13. Sec. 18, T. 3 S., R. 10 W., 1,210' N and 980' E of SW corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59). Middle fauna.

Mollusca
 Bivalvia
Chlamys behringiana (Middendorff)
Compsomyx subdiaphana (Carpenter)
Cyclocardia sp., aff. *C. occidentalis* (Conrad)
Glycymeris septentrionalis (Middendorff)
Irusella lamellifer (Conrad)
Pandora wardiana Adams [= *Pandora grandis* Dall of Yerkes, 1972]
Patinopecten caurnus (Gould)
Pododesmus macroschisma (Deshayes)
 Gastropoda
Nassarius perpinguis (Hinds)

Field No.: F-14. Sec. 18, T. 3 S., R. 10 W., 1,560' N and 2,040' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca
 Bivalvia
Irusella lamellifer (Conrad)
 Gastropoda
Fusinus arnoldi (Cossmann)
Turritella cooperi Carpenter

Field No.: F-15. Sec. 18, T. 3 S., R. 10 W., 1,825' N and 1,490' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by C. W. Hoskins. Identified by C. W. Hoskins (Yerkes, 1972, p. C59).

Mollusca
 Bivalvia
Panope abrupta (Conrad)
Trachycardium quadragenarium (Conrad)
 Echinodermata
 Echinodea
Dendraster sp., *D. venturaensis* Kew

Field No.: F-16. Sec. (32), T. 2 S., R. 10 W., artificial cut 1,735' N and 600' W of SE corner of section, La Habra 7.5' Quadrangle. Collected by R. F. Yerkes. Identified by W. H. Holman and J. G. Vedder (Yerkes, 1972, p. C59).

Mollusca
 Bivalvia
Panope sp., cf. *P. abrupta* (Conrad)