SIMI VALLEY

A JOURNEY THROUGH TIME

Historical Text by Patricia Havens

Photographs Compiled and Edited by Bill Appleton

Published by the Simi Valley Historical Society and Museum
1997

Holt Bros. combine harvester on the Simí about 1895.

Photo by Garden City Photo Co., courtesy Juanita Gillibrand Brooks.

FIRST EDITION

Frontispiece: Portrait of Laura Jaques Appleton
by John Sparhawk Appleton, c. 1907

IBSN 0-9659442-0-4
Library of Congress Catalog No. 97-092279

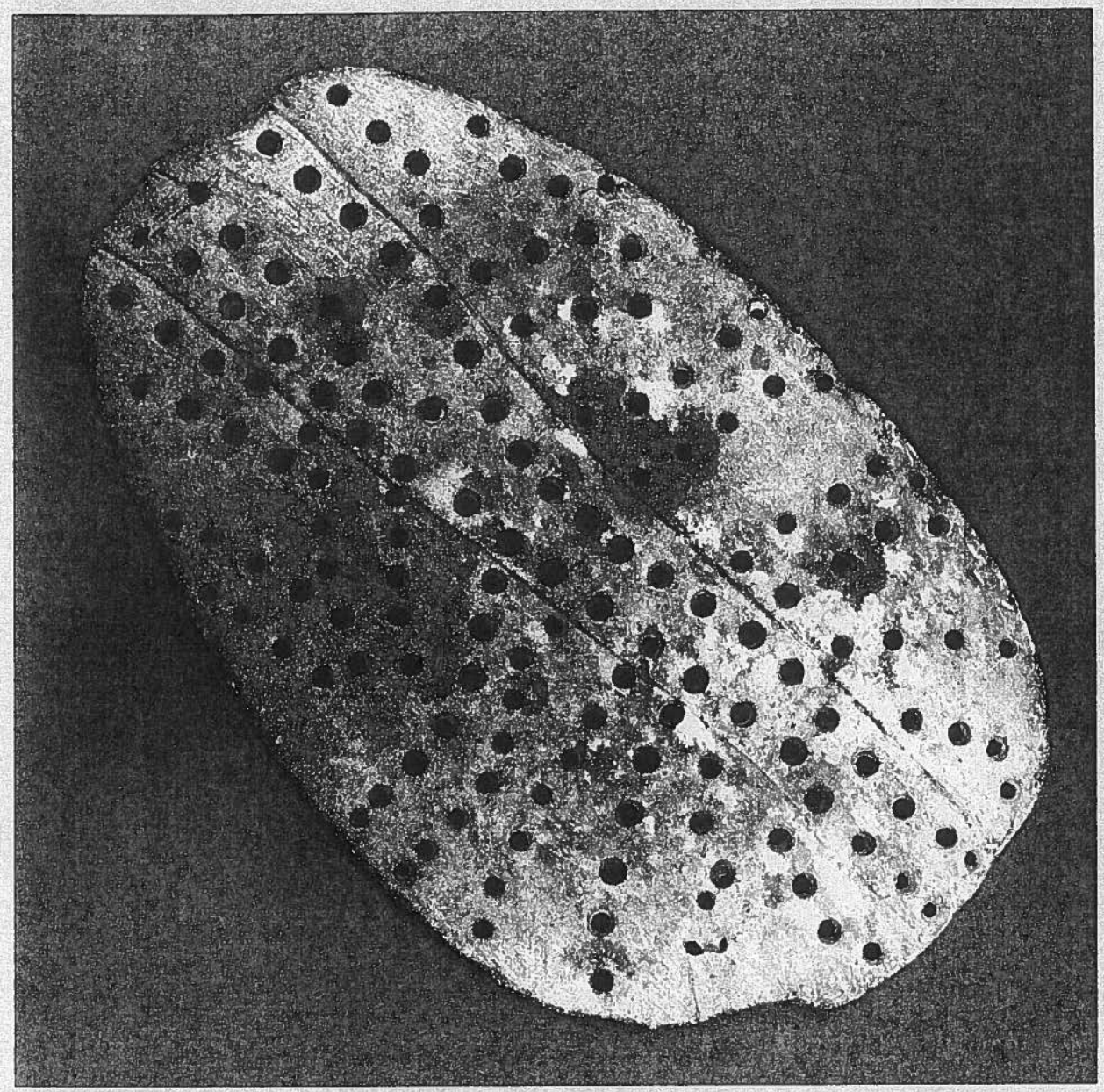
b g f e d c a

This book was published by
Simi Valley Historical Society and Museum
137 Strathearn Place
Simi Valley, California 93065

Editorial Director: Patricia Havens
Designer: Bill Appleton

Printed by BookCrafters
Chelsea, Michigan
USA

Table of Contents



This effigy tablet (16x25 cm – 6.25x10 in) was found in Tapo Canyon by Philip Walton "Bo" Gillibrand around the year 1900. Gillibrand's wife, Mabel, stated that "Bo found it up on that high mountain behind the house there." Later, Juanita Gillibrand Parker gave it to the Santa Barbara Museum of Natural History. In the 1930s a similar object found on Catalina Island was thought to be a Chumash calendar stone. (Photo by Bill Appleton. Courtesy Santa Barbara Museum of Natural History.)

Chapter One

Chumash Indians in Simi Valley

John R. Johnson, Ph.D
Santa Barbara Museum of Natural History

Many of us who live in southern California are aware of the rich Native American legacy of our region. The culture of the Chumash Indians is especially well known, because of fine examples of their material culture preserved in museums, their mysterious rock paintings still remaining in back country locations (see pictograph photos on pages 6 and 7), and their colorful narrative folklore.[1] Much more information is available today about Chumash Indian culture and history than existed previously, because of intensive study of two important sources of information: (a) the ethnographic papers of John P. Harrington, who collaborated with elderly Chumash Indians to preserve a record of their language and culture and (b) data preserved in ecclesiastical registers kept by the early Franciscan missionaries who worked among the Chumash. These records supplemented by information derived from archaeological research allow the Chumash history of the Simi Valley to be reconstructed.

Prehistory

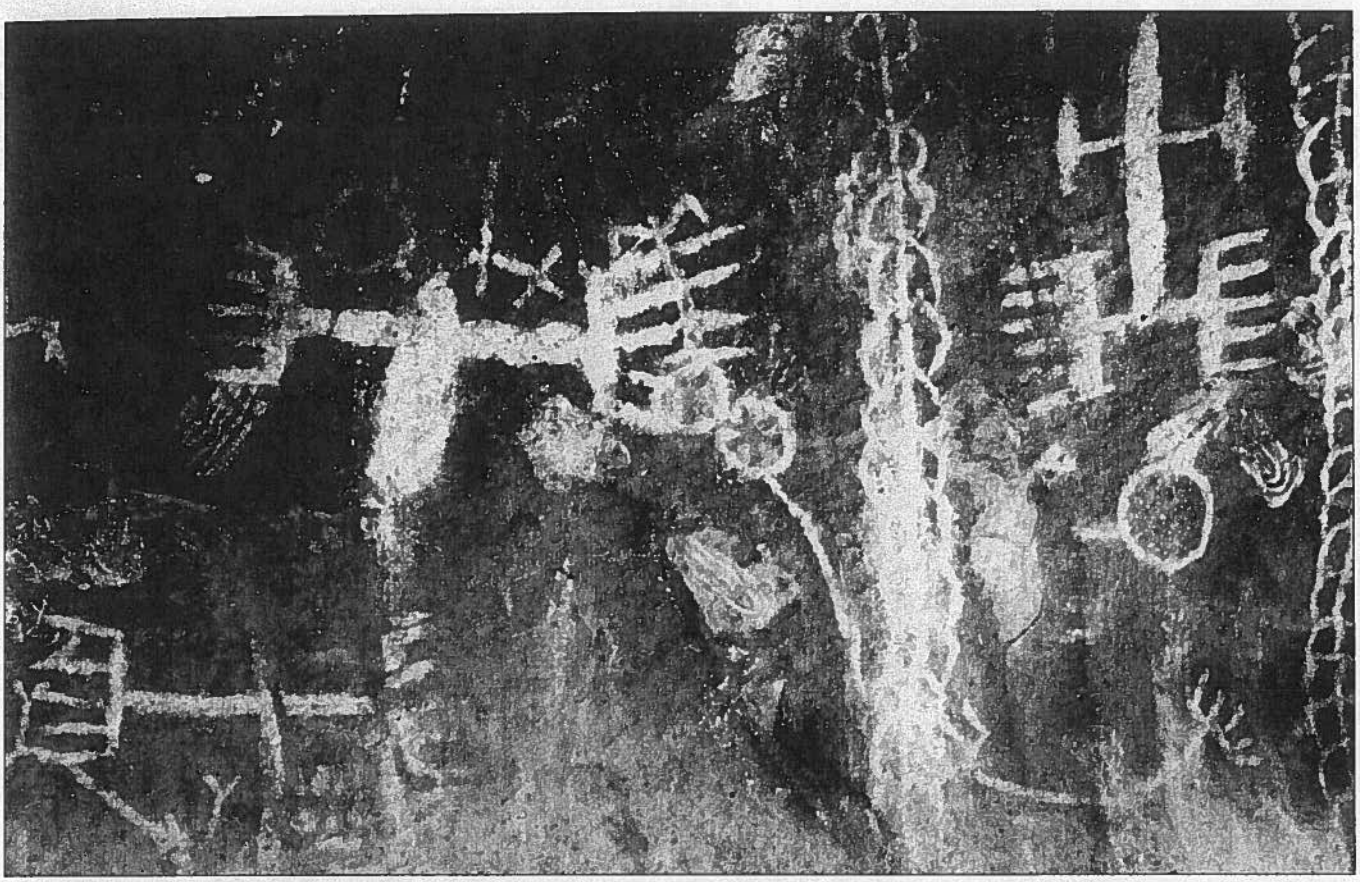
Native American presence in the Simi Valley probably extends as far back as 10,000 to 12,000 years ago. Archaeological investigations in the San Joaquin Valley and on the Northern Channel Islands provide evidence that people had arrived in California by the end of the Pleistocene. At that time, glaciers still covered much of Canada, and Columbian mammoths and other now extinct species still ranged over parts of California.[2]

No one really knows when the first people arrived who spoke a language ancestral to that spoken by the Chumash Indians. The deep linguistic divisions between the various branches in the Chumash family tree suggest that they may have existed for 5,000 years in south central California. Linguists used to assign the Chumashan Family to the Hokan Stock, a group of Indian languages with ancient roots in California, but recent research has cast considerable doubt on this hypothesis. The Chumash languages are now believed to be a linguistic isolate with no established relationships to any other family.[3]

The archaeological record reveals substantial Native American cultural change throughout the millennia leading up to the arrival of Europeans. Between about 8,000 and 5,000 years ago, a cultural pattern commonly called the "Millingstone Horizon" prevailed through much of our region. As the name implies, many millingstones (manos and metates) compose a large part of the artifact inventory at archaeological sites dating to this period. The last 2,000 years or so of this part of the Early Period have been called the Altithermal, because the climate was quite warm and dry in much of western North America. Fewer archaeological sites have been dated from the Altithermal, suggesting that lower population levels may have resulted from unfavorable climatic conditions.[4]

About 5,000 years ago, the mortar and pestle made their first appearance. Some archaeologists believe that acorn processing began at this time. Another interpretation is that the mortar and pestle may have been used initially to process the tuberous roots of plants found in marshland settings. Population did not really begin to climb in the Santa Barbara Region until about 3,000 years ago as the result of increasingly effective hunting and fishing equipment and more intensive use of local resources. At about 2,000 years before present, the tomol or plank canoe began to be used for fishing and transportation between the mainland and islands.[5]

The Chumash people had to adapt to unfavorable conditions during a major drought and corresponding warming in sea temperatures between about AD 1150 and 1300. It was during this transitional period that the regional Chumash exchange system evolved, based on shell bead money mass-produced on the Northern Channel Islands. Resources and manufactured goods from many different local areas within south central California were traded between towns using bead money as a currency.



A close-up photo of the central portion of the Burro Flats pictograph cave. The many figures depicted by the Chumash in this cave painting have mystified viewers through the ages. For the last 20 years anthropologists have recognized that this cave was used as a winter solstice observatory. (Photo by Mike Kuhn. Courtesy Simi Valley Historical Society and Museum.)

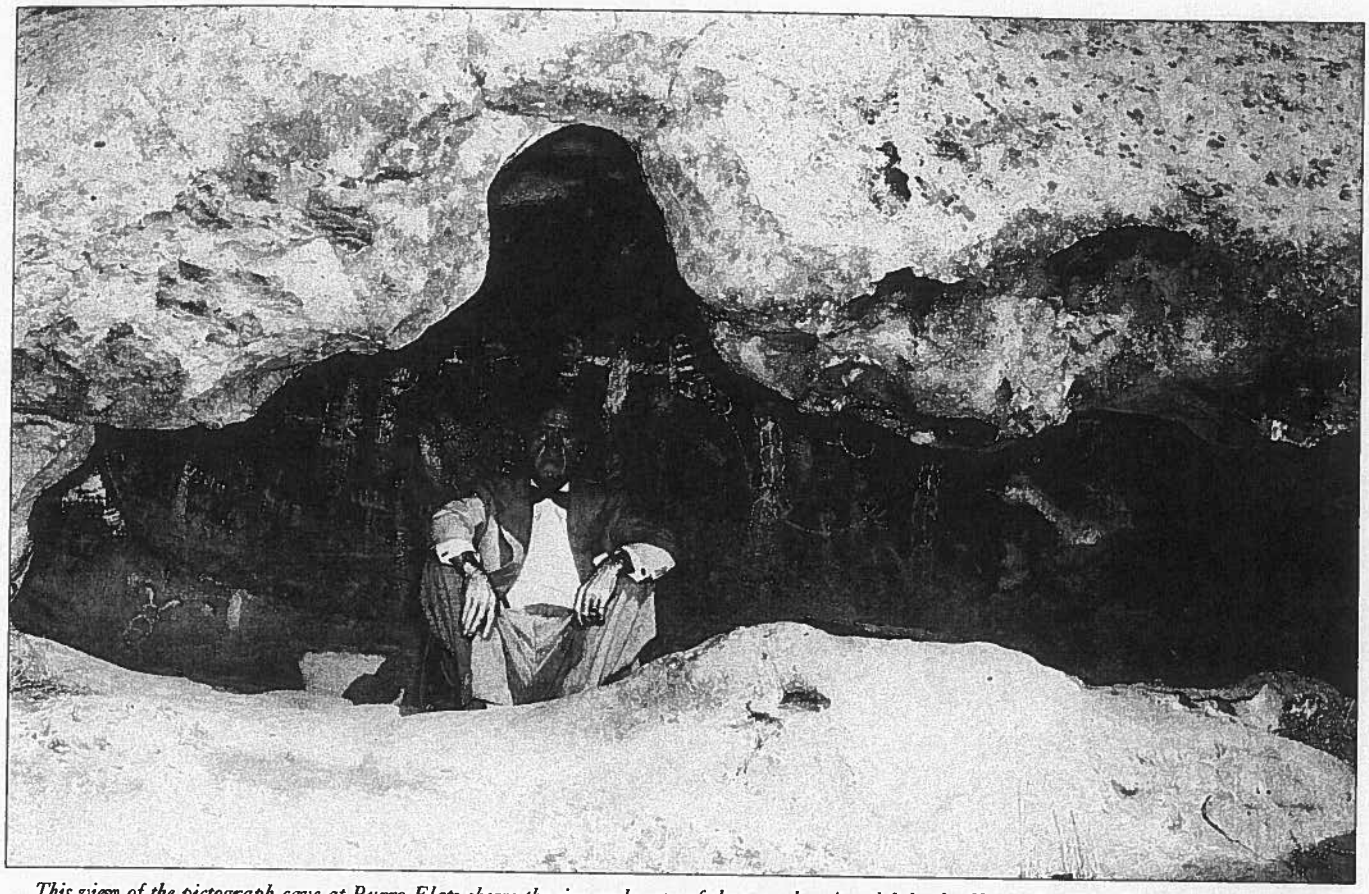
John Peabody Harrington worked for the Smithsonian Bureau of American Ethnology doing field work with Indian tribes across the United States, Canada, Mexico, Central and South America. (Photo courtesy Smithsonian Institute.)

This economic exchange system took advantage of the natural environmental diversity that existed within Chumash territory to buffer food shortages. It worked well as a means of offsetting shortfalls caused by extreme climatic events.[6]

Native towns in the Simi Valley were well situated to participate in this trade system that was so much a part of Chumash culture during the seven centuries preceding Spanish-Mexican settlement in California. The Oak Ridge formation near Moorpark was a source for fused shale, an obsidian-like glass, formed from the melting of silicates during ancient fires in oil shale deposits. Fused shale was used by the Chumash for manufacturing arrow points and other chipped stone tools and was widely traded throughout the region.[7] The Simi Valley sat at the crossroads of trails that linked communities speaking different Indian languages. Undoubtedly the towns in the Simi Valley took advantage of their central location to broker exchange between coastal and interior regions.

Simi Valley Chumash and Neighbors

Records kept by early Franciscan missionaries make it possible to reconstruct the Chumash history of the Simi Valley during the early years of Spanish settlement in California. The names of 130 people from native towns in the valley have been identified in the San Fernando and San Buenaventura mission registers between 1798 and 1829.[8] This number implies an orig-

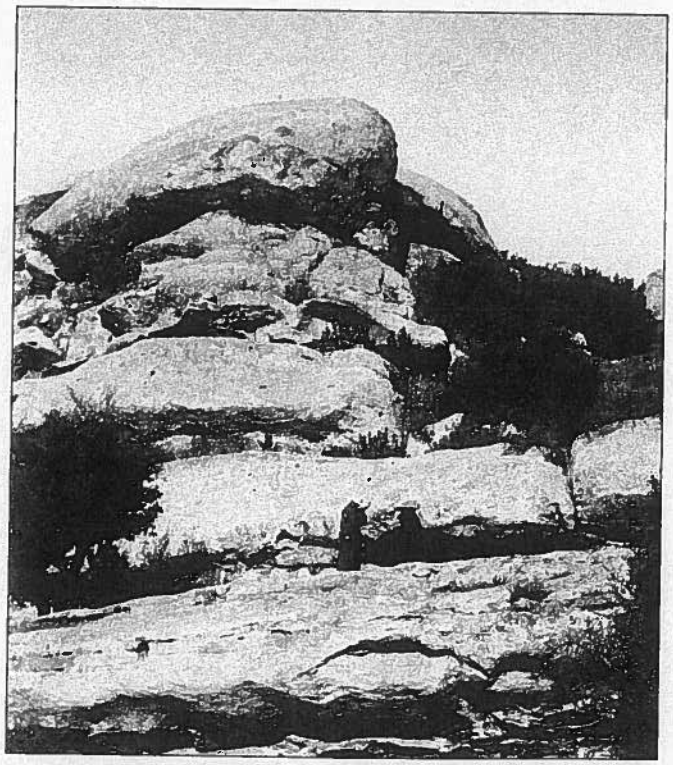


This view of the pictograph cave at Burro Flats shows the size and scope of the cave drawings left by the Chumash. This photograph was taken in the 1950s by North American Aviation, later known as Rocketdyne. Note the natural notch in the cave above the man's head which allowed a shaft of sunlight to emphasize portions of their pictograph having to do with the winter solstice. (Photo courtesy Simi Valley Historical Society and Museum.)

inal population in the neighborhood of 250-400 people. The introduction of European diseases resulted in high mortality, so that only an estimated one third to one half of the Simi Chumash were eventually baptized.[9]

The native people who inhabited the Simi Valley spoke an interior dialect of the Ventureño Chumash language. They were in the southeastern corner of the territory occupied by speakers of several Chumash languages, extending from the southern Salinas Valley to the western Santa Monica Mountains. To the west and south of the Simi Valley were a number of Ventureño Chumash settlements in the Santa Monica Mountains, along Calleguas Creek, and within the lower Santa Clara River Valley.

North and northeast of the Simi Valley, on the other side of Oak Ridge and the Santa Susana Mountains, were settlements occupied by Tataviam (Alliklik) Indians along the upper Santa Clara River Valley and its tributaries.[10] To the east on the other side of Santa Susana Pass was the San Fernando Valley, territory inhabited by speakers of the Fernandeño dialect of the Gabrielino (Tongva) language. The Tataviam and Gabrielino languages belonged to the Takic Branch of the Uto-Aztecan Linguistic Family and were entirely unrelated to the Chumash languages.



This view of the pictograph cave at Burro Flats shows the natural setting in the terrain of the Santa Susana mountains. (Photo courtesy Simi Valley Historical Society and Museum.)

Origin of the Name Simí

The presence of thread-like clouds that sometimes may be

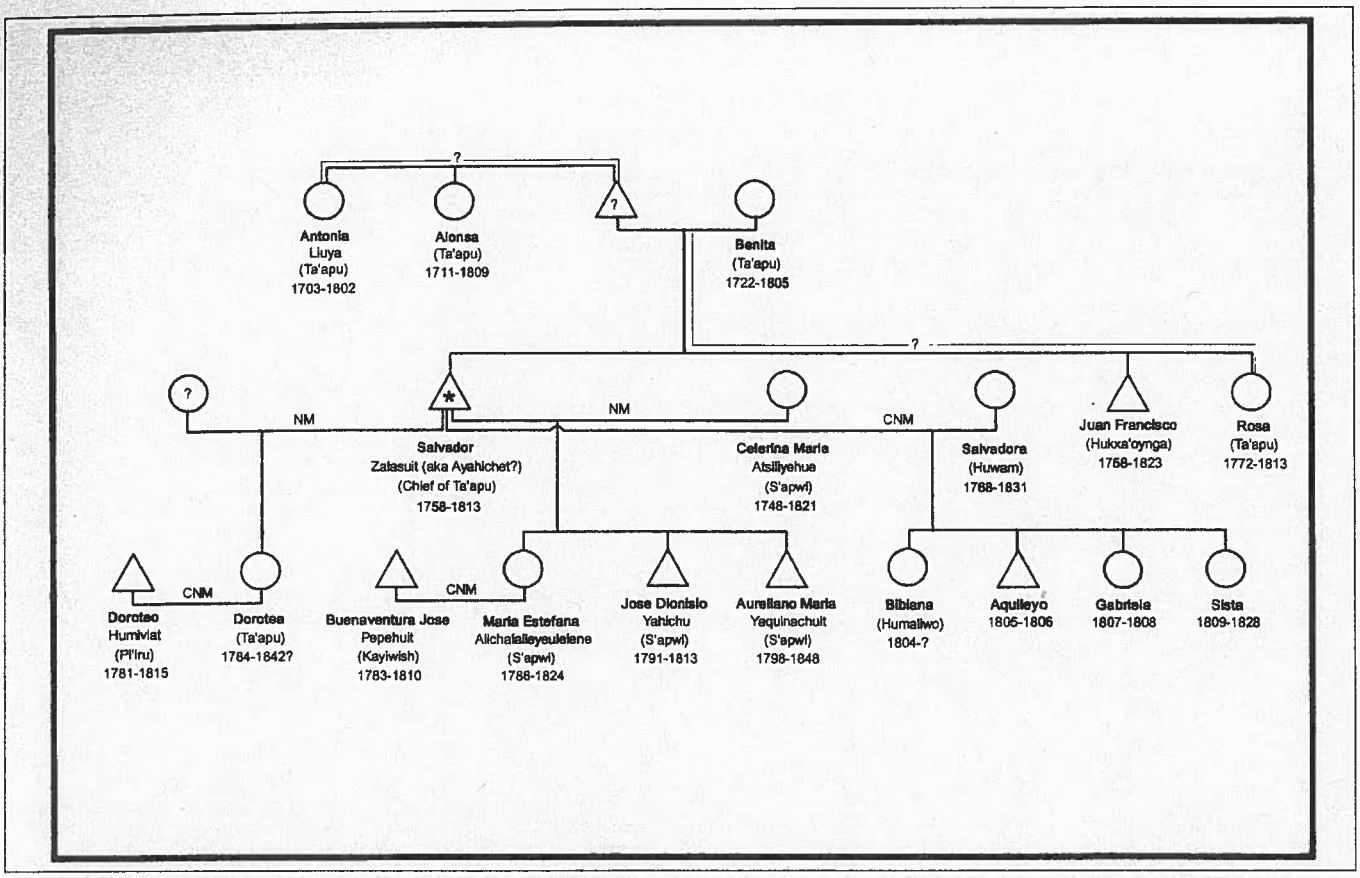
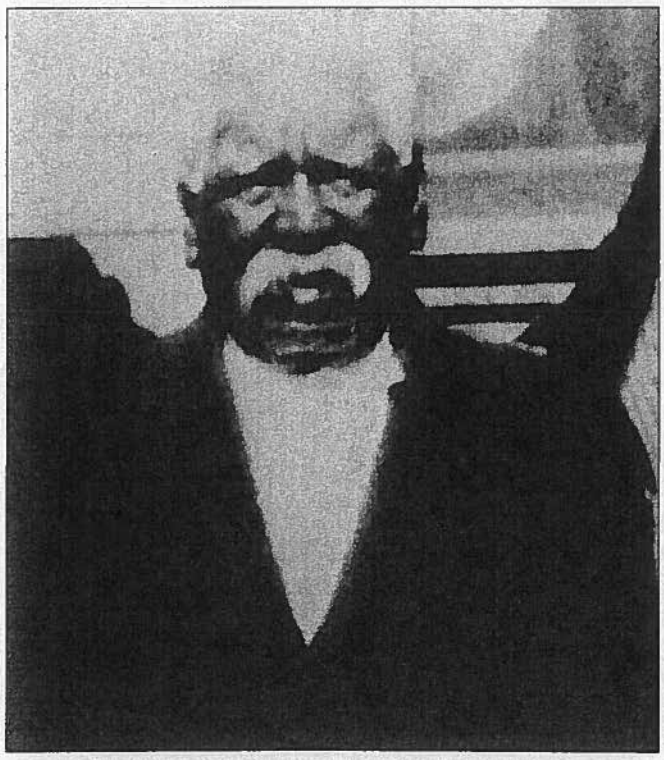


Figure 1. Genealogical chart of the family of Salvador Zalasuit, the chief of Ta'apu. Chief Zalasuit was born in 1758 and baptized in 1804 at the mission in San Fernando where he was given the name Salvador. (Figure by John R. Johnson, Ph.D. Courtesy Santa Barbara Museum of Natural History.)



Antonio María Ortega (1857-1941), great grandson of Tiburcio Cayo from Ta'apu, Simi Valley Chumash. (Photo courtesy of Beverly Folkes, Ortega's granddaughter.)

observed in the Simi Valley gave rise to its Chumash name, ***Shimiyi***, because the root of this word [mi] means "thread" in the Ventureño Chumash language. Perhaps the name derived from strands of mist from coastal fog that move into the Oxnard Plain and wind their way up Calleguas Creek and the Arroyo Las Posas into the Simi Valley. Or perhaps another weather pattern produces the appearance of wispy clouds in the sky over the valley. The Chumash were keen observers of the natural world and often bestowed their placenames according to characteristic phenomena found at particular localities.

The origin of the name ***Simí*** was preserved because of the work of the famous Smithsonian anthropologist John P. Harrington, whose brother, Robert E. Harrington, lived in the Simi Valley. An elderly Chumash Indian, Fernando Librado, told John Harrington in 1913 that a former San Fernando Mission Indian, Manuel "Capón," had told him how the valley came to be named:

> *Long ago the Tapo ranch had something like a mist or cloud. Can see it now sometimes in November. The threadlike cloud started at Tapo and went south. Kmi 'my thread.' Lokakmiash, 'it is my thread.'*[11]

Robert Harrington later explained the name in this way:

> *The word Simiji in Indian meant the little white wind clouds so often seen when the wind blows up here and*

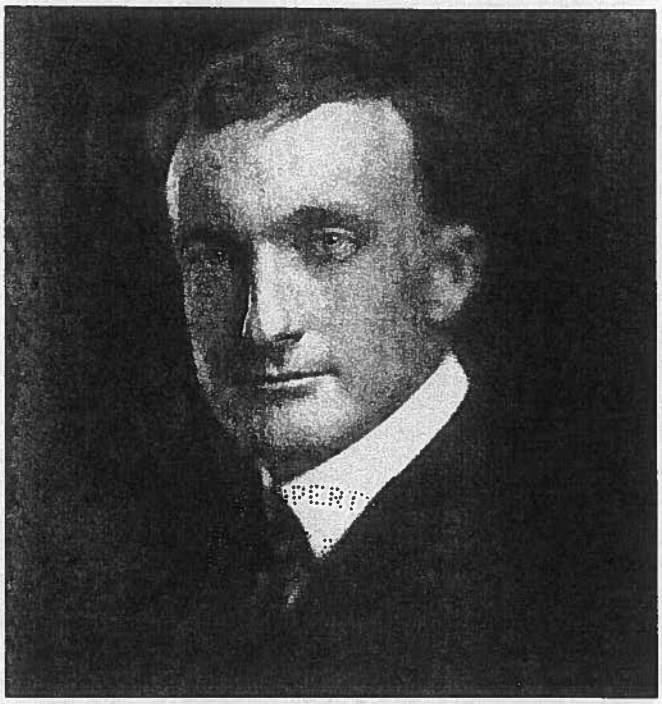
Indians living on the coast, as most of them did, would never venture up here when those wind clouds were in the sky. The word Simiji was contracted by whites to the word Simi. There are other explanations about the name Simi, but this one was given to me by my brother who worked over 40 years for the Smithsonian Institute and it seems most plausible to me.[12]

Chumash Villages in Simi Valley During the Mission Period

Three native settlements existed in the Simi Valley during the Mission Period: ***Ta'apu***, ***Shimiyi***, and ***Kimishax***.[13] The respective names of these "rancherias" were usually spelled ***Taapu*** or ***Tahapu***, ***Simii*** or ***Chimii***, and ***Quimishag*** or ***Quimisac*** by Spanish missionaries. Variants of these place names may be seen on modern maps as Tapo Canyon, Simi Valley, and Quimisa Road.

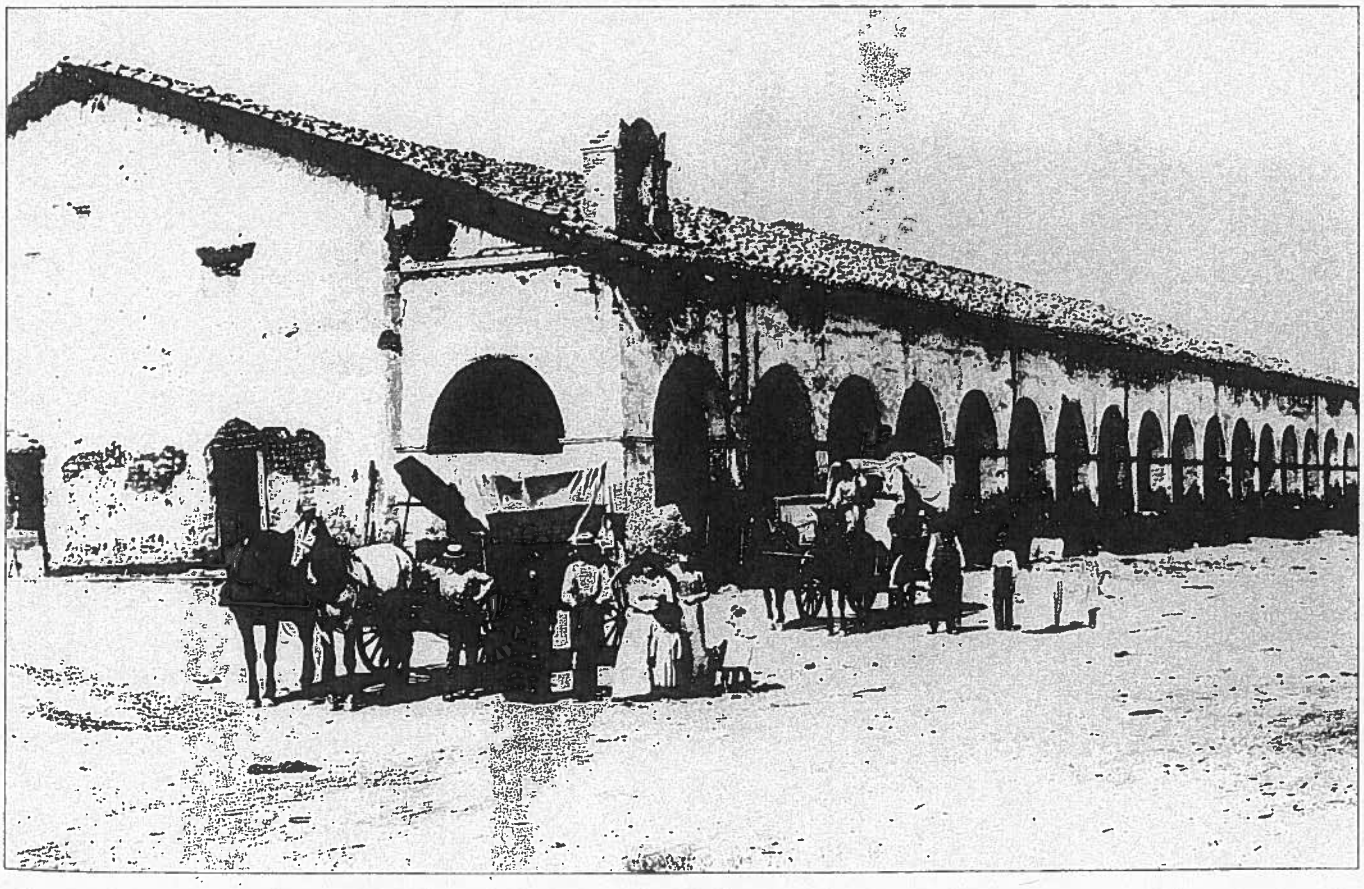
The mission records may be used to trace family relationships and marriage patterns between the Simi Valley Chumash and neighboring Chumash, Tataviam, and Fernandeño towns. They also reveal chronology of migration of native people in the Simi Valley to mission communities.

Ta'apu was the largest of the three Chumash towns in the Simi Valley and was the only one that apparently had a chief in residence. The name of this chief was ***Zalasuit***, baptized in 1804 as Salvador at Mission San Fernando. Only the largest Chumash towns had chiefs living in them, whose authority would sometimes extend over smaller, neighboring villages.[14] A total of 76 people have been identified from ***Ta'apu*** in the mission registers. Only seven of these individuals were baptized at



John Peabody Harrington (1884-1961) left voluminous records of his interviews with the Chumash that enabled modern anthropologists to produce a number of books on the Chumash language and culture. (Photo courtesy Santa Barbara Museum of Natural History.)

After the founding of the San Fernando Mission in 1797, most of the Chumash from the villages of Ta'apu, Shimiyi and Kimishax were baptized at the mission. The baptismal, marriage and burial records then became a part of the mission archives. (Photo c. 1902, courtesy California Historical Society, Title Insurance and Trust Photo Collection, Dept. of Special Collections, USC Library.)



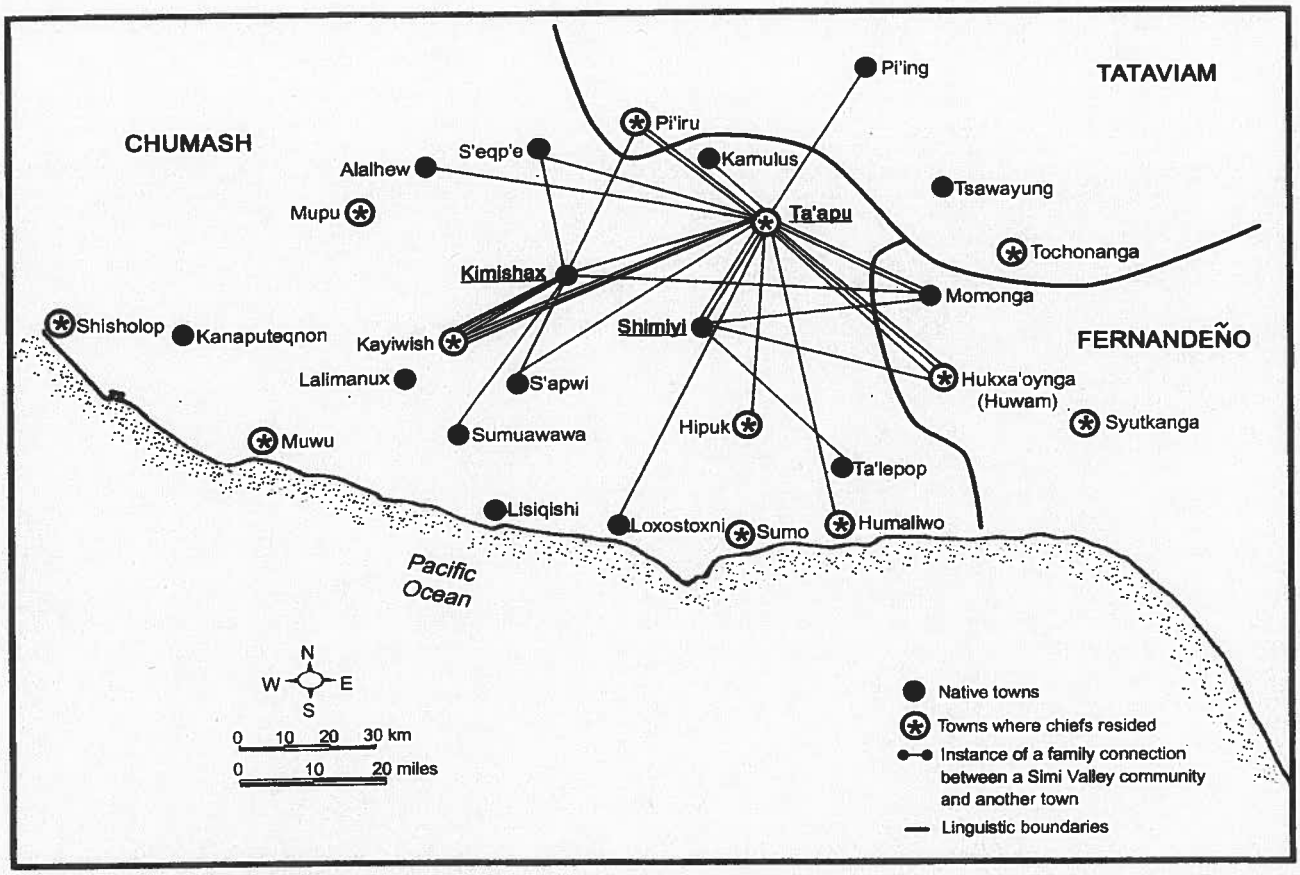
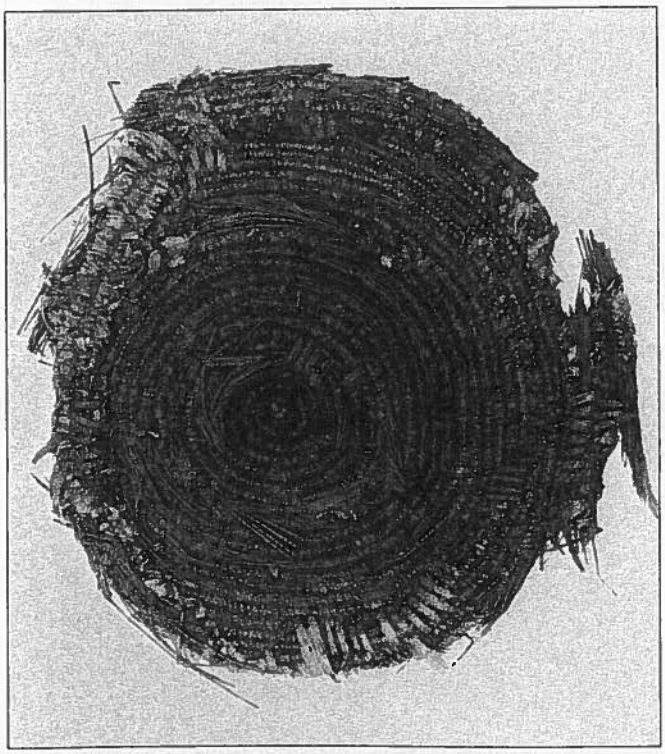


Figure 2. Map of kinship links between Simi Valley Chumash villages of Ta'apu, Shimiyi and Kimishax with their surrounding communities. (Figure by John R. Johnson, Ph.D. Courtesy Santa Barbara Museum of Natural History.)



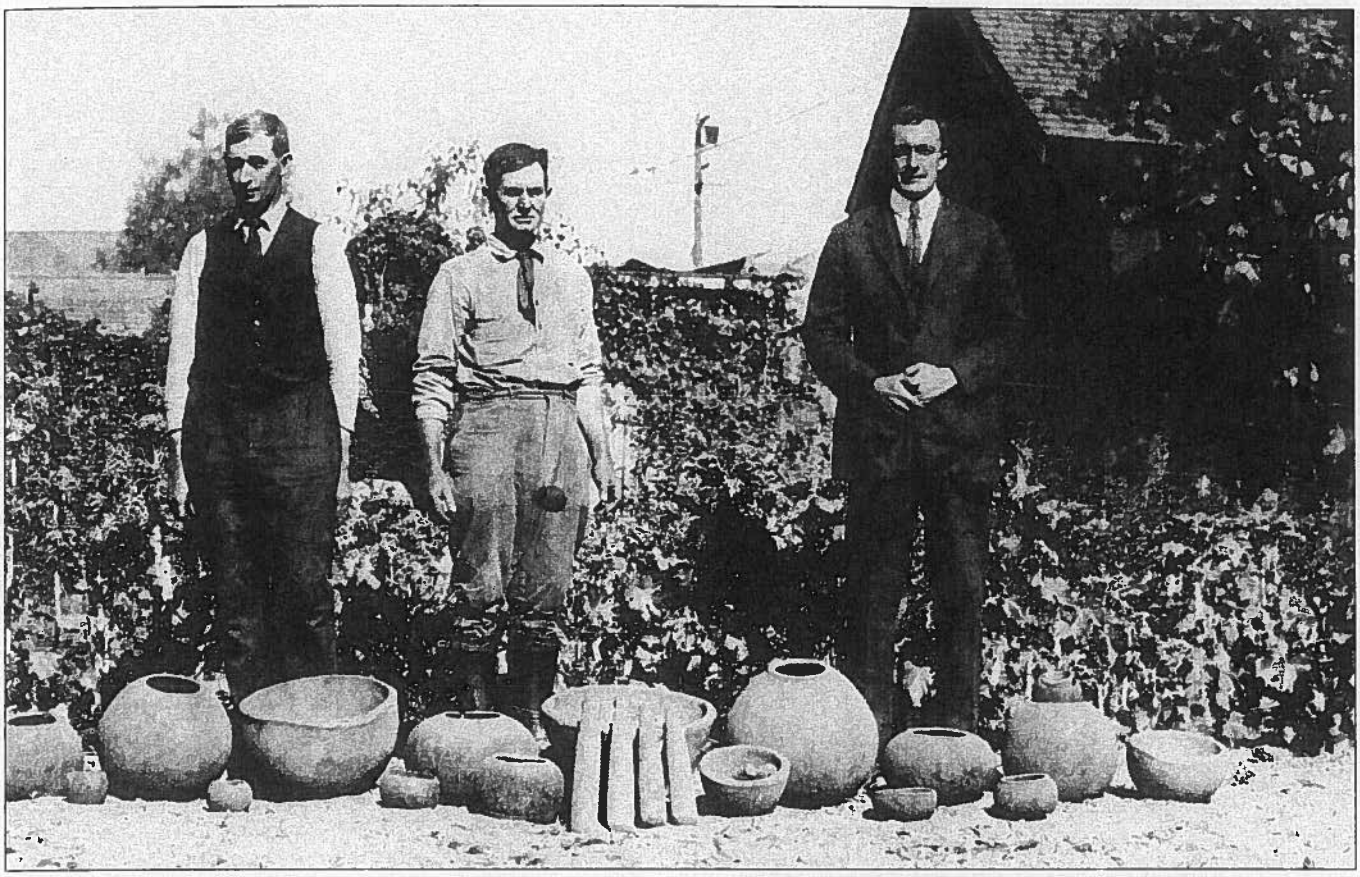
The base of a Chumash basket, possibly a burden or cooking basket, found on the Orrin Sage ranch in Simi Valley near Burro Flats. Basket base is 25.5 x 24 cm (10.25 in x 10 in). (Photo by Bill Appleton. Courtesy Santa Barbara Museum of Natural History.)

Mission San Buenaventura. The rest went to Mission San Fernando.

Based on the number of baptisms listed in the mission registers, ***Shimiyi*** and ***Kimishax*** seem to have been about equal in size, each being about a third the size of ***Ta'apu***. All but two of the 24 baptisms tabulated for ***Shimiyi*** were entered in the register of Mission San Fernando with the remaining two recorded at San Buenaventura. ***Kimishax***, located somewhere in the Moorpark vicinity, had more baptisms at Mission San Buenaventura than either of its neighbors upstream. Only eight of its people were listed in the San Fernando book of baptisms.

Conversion of the Chumash population in the Simi Valley did not begin until after the foundation of Mission San Fernando. The first two individuals baptized were two sisters from ***Shimiyi*** named ***Sutyelelene*** and ***Lagimelelene***, 12 and 18 years old respectively. They were given the names María de los Dolores and María Teresa at the time of their baptism on January 8, 1798.[15] The vast majority of people from the Simi Valley were converted to Catholicism and moved to the missions within the years 1802-1805 (Figure 4, p. 14). A few more adults were baptized in the period between 1810 and 1812.

By 1816, the old Chumash town site of ***Ta'apu*** was in use as a sheep camp. Some Mission Indian families were stationed there, which can be seen by the fact that a child was occasionally born at the ***Rancho de los Borregos de Taapu***.[16] A few



John P. Harrington (right), David P. Rogers (center) and unidentified assistant, with stone Indian artifacts found in Santa Barbara. Rogers was the first director of the Santa Barbara Museum of Natural History and assisted Harrington with his research during the excavation of the Burton Mound. (Photo c. 1920s, courtesy Smithsonian Institute.)

unbaptized Indians lived there as well, who apparently worked for Patricio and Rafael Pico, *vecinos* of the *Rancho San José de Gracia y Simí.* One of these "gentile" Indians was Francisco *Alisanaguit*, who was baptized at the end of his life at Rancho Camulos in 1824 by Thomas, Indian sacristan of Mission San Fernando.[17] Another holdout was José Antonio *Chiojo* (alias *Aguiju*), who had two daughters born at *Ta'apu* in 1816 and 1817. He too was baptized on his deathbed in 1825 by Ricardo, a San Fernando Mission Indian, who was working at the *Rancho de Tapu.*[18] The last Indian listed from *Ta'apu*, was a man baptized near death at the Mission Rancheria at San Buenaventura in April, 1829.[19]

The length of time for conversion of the native population from *Ta'apu* was unusual for Chumash towns in the Santa Monica Mountains. For most towns, no further baptisms were recorded after 1809.[20] By virtue of being located adjacent to a private rancho, San José de Gracia y Simí, some people from *Ta'apu* seem to have exercised the option of working for the rancho rather than joining mission communities. Times were hard in early nineteenth century. Diseases had taken their toll of the Chumash population. A major twelve-year drought had begun by 1804, one of the worst experienced over the past five centuries. Wild seed and acorn crops were diminished because of lack of rainfall and over-grazing by large herds of sheep, horses, and cattle introduced by Spanish settlers and missionaries.

Photograph of a diorama at the Santa Barbara Museum of Natural History depicting a Chumash solar shaman performing a ritual. (Photo courtesy Santa Barbara Museum of Natural History.)

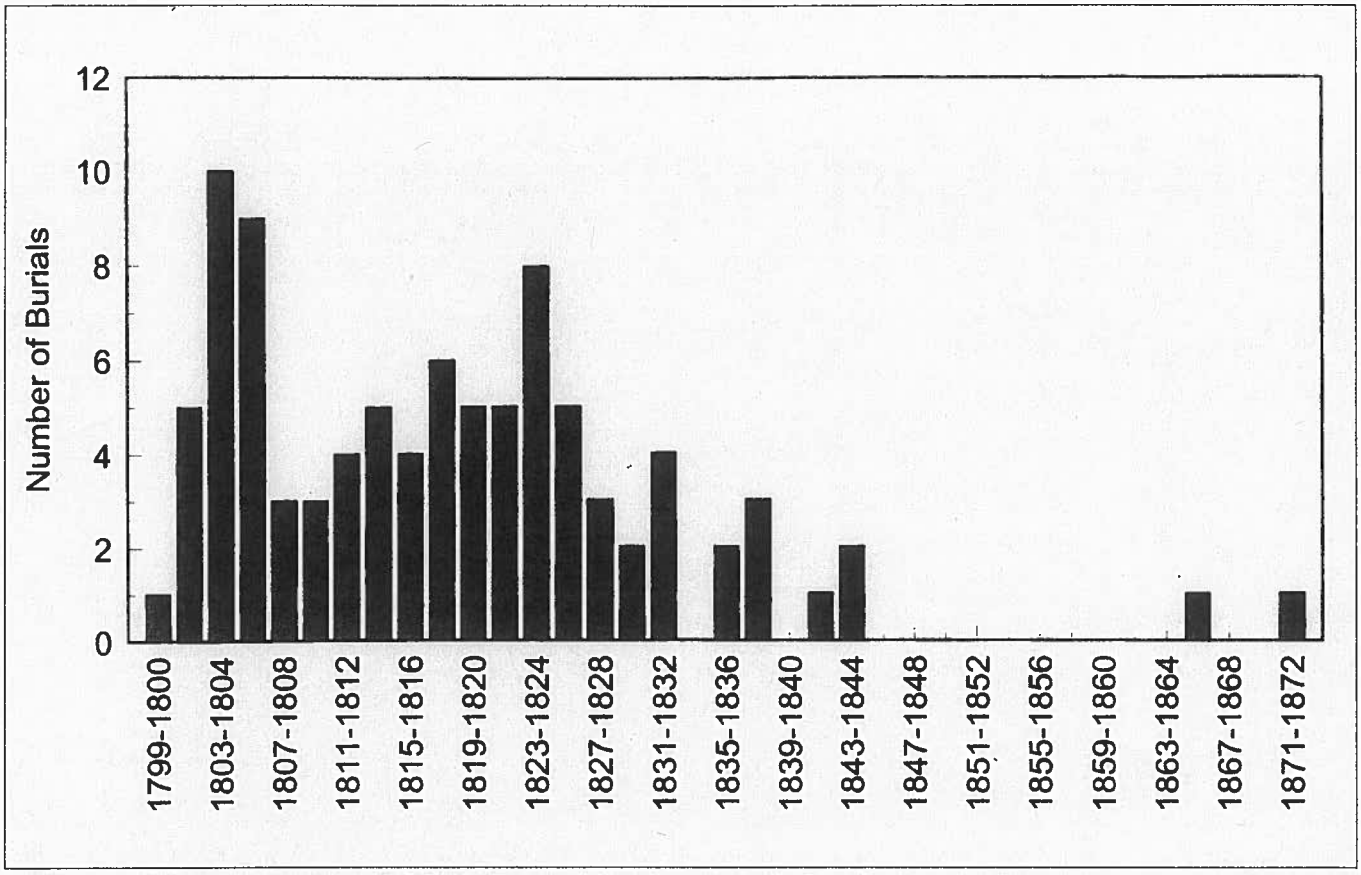


Figure 3. Recorded burials of baptized Chumash from Simi Valley at missions San Fernando and San Buenaventura. (Figure by John R. Johnson, Ph.D. Courtesy Santa Barbara Museum of Natural History.)

It was the force of circumstances, as much as anything else, that led the Chumash Indians to migrate to the missions.[21]

Family of the Chief of Ta'apu

Salvador *Zalasuit*, the chief of *Ta'apu*, was baptized at Mission San Fernando on February 18, 1804 when he was 46 years of age.[22] He was the first listed in the baptismal register in a group of sixty men and women who formally were incorporated into the mission's Indian population on that day. His entry immediately preceded that of another chief, Miguel *Semenia*, the capitán of El Escorpion (*Huwam*). Also baptized the same day was Salvador's daughter, Dorotea, who was married to a man from the Tataviam town of *Pi'iru* on Piru Creek.[23]

Salvador *Zalasuit* had a number of relatives baptized at Mission San Fernando (Figure 1, p. 8). His mother, Benita, and sister, Rosa, had been come to the mission in October, 1802 from *Ta'apu*.[24] Another sister, Januaria, arrived in March, 1805 with her husband, Januario, who was also from *Ta'apu*.[25] It was frequently the missionary custom to bestow masculine and feminine versions of the same Spanish name to husbands and wives who had been living as a married couple in native society at the time they were baptized.

Two elderly aunts of the chief of *Ta'apu*, Antonia and Alonsa, with ages estimated at 98 and 90 years old respectively, were apparently living at *Pi'ing*, a Tataviam settlement on Castaic Creek, where they were baptized in 1801.[26] Salvador's wife, Salvadora, and his brother, Juan Francisco, were from El Escorpión, a settlement at the west end of the San Fernando Valley, called *Huwam* by the Ventureño Chumash and *Hukxa'oynga* by the Fernandeño. El Escorpión seems to have possessed a mixed Chumash and Fernandeño population.[27] Salvador *Zalasuit*'s family connections to Tataviam and Fernandeño communities underscores his chiefly participation in an intertribal social network that crosscut language boundaries.

Like many other Chumash chiefs, Salvador *Zalasuit* seems to have been polygamous. Two wives were baptized at the missions. His wife, Salvadora, did not join him at San Fernando until four months later, at which time they were formally married in a Catholic ceremony.[28] Another wife, Celerina María *Atsiliehue*, of *S'apwi* (El Conejo) was baptized at Mission San Buenaventura two years later.[29]

Salvador *Zalasuit* had eight children from his various marriages. Five of these were born before he arrived at Mission San Fernando. Their birthplaces recorded in the mission registers give some indication of Salvador *Zalasuit*'s changing residences at various Chumash towns in the Santa Monica Mountains during the course of his life. His eldest daughter, Dorotea, whose mother is unknown, had been born at *Ta'apu*

in 1784. Three children were born between 1786 and 1798 at *S'apwi* in the Conejo Valley to Salvador *Zalasuit*'s next wife, Celerina María *Atsiliehue*. His first daughter by his last wife, Salvadora, was born in 1804 at *Humaliwo* (Malibu). Three other children were born to Salvadora at Mission San Fernando between 1805 and 1809, two of whom died as infants.[30]

Social Networks of the Simi Valley Chumash

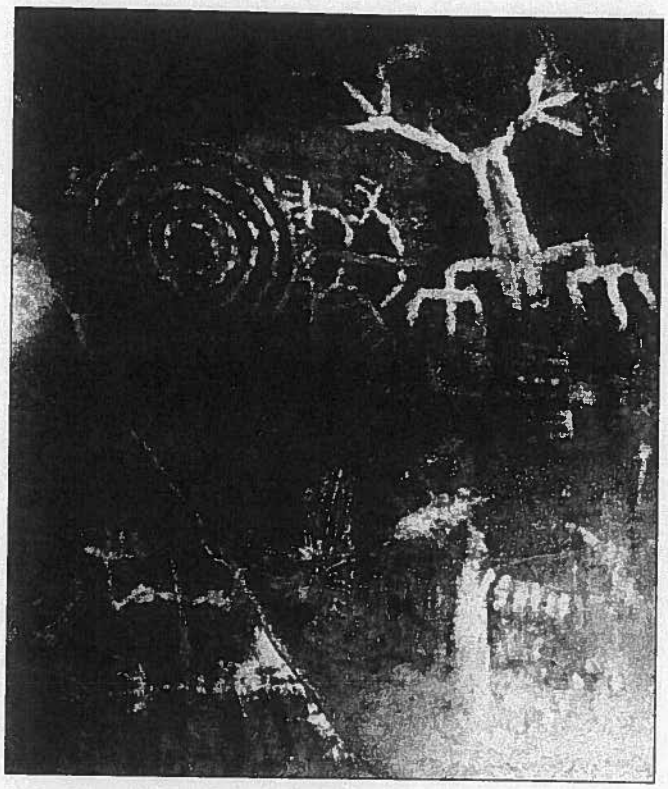
This brief case study of the family of the chief of *Ta'apu* illustrates how Chumash intervillage social relationships may be understood by reconstructing marriage and residence patterns from mission register evidence. Salvador *Zalasuit* had close family links to *S'apwi*, *Humaliwo*, *Huwam*, *Pi'iru*, and *Pi'ing*, extending from the coast to the interior and to communities speaking three different Indian languages. No other family from the Simi Valley had such a widespread social network. These kinship links probably reflect the important role of the chief of *Ta'apu* with respect to political alliances and intervillage economic exchange.

Figure 2 (p. 10) maps the intervillage links from the three Chumash towns in the Simi Valley based on data in the San Fernando and San Buenaventura mission registers. The greatest number of family connections (7 links) were to *Kayiwish* (Cayeguas) in the Santa Rosa Valley, half way to the large, important coastal Chumash town of *Muwu* (Mugu). Two towns at the west edge of the San Fernando Valley, *Momonga* (Las Piedras) and *Huwam* (El Escorpión), had four links each to Simi Valley towns. Three links were to *Pi'iru* in Tataviam territory. Both *Ta'apu* and *Kimishax* had more family connections to towns outside the Simi vicinity than they did to other communities within their own valley. *Ta'apu* had the greatest density and widest range of intervillage links, in part because of the extensive family relationships of its chief.

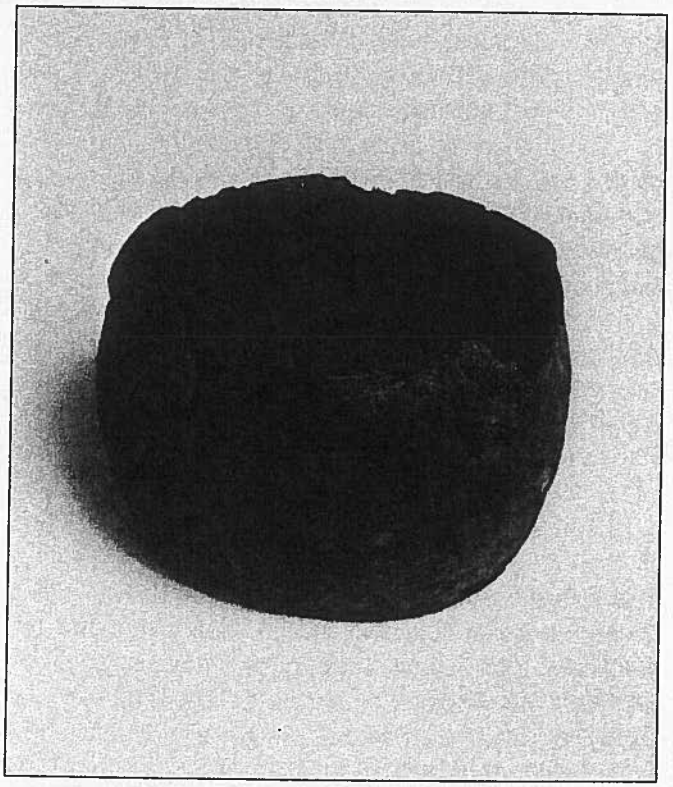
Population Trends

During the Mission Period mortality among California Indians was high because of increased exposure to introduced European diseases. The worst epidemic during the early nineteenth century was in 1806 when measles spread throughout all the missions from south to north and presumably beyond to tribes located outside the area of Spanish settlement. In February and March, 1806 more than 130 Mission Indians died at San Fernando as a result of this contagion, about 12 percent of those living there at the time. The highest mortality throughout the Mission Period occurred among the very young, so that with each succeeding generation there were fewer numbers of Indians.[31] This pattern continued beyond the Mission Period until nearly the end of the nineteenth century.

Burial records have been identified for 90 of the 119 Indians from the Simi Valley baptized at Missions San Fernando and San Buenaventura. Two reasons why nearly a quarter of the Simi Valley Chumash converts lack information regarding when they



A detail of the Burro Flats pictograph cave showing Chumash figures. (Photo by Mike Kuhn.)



This Chumash bowl-shaped basket (20 cm diameter) was found in 1965 on the Hummingbird Ranch by Patrick Bousquet. (Photo by Bill Appleton. Courtesy Ventura County Museum of Art and History.)

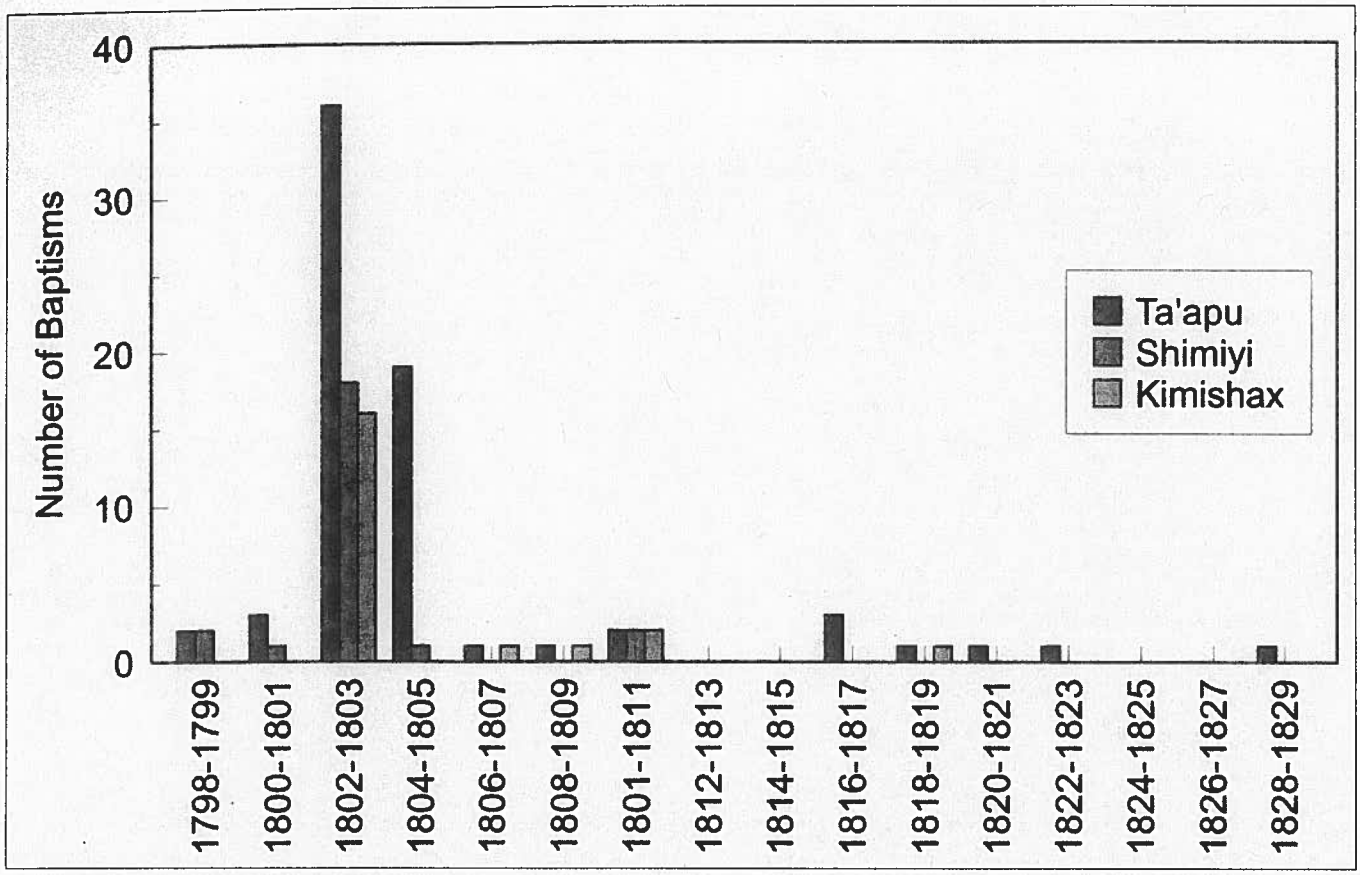


Figure 4. Baptisms of Chumash Indians from the villages of Ta'apu, Shimiyi and Kimishax. (Figure by John R. Johnson, Ph.D. Courtesy Santa Barbara Museum of Natural History.)

died are that (a) some deaths went unnoticed by the missionaries and (b) some Indians who survived the Mission Period moved out of the local area so their records have not yet been found. The number of deaths per year for the Simi Valley Chumash is plotted in Figure 3 (p. 12). This chart indicates that by 1820, more than 60 percent of those born in Simi Valley Chumash towns were no longer living. By 1840, shortly after secularization of the missions, less than a dozen remained who had known village life in the Simi Valley before joining mission communities. At least six of these were still living at San Fernando, San Buenaventura, and Santa Barbara in 1851-1852, when they were tabulated during the federal and state censuses.[32]

Three Chumash Biographies from Simi Valley

Sometimes the most effective way to gain an understanding of the experience of Chumash Indians during and after the Mission Period is to examine those records pertaining to their personal lives. Biographical reconstruction based on surviving historical and ethnographic records provide an insight into how individual California Indians adapted to the colonization of their homeland. The three individuals whose biographies have been presented here are the best known among those Chumash Indians who came from the Simi Valley. To a large extent, they are representative of the lives of many Native Americans who survived beyond the Mission Period.

Tiburcio Cayo (1793-1844)

Tiburcio *Cayo* came to Mission San Fernando from *Ta'apu* when he was ten years old. He was among more than seventy Chumash Indian converts, mostly from the Simi Valley, who were baptized in early February, 1803. His mother, baptized as "Tiburcia," also from *Ta'apu*, did not enter the mission until August, 1804, and his older brother, José Vicente "Zapato," came even later, not joining the mission until 1812.[33]

When he was about seventeen years old in 1810, Tiburcio married Teresa, a Fernandeño (*Tongva*) girl from *Syutkanga* (Encino) who had been baptized at Cahuenga in 1800.[34] This couple had seven children born at Mission San Fernando between 1810 and 1831. Two of these are known to have died as infants, three reached adulthood and were married, and for the remaining two, there is no further record. One of Tiburcio's and Teresa's married children, Marcos Evangelista, died in 1839 when he was twenty. The other two, Paula and Agueda, survived the Mission Period. Paula married Francisco de Asís *Papabubaba*, a Tataviam Indian, and Agueda married Roque, a Chumash Indian from Mission Santa Barbara.[35]

In 1843, Tiburcio *Cayo*, Francisco *Papabubaba*, and another

Mission Indian, Roman, petitioned the Mexican Governor of California, Manuel Micheltorena, for Rancho Encino.[36]

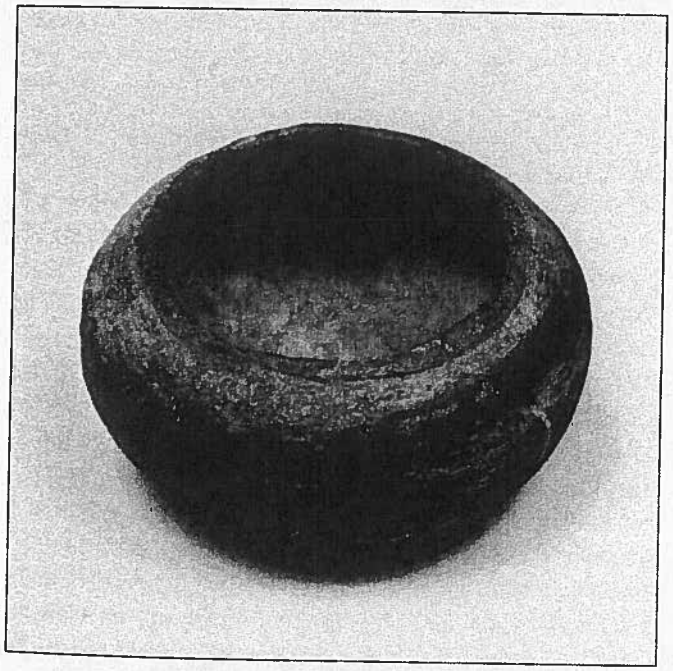
Their application was favorably received, and their grant was issued on July 18, 1845 by Governor Pio Pico, although by this date, Tiburcio was deceased. Tiburcio's other son-in-law, Roque, took his place as co-grantee. Francisco *Papabubaba* died in 1847, and his portion of the rancho was later inherited by his daughter, Rita. Roque went off to the placers in the Sierra Nevada during the Gold Rush and was never heard from again.[37]

Rita and her aunt Agueda held onto Rancho El Encino as long as they could, but their property rights were eventually acquired by Vicente de la Ossa. In 1862 Rita wed Fernando Ortega, a Yaqui Indian, who had once worked for de la Ossa and was well known as a carreta-maker.[38] Their son, Antonio María Ortega, had a large family in San Fernando, and through him many lineal descendants of Tiburcio *Cayo* survive today. A number of these continue to live in the San Fernando Valley and Santa Monica Mountains.[39]

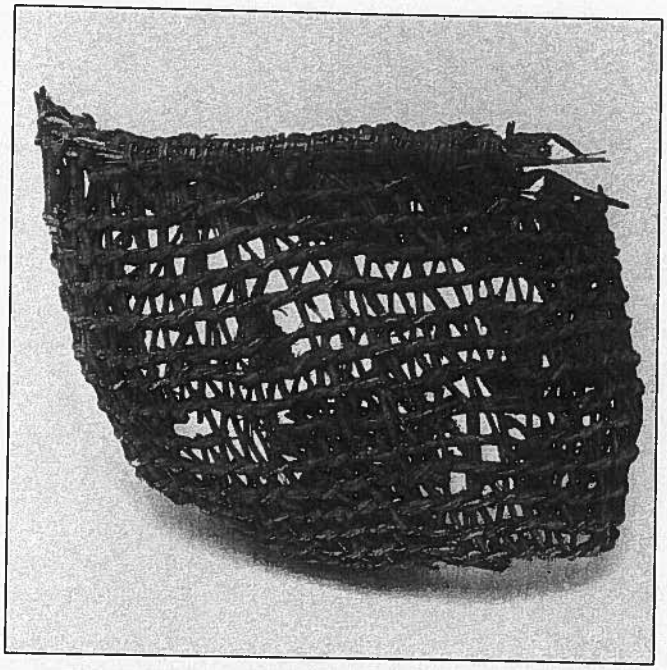
María del Pilar Siguisalmeulgel (1807-1860)

María del Pilar *Siguisalmeulgel* was baptized at Mission San Fernando on December 22, 1807 when she was eight months old. Her parents were "gentiles" (unbaptized Indians) named *Samayat* and *Liguichinuna* from *Ta'apu*. María del Pilar was later known simply as "Pilar." She was named in honor of her godmother, María del Pilar Higuera, the stepdaughter of Patricio Pico, *vecino* of Rancho Simi.[40]

Pilar's father had two brothers previously baptized at San Fernando Mission, Felipe Santiago and Mariano. In various records, both were said to be from *Momonga* on the east side of Santa Susana Pass near the present town of Chatsworth.[41] Pilar had three siblings who were also baptized as infants at Mission San Fernando. The last of these, Hermenegilda, was baptized in 1812. Hermenegilda's godmother was Teresa, wife of Tiburcio *Cayo*. There is no explicit statement in the mission registers that either of Pilar's parents were ever baptized at Mission San Fernando, but they may have been among those adults listed later from *Ta'apu* for whom no relatives were specified.[42]



A small Chumash bowl (9 cm diameter x 4 cm deep) made of steatite found on the Orrin Sage ranch in Simi Valley. (Photo by Bill Appleton. Courtesy Santa Barbara Museum of Natural History.)

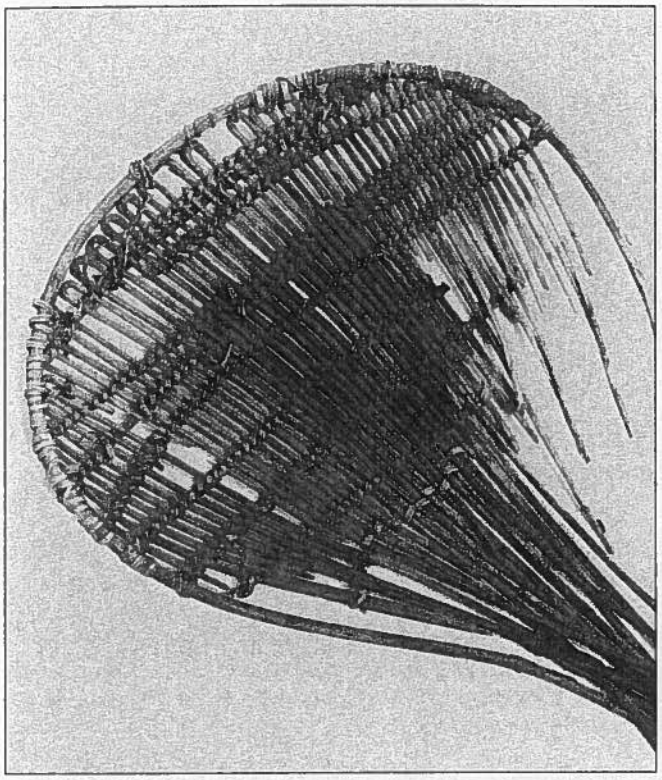


A Chumash gathering basket found in one of the caves on the Hummingbird ranch in the early 1960s (Photo by Bill Appleton, courtesy Patrick Bousquet collection.)

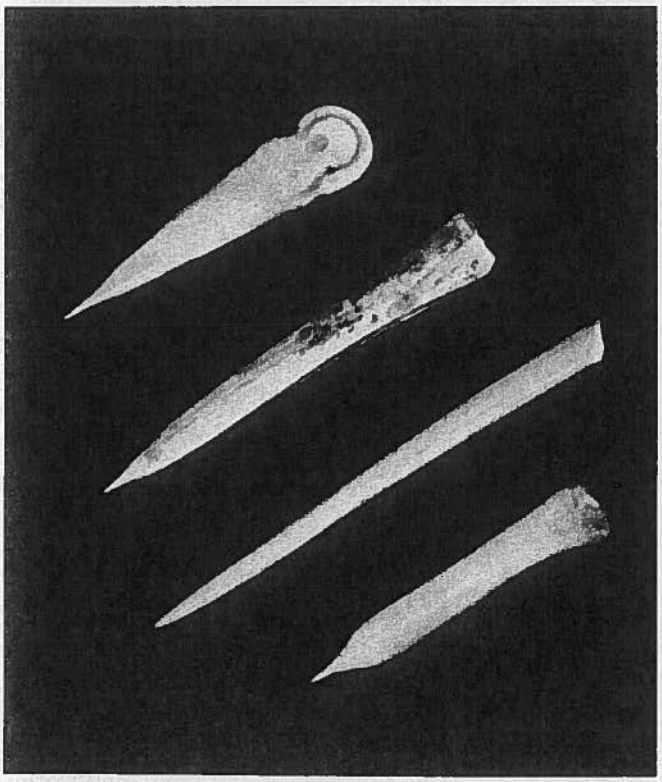
Pilar was married four times but bore no children. Her first husband was José de Jesús, a Tataviam Indian and vaquero for the Mission, whom she wed in 1821. Following his death in 1828, Pilar married Pedro Regalado *Tucupio* from *Syutkanga* (Encino). The latter died in 1835. Pilar then moved to Santa Barbara, where she wed Teofilo *Liliuanaitset* in 1840. Teofilo was the son of José Crespín *Kamuliyatset*, former chief of *Liyam* on Santa Cruz Island. After Teofilo's death, Pilar remarried in 1849 to Justo María *Guichiajahuichet*, a widower from Mission San Buenaventura, who originally came from Santa Cruz Island.[43]

In the 1852 California State Census, "J[usto] Ventureño" and Pilar were listed in a community of Chumash Indians just west of the mouth of the Goleta Slough. The chief of this settlement was Pilar's former father-in-law, José Crespín *Kamuliyatset*, who continued in the same political role he had on Santa Cruz Island. Most of the Indians who lived at this Indian community were from Santa Cruz Island.[44]

Luisa Ygnacio, who later served as a Barbareño Chumash consultant to J. P. Harrington, married a man brought up as a stepson in José *Kamuliyatset's* home.[45] Luisa knew Pilar quite



A Chumash seed beater (39.5 cm x 28 cm) found on the Hummingbird Ranch by Patrick Bousquet. (Photo by Bill Appleton. Courtesy Ventura County Museum of Art and History.)



Four bone awls found on the Orrin Sage ranch in Sim Valley. (Photo by Bill Appleton. Courtesy Santa Barbara Museum of Natural History.)

well, because they were neighbors in the same Indian community in the early 1850s. She described to Harrington her reminiscence of Pilar as an Indian healer. This account gives us some idea of the methods of treating illness used by the Simi Valley Chumash:

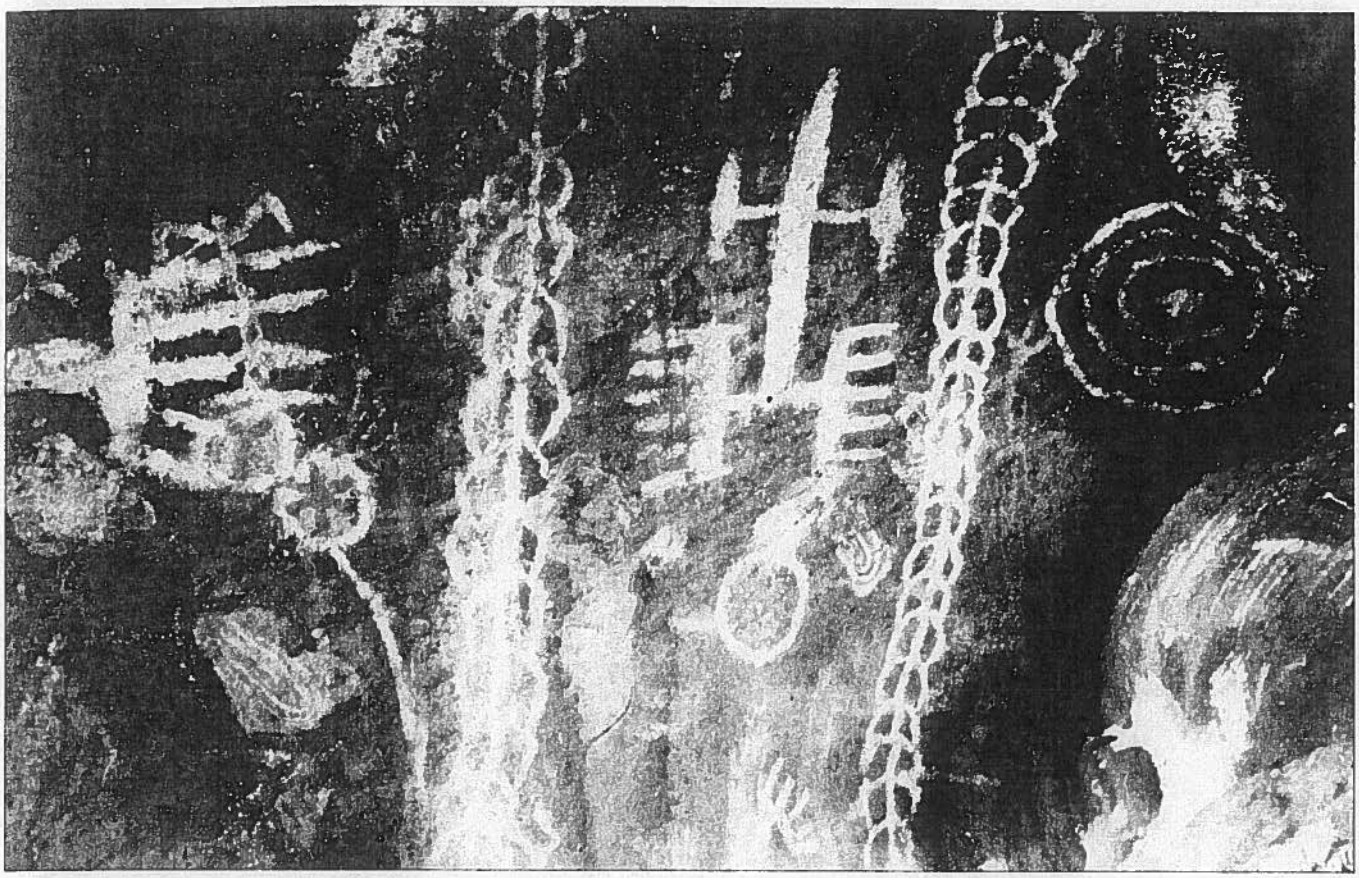
> *Pilar was a woman who had been taught methods of curing the sick by her father, a hechicero [witch doctor] from San Fernando. They knew many things there in San Fernando. Once Martina was sick and dying in the house of [José Crespin] Kamulyatset near the beach at La Goleta. Pilar came, and the people there were already crying, for they thought Martina to be dying. Pilar told Martina that she had never cured anybody yet but that her father had taught her clearly how to cure. Pilar toasted chilecote and painted Martina's body with the mashed kernels. She did not paint in solid colors, but like lines or dots. Pilar understood the human body.*
>
> *While Pilar painted she also sang. Then she rubbed Martina's body in certain ways - arms, trunk, and legs, and thus removed the sickness so that it left her body . . . Martina recovered and Pilar soon gave her toloache [Jimson Weed medicine] to drink. "You were going to die and not get well and so it is well that I gave you toloache soon..." After giving Martina toloache, Pilar told her to abstain from eating salt, meat and fat and not to have intercourse with a man for a year for toloache required much diet.*[46]

Another mention of Pilar in Harrington's notes occurs in connection with information about the Lone Woman of San Nicolas Island, who was found living by herself in 1853 and brought to Santa Barbara. According to Lucrecia García, who heard the story from her mother, Luisa Ygnacio:

> *Martina and other Indians came and saw her [the Lone Woman] at various times (singly) and brought her clams. She ate them raw. ... And they could not make her understand.... They said her language was a little like San Fernando but different. Later Pilar who talked [the] San Fernando [language], went to see her and could not talk with her either although she said many words were the same as San Fernando.*[47]

The Lone Woman of San Nicolas Island may have spoken an Island dialect of the Gabrielino (*Tongva*) language or a language more akin to Luiseño.[48] Having been raised at San Fernando Mission, Pilar was exposed to several Indian languages spoken there. Her own native speech was the local Ventureño Chumash dialect of the Simi Valley. Pilar's first two husbands spoke Tataviam and Fernandeño (a dialect of Gabrielino), so she undoubtedly knew something of these languages as well. Her difficulty in deciphering the language spoken by the Lone Woman of San Nicolas Island may be attributed to the fact that Pilar was unfamiliar with the Lone Woman's particular dialect (especially if the latter's speech was more closely related to Luiseño), and/or that Pilar herself was actually not a fluent speaker of Fernandeño/Gabrielino.

Not much is known of Pilar's last years. Her last husband, Justo María, is known to have left town to live with another



A detailed photograph of the Burro Flats pictograph cave. (Photo by Mike Kuhn. Courtesy Simi Valley Historical Society and Museum.)

Chumash woman from San Buenaventura. He died in 1861, and by then Pilar was also deceased. According to Luisa Ygnacio, Pilar was buried at Mission Santa Barbara.[49]

Leopoldo Cuticucagele (1799-1865)

Leopoldo *Cuticucagele* was baptized from *Ta'apu* at Mission San Fernando on February 6, 1803, the same day as Tiburcio *Cayo*.[50] As his age was estimated at four years old, it is likely his parents or other relatives accompanied him to the mission, but these have not been identified in any entry yet discovered.

Leopoldo was married twice. His first wife was Dominga whom he married in 1816. She was from *Muxunga*, a Fernandeño (*Tongva*) town in Big Tujunga Canyon.[51] After Dominga's death two years later, Leopoldo transferred to Mission Santa Barbara where he married Inocencia, who also had originally been baptized at San Fernando.[52]

Leopoldo *Cuticucagele* was at Mission Santa Barbara during the Chumash uprising of 1824. He was captured and interrogated by an officer of the Santa Barbara Presidio, leaving us with one of the few eye-witness accounts of what happened among the group of Chumash Indians who fled the missions. Leopoldo apparently did not participate in direct hostilities between the presidio soldiers and Indians in Mission Canyon but later joined the rebels at their camp at Los Prietos on the upper Santa Ynez River. Perhaps because he was still considered an outsider to the Barbareño Chumash, Leopoldo's clothing was taken from him by the Indian leader, Andres *Sagimomatse*. He then joined a friend and headed on his own for the Southern San Joaquin Valley, where most of the Santa Barbara Indians soon followed. Leopoldo mistrusted the rebels and so, fearing for his life, crossed the mountains into the upper Santa Clara River Valley, where he was apprehended by the Indian vaqueros of San Fernando who were working at the mission Rancho San Francisco Xavier.[53] The uprising ended after successful negotiations were concluded and amnesty granted to the Indian participants in June, 1824.

In his later years, Leopoldo *Cuticucagele* was known to Fernando Librado, when the latter was growing up at San Buenaventura in the 1840s and 1850s.[54] Librado said he had a reputation as having been a fine vaquero at San Fernando. Leopoldo was known as *Tumxiwalu*, because *tumxis* meant "bragger" in the Ventureño Chumash language. Leopoldo was called thus because he was always boasting of his success as a lady's man.[55]

Leopoldo was listed in the 1852 California State Census among Indian families who are known to have been living and working in the Piru and Camulos regions. His occupation was listed as "shepherd," so perhaps he was working on a ranch in the vicinity, maybe even the Rancho Tapo, which was located

Sally Verdugo (seated) daughter of Antonio María Ortega and (left to right standing) daughter Martha Laura, nephew Abel Salazar and niece Beverly Folkes. (Photo by Phil McCarten, Los Angeles Daily News, 1993. Courtesy Santa Barbara Museum of Natural History.)

where he had been born.

About 1864, Fernando Librado visited San Buenaventura and described the last of the older generation of Indians whom he had known as a boy. One of these was Leopoldo who was living in a tule house on the east side of the Ventura River with two other elderly Chumash men. Librado reported that "one of the old men told me that they were very glad I was not ashamed to talk the Indian language. They told me to continue in use of it and to keep the beliefs; if I did so, I would live a long time." Leopoldo died in 1865 and was buried in the cemetery of Mission San Buenaventura.[56]

Conclusion

The information presented in this chapter illustrates how much more is known today about the Native American history of the Simi Valley than has previously been available. Detailed studies of Chumash ethno-history based on mission records and J.P. Harrington's early twentieth century interviews are bringing this legacy to light. Yet the Historic Period that we know the most about represents less than one percent of the time in which Native Americans have inhabited our region.

Although the broad outlines of Chumash prehistory were sketched by way of introduction to this chapter, much more archaeological work remains ahead to achieve a more complete understanding of human cultural change in the Simi Valley itself. The Simi Valley was situated in an ethnic frontier where Native American groups speaking three distinct languages lived adjacent to one another. Many research questions may be asked that are unique to this situation. When did these groups arrive in the region? How did they relate through time? Did they leave particular cultural patterns recognizable in the archaeological record? What role did the Simi Valley play in the pervasive exchange system that arose during the Late Period? How did the people living in the Simi Valley respond to climatic fluctuations that are documented in our region's past?

Answers to these and other questions about prehistory will provide a more complete understanding of how human cultures changed in our region. Knowledge of past cultural and environmental relationships provides a context in which present conditions may be understood.

Notes

(1) *Campbell Grant, The Rock Paintings of the Chumash: A Study of a California Indian Culture* (Santa Barbara: Santa Barbara Museum of Natural History, 1993); Travis Hudson and Thomas Blackburn, *The Material Culture of the Chumash Interaction Sphere*, 5 vols. (Menlo Park and Santa Barbara: Ballena Press/Santa Barbara Museum of Natural History Cooperative Publication, 1982-1987); Thomas C. Blackburn,

December's Child: A Book of Oral Narratives (Berkeley: University of California Press, 1975).

(2) Michael J. Moratto, *California Archaeology* (New York: Academic Press, 1984), 34-37, 81; Jon M. Erlandson, "Early Maritime Adaptations on the Northern Channel Islands," in *Hunter-Gatherers of Early Holocene Coastal California*, ed. by Jon M. Erlandson and Roger H. Colten (Los Angeles: UCLA Institute of Archaeology, 1991), 101-111.

(3) This paragraph summary of linguistic prehistory is based on the author's discussions with researchers who have intensively studied Chumashan languages: Kathryn Klar, Marianne Mithun, and Kenneth Whistler; cf., Kathryn Klar, "Topics in Historical Chumash Grammar" (Ph.D. dissertation, University of California, Berkeley, 1977).

(4) Michael A. Glassow, Larry R. Wilcoxon, and Jon M. Erlandson, "Cultural and Environmental Change during the Early Period of Santa Barbara Channel Prehistory" in The *Archaeology of Prehistoric Coastlines*, ed. Geof Bailey and John Parkington (Cambridge: Cambridge University Press, 1988) 64-77; Moratto, California Archaeology, 126-130; William J. Wallace, "A Suggested Chronology for Southern California Coastal Archaeology," *Southwestern Journal of Anthropology*, 11:214-230 (1955). The Millingstone Horizon is equivalent to the "Oak Grove" Period as originally identified by David Banks Rogers, Prehistoric Man of the Santa Barbara Coast (Santa Barbara: Santa Barbara Museum of Natural History, 1929).

(5) Michael A. Glassow, "Middle Holocene Cultural Development in the Central Santa Barbara Channel Region," in *Archaeology of the California Coast during the Middle Holocene*, eds. Jon Erlandson and Michael A. Glassow (Los Angeles: UCLA Institute of Archaeology, in press); Glassow, Wilcoxon, and Erlandson, "Cultural and Environmental Change during the Early Period," 67, 74; Chester D. King, *The Evolution of Chumash Society: A Comparative Study of Artifacts Used for Social System Maintenance in the Santa Barbara Channel Region Before A.D. 1804* (New York: Garland Publishing, Inc., 1990).

(6) Jeanne E. Arnold, "Complex Hunter-Gatherer-Fishers of Prehistoric California: Chiefs, Specialists, and Maritime Adaptations of the Channel Islands," American Antiquity, Vol. 57(1):60-84 (1992); John R. Johnson, "Social Responses to Climate Change among the Chumash Indians of South Central California," paper prepared for "Global Change in History and Prehistory," a workshop organized by the Forest Sciences Lab, U. S. Forest Service, Albuquerque, and the Anthropology Department, Rice University, Houston, September 3-6, 1995; Chester King, "Chumash Intervillage Economic Exchange," in *Native Californians: A Theoretical Retrospective*, ed. Lowell Bean and Thomas Blackburn (Socorro, NM: Ballena Press, 1976), 288-318. Mark L. Raab and Daniel O. Larson, "Trouble in Paradise: The Late Holocene Paleoenvironment and Cultural Change in Coastal Southern California," paper presented at the Society for California Archaeology Annual Meeting, Eureka, California, April, 1995.

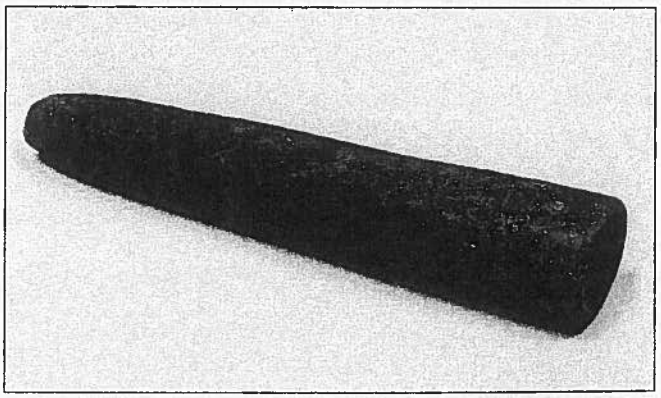
(7) Clay Singer, "The Prehistory of Fused Shale in Southern California," in *The Social and Economic Contexts of Technological Change*, The World Archaeological Congress (Southampton: Allen and Unwin, 1986).

(8) The mission register data cited in this chapter were compiled during a recent study for the National Park Service that documents Chumash population history and community continuity. Msgr. Francis J. Weber of the Archdiocese Archives of Los Angeles at Mission San Fernando and Fr. Virgilio Biasiol, O.F.M., of the Santa Barbara Mission Archive Library graciously assisted access to copies of original registers. The author was assisted in his work with the San Fernando and San Buenaventura records by Eleanor Arellanes, Robert Edberg, Scott Edmondson, Robert Lopez, Sally McLendon, and Julie Tumamait. See Sally McLendon and John R. Johnson, "Establishing the Ethnohistorical Basis for Cultural Affiliation in Areas Controlled by Chumash people and Presently under National Park Service Stewardship," 1985, report prepared under Cooperative Agreement No. CA-0434-1-9001.

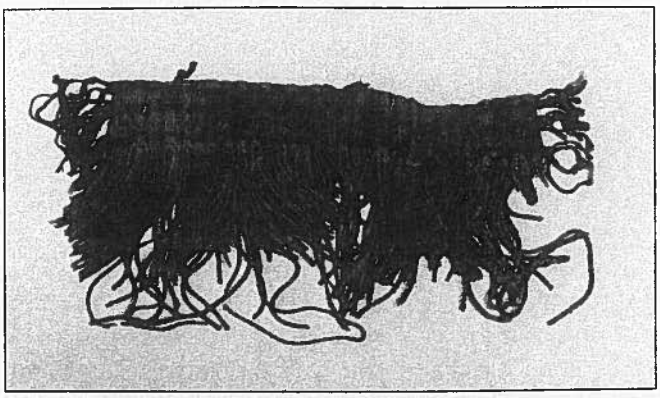
(9) The effects of introduced diseases on the Chumash population have been documented by Phillip L. Walker and John R. Johnson, "The Decline of the Chumash Indian Population," in *In the Wake of Contact: Biological Responses to Conquest*, eds. C. S. Larson and G. R. Milner, (New York: John Wiley and Sons, Inc., 1994), pp. 109-120, and Daniel L. Larson, John R. Johnson, and Joel C. Michaelsen, "Missionization among the Coastal Chumash of Central California: A Study of Risk Minimization Strategies," *American Anthropologist*, Vol. 96(2):263-299 (June 1994).

(10) Chester D. King and Thomas C. Blackburn, "Tataviam," in California, vol. 8 of *Handbook of North American Indians*, ed. Robert F. Heizer (Washington, D.C.: Smithsonian Institution Press, 1978), pp. 535-537, and John R. Johnson and David D. Earle, "Tataviam Geography and Ethnohistory," *Journal of California and Great Basin Anthropology*, Vol. 12(2):191-214 (1990).

(11) J.P. Harrington's linguistic and ethnographic papers



A stone pipe (length 17 cm or 6.75 in) believed to have been used by the Chumash and found on the Orrin Sage ranch in Simi Valley. (Photo by Bill Appleton. Courtesy Santa Barbara Museum of Natural History.)



A fragment of a Chumash plant fiber skirt made of fine cordage (perhaps milkweed) found at the Hummingbird Ranch by Patrick Bousquet. (Photo by Bill Appleton. Courtesy Ventura County Musem of Art and History.)

regarding the Chumash have been estimated at about 300,000 pages, encompassing nearly 100 microfilm reels [John P. Harrington, Southern California/Basin, Part 3 of Ethnographic Field Notes, Washington, D. C.: National Anthropological Archives, Smithsonian Institution (Microfilm edition, Millwood, N.Y.: Kraus International Publications, 1986)]. His notes regarding Shimiyi were found in the place name section of his Ventureño "slip file."

(12) Robert Harrington used [j] instead of [y] for his spelling of the Chumash name for the Simi Valley. In doing so, he was following the example of his brother, John Harrington, who also used [j] for [y] in his linguistic recordings. His quotation comes from a newspaper article: R. E. Harrington, "Indian Caves here may be preserved," ***Enterprise-Sun & News***, Wed., May 21, 1969, p. 33. The author is indebted to Pat Havens for calling his attention to this article.

(13) The glottal stop ['] found in Chumash names like Ta'apu is pronounced like the catch in your throat as may be seen in English in the expression "oh-oh." The [x] in Kimishax sounds like the "ch" in Bach.

(14) For example, only the four largest towns out of ten settlements on Santa Cruz Island had a chief in residence. See Travis Hudson, Thomas Blackburn, Rosario Curletti, and Janice Timbrook, ***The Eye of the Flute: Chumash Traditional History and Ritual as Told by Fernando Librado Kitsepawit to John P. Harrington*** (Santa Barbara: Santa Barbara Museum of Natural History, 1977), 14, and John R. Johnson, "An Ethnohistoric Study of the Island Chumash" (M.A. thesis, University of California, Santa Barbara, 1982), 117.

(15) SFe Bautismos, Nos. 58 and 59.

(16) SFe Bautismos, No. 2225.

(17) SFe Bautismos, No. 2576.

(18) SFe Bautismos, No. 2597.

(19) SBv Bautismos, Vol. 2, No. 1123.

(20) McLendon and Johnson, "Establishing the Basis for Cultural Affiliation," Chap. 7.

(21) Larson, Johnson, and Michaelsen, "Missionization among the Coastal Chumash."

(22) SFe Bautismos, No. 1166. Zalasuit seems to have also been known by the Chumash name "Ayahichet," according to information in the San Buenaventura mission records. Three children of "Ayahichet" were baptized at Mission San Buenaventura from the Chumash town of S'apwi (El Conejo). Later, the marriage record of one of these sons, José Dionisio Yahichu, reveals that "Ayahichet" had been baptized by the name of Salvador at Mission San Fernando (SBv Marriage No. 662). The only man named Salvador at San Fernando who was old enough to be Jose Dionisio Yahichu's father was Salvador Zalasuit. Although uncommonly documented, it was not that unusual for Chumash men to be known by more than one personal name in their native language.

(23) SFe Bautismos, No. 1203.

(24) SFe Bautismos, Nos. 672 and 673.

(25) SFe Bautismos, Nos. 1426 and 1427.

(26) SFe Bautismos, Nos. 517 and 518.

(27) SFe Bautismos, Nos. 1313 and 960. Alan K. Brown, "The Aboriginal Population of the Santa Barbara Channel," ***Reports of the University of California Archaeological Survey***, No. 69 (1967), p. 8; Chester D. King, "Prehistoric Native American Cultural Sites in the Santa Monica Mountains," 1994, report prepared for the Santa Monica Mountains and Seashore Foundation under Cooperative Agreement No. 8000-2-9008 with the National Park Service, Western Region, pp. 88-89.

(28) SFe Marriage No. 345.

(29) SBv Bautismos, Vol. 1, No. 2197.

(30) SFe Bautismos, Nos. 1482, 1650, and 1754; SFe Entierros, Nos. 579 and 750.

(31) Walker and Johnson, ***A Decline of the Chumash Indian Population***.

(32) Five of these six were from Ta'apu and one had been born at Kimishax.

(33) SFe Bautismos, Nos. 849, 1320, and 2010.

(34) SFe Marriage No. 485.

(35) SFe Marriage Nos. 765 and 900.

(36) Encino the site of the old Fernandeño town of Syutkanga where Tiburcio's wife, Teresa, had been born Expediente No. 458, Land Grant records, Spanish Archives California Secretary of State Archives, Sacramento.

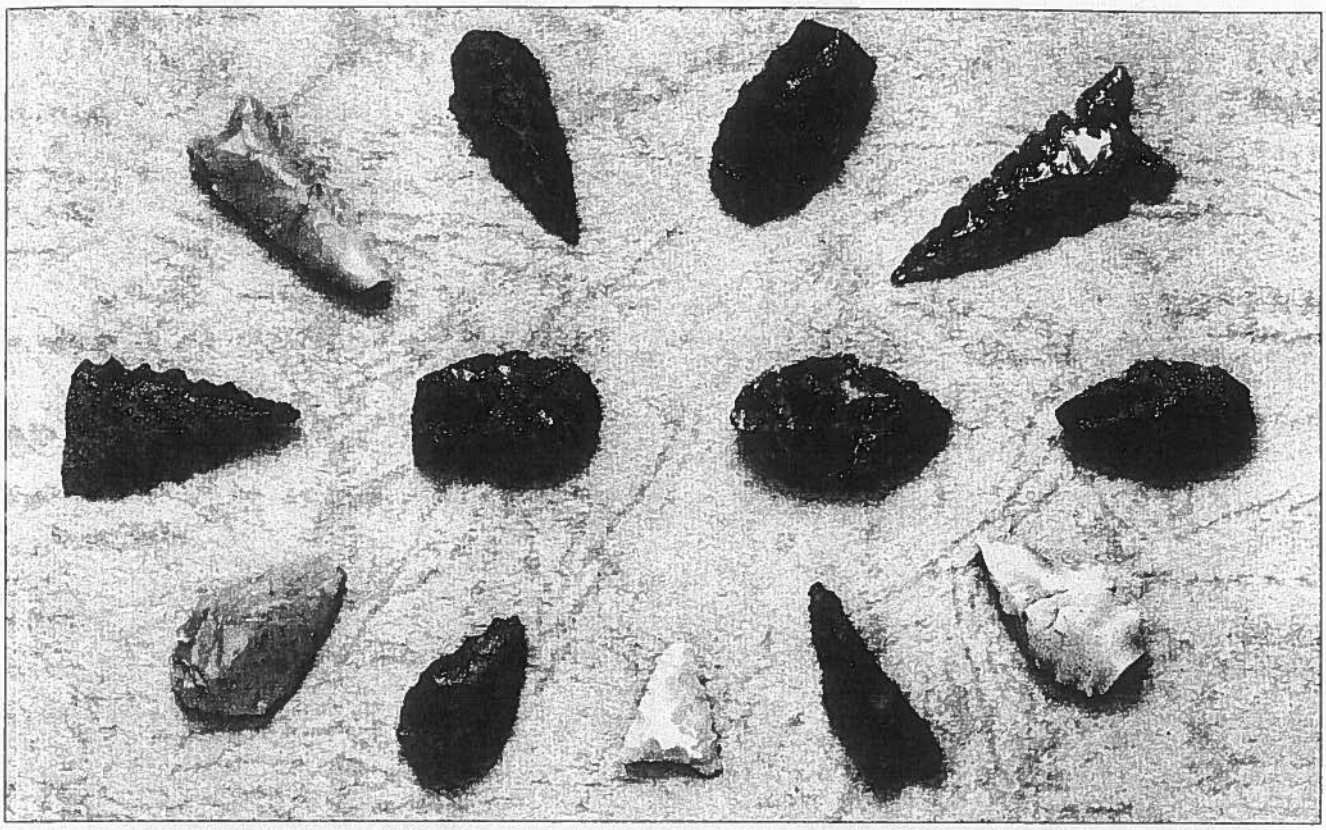
(37) G. Cowan, ***Ranchos of California*** (Los Angeles Historical Society of Southern California, 1977), 34; Southern District Case No. 392, Land Grant records, Bancroft Library Berkeley.

(38) Frank F. Latta, ***The Saga of Rancho El Tejón*** (Santa Cruz: Bear State Books, 1976), 61.

(39) The author is indepted to Beverly Salazar Folkes, Rudy Ortega, and Alan Salazar for information regarding Antonio María Ortega's family tree.

(40) SFe Bautismos, No. 1685.

(41) Felipe Santiago was listed from the Ranchería de las Piedras, the Spanish name for Momonga (SFe Bautismos, No 53). Mariano was originally baptized as a native of Ta'apu (SFe Bautismos, No. 1046), but later was said to be from "Momona'



A collection of Chumash arrowheads of various types of materials including obsidian, discovered on the Hummingbird ranch by Patrick Bousquet in the early 1960s. (Photo by Bill Appleton, courtesy Patrick Bousquet collection.)

when he wed for the second time (SFe Marriage No. 674).

(42) SFe Bautismos, Nos. 1293, 1470, 2015.

(43) SFe Marriage Nos. 698 and 774; SFe Entierros Nos. 1741 and 2047 SBa Marriage Nos. 1357 and 1407.

(44) José Crespín Kamuliyatset was also known as José 'Sudon" because he used the sweathouse frequently. His biography is sketched in McLendon and Johnson, "Establishing the Basis for Cultural of the Affiliation," Chap. 10. Also see Travis Hudson,: *Breath Sun: Life in Early California as Told by a Chumash Indian, Fernando Librado, to John P. Harrington* (Banning: Malki Museum Press, 1979), 155, and Travis Hudson, Jan Timbrook, and Melissa Rempe, *Tomol: Chumash Watercraft as Described in the Ethnographic Notes of John P. Harrington* (Socorro, NM: Ballena Press, 1978), 178- 179.

(45) Luisa Ygnacio married her first husband, Policarpo, in 1851 (SBa Marriage No. 1413).

(46) Phillip Walker and Travis Hudson, *Chumash Healing: Changing Health and Medical Practices in an American Indian Society* (Banning: Malki Museum Press, 1993), 48.

(47) John P. Harrington, microfilm of Chumash ethnographic notes on file at the UCSB Department of Anthropology, Reel 1, Fr. 182. A nearly identical account was provided by Luisa Ygnacio to Harrington (Travis Hudson, "Recently Discovered Accounts Concerning the 'Lone Woman' of San Nicolas Island," *Journal of California and Great Basin Anthropology*, Vol. 3(2):187-199 (1981), 194).

(48) Pamela Munro, Takic Foundations of Nicoleño Vocabulary, Manuscript on file, Department of Anthropology, Santa Barbara Museum of Natural History.

(49) Travis Hudson, Additional Harrington Notes on the Lone Woman of San Nicolas Island, *The Masterkey* 54(4):109-112 (1980), n. 5. Justo María, "widower of María del Pilar," was buried at Mission San Buenaventura in 1861 (SBv Entierros, Bk. 2, No. 1202).

(50) SFe Bautismos, No. 822.

(51) SFe Marriage No. 615.

(52) SBa Marriage No. 1219. The padrón (census of Indian families) of Mission Santa Barbara shows Leopoldo Cuticucagele as a transfer from San Fernando.

(53) S. F. Cook, "Expeditions to the Interior of California, Central Valley, 1820-1840," *Anthropological Records*, 20:5 (1962), pp. 153-154.

(54) Contrary to what has been previously published about Fernando Librado being more than 100 years of age when he worked with Harrington, he was actually born in 1839, not 1804 as previously supposed. See John R. Johnson, "The Trail to Fernando," *Journal of California and Great Basin Anthropology*, Vol. 4:132-138 (1982).

(55) Hudson, *Breath of the Sun*, 120.

(56) Hudson, *Breath of the Sun*, 134; SBv Entierros, Vol. 2, No. 1242.

Chapter Nine

Geologic Profile of Simi Valley

Richard L. Squires, Ph.D
California State University, Northridge

Simi Valley is in the western part of a region called the Transverse Ranges province. This province extends for a distance of about 300 miles (483 km), from the most westerly part of the southern California coast at Point Arguello in Santa Barbara County (near the town of Lompoc), to just beyond the eastern end of the Little San Bernardino Mountains in central Riverside County. In the vicinity of Simi Valley, the province is about 40 miles (65 km) wide.

The Transverse Ranges province is geologically very complex and comprises chains of mountain ranges that extend east-west and are separated by valleys. Simi Valley is one of these valleys. The Transverse Ranges province is divisible into over a dozen smaller regions, and one of these is the Ventura basin. The western half of the basin is presently covered by the Pacific Ocean. The eastern boundary of the basin is the San Gabriel fault, which extends along the San Gabriel Mountains and across the Santa Clarita Valley. To the north, the Ventura basin is bounded by the Santa Ynez Mountains and Topatopa Mountains, and to the south by the Santa Monica Mountains. Simi Valley is situated within the Ventura basin.

Like most of the valleys in the Transverse Ranges, Simi Valley contains a thick section of clastic sedimentary rocks. These kinds of rocks are layered and resulted from the compaction and cementation of sediments. Simi Valley is unusual because this section of rocks, which measures about 24,400 feet (7,438 m) in thickness, is in a relatively small area that is only about 10 miles (16 km) long and 9 miles (14.5 km) wide. To the north, Simi Valley is flanked by the Big Mountain area and the southwestern part of the Santa Susana Mountains (Figure 1). To the south and east, the valley is rimmed by the Simi Hills. To the west are unnamed hills that separate the valley from the Tierra Rejada Valley and Little Simi Valley.

The sediments that originally comprise clastic sedimentary rocks consist of particles of pre-existing rock. The sizes of the particles, listed in order of increasing size, are mud, silt, sand, pebbles, cobbles, and boulders. Following compaction and cementation, mud becomes mudstone; silt becomes siltstone; sand becomes sandstone; and the pebbles, cobbles, and boulders become conglomerate. Clastic sedimentary rocks are layered with the oldest layer (bed) at the bottom of the stack and the youngest layer at the top.

There are ten clastic sedimentary rock units exposed in the Simi Valley area (Figure 1). There is also a volcanic rock unit that resulted from lava flows. Collectively, these various rock units range in geologic age from Late Cretaceous (about 75 million years) through early Pleistocene (about 1 million years). Overlying the youngest rock unit are unconsolidated sediments deposited in the last 100,000 years or so. The sedimentary rock units and overlying unconsolidated sediments are listed below in proper order, along with their respective geologic time intervals. Nonmarine refers to river deposits, and marine refers to ocean deposits.

Alluvium (nonmarine, Holocene, last 10,000 years)
Terrace deposits (nonmarine, upper Pleistocene, about 500,000 to 10,000 years)
Saugus Formation (marine to nonmarine, upper Pliocene to lower Pleistocene, 3 to 1 million years)
Modelo Formation (marine, middle to upper Miocene, 12 to 6 million years)
Calabasas Formation (marine, middle Miocene, 13 million years)
Conejo Volcanics (marine to nonmarine, middle Miocene, 14 million years)
Vaqueros Formation (marine, upper Oligocene to lower Miocene, 23 to 20 million years)
Sespe Formation (nonmarine, middle Eocene to upper Oligocene, 45 to 24 million years)
Llajas Formation (nonmarine to marine, lower to middle Eocene, 54 to 50 million years)
Santa Susana Formation (marine, upper Paleocene to lower Eocene, 64 to 56 million years)
Las Virgenes Sandstone (nonmarine to marine, lower Paleocene, 64 million years)
Simi Conglomerate (nonmarine to marine, lower Paleocene, 65 million years)
Chatsworth Formation (marine, Upper Cretaceous, 75 to 70 million years)

Notice that the sedimentary rock units have names that generally reflect their geographic occurrence and their major rock type. If the rock unit consists of several major rock types (e.g., siltstone, sandstone, and conglomerate), then the term "formation" is used. The names "Simi Conglomerate," "Santa Susana Formation," and "Llajas Formation" are derived from Simi Valley place names. The names of the other rock units are derived from other locales in southern California.

All of the Simi Valley rock units, except the Chatsworth Formation, were formed during an interval of geologic time called the Cenozoic Era (from 66 million years ago to Recent). Sub-intervals of Cenozoic time (listed from oldest to youngest) are the Paleocene, Eocene, Oligocene, Miocene, Pliocene,

Pleistocene, and Holocene. The Chatsworth Formation formed during the last part of the Mesozoic Era during Cretaceous time, which immediately preceded Paleocene time.

To understand the complex geologic history of Simi Valley, it is necessary to discuss the theory of plate tectonics. According to the theory, the earth's crust (lithosphere) today is constructed of seven huge slabs called plates. These plates are in constant motion, driven by hot magma moving just under the crust. The boundaries of the plates are either sea-floor spreading centers, subduction zones, or transform faults.

A *sea-floor spreading center*, also called a ridge or rise, is a long fracture on the ocean floor where heat and molten matter (magma) escape. The magma soon hardens and forms oceanic crust that is made up of basalt rock. If a plate consists mostly of oceanic crust, it is called an oceanic plate. Oceanic plates grow outward from spreading centers as new rock is added there. Eventually, the basalt rock is pushed aside as new magma rises to fill the space, solidify, and become a new part of the growing plate. Oceanic crust is about 3 miles (4.8 km) thick and is young material, geologically speaking. The oldest oceanic basalt that can be found on the ocean floor today is about 160 million years old.

A *subduction zone* is a long fracture (called a trench) on the ocean floor where plates collide. One plate underrides the other plate, plunges into the earth's interior, and its leading edge is melted. The entire process is called subduction. Collisions can take place between two oceanic plates, one oceanic and one continental plate, or two continental plates. Continental plates are those that are capped with a significant amount of continental crust that is derived from remelted oceanic crust as it descends into the earth in the subduction zone. Continental crust, which consists largely of granite, is lighter than oceanic crust and is not subducted. The process of formation of continental crust has been going on since the early history of the earth. The oldest known continental crust is about 4 billion years old. Today, about one-third of the earth's surface is continental crust; the other two-thirds consists of oceanic crust. Continental crust ranges in thickness from about 18 to 30 miles (29 to 48 km).

A *transform fault* occurs where the portion of a plate or spreading center on one side of a fault moves horizontally relative to the portion on the other side of the fault, and crust is neither created nor destroyed. Transform faults usually trend perpendicularly across sea-floor spreading centers, but, interestingly, no volcanic action takes places along the transform fault itself. Most transform faults are located on the ocean floor, but a few, including the San Andreas fault in California, are situated on the continents.

From Chatsworth Formation time about 75 million years ago to upper Sespe Formation time about 30 million years ago, the western margin of North America was a subduction zone. An offshore spreading center (East Pacific Rise) was slowly moving the oceanic plate underneath the North American plate. From Chatsworth Formation time through Llajas Formation time, the interaction of the oceanic plate with the continental plate caused repeated downwarping or subsidence of the crust, thereby allowing deep-ocean waters to repeatedly cover the Simi Valley region.

Chatsworth Formation

Accumulation of the Chatsworth Formation began during the latter part of Cretaceous time. The formation is 6,000 feet thick (1828 m) and is the thick-

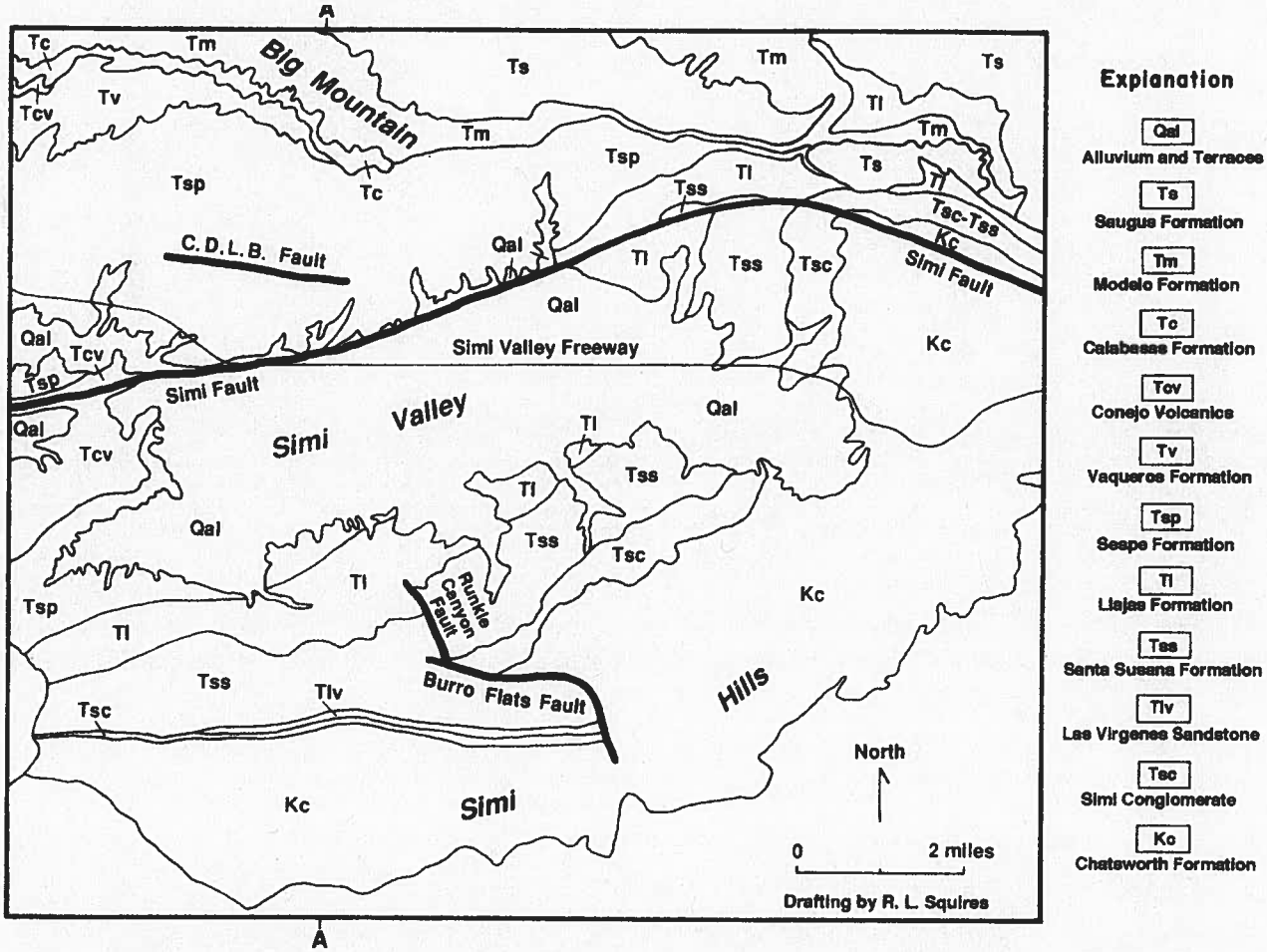


Figure 1. Generalized geologic outcrop map of Simi Valley showing exposures of the rock units, unconsolidated deposits, and major faults. Modified from Squires' (1983) geologic map in Squires and Filewicz (1983). A-A' refers to traverse of geologic cross section shown in Figure 5.

est formation in the Simi Valley area. Sandstone is the main component of the formation, and the sandy material was derived from mountain highlands to the south and transported to the edge of the continent by rivers. Very dense ocean currents, called turbidity currents, then eventually transported the sandy material from the shoreline down into a submarine canyon. At the mouth of the submarine canyon, in water depths of several thousand feet, the sands formed a delta-like accumulation called a submarine fan. After each turbidity current deposited its load of sand onto the submarine fan (thereby forming what is known as a turbidite deposit), fine mud settled out of suspension. This deep-sea submarine-fan complex comprised, not only the Chatsworth Formation, but also similar deposits of equivalent age in the Santa Monica Mountains and in the Santa Ana Mountains (Orange County).

Fresh exposures of the Chatsworth Formation can be readily observed in the extensive roadcuts along the Simi Valley Freeway in the Simi Hills, where the formation consists of thick-bedded gray sandstones interbedded with thinner mudstones. The rocks in these roadcuts are darker in color than those in the immediately surrounding hills because the roadcuts show unweathered rocks. Weathered exposures of the Chatsworth Formation are brown to reddish brown.

Additional roadcuts in the Chatsworth Formation occur along Santa Susana Pass Road, Corriganville, in Black Canyon Road, Box Canyon Road, and at the top of the Simi Hills near the Rocketdyne Santa Susana Field Laboratory. In addition, the Chatsworth Formation can be seen along the trail at Rocky Peak Park. The best area to see the Chatsworth Formation is at the east end of Simi Valley just east of Kuehner Drive. There, one can see large tilted slabs of sandstone. These sandstone beds were tilted about 400 from the horizontal by earth movements that took place when the Simi Valley syncline (discussed later) was formed.

During the time when the sediments comprising the Chatsworth Formation were accumulating, much of southwestern California (including the Simi Hills region) was several degrees of latitude farther south than it is today. Most of southwestern California may have been situated on a part of the crust that had been moving northward along the western edge of the North American continent for many millions of years before Chatsworth Formation time. Collision between this part of southern California and North America may have taken place just after Chatsworth Formation time. When the Chatsworth Formation was accumulating, however, the Simi Hills and the Santa Monica Mountains were together, possibly in an area that is now the Santa Ana Mountains in Orange County. During Miocene time about 60 million years later, they were separated from each other to their present locations by lateral movement along active faults.

The Chatsworth Formation accumulated when dinosaurs were present in the western United States. Dinosaurs, however, were not present in the Simi Valley area because of the existence of deep-sea conditions. The types of fossils found in the Chatsworth Formation are mainly deep-water microfossils of one-celled organisms called benthic foraminifera. Near the base of the formation, macrofossils (fossils large enough to be studied without the aid of a microscope) are found in beds that were deposited in somewhat shallower water than most of the rest of formation. These macrofossils, mostly snails (gastropods), clams (bivalves), ammonites (extinct creatures related to modern nautiloids), and shark teeth, were deposited in temperate (cool) waters. A total of approximately 54 species of snails, clams, and ammonites have been reported from the Chatsworth Formation. Some of the ammonite shells are quite large. They can be nearly two feet (60 cm) in diameter and weigh over a hundred pounds.

Some oil has been found in the Chatsworth Formation, but only in the Horse Meadows oil field north of Northridge. It is one of the few fields in southern California in which oil has been obtained from Cretaceous rocks.

Overlying the Chatsworth Formation is the Simi Conglomerate, which was deposited during the earliest part of the Cenozoic Era. The two formations are separated by an erosional surface called an unconformity. Following deposition of the Chatsworth Formation, the deposits were uplifted and subsequently eroded to produce the unconformity. The uplift may have been caused by the above-mentioned collision between southwestern California and North America. The gravels and sands that make up the conglomerate and sandstone deposits of the Simi Conglomerate were derived from nearby mountainous highlands to the east. Some of the rivers that cut through these mountains probably flowed from regions now in the Mojave Desert of southeastern California.

Along the south end of Burro Flats, in the Rocketdyne Santa Susana Field Laboratory area at the top of Simi Hills, the Burro Flats fault (Figure 1) bends to the north where it passes into another fault, called the Runkle Canyon fault, about 0.5 miles (0.8 km) west of Runkle Canyon. Just west of where these faults are, the Simi Conglomerate is 490 feet (150 m) thick and is overlain by the Las Virgenes Sandstone and the Santa Susana Formation. Toward the western edge of Simi Valley, the Simi Conglomerate thins to just a few feet thick.

The Simi Conglomerate

The Simi Conglomerate, Las Virgenes Sandstone, and Santa Susana Formation west of the Burro Flats and Runkle Canyon faults represent a transitional sequence from river deposits to shallow-marine deposits to deep-marine deposits, respectively. Initially river, and then, shoreline to shallow-marine sands accumulated and make up the conglomerates of the Simi Conglomerate, the sandstones of the Las Virgenes Sandstone (300 to 640 feet thick = 100 to 195 m), and the lower part of the Santa Susana Formation, respectively. Eventually, as subsidence continued and waters deepened, silts and muds accumulated and make up the siltstones and mudstones of the remainder of the Santa Susana Formation. The total thickness of the Santa Susana Formation in this area is 3,370 feet thick (1,030 m). Macrofossils are locally abundant in the shoreline and shallow-marine deposits and consist mainly of many species of snails, clams, and nautiloids. The ocean waters were quite warm and subtropical species flourished. The gastropod Turritella was especially common at this time. Some fairly large specimens of nautiloids up to about 1 foot (30 cm) in diameter have been found, and a few specimens preserve their mother-of-pearl irridescence.

The sequence of Las Virgenes Sandstone and Santa Susana Formation formed mostly during Paleocene time, about 64 to 56 million years ago, and make up one of the best exposures of marine rocks of this age anywhere in western North America.

East of the Burro Flats and Runkle Canyon faults, the Simi Conglomerate and the Santa Susana Formation both consist of deep-marine deposits that accumulated in a similar fashion as the submarine-fan deposits of the Chatsworth Formation. The Simi Conglomerate in this area is quite variable in thickness and ranges from 100 to 1,440 feet (30 to 440 m), and the thickness of the Santa Susana Formation in this area is about 3,400 feet (1,050 m). Nonmarine deposits are not recognized on this side of the fault; nor is the Las Virgenes Sandstone. Shallow-marine macrofossils are locally abundant in the lower part of the Santa Susana Formation east of the Runkle Canyon area, but the shells were transported by ocean currents from nearby shallow-marine waters into the deeper marine waters. The shells consist mostly of warm-water, subtropical snails and clams. Also some nautiloids, scaphopods (tube-dwelling animals closely related to snails and clams), and shark teeth have been found. A total of about 145 species of macrofossils have been collected from the Santa Susana Formation east of the Runkle Canyon area.

The uppermost part of the Santa Susana Formation east of the Burro Flats and Runkle Canyon faults formed during earliest Eocene time, about 56 million years ago. The sandstones in this part of the formation reflect a shallowing event. Locally, warm-water snails, clams, and solitary corals can be found.

The Burro Flats and Runkle Canyon faults are very significant because they put, side-by-side, deposits of the same age but of vastly different types of environments. The deposits on either side of the fault complex, nevertheless, look quite similar.

Exposures of the deep-marine Simi Conglomerate can be observed on the south side of the Simi Valley Freeway in a roadcut between Kuehner Drive

and the Yosemite Avenue overpass. The overlying Santa Susana Formation is exposed a short distance to the west along the north side of the Simi Valley Freeway in the vicinity of the Yosemite Avenue overpass, where steel-gray deep-marine mudstones form low hills.

The Llajas Formation

Overlying the Santa Susana Formation, on both sides of the Burro Flats and Runkle Canyon faults, is the Llajas Formation, which was deposited during most of Eocene time, about 54 to 50 million years ago. An unconformity separates the two formations. Following accumulation of the Santa Susana Formation, uplift resulted in erosion of some of this formation. The gravels that make up the conglomerate at the base of the Llajas Formation were deposited at the shoreline by rivers that flowed through a nearby mountainous highland to the east. Eventually, subsidence allowed the return of ocean waters, which, through time, deepened enough to allow formation of a thick section of shallow-marine storm-influenced sands, followed by a thin section of moderately deep-marine silts. These sediments make up the sandstones and siltstones of the formation. The thickness of the Llajas Formation is about 1,790 feet (545 m). Locally, macrofossils are very abundant in the shallow-marine deposits and consist mainly of warm-water, subtropical benthic foraminifera, snails, clams, and nautiloids. Also, some scaphopods, crabs, heart-urchins, and shark teeth have been found. A total of 107 species of macrofossils have been collected from the Llajas Formation, and some representative species are shown in Figure 2. These species are from a three-feet-thick (90 cm) sandstone layer known as the "Stewart bed."

Although most of the fossils in the Llajas Formation were concentrated in channels by means of the action of storms, the fossils in the "Stewart bed" lived together in a community that was positioned at the edge of a slope where the ocean floor began to deepen significantly. This slope edge was at least 6 miles (10 km) long, and it was where ocean currents upwelled and brought plentiful food to the animals.

Deposition of the Llajas Formation coincided with the warmest time of the Cenozoic Era about 54 million years ago. The early Eocene was the time of the last true greenhouse climate in the world. Warm climate was widespread because there was no land situated over the poles, and as a result, there was little mixing of the cooler polar waters with the warmer ocean waters elsewhere in the world. Even in the high Arctic, conifer-hardwood and deciduous-hardwood forests blanketed the land. Conditions were warm enough to support palms, cycads, tortoises, and alligators at a latitude of 77 degrees north in Ellesmere Island, Canada. Tropical to subtropical conditions extended as far north as southern England and probably as far north as the Gulf of Alaska. The Atlantic Ocean was narrower than today, and Central America was under water. There was a strong equatorial current that extended from the area now known as Pakistan, north Africa, and France into the Central American region. A branch of this current also extended along the west coast of North America. Many of the snail and clam species found in the Llajas Formation are closely related to species found in Pakistan, north Africa, and France. A few are the same.

As will be mentioned later, oil has been found in the Llajas Formation. Some of the wells that produce oil from the Llajas Formation were drilled just after the turn of the century, and a few of these wells still have the original oil-drilling equipment in daily operation (Figure 3). In lower Chivo Canyon on Marr Ranch, in the northeastern part of Simi Valley, there is also an active oil seep associated with oil-saturated sandstone of the Llajas Formation.

The Llajas Formation is not accessible to the public anywhere in Simi Valley, except in one very small exposure along Tapo Canyon Road at the mouth of Tapo Canyon, north side of Simi Valley. The conglomerate at the base of the Llajas Formation makes up a ridge just east of the golf course along the mouth of Las Llajas Canyon, near the northern end of Stearns Street. Grass-covered foothills on both sides of Runkle Canyon, on the south side of Simi Valley, consist of the Llajas Formation.

The Sespe Formation

Overlying the Llajas Formation is the Sespe Formation which was deposited during middle Eocene to late Oligocene time, about 45 to 24 million years ago. An unconformity separates the two formations and indicates uplift and erosion of the Llajas Formation prior to deposition of the Sespe Formation. The Sespe Formation, which is 5,430 feet thick (1,655 m), consists almost entirely of flood deposits laid down in river channels and on the adjacent floodplains. Initially, there were braided rivers (similar to those in southern California today) characterized by sand and gravel bars. Then, after much deposition, the land became fairly level, and muddy meandering rivers (similar to the Mississippi River) crossed the broad floodplains. During the time when the rivers changed from braided to meandering, and throughout the time of the meandering rivers, abundant land animals lived in the rivers and along the shores of the rivers. Among these animals were freshwater snails and clams, fish, frogs, turtles, snakes, crocodiles, birds, rodents, primitive land mammals (for example, rhinoceroses and camels), and primates. For a more elaborated treatment of these types of fossils and the environments in which they lived, see Lander (this volume). Toward the end of Sespe time, renewed uplift caused the return to braided rivers and the accumulation of sands and gravels.

Exposures of the Sespe Formation (lower to middle parts) are extensive along the north side of Simi Valley Freeway, especially near Madera Road. There are also excellent exposures along Tapo Canyon Road on the north side of Simi Valley. The Sespe Formation (lower part, braided-river deposits) is exposed in some of the foothills between Erringer Road and First Street on the south side of Simi Valley.

As will be mentioned later, oil and gas have been found in the Sespe Formation on the north side of Simi Valley.

During upper Sespe Formation time, there was a dramatic change in the interaction between the oceanic plate and the western edge of the North American continent. A transform fault offsetting the East Pacific Rise that had been pushing the oceanic plate to the west since Cretaceous Formation time now intersected the western margin of North America in the vicinity of central California. When this happened, about 30 million years ago, the subduction margin was slowly replaced by a margin in which the oceanic plate slipped past one another horizontally (in a sideways motion). This slippage occurred along the large transform fault associated with the sea-floor spreading center. Slippage has continued northwest and southeast of the intersection to present day at a rate of about 2 inches (5 cm) per year; hence, the transform fault has been increasing in length. Today, the transform fault is represented by the San Andreas fault. Slippage along this fault has caused the earth's crust west of the fault to move northwest away from the rest of southern California, which lies east of the San Andreas fault. In about 10 million years, Los Angeles will be adjacent to San Francisco.

Vaqueros Formation

The top of the Sespe Formation interfingers with shallow-marine deposits at the bottom of the overlying Vaqueros Formation, which was laid down during late Oligocene to early Miocene time, about 23 to 20 million years ago. The Vaqueros Formation consists of sandstone and siltstone that represent a transitional sequence from marsh and beach to shallow-marine deposits. The formation is about 1,600 feet thick (310 m) near the northwestern margin of Simi Valley but is not present east of the Big Mountain area because of erosion that took place prior to the deposition of the overlying Calabasas Formation. Volcanic glass debris in the Vaqueros Formation indicates active volcanism was occurring during deposition of this formation. Initially, the ocean waters spread northward and eastward across a relatively flat coastal floodplain with wave-dominated sandy beaches and coastal salt marshes. Continued deepening of the marine environment resulted in a fairly deep offshore shelf environment, but water depths did not exceed 180 feet (60 m). Gradual uplift or a sea-level rise then took place, with an associated decrease in water depth. Limestone beds composed almost entirely of snails, large oysters, other large clams, and barnacles are fairly common in

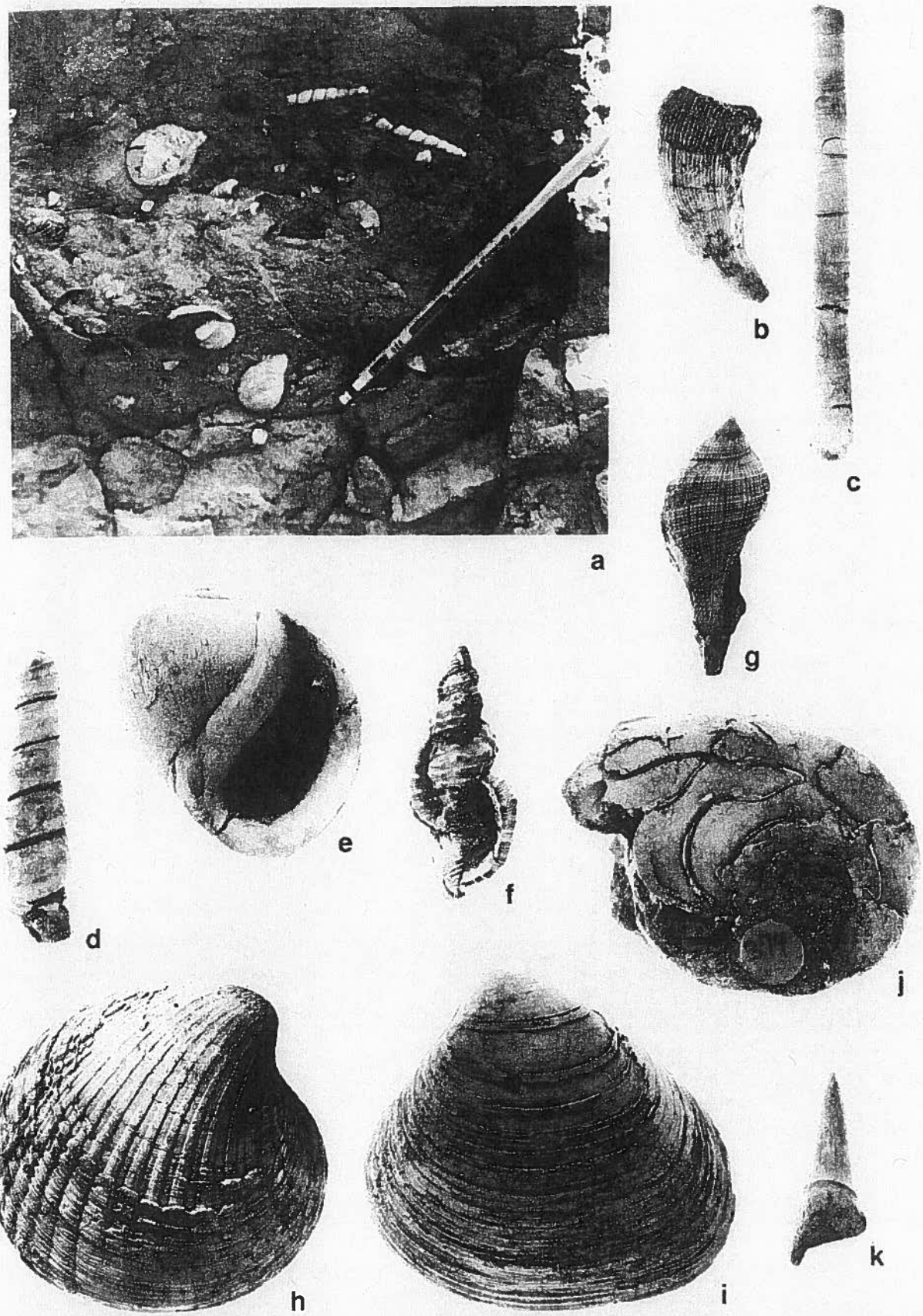


Figure 2. Representative macrofossils from the marine "Stewart bed" of the Llajas formation, north side of Simi Valley. All specimens are the same ones used in Squires (1984); a) typical exposure of the "Stewart bed"; b) solitary coral, Trochocyathus striatus, height 36 mm; c) scaphopod, Dentalium stentor, height 76 mm; d) snail, Turritella andersoni lawsoni, height 38 mm; e) snail, Eocernina hannibali, height 47 mm; f) snail, Cymatium (Septa) janetae, height 43 mm; g) snail, Ficopsis remondii crescentensis, height 43 mm; h) clam, Venericardia (Pacificor) hornii calafia, height 110 mm; i) clam, "Crassatella" uvasana, height 58 mm; j) nautiloid, Aturia myrlae, height 26 mm; k) shark tooth, Odontaspis sp., height 32 mm.

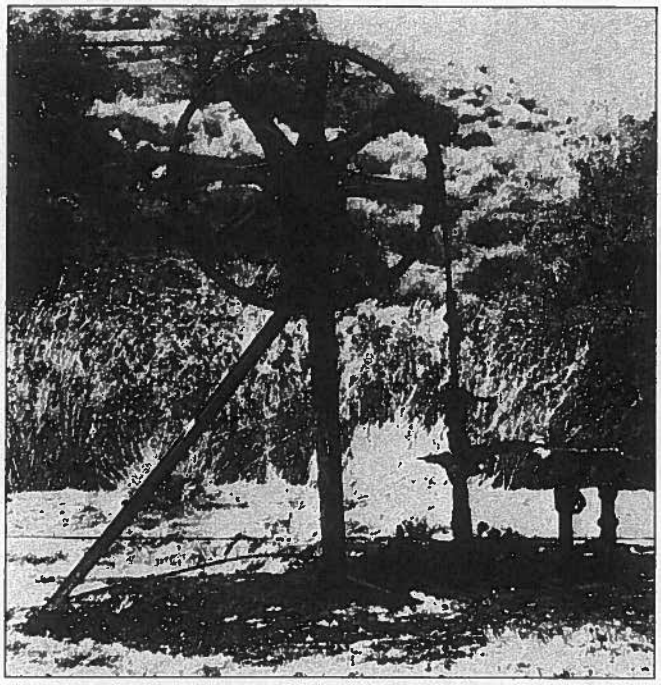


Figure 3. A turn-of-the century oil-well pump, used until recently on the Marr Ranch, northeastern Simi Valley. Photograph by R. L. Squires.

the shallow-marine, upper part of the formation. A representative snail and scallop are shown in Figure 4. The Vaqueros Formation in Simi Valley has also yielded a few marine mammals (porpoise and sea lion). The formation is exposed only in the northwestern part of Simi Valley on the south flank of Big Mountain.

Conejo Volcanics

Overlying the Vaqueros Formation near the western margin of Simi Valley is a thin interval of Conejo Volcanics, and an unconformity separates the two formations. The Conejo Volcanics first accumulated as submarine lava flows, but eventually the volcanic pile became emergent through continued outpouring of lava flows and volcanic debris during middle Miocene time. The volcanics are not present beyond the north-central part of Big Mountain because of erosion that took place prior to the deposition of the overlying Calabasas Formation. The source area for the volcanics is the Conejo Hills southwest of Simi Valley. Radiometric age dates of the volcanics indicate that the Conejo Volcanics accumulated about 14 million years ago. The chemical composition of the Conejo Volcanics strongly points to a subduction zone-related origin for these rocks. Why there was volcanic activity during Conejo time is not clear, but some form of subduction may have occurred. Soon thereafter, slippage (discussed earlier under the Sespe Formation) along the San Andreas fault caused the presumed subduction-zone activities in the Conejo Hills area to cease because no more volcanic activity took place after 14 million years ago.

Exposures of the Conejo Volcanics are also present along Olsen Road in the vicinity of the Ronald Reagan Presidential Library and underlying the hill with the cross on it. At these two locales, the Conejo Volcanics are about 200 feet thick (60 m). The volcanics also flowed southward into the western Santa Monica Mountains area.

The Calabasas Formation

The Calabasas Formation was deposited during middle Miocene time about 13 million years ago. Near the extreme northwestern corner of Simi Valley (Figure 1), the formation overlies the Conejo Volcanics and an unconformity separates the two formations. Elsewhere along the south flank of Big Mountain, the Calabasas Formation overlies the Vaqueros Formation and an unconformity separates the two formations. The Calabasas Formation is about 295 feet (90 m) thick near the western margin of Simi Valley but is not present east of Big Mountain because of erosion that took place prior to the deposition of the overlying Modelo Formation. The sandstones of the Calabasas Formation are composed of beach sands and nearshore-marine deposits. Fossils are fairly common and include barnacles, scallops, sand dollars, and some whale vertebrae. In the Simi Valley area, the Calabasas Formation is present only in the northwestern part of Simi Valley on the south flank of Big Mountain.

The Modelo Formation

The Modelo Formation overlies the Calabasas Formation and an unconformity separates the two formations. The Modelo Formation was deposited during middle Miocene time, about 12 to 6 million years ago. The formation is 1,970 feet thick (600 m). The basal part of the formation consists of silty sandstone extremely rich in shallow-water benthic foraminiferal microfossils. The remainder of the Modelo Formation consists of diatomite, a soft white siliceous (rich in silica) deposit that formed in a cold, deep-marine environment and is composed largely of the remains of microscopic floating algae (diatoms). Tremendous diatom blooms were responsible for staggering numbers of diatoms which subsequently died and settled to the ocean floor. This high productivity was spawned by late Miocene climatic cooling which intensified oceanic upwelling. The deep basinal depositional setting of the Modelo Formation was similar to the present offshore southern California continental borderland, the Gulf of California, and the western margin of South America. The basin in which the Modelo Formation in Simi Valley accumulated subsided rapidly and received a considerable thickness of sediment. These organic-rich deposits are the primary source for the rich oil accumulations in various rock units in Simi Valley.

The white diatomite in the Modelo Formation forms very distinctive exposures. Diatomite is exposed along the flank of Big Mountain, just west of Tapo Canyon, and forms a prominent cliff that many residents of Simi Valley refer to as "White Face." The top of Big Mountain is also made up of Modelo Formation diatomite. There are no stands of trees on top of Big Mountain because diatomite is not conducive to having water flow freely through it, and, therefore, deep-rooted plants cannot grow there. It is interesting to note, that the "rolling-hills" look that Big Mountain possesses resembles grass-covered hills of the Midwest. For that reason, movie companies filmed in the vicinity of Big Mountain when they wanted the "look"of Kansas or Minnesota. Many of the outdoor scenes in the TV series "Gunsmoke" were shot in the Big Mountain area. Also, the scene of Laura Ingalls running down a grassy, flowered-covered slope in the opening of the TV series "Little House on the Prairie" was filmed with Big Mountain landscape. The set of the town of Walnut Grove (supposedly a town in Minnesota) in the show "Little House on the Prairie" was built on the top of Big Mountain at its east end.

The Modelo Formation in Simi Valley has also yielded remains of land plants, clams, fish, whale bones, and possibly sea lions.

During Miocene time, there seems to have been 64 to 81 degrees of clockwise rotation of the western Transverse Ranges. Also, within the last few million years, a large "bend" has formed in the San Andreas fault in southern California north of the Transverse Ranges. This "bend" has caused the crustal plates to push against each other, as well as to slip past each other. Forces related to the pushing have caused rock layers south of the fault to be extremely compressed and form geologic structures or folds called synclines and anticlines, or to be cut and offset by faults.

Simi Valley is situated in a syncline caused by the compression (pushing) related to the "bend" in the San Andreas fault. A syncline is a "U"-shaped fold in which the rock layers are younger in geologic age nearer the middle of the structure. Simi Valley, furthermore, is in a syncline that plunges (tilts) downward in a westwardly direction. In order to visualize a plunging syncline, take a piece of paper, fold it into a "U" shape, and tilt it down and away from you.

Big Mountain just north of Simi Valley is an anticline. An anticline is an inverted "U"-shaped fold in which the rock layers are older in geologic age near the middle of the structure. If the rock conditions are right, oil can accumulate along the axis of an anticlines, and Big Mountain is one such

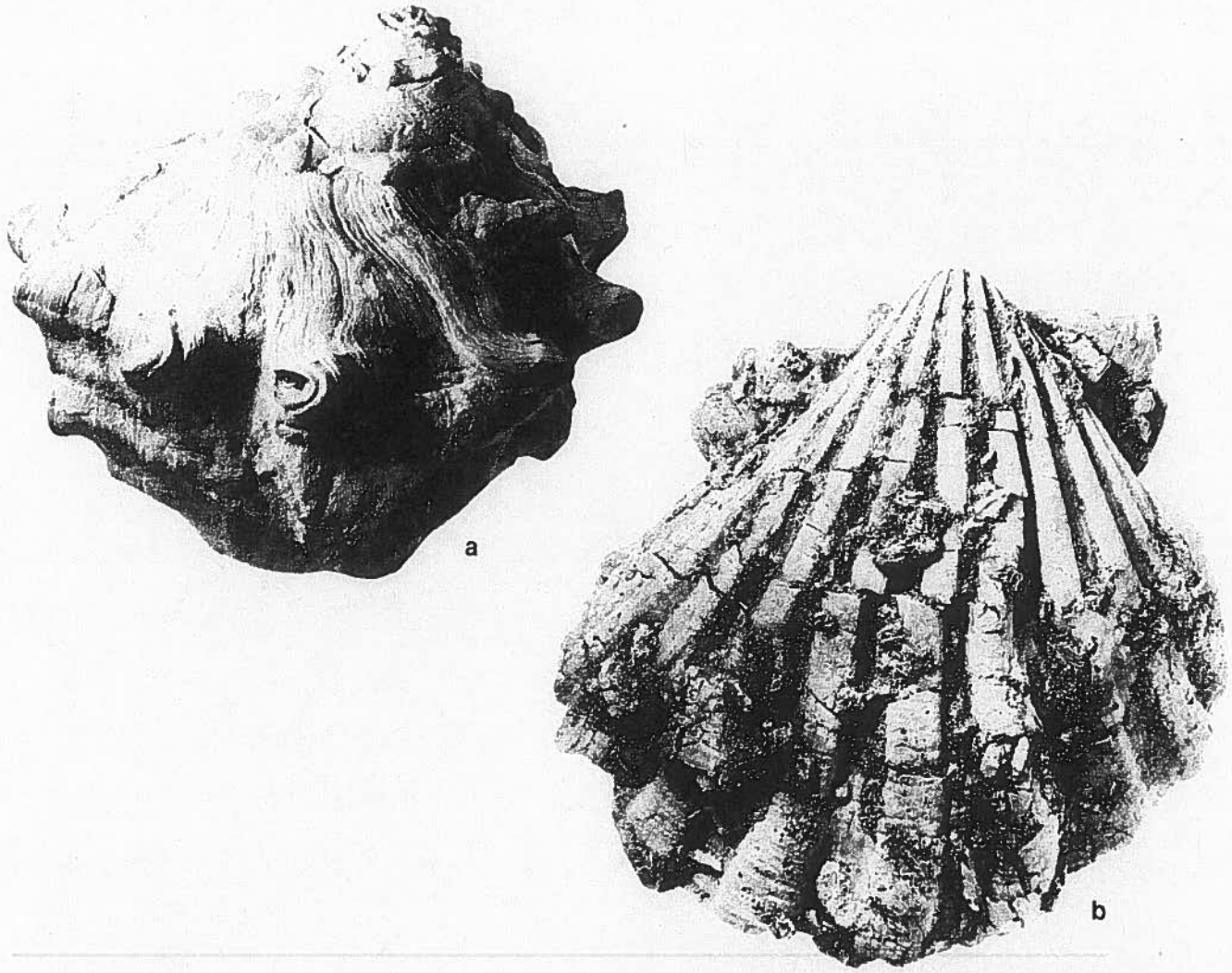


Figure 4. Two representative macrofossils from the Vaqueros Formation, Big Mountain Oil Field area, north side of Simi Valley. Both specimens photographed by R. L. Squires; a) snail Rapana vaquerosensis imperalis, height 100 mm; b) clam Macrochlamis magnolia, height 130 mm.

example. A significant quantity of oil has been found in the Big Mountain Oil Field by the Unocal Corporation. Production is from the Sespe and Llajas formations.

The Simi Fault

The Simi fault is present along the base of the nearly straight foothills just north of the floor of Simi Valley. The fault, which parallels the Simi syncline and the Big Mountain anticline, trends in an east-west direction (Figure 1). The fault is part of the Simi-Santa Rosa fault system, which is about 30 miles (48 km) long. This fault system extends from the vicinity of Devil's Canyon, which is north of Chatsworth, to near the city of Camarillo. In Simi Valley, the Simi fault is not exposed because it is covered by alluvium.

The Simi fault system may have formed as early as 15 to 12 million years ago, but compressional forces since then have been responsible for most of the uplift associated with the fault. Recent studies indicate that the Simi fault has only a very low level of seismic activity, and, therefore, the fault is classified as being only potentially active. An "active" fault is one that has displayed movement within the last 10,000 years (Holocene time).

The Simi fault is not clearly understood. Most geologists believe that along most of its course, the northern side is uplifted and has been pushed out over the southern side by earthquakes related to compressional forces; thereby, producing a reverse fault (Figure 5). Some geologists believe that this reverse fault cuts into the earth at a relatively low angle and should be referred to as a thrust fault. The amount of vertical displacement of rock units cut by the Simi fault is about a mile (1.6 km) near the western margin of Simi Valley but only about 1,000 feet (300 m) in the vicinity of the Marr Ranch in the northeastern part of the valley.

There is also a small component of horizontal (sideways) slippage movement on the Simi fault. In a few places, such as the Chivo Canyon area on Marr Ranch in northeastern Simi Valley, exposures of the upper Santa Susana Formation and the Llajas Formation have been offset by the Simi fault and moved about 0.5 mile (0. 8 km) to the west relative to the exposures of these rock units on the other side of the fault (left-lateral offset) (Figure 1).

The Simi anticline lies just north of the Simi fault between Madera Road and Tapo Canyon Road. This anticline parallels the trend of the fault, and is the result of bending (or drag folding) of rock layers in the immediate vicinity of the Simi fault (Figure 5). Low amounts of oil and gas have been extracted from porous sandstones of the Llajas and Sespe formations.

The Cañada de la Brea (C.D.L.B.) reverse fault north of the Simi Valley Freeway in the northwestern part of Simi Valley (Figure 1) is another fault that has drag folds (Figure 5). The C.D.L.B. Oil Field has produced oil from these folds.

The Saugus Formation

The Saugus Formation overlies the Modelo Formation, and an unconformity separates the two formations. The Saugus Formation is about 2,130 feet thick (650 m). The lower part was deposited in a shallow-marine environment adjacent to a wave-dominated river delta. The sandstones in this part

of the formation are locally very rich in fossils. A total of 106 species of macrofossils have been collected. Most are shallow-marine, cool-water snails and clams (especially oysters and scallops). Some representative macrofossils are shown in Figure 6. Locally, the oyster shells are abundant enough to form limestone beds called oyster coquinas. Some of these coquinas have been commercially quarried as a source of calcium. Some of the Saugus Formation snail and clam species still thrive in cool, shallow waters off the coast of California.

Also found in the lower part of the Saugus Formation, which was deposited mostly during Pliocene time about 3 million years ago, are some brachiopods (lamp shells), bryozoans, scaphopods, barnacles, sea urchins, sand dollars, great-white shark teeth, and a small collection of the rare remains of birds (albatross), baleen whales, a beaked whale, and land plants (California Live Oak). The whale specimens are unstudied.

The upper part of the Saugus Formation, which was deposited during early Pleistocene time about 1.5 to 1 million years ago, was deposited by rivers crossing the subaerial (exposed) part of the river delta. The sandstones and conglomerates in this part of the formation have yielded the remains of horse, tapir, deer, and mastodons in the northwestern San Fernando Valley (see Lander, this volume).

At the boundary between the lower and the upper parts of the Saugus Formation, shallow-marine beds interfinger with river deposits. Sand and gravel quarries in Tapo Canyon on the northern side of Simi Valley are in the Saugus Formation.

The Saugus Formation is not accessible to the public anywhere in Simi Valley. Most exposures of the formation are along the north and northeastern margins of Simi Valley. Erosion prior to the deposition of the Saugus Formation in this area (Figure 1) removed several formations and allowed the Saugus Formation to directly overlie the Llajas Formation and, locally, overlie the Santa Susana Formation.

Terrace deposits locally overlie the Saugus Formation and other formations in the northern part of Simi Valley. These nonmarine deposits consist of river-transported debris derived from underlying rock units, especially from the Modelo Formation. The terrace deposits have yielded the remains of extinct, Pleistocene land mammals, including horse, ground sloth, and mammoth that lived about 500,000 years ago (see Lander, this volume). During the Pleistocene, southern California was much cooler and wetter than today.

The Simi Alluvium

The youngest deposit in Simi Valley is the alluvium, which is unconsolidated sediment that underlies the floor of Simi Valley. The alluvium, which has been deposited by modern streams flowing across the valley floor, is several hundred feet thick. As mentioned earlier, Simi Valley is a westwardly plunging syncline. Groundwater, therefore, flows toward the western end of the valley, and the water table (depth to free-flowing underground water) is very shallow. Artesian water would flow in this area if rainfall and surface drainage were sufficient. If Simi Valley experienced a wet year, groundwater flowing westwardly in permeable beds (aquifers) within the alluvium would build up high hydrostatic pressure. If a well or fracture intersected any of the aquifers, there would be a flowing well or an artesian spring.

In retrospect, the Simi Valley region is a geologically complex area that has had a dynamic and varied history during the last 75 million years. The type of sediment deposited at any given time was dependent largely on geologic events occurring along the western edge of the North American continent. Simi Valley has been profoundly affected by the change from a subduction margin to a slipping transform margin that occurred about 30 million years ago and is presently still affecting western California from the Mexican border to north of San Francisco. Simi Valley also has seen a profound change in marine climate from warm and tropical to cool and temperate. For most of the last 75 million years, Simi Valley has been covered by deep to shallow seas. Startling with Chatsworth Formation time and ending with lower Saugus Formation time, the sea advanced seven times across Simi Valley. Only during Sespe Formation time did the ocean retreat from the area for a relatively long interval. The present-day condition of Simi Valley is just a continuation of the retreat of the ocean that began when the upper part of the Saugus Formation began to be deposited about 1.5 to 1 million years ago.

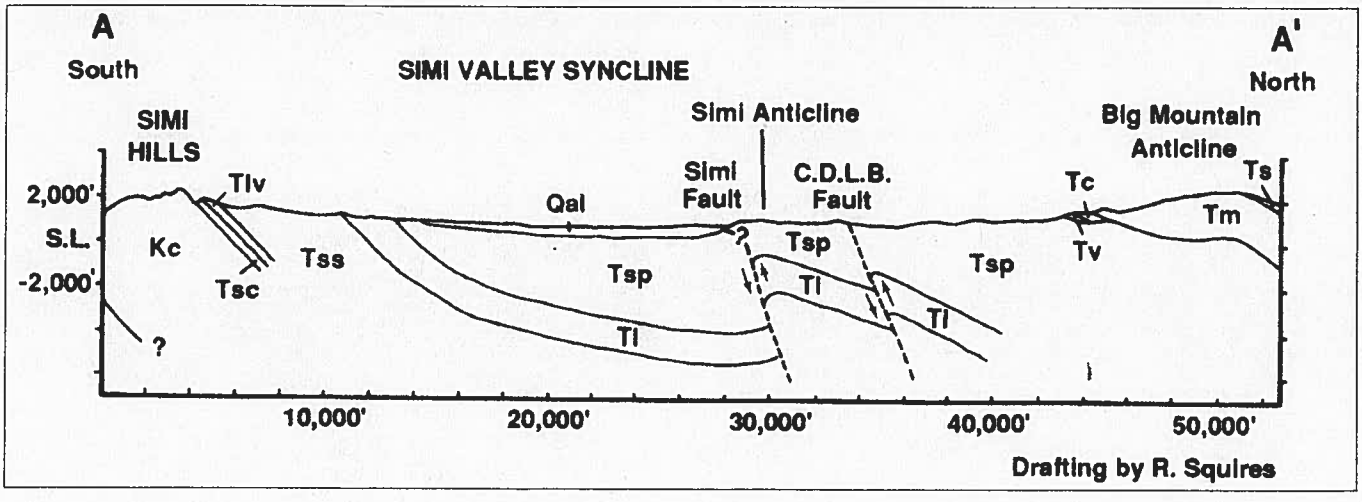
ACKNOWLEDGMENTS

The author would like to thank certain land owners for graciously allowing me and my students to conduct geologic research on their private properties. Individuals include George Boyle (deceased), Phillip W. Gillibrand, Gerald Haigh (deceased), Wiff Haigh (deceased), Dale Poe, Orrin Sage, Jr., and Jim Runkle (deceased), R. Turley, and John Varble. Corporations include Brandeis-Bardin Institute, Getty Oil (now owned by Texaco), Lang Ranch Company, Marr Ranch Association, Moreland Development, Rocketdyne Santa Susana Field Laboratory, Southern Pacific Milling Company, Stratheam Cattle Company, and Unocal Corporation. Without their cooperation, attempts to better understand the geologic history of Simi Valley would have been impossible.

The author thanks Simi Valley residents David Liggett and Erica Sheldon who kindly read an early version of the manuscript and offered suggestions that improved it. The manuscript also benefited from a review by Bruce Lander (Paleo Environmental Associates, Inc.).

E. Bruce Lander supplied information about the fossils of back-boned animals in Simi Valley. Lawrence G. Barnes (Natural History Museum of Los Angeles County) provided information on the types of marine back-boned animals found in the Saugus Formation. Tony Marro and Ali Tabidian, both of California State University, Northridge, shared their knowledge about groundwater conditions of Simi Valley. Peter W. Weigand, California State University, Northridge, shared his knowledge of the Conejo Volcanics. (See appendix for literature cited.) □

Figure 5. Geologic cross section of western Simi Valley along a longitude coincident with A-A' in Figure 1. Modified from Collender (1991, cross-section A) in Blake and Larson (1991). Horizontal scale equals vertical scale. Geologic symbols same as those used in Figure 1.



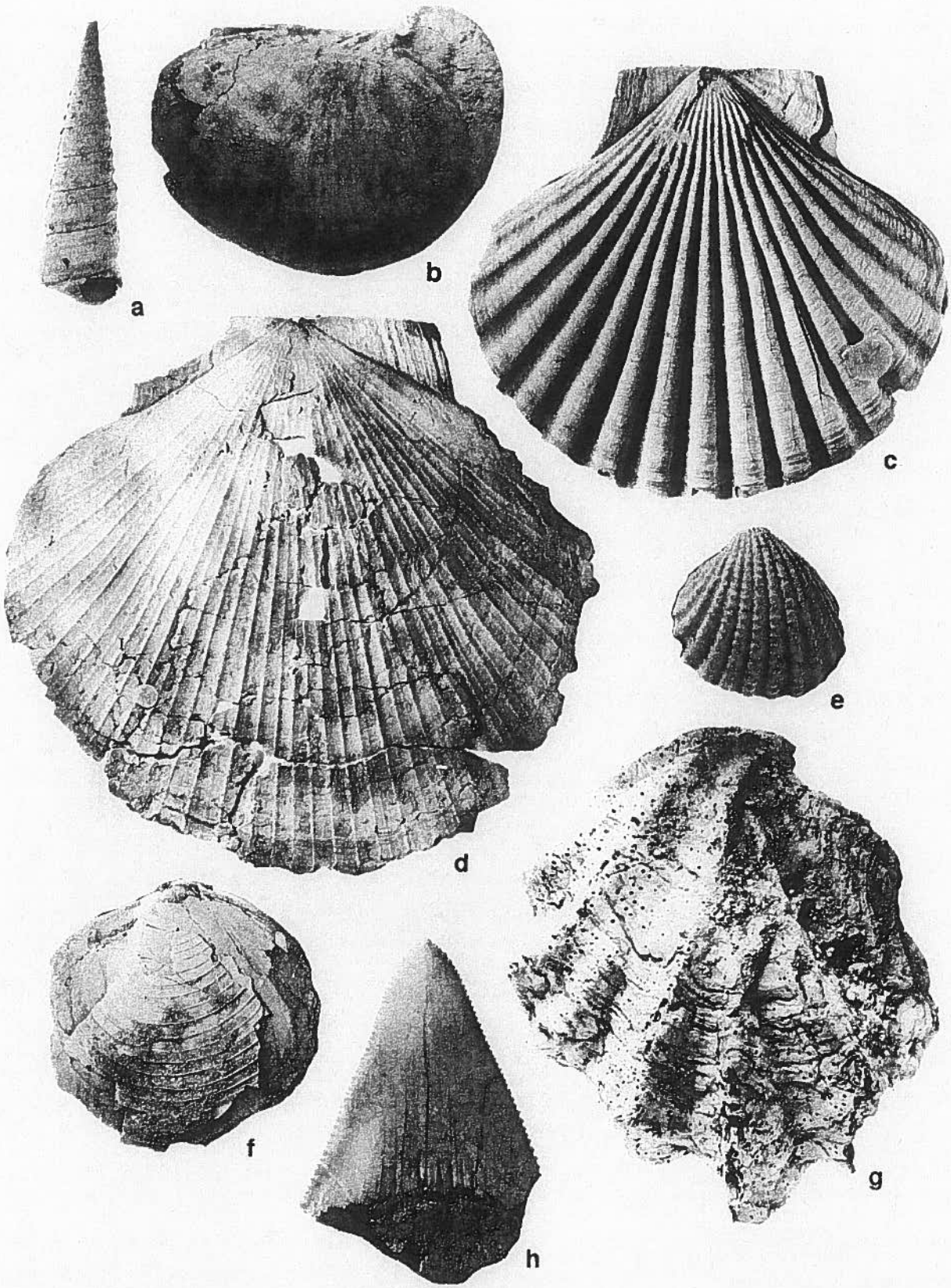
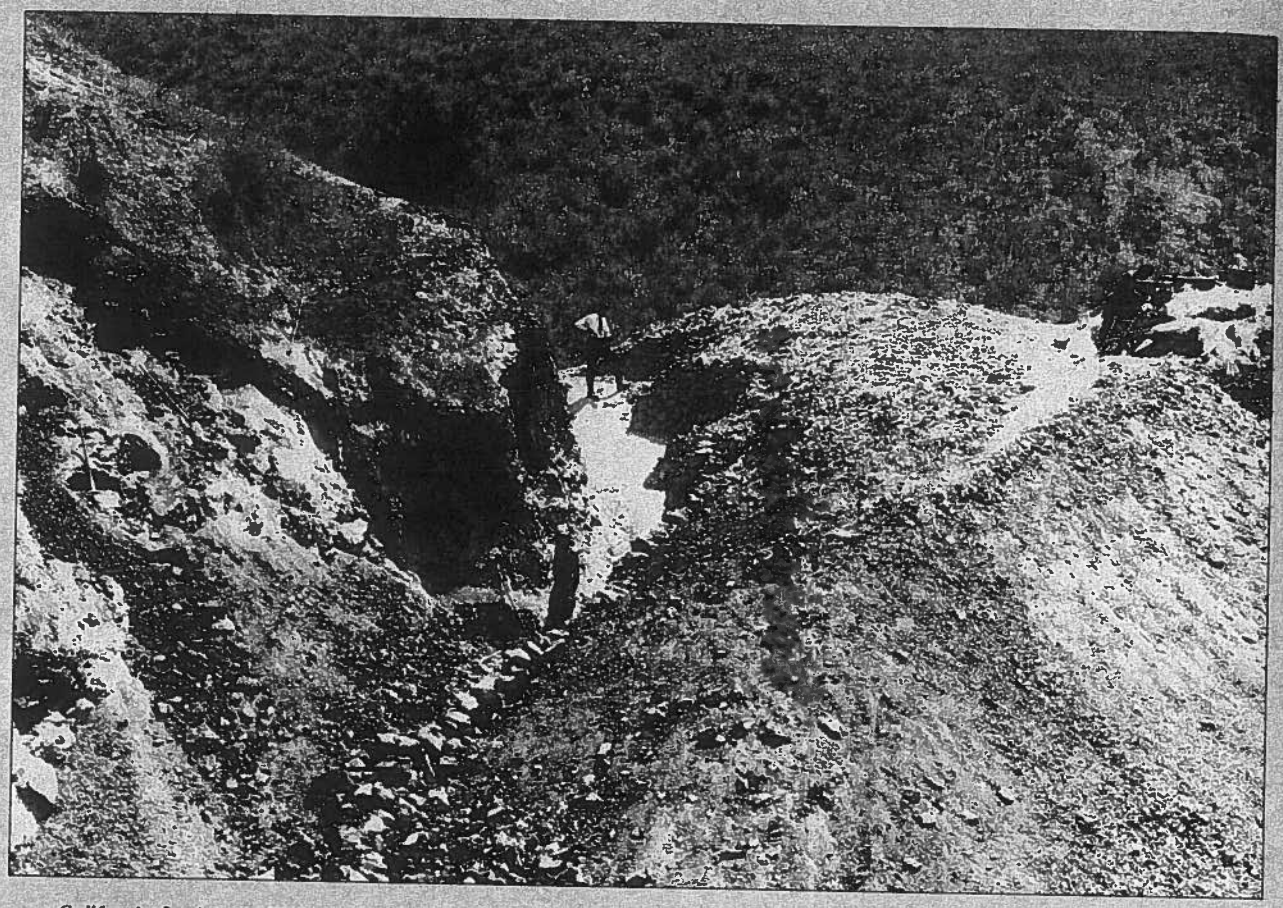


Figure 6. Representative macrofossil from the marine part of the Saugus Formation, north side of Simi Valley. All specimens are the ones used in Squires and White 1983 in Squires and Filewicz 1983; a) snail Turritella cooperi, height 33 mm; b) snail Crepidula princeps, width 90 mm; c) clam Pecten (Pecten) hellus, height 55 mm; d) Patinopecten healeyi, height 156 mm; e) clam Cyclocardia occidentalis, height 18 mm; f) clam Lucina (Lucinoma) annulata, height 52 mm; g) clam Dendostrea vespertina, height 86 mm; h) great-white shark tooth Carcharodon sp., height 60 mm.



California Institute of Technology (CIT) fossil site 150 in upper middle member of Sespe Formation. Site existed in area now occupied by Waste Management of California, Inc., Simi Valley Landfill and Recycling Center. Quarry excavated at site yielded diverse late middle Eocene (early Duchesnean North American Land Mammal Age) Pearson Ranch Local Fauna, which includes large semi-aquatic rhinoceros Amynodontopsis bodei (see Figure 7) and large primitive hyena-like carnivore (creodont) Hyaenodon vetus (see Figure 6). From CIT files at LACM.

Rocketdyne

Santa Susana Field Test Laboratories

John R. McCarthy

When the ground shakes and roaring thunder flaps your pants, and pounds your chest, when brilliant lights flare the sky and a towering cloud batters into the high heavens, only in Simí do people smile, have happy faces. Simí is very a special place. Simí is among the safest cities of its size in the nation. It has a solid, solvent, effective city government. Pioneer families still serve in the foundations of its society. Simí is where LA cops come to not live in the conditions where they work. This Simí is a small elongated valley surrounded by mountains. Its east end butts the Santa Susana Mountains separating Simí from the San Fernando Valley. Mount McCoy (to me Cross Mountain) blocks the west end where Simí drains arcing northwest around foothills to the Pacific Ocean. Geologists know when they see our hills and mountains, we are an active seismic zone. This is a slow process, but changes can come with explosive violence. Still, lifetimes may pass without us noticing it, because most of the time it is beautiful and nice. Nobody has an excuse to be surprised at earthquakes, landslides, erosion, and molten lava expulsion. Nature's warning signboards are clearly and profusely posted. What else is special about Simí? Overlooking Simí is that unique something called, "The Hill," Rocketdyne's Santa Susana Field Test Laboratories (SSFL).

Rocketdyne is the company where America's rocket engines were perfected allowing America to achieve mastery of space, and in that process protect our way of life from totalitarian attack bent on our destruction. Considered the crown jewel of the best company, of the best industry, of the best country on Earth, Rocketdyne was planted and nurtured to grow in the secluded wilds of the Santa Susana Mountains overlooking Simí by North American Aircraft (NAA). It was a good safe place to work. Safer than working other jobs never doing anything dangerous. Rocketdyne's NAA management was great to work with. Its research work proved exciting and fulfilling, and an amazing opportunity for me.

What else was special about Rocketdyne? The people. The quest to learn. The team. Loving to work hard. Never wanting to blame somebody else, only know the truth. The importance of the mission. Honesty and self respect, and being on a winning team as a Rocketdyner. Being the very best in the entire world.

Rocketdyne's destiny started decades before Rocketdyne when America and the world provided the right conditions to create Rocketdyne's parent company, North American Aviation (NAA). Rocketdyne was formed later (November 1955 by NAA) specializing in America's critical rocket propulsion. I'll describe this from memory and opinions based on experiences, training and studies, including having been forced to formally study world history as a professional military officer. To that I'll add my experiences as a scientist, engineer and manager researching rocket propulsion for NAA's Rocketdyne.

Things begin at a time our country suffered in a depression that was a world wide crisis. I remember some of it. It was right on schedule preceding the next of an endless series of huge wars. It followed the previous winners high living free spending splurge after the last huge war. Voting people don't usually reelect governments that haven't eliminated their people's suffering, even in America. President Hoover was given little credit and sometimes publicly denounced as un-American and unconstitutional for some startling things he did to help America survive better than many other countries. Worse, what foreign countries did changed America as much as what we did. France used war preparations (the only proven cure) to become the most feared military power on earth. The USSR massacred untold millions of its own people as well as making war preparations, including a total whole second army nobody else knew existed. Germany swept into power a man promising to break their own laws to end their depression, to make its people proud, and he did. Later he waged the next world war against America.

The American people wanted isolation and an end to their depression. They elected a new president, Roosevelt, when they were told he would do more, end the depression, and honor our laws. This became a critical time in American survival, because our Congress and courts fought and stopped some of Roosevelt's major efforts to end the depression. By the end of his first term he faced the same problem as Hoover, the depression wasn't over. The people didn't want war preparations needed to end the depression, and critically needed for our future. Looking back, re-electing Roosevelt is a critical accomplishment of the twentieth century. Re-electing him may have saved our nation. He continued creating a growing self defense business climate.

One result was the start and success of North American Aviation, Inc. Planes would become a dominating weapon. Some Americans understood and moved to exploit, to solve our need by reducing America's lack of airplane capabilities. NAA was one whose heart was in flying and their country, not in profits and glory and power over others. NAA started as a small company in 1934 in Dundalk, Maryland, and moved to Southern California. Under Dutch Kindelberger, by 1936 NAA had 100 employees. By 1956 it had built more supersonic aircraft than all other companies combined, and diversified into missiles, rocket engines, nuclear energy, and electro-mechanical equipment, a diversity unrivaled in the industry. Back in the frightening days building towards the start of World War II, this keen minded engineer, Dutch Kindelberger, took to the idea his company could design and produce in a few months the first flying prototype of a new fighter plane. It would be the world's best economical airplane superiority fighter for the US Army. Kindelberger's "garage" team had a crazy motto like, "From first design line on paper to first takeoff flight dripping oil down a runway in a hundred and some days." (See NAA's history for the exact number of days.)

In "the garage" he and his design buddies did it, I think then on the south edge of what is now LAX, and indeed dripped oil profusely as their first hand built plane took off and flew its first flight within their promised time. So they created the famous P-51 Mustang from North American Aviation, Inc. Rocketdyne was created after the war as a division of NAA. Dutch Kindelberger (Chairman NAA Board), Lee Atwood (President NAA) and Sam Hoffman (President Rocketdyne) became legends in company and aviation history.

I learned from a long time NAA company lawyer, shortly before he was to retire, that there was a Communist inspired strike against NAA before WW II. The world Communists easily gathered to themselves leadership of the local aircraft workers' union. Like anywhere else, at UCB, in the AMA, in the PTA, in AARP, even in government elected and appointed jobs, by devoting full time and hard work, ignoring making themselves a living, they made themselves so useful and productive those Communists soon occupied all offices of power.

To retard America's move toward war potential, the aircraft union Communist bosses ordered a strike at the NAA plants. NAA workers were patriotic Americans and refused. They kept on working and replaced their Communist leaders with patriotic men they trusted. That ended the anti American strike nonsense. Never did NAA's unions gain the power they might have, because of this ugly, abortive, treasonous try to hurt America before WW II started.

NAA was a team. NAA was a group of hard working, hands dirty, ready to say what they think, smart individuals who inherently worked as a team to maximize their human potential. They were also nice people, friendly, more concerned about the wellbeing of others than themselves. Being good neighbors with communities was an absolute, not a choice for NAA.

There was polish, style, grace, culture, respect and a code of honor that became known as the "NAA way." NAA understood leadership of intelligent talented people, getting the most from high human quality resources. They knew work had to be fun, exciting, like their designing and building that first P-51 Mustang. They were super role models. People wanted to work with them and follow their leadership.

NAA made besides the propeller driven war P-51 Mustang fighter, the T-6 Texan and the B-25 Mitchell bomber during WW II. NAA's F-86 Saber jet and F-100 Supersaber (supersonic) jet fighters brought America into the high performance jet aircraft arena.

Kindelberger during and after WW II proved to have a magic gift. He could wander unidentified halls in the confused and bewildered Washington DC megamess as if smelling a scent, stop before an unmarked door. He'd open it and go in to find a man behind a desk, never before seen or known, who looked in anguish. The man, astonished at someone appearing, would tell of frustration, his terrible problem. He had the money he needed to build some airplanes, or some rockets, and no idea how or where to turn to do it. Kindelberger would smile, extend his hand, tell him words to the effect, "My good man, your problems are solved. I'll do it for you." And he did.

Trying to keep his talented team together after peace broke out, NAA continued to build a fine well designed civilian plane (the Saberliner I believe). They were selling it for less than its production costs to keep the plant open and their people employed. At one stockholder's meeting a big stock holder approached and asked if there was any way he could buy one of those nifty Saberliners at cost? The whole Board of Directors stared at him openmouthed, and finally told him no, but they sure wished there was a way he could. He never knew what they meant.

America faced the challenge of becoming best in rockets. America and the USSR understood the rocket propulsion Germany started would be critical to survive and dominate the world. The Soviets made sure they captured the super secret Nazi rocket development facilities at Peenemunde. However, the German rocketry leader Von Braun (broken arm and all) led his German civilian rocket scientists and experts west to surrender to the American Army. The Soviet KGB got the German rocket hardware and landscape, and America's Army got the German rocket brains.

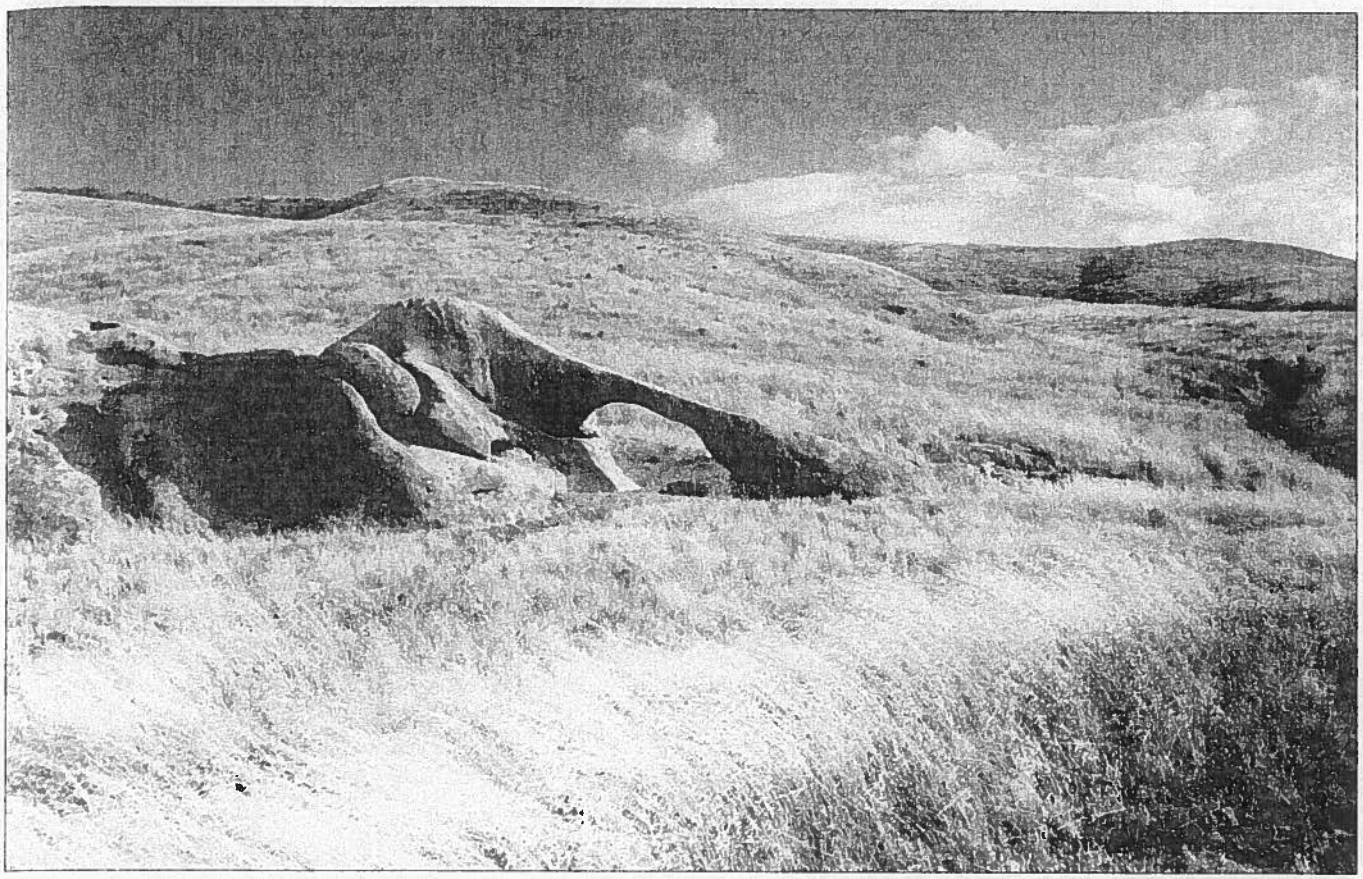
Surrendering to the enemy (that's us) conquering your country is unforgettable suffering. Once that's done, it isn't forgotten. Von Braun's rocket brains surrendered their loyalty to the US Army. They supported only the US Army, causing American government dismay. Eventually we formed NASA to help get out of that pickle, and began working hard to master rockets. At first it was hard to beat Von Braun's aging geniuses. Soon America created its own growing world's foremost rocket experts exceeding anybody else on earth.

When the war ended in Europe, the USSR and America continued struggling to win in rocket engines and space weapons. America's second brain trust was us, its rocket scientists. While secrecy was important, it was not this time hiding us from the Soviets. Instead it was quietly invested in the Army, NASA, NAA, later the Air Force, some in the Navy, other companies, Universities and places. From my point of view, Rocketdyne became the central and most successful (non-government agency) propulsion part, where our government contracted us work to create what they needed. Some work was advanced research where we advised what best they should do with our latest knowledge and data.

We certainly were not all of it. At White Sands a German V2 went wild, turned and flew down into Mexico to crash, becoming the first and only war rocket fired from mainland America into a foreign country.

My first NAA boss, Lew Wessels, told how NAA rocket research started with German propellants and small rocket motors tested in a parking lot on the southeast side of the LA airport. Movie cameras took pictures of pressure dials, clocks, lights as valves actuated, and small engines either fired or blew up.

This pioneering work approach succeeded one day in burn-



Elephant Rock (Ventura County Historical Landmark No. 136) was a favorite destination for hiking and picnicking by local residents and visitors to Simi Valley over the years. It may be viewed from College Street, which is approached by Crosby Street, south of Royal Avenue between Sycamore Drive and Erringer Road. (Photograph by Bill Appleton.)

ing up a NAA vice president's car parked in the parking lot, and the rocket stuff was moved to uninhabited wild lands north of LA. The "civilized" factory and offices were set up in a field in Canoga Park along Canoga Avenue, where the engine production plant would later make deliverable rocket engines. The experimental rocket engine research firings were set up in wild desolated hills north and west of the San Fernando Valley in the Santa Susana Mountains, overlooking the (seeming to LA) nearly deserted landscape of Simí.

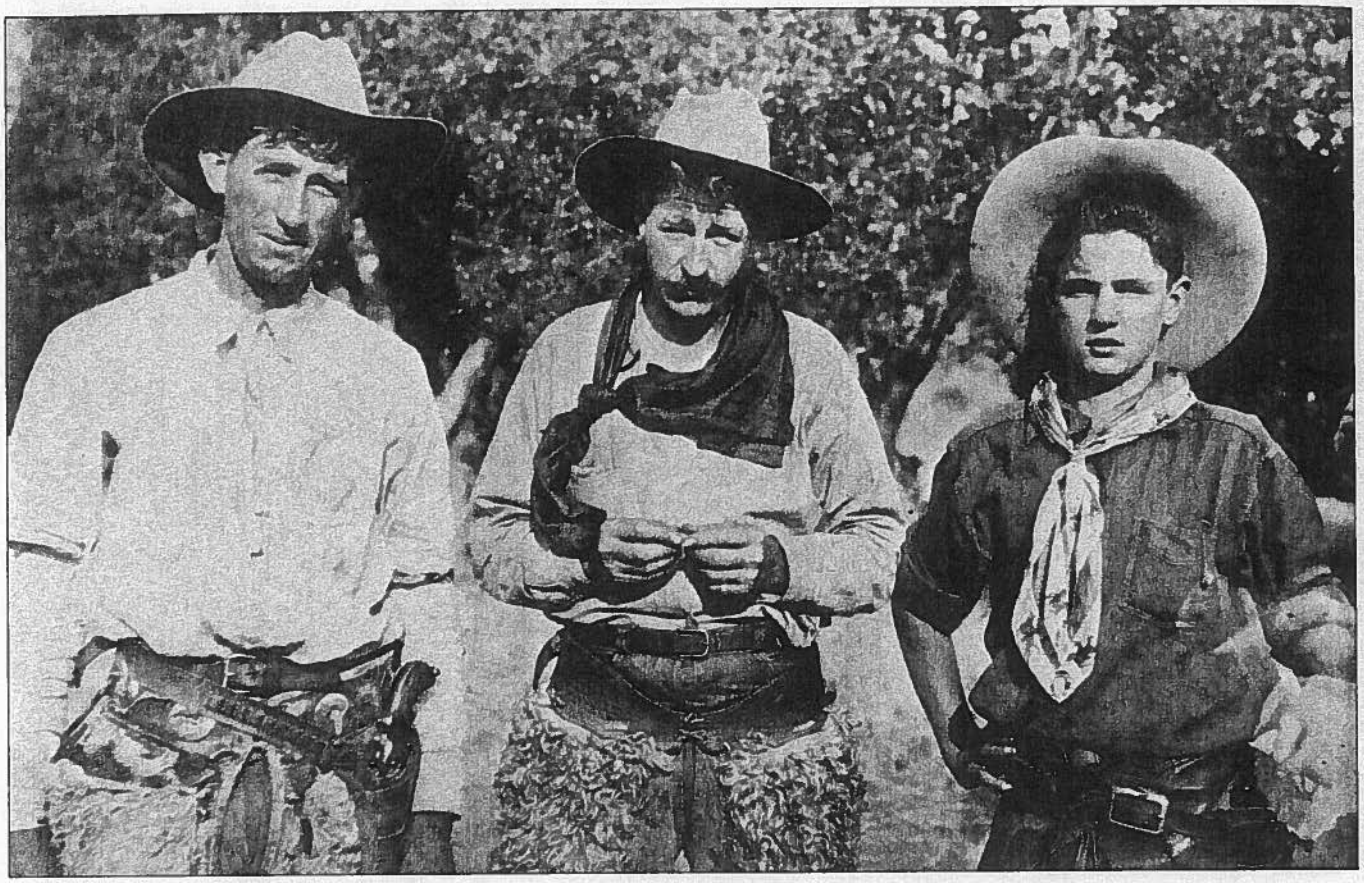
This pink patina sandstone and dry desert chaparral was Chumash Indian land before the Europeans, and later the scene of western cowboy movie shoots. It became small research rocket labs, and soon large test stands for large Rocketdyne engines that our advanced research let Rocketdyne design, test and produce for sale.

Canoga Park was farmland fields and chicken-houses. Simí was orange groves, onion fields, walnut orchards, a railroad track, a few cow, chicken and turkey farms. Blalocks' home on the north hills west of Whiteface marked about the only visible civilization rising above the valley floor.

"The Hill" as the test laboratories were called, was so remote it was deemed unfindable by civilization. This move brought the NAA its new Division called Rocketdyne, and got it so far out in the wilds, it was thought it would not again disturb civilized people at work or at home. If that only could have been true. The economic boom this business brought invited others to follow Rocketdyne, soon populating the San Fernando Valley with people and new cities almost solid from mountain to mountain, creeping up into the hills to harass our testing and research work.

Outside LA in Ventura County, fire trails became roads for "The Hill" workers living in Simí and Thousand Oaks. Civilization and potentially crabby neighbors slowly closed in on all sides, until ultimately it was not much improvement over the airport parking lot. (That parking lot where our rocket tests started, was occupied for a long time by the Proud Bird Restaurant, but ultimately was swallowed up by the Los Angeles airport itself.)

When I started working up on The Hill, I drove to work from Fillmore up Grimes Grade, through Simí and up Black Canyon. My only stop sign after leaving Fillmore was in Moorpark. Initially workers parked their cars between the rocks on sloping dirt and flattened weeds outside the security guarded fence, clumped together in a herd so only the last few cars to arrive could get out to drive away. People left their car keys in their ignitions so others needing a car could use any available car not blocked in. Soon they bulldozed a flatter more organized parking area so workers could use their own cars. That's about the time I arrived, with the cleared parking area being enlarged every few weeks or months.



Bo and To Gillibrand and a young boy during filming on the Gillibrand ranch circa 1920s. (Photo courtesy Simi Valley Historical Society and Museum.)

The Hill, officially named Santa Susana Field Laboratories, developed on what previously was called Burro Flats. NAA bought this land in the late 1940s. The Hill was divided into areas, the rocket part mostly in middle and eastern rocky canyons. On the west was the start of a flat meadow where Rocketdyne's land ended. Our atomic research facilities developed there. I hear this flat area being called Jackass Flats (as was a Simí dry lake area). During Apollo, The Hill had 6000 workers and ran three shifts a day, and usually weekends. A slightly less exciting road (The Front Road) was graded and even paved, going down the eastern slopes of The Hill to the San Fernando Valley, giving better access to Canoga Park and Chatsworth.

Chatsworth was unpopulated like Simí, connected to it by only the Pass Road going through the same mountain gap the pioneer trail road once used, past the Pass Club gambling place, which rumor had was one of the best cafe lunches anywhere around. Near the crest of the Pass Road, Box Canyon Road connected to Chatsworth Lake and the San Fernando Valley end of The Hill Front Road. I was warned not to stop or walk around Chatsworth Lake (mostly a beer hall) or Box Canyon. The sparse inhabitants could be unpredictable, sometimes dangerous. It was hinted outside people might vanish without a trace. I never had any problems.

How did I become part of this? I graduated a chemical engineer from UCB after the President commissioned me officer O4019163 in the Corps of Engineers, Combat, US Army. I married a lady from Fillmore named Lois (graduate of UCSB, then UCSF medical school). I left a promising professional Army career for better civilian family life and to do scientific work. With job offers in hand, a paid for and owned home in an East Bay foothill valley, we visited Lois's parents in Fillmore. This let me interview LA's aerospace companies, including NAA's Rocketdyne. End result: I came south in 1956 to work advanced science research in Rocketdyne's Research Department as NAA employee number 270647 at "The Hill" above Simí in the Santa Susana Mountains.

We lived a while in the San Fernando Valley, where our son Paul was born, before we bought our Pitts Road home in Simí. It came close to fulfilling all but one of my fifteen invest and live criteria, including neighbors, good place name I liked, and OK road name (said to mean full of potholes). Road and place names are important because they attach to my name, identify, describe, and stereotype me to the world wherever I go. I won't accept most names for that. Good long time neighbors include Anna Hayes south across Pitts Road (garden flowers, vegetables, dried flower art); to the west is Doris Barthelmus growing yard flowers and keeping an eye on things for us.

I heard the place's name, Simí, is from a Chumash Indian name in the valley. I liked Simí. It provokes and sounds human pride and honor saying it. Like "The Marines," Simí stands

straight, tall, proud saying it, and America's flag proudly waves. So I live and raise my family in Simí, on Pitts Road, in the east shadow of Cross Mountain. That's an honorable address one can be proud to say, where my children and grandchildren can grow up.

I live today in the same house, now four houses east on "Royal Avenue" from Sinaloa corner. My road now is called Royal Avenue. I was told Royal came from a royal blue color a Royal housing development was painted. Somebody wanted naming my road Royal to help advertise and sell houses. Widening the road took my tree, most of my front lawn, and six parking spots. Royal now is a four lane (plus turn lane) major traffic route, with car counts in the tens of thousands, not ones and twos. I now think "Pitts" came from an historic Simí family name, and "Royal" from a beloved, cherished horse (Harringtons') named Queenie.

Others continue to come to Simí like I did, because it's quiet, affordable, safe, has better schools, and usually somewhat better climate and air. Also because our City is a neat place, with one of the best city governments I've seen, and honestly does care and is concerned for people. I'm told we now have over a tenth of a million people. When I arrived others guessed numbers like five thousand, or ten thousand, lived in Simí.

I look a mile west to the cross in the sky on Cross Mountain (Mount McCoy) and remember a man in a loincloth (a long story) whispering Indians always mounted a sacred stick cross with eagle feathers there, long before conquistadores decided to install their bigger more frightening cross to replace it. In earlier days, on Easter mornings people on horses use to clop through my front yard going west on Pitts Road, sometimes followed by the family dogs, to attend Easter sunrise services at the cross on top of Cross Mountain. The Simí Rotary Club runs a generator shining lights on the cross during the nights for the Easter week, and for the last couple of decades keeps a man there at night to prevent vandalism. Another sign of our times, our cross is no longer scary enough to protect itself.

Occasionally horses would clop by my bedroom window in the early morning going into my back yard to visit blue eyed horses (who left when we bought our place). Then the horses would settle down to eating my rose bushes and rose trees, a quite valuable service, because my roses always came back lush and beautiful after they did that. Those horses are today gone to the great pasture in the sky. It also means an hour later a woman in house slippers and bath robe, half combed hair flying, won't come striding down the middle of Pitts Road looking for her horses.

So what was Rocketdyne like. How was working at Rocketdyne's "The Hill"? The Hill test area was a sensitive location. For years planes were forbidden to fly over, and hikers "gently" turned away when they wandered in. There the best and most courageous explorers of our time on earth bravely stuck their heads and arms into the unknown. Carefully using all their skills to make the work safe for themselves and other workers, they faced challenges, no matter how wild or otherwise risky, to learn the unknown, put it safely to work for the betterment of America and mankind.

Things were wonderful and not always so wonderful. A very safe place to do technical work, Rocketdyne everyday, everywhere, did things fraught with potential danger. Working with the world's most violent and toxic materials at Rocketdyne proved safer than working almost anywhere else where no unusual or unknown dangers existed. Yes, where I worked we didn't like those darned three wheel scooters that Jake Hayes so aptly describes in his adjacent pages. The Hill did get rid of them.

Great wonderful friends were injured and sometimes died mostly from diseases and car accidents, rarely human shootings, all away from work. Very rarely did we suffer from our going into the unknown and learning the hard way. But, nothing worth having can be had without some risk, some cost, some pain. Certainly, the memory of Stan Tykarski will persist until all who worked with and knew Stan perish from this earth.

We and our families paid a high price to give total dedication to our job invading and conquering the unknown. We did it. It is our gift to you, communities like Simi and their people, to our children and America's future. And to our own sense of honor.

Almost everyone was a hero, so that status went seemingly unknown and unfelt, an expected cost of joining such an exclusive club. Janitor to Director and Chief, all participated as a team. All were important. Anyone fail and it made all around them fail. That made everyone want all the others to succeed, a rare and unrecognized powerful condition that makes man break the seeming barriers of the impossible to surge upward as if endowed with some great powerful spirit. Cooperation beats competition.

Except for a few last years of 35 concerned with Rocketdyne, I always had only bosses I liked, admired, enjoyed working for, from whom I learned and profited. They were NAA types, many Ph.Ds: Research VP Bob Thompson, John Tormey, Bob Levine, Bob Lawhead, Tom Coultas, Stan Greenfield, Hal Wolf, Bob Seader. As hard as I worked and cared, they worked harder and cared more.

On the other more important end I worked and learned from the world's most magnificent technicians, dozens of them like Ed Madsen, Stan Tykarski, Milo Tibbetts, Carl Labertew, Pat Patterson, Chuck Jones, Jake Hayes, Ed Ostrowski, Bernie Steinbacher, Lee Wells, Al Feldman, and so many more. Then fantastic research engineers like Bud Ford, Bill Hines, Leo Kusak, Bill Miller, Lydia Manson, Carl Jensen and many more. I was helped by one-of-a-kind geniuses like Bob Schaus, George Hood, Ed Rojec, Jim Glass, Bill Wagner, Bob Oberg, Paul Combs, Bob Bright and an endless list.

I got to work with and for some great true professionals like Howard Griggs, Dave Huang (Chiang Kai Shek's Air Defense Minister during the long war and WW II), Hank Wieseneck, Sam Iacobellis, Mat Ek, Hank Weiss, Jim Thompson, Leonard

Kimball, Paul Coffman. And I was helped by some great people, who more than once saved my butt, like Al DiSepio, Bud Ecroyd, Fred Couture, Bob Bright, Joe Glantz, Norma (Sutton) Fujikawa, Frank Gunderloy and Ed Cain.

Some of us joked that Chinig-Chinisch, the power God of the Chumash, was there in us as we worked among red sandstone rocks, cliffs and canyons adorned with Chumash relics, and wonderful polychrome pictographs in a cliff "cave." Captain Bud Ecroyd on occasion would give fascinating tours studded with information I wish I could remember. Our astonishing achievements perhaps can't be better explained, although I attribute them to the most effective American generations known, working fully dedicated to the cause of science, engineering and country, not knowing, let alone thinking, we could do anything other than succeed.

Some of us working at Rocketdyne bought homes, raised children, invested, became parts of our communities like Simí. To us, we arrived in cherished beautiful areas deeply enhanced by pioneer traditions and families, to which we tried to bring the best being an American offered, and wanted to make things better, society improved at home as in our jobs. Still our jobs dominated our minds and souls. Our brains didn't add together, they multiplied, and the challenges we took and solved leaped in severities and impossibilities.

Certainly every step, every struggle was hard, fraught with failure, tense with potential danger to be prevented. We laughed at the slogan, "The impossible takes a moment longer," not realizing we did that every day and succeeded. One wonders when, if ever, will man put it together so profoundly again. Will the future ever hold more Rocketdynes and more Simís?

Our rocket propulsion was for huge space vessels, because our A-bombs were huge. I personally worked A-bombs, and knew that was true. However our AEC scientists and engineers worked and made them soon small, cleaner, and more powerful. That meant big boosters were not needed, and Eisenhower cancelled the big rocket stuff except limited development and science. Rocketdyne dropped from nearly 20,000 workers to I think some 2800, and what a rare mix of people that left us to be.

When the Soviet Sputnik startled America, President Kennedy called for new dedication to space and rockets, and going to the moon in a bloodless war where we fought, like in an Olympics, by superior performance in space, not blood on a battlefield. Kennedy stopped the world war cycle, for the first time in known history. The Moscow KGB edicted space military command be their most important, more so than nuclear command, and drove to no matter the cost and human lives to win that space race.

The Atlas, Thor, Jupiter, Apollo and Saturn rocket systems were successfully developed and propelled by massive Rocketdyne rocket engines, safely and reliably doing things far beyond what the physics of the day would otherwise provide. At Aerojet our cohorts were building storable rocket engines for the Titan missiles (to replace Rocketdyne's engined Atlas missiles) partially achieved using Rocketdyne science; my Rocketdyne team and I personally measured for them in heat transfer experiments.

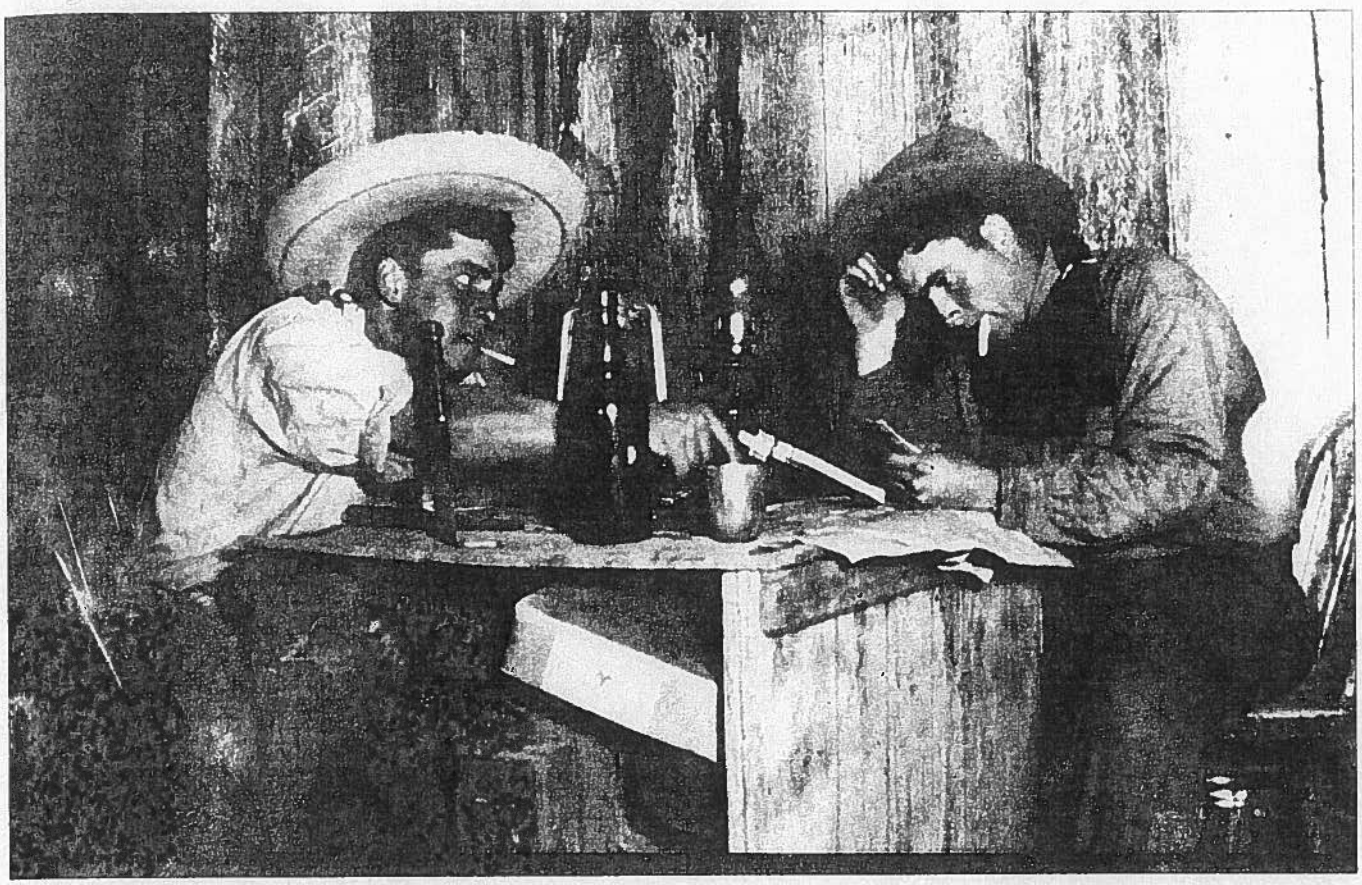
We went to the moon, put man on the moon, brought him back. The Soviets failed to do that in space, driven more to conquest and weapons advantages by tyrannical leaders. The USSR achieved man in space capability using huge expensive complex rocket systems putting huge tonnages in orbit. To be honest, I give credit to the Soviets for that. Now we cooperate with them, trying to mate our best with their best to (be cheap) get more on less money. I now know they did amazing rocket things on their own.

Research is fantastic, learning new things never before known but it is isolated. Others and the news tell us what goes on. We learn happenings indirectly through others. We hear different sides to get a more complete overview than many. For instance, "casual and cheap" can save money, and can bring tragic payoff. Our space cooperation with Russia hopefully pays off and saves money. But our Congress wanted NASA loose, publicity and PR oriented, less cautious for technical excellence. Telling bosses that was suicidal, could hurt the space effort, was silenced in fear of retaliation from Congress and the White House.

One day on an embarrassingly delayed launch, which had been held too long and was in places too cold or iced up, most companies including Rocketdyne voted not to launch. One by one they were forced into submission by not being able to show NASA any of their own equipment wasn't ready, or at NASA's request were ordered to vote to launch by their own company top bosses, because only NASA was exceeding NASA's own launch limits, and NASA is the boss. Nothing seemed wrong except it was a condition that had not been previously completely tested to absolutely show it was always safe. When that Space Shuttle with a "teacher on board," blew up during launch, Congress of course blamed NASA and the solid propulsion companies, not themselves.

Hard times came to aerospace companies including Rocketdyne. Kindelberger and friends aged as Washington's aerospace business declined. Apparently they thought NAA becoming part of a more diversified company was the best way to survive. Kindelberger looked for someone to give NAA to, along with NAA's huge cash accumulation. That someone was Rockwell, a collector, a buyer and seller of companies creating Rockwell International. He was a visionary and dreamer like NAA. He was a gentleman with honor. Rockwell's daughter, rumor has it, said: "Only once in the history of earth could a stranger knock on the door and offer to give to you the world's most famous company along with one of the world's largest fortunes, 'please take them won't you?'"

At first life went on under Rockwell unchanged. The B-1 Division and the Space Shuttle Division produced products in the proud successful NAA way. Rockwell ran the Cape Canaveral launch facility until awarded to another company. Our Space



In this mock scene, young Simi pioneers Dave Strathearn and Lonnie Ellis are acting out a card game in which trouble seems to be brewing. They may have been influenced by dime novels or by some of the early two-reel westerns as they had some fun with this play-acting. (Photo courtesy Bob Ellis collection.)

Shuttle Main Engines power the Shuttle mission after mission. Nothing is forever. The world changes, America changes, Rockwell changes. Rocketdyne, once the crown jewel of NAA, was the best place in the world to work. Then the nation powered down in quality and commitment. Now other large corporations sack their managements for big dollar gains downsizing and consolidating.

While Rockwell's changes were not at first dramatic, time and power was against maintaining our excellence. Some years ago Rockwell lost Rockwell to his most trusted top men. It all led to both good and bad. For instance, Rocketdyne, once offering the best worker benefits packages, changed to where today some use their wive's or husband's better medical insurance when they work for other companies. On the other hand, we stay a solvent company while other aerospace and aircraft companies did not.

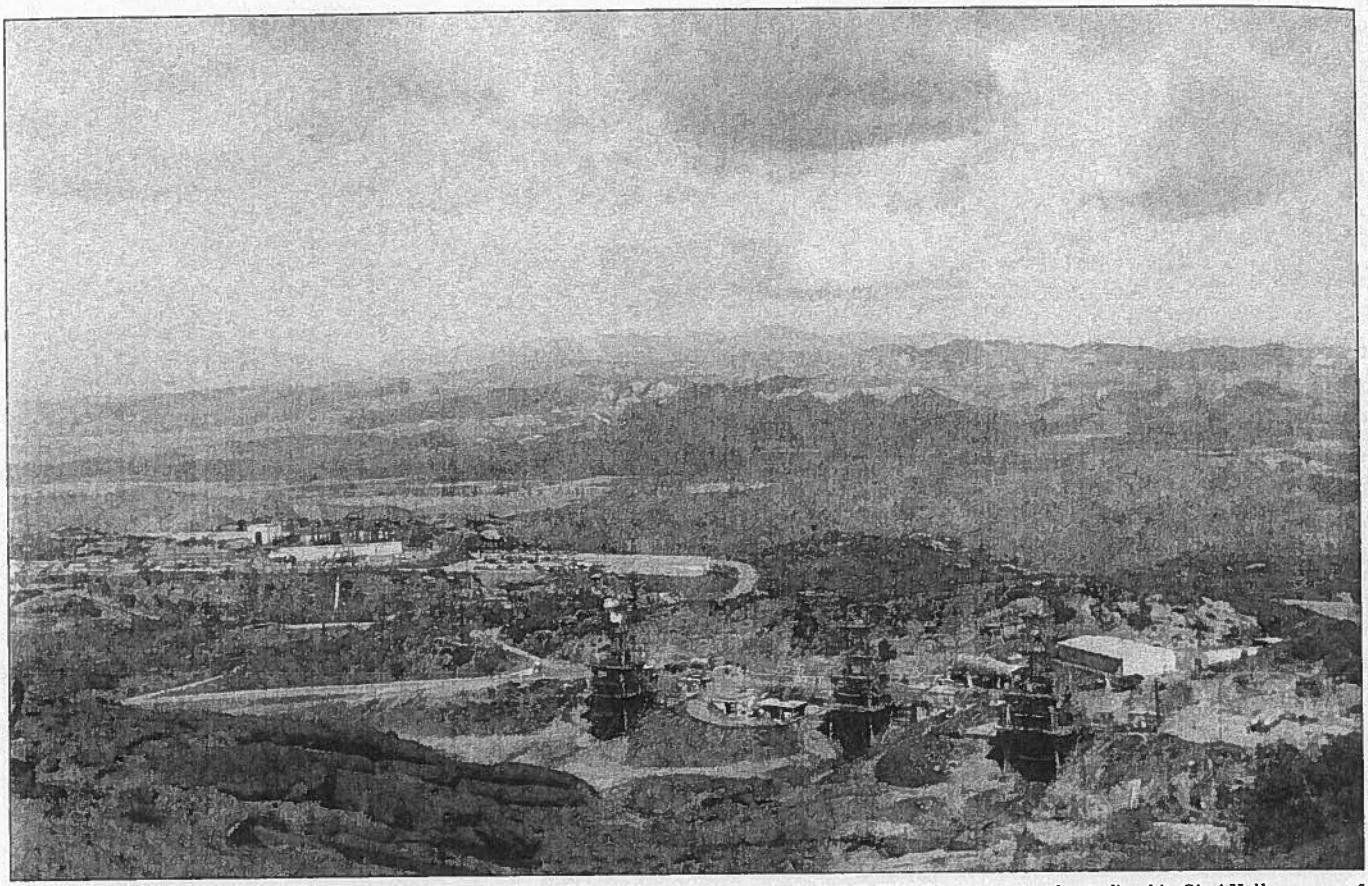
This brings us to the end of a cycle. Rocketdyne was created, did its critical job very well, and is no longer as important. A price of being really successful is eliminating your own job and society's need for you. It's not new. Throughout history if you've been great, expect to be forgotten when no longer needed.

The future? Rocketdyne's original American brains are nearly gone. I do not think we did enough to replace our capabilities and better us. My loyalty to NAA and Rocketdyne is strong, but not blind. There are great new younger people, whom I doubt have or will be given the chance to grow and produce as I and most of early Rocketdyners did. Wasting them is a crime. Today I think Amgen (new biochemical company) is like Rocketdyne was. I am relieved the spirit still lives. I can hope, however foolish, it can and will be for Rocketdyne and NAA again.

Some things still go right. Don Fulton, an old friend and associate at Rocketdyne, keeping the faith in Advanced Programs, announced (Rockwell News, 5 June 1996) the Reusable Launch Vehicle (RLV), our next space vehicle after the Space Shuttle, is being decided. Rocketdyne, like the old days, is the propulsion engines provider for all three of the X-3 RLV competing bids.

The government will select one of three competing designs. Lockheed Martin's uses a Rocketdyne Linear Aerospike Engine, a new type of engine with a fascinating history. McDonnell Douglas's uses presumably three engines that are derivatives of Rocketdyne's very successful Space Shuttle Main Engine. Rockwell's own in this competition uses presumably six smaller engines, again derivatives of our Shuttle Main Engine.

Rocketdyne will make the rocket engines for any design the government chooses. That sounds like the power, confidence and competence I remember in Rocketdyne. My mind pictures, hears Don in his dramatic bouncy way shouting, 'Baloney. Rocketdyne isn't going with one design. We're doing ALL THREE SYSTEM DESIGNS. Damn it, each engine system is going to be the best rocket engines ever on this earth, Rocketdyne Engines.' Don moves so dramatic chalk slipping



North American/Rocketdyne facilities sprawled out over the hills at the southeast corner of Simi Valley. Numerous employees lived in Simi Valley, many of them members of pioneer families, among others who returned from military service in World War II just in time to be in on the beginning of the Santa Susana Field Laboratories. (Photo courtesy Simi Valley Historical Society and Museum.)

from his fingers flies smashing on the chalk board. 'Woops. Didn't mean to do that.'

Hey, it was truly grand. America's top brains were good. America won. The Soviets lost. That's so great for humanity that Simí's and Rocketdyne's part should never be forgotten or lost. A bright point is the good relations between Simí and Rocketdyne. Everyone envies us, so we must have done something right, something good. Rocketdyne, me, and Simí.

Rocketdyne Recollections

Jake Hayes

The first time I remember even hearing of Rocketdyne (then North American Aviation) was probably 1949 or thereabouts. I recall Augustine Gonzalez talking about being employed on a crew clearing brush for the original test site, probably the Bowl area, where the first studies of German V-2 rocket test firings were conducted. Of course that was quite a few years before my original hire date in April of 1957.

I had never given the place much thought. However, upon discharge from the U.S.A.F., I was only able to find a job driving a water truck for a spray crew in the Goleta area—at less pay than the service, so a military career was not unappealing at the time. Alas, my brother-in-law Neil suggested, "Perhaps Rocketdyne can save the day. I'll get you an interview for a test stand mechanic's job."

My first contact with Rocketdyne was an interview with an individual whom we'll say failed to recognize my finer points, as he didn't hire me. However, having talked to this individual, I realized that being candid and truthful had probably not been to my advantage. Anyway, bummer, back to the lemon orchards of Goleta.

Our spraying pursuits often put us in the flight paths of the Goleta Airport, and wouldn't you know it, PSA was flying the Convair 440, the very type we were phasing into our outfit at Brooks Field when I left. Boy, the Air Force is looking better all the time.

Again, Neil saves the day with another Rocketdyne interview. This time the interviewer and recognizer of all that is moral and good, Al Holtgrave, my leadman-to-be, reviews my application. Al asks, "Can you read blueprints?" "Two at a time," said I. "Very good," says he, "I can barely read three at a time and I run this outfit." At that very moment a test stand "Grunt" was born and there was conceived a kinship with a company that was to span 33 years.

By the time I made the scene, the Santa Susana Field Laboratory known commonly as SSFL was very well established, employing in its heyday 2500 to 3000 people. It covered some 1700 acres in area, was divided into 2 main areas, 1 and 2, comprised of 6 major test-firing units each having 3 test stands, 5

components test labs, CTLs 1 through 5, support groups including weld shops, experimental machine shops, test equipment groups, electronic/instrumentation groups, advanced program groups, security and fire departments, two cafeterias, 2 nurse's stations, supply and warehousing. This was just Rocketdyne. Atomics International, another division of NAA, had a site of similar proportion right next door. SSFL even had its own liquid oxygen manufacturing plant which also gave it the capability to supply liquid and gaseous nitrogen. At one time there were at least 8 tank trucks on the go at all times, hauling to storage sites at the test stands or CTLs.

Having passed the pre-employment physical and a several-hour delay for a security check, I was told where to park at area 2 SSFL and to stand in front of the area 2 security building and wait for transport to Coca area. Shortly a 3-wheel scooter appears, makes a 360 on 2 wheels. A hardhatted character announces, "Hop in, my name is John L. Sullivan. Safety first is the name of my game." He accelerated down the hill towards Bravo; we were weightless for a full 20 seconds, and at the base of the hill he continued to accelerate through the right-hand curve at the bottom. I thought then the safest thing I could do was get out and not ride with this guy again—I maintained that thought all through our acquaintance. We finally arrived safely at the Coca pre-test building, probably because the last half-mile was uphill and the scooter was under-powered. As it turned out there were two John L. Sullivans, "Big" and "Little," no relation, first and second shift supervisors and both a menace on a 3-wheel scooter. By the way, the 3-wheel scooters were banned a year or so later as just too dangerous to personnel.

My first night at work was also quite an experience. I was given a short tour of the 3 test stands, then turned over to the area safety man, one Perry Richison, for my safety indoctrination. Perry showed me the fire hoses, the fire blankets, first aid kits, how to call for help by alarm and phone, etc. etc. He then said to stand right in this one spot—he pulled a chain, and I was soaked by a deluge of water. "That is a safety shower," said he. I've yet to forget that safety shower. Shame on those who question safety practices in the American workplace.

With safety utmost in my mind and already wearing the ever-present hardhat, I reported to Coca 2 for work. The crew, Al Holtgrave presiding, Dallas Rudell crew chief and second in command, was setting up for test. I was told to stand out front, out of the way with the rest of the new people and observe for now. As it turned out, I was not the only "rookie" or new hire, as those were the good old cost-plus days and the more of everything the better. That meant people, money, anything, the more the merrier, the sky seemed the limit.

Coca 2 was setting up to test the Atlas B1 booster package, a configuration of stacked liquid oxygen and fuel (RP1 or refined kerosene), turbo pumps and two 150K chambers with room for the eventual S-4 Sustainer engine in between. The Sustainer was to show up a few months later with its two 1K Vernier engines. This configuration was the forerunner of the Atlas Intercontinental Ballistic Missile or ICBM.

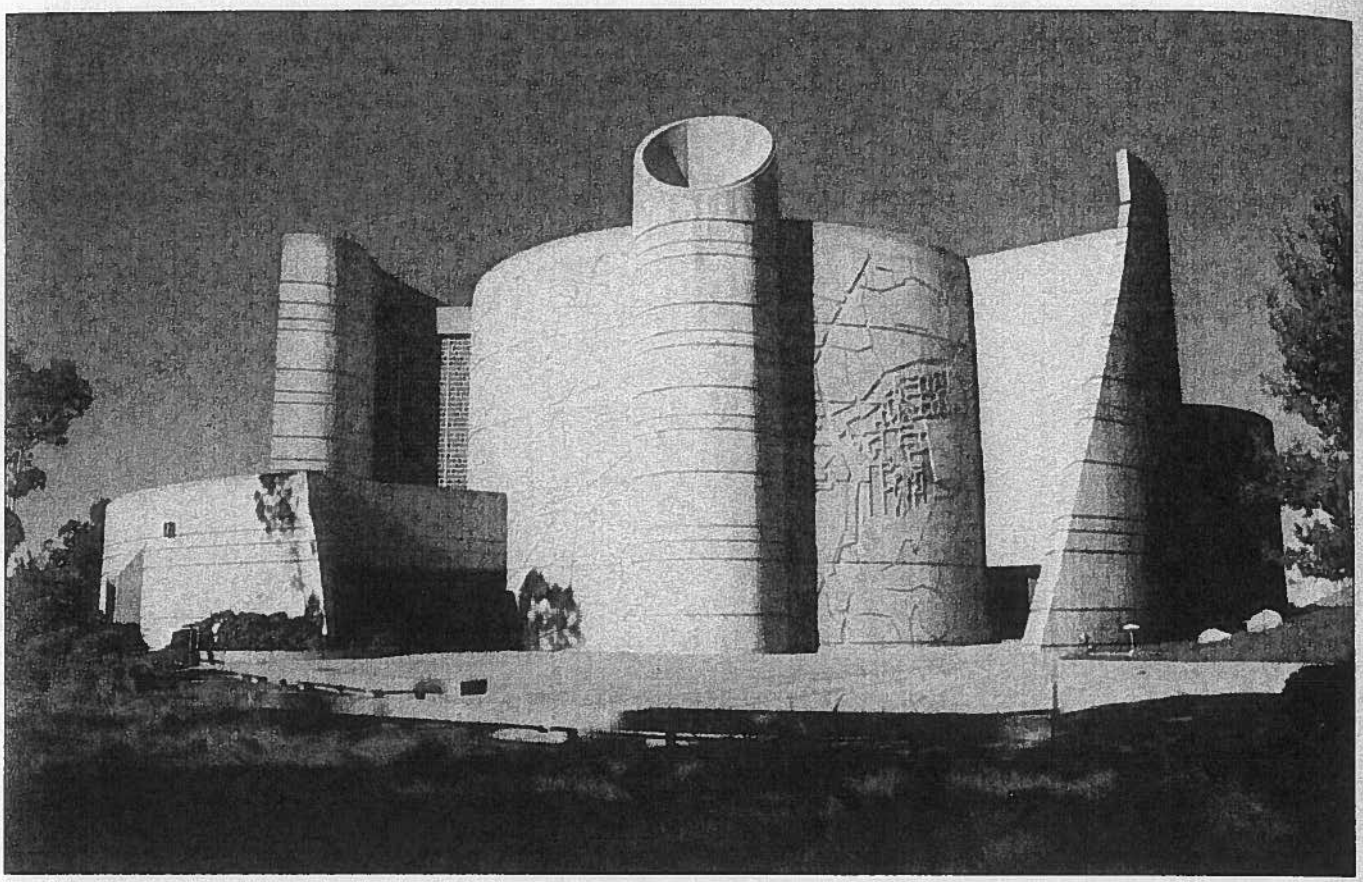
The Atlas later became a standard launch vehicle and is still very much in use today, 39 years later. I can't recollect for sure, but it seems that first test I observed was successful—that meant the engine got into main stage for whatever duration and shut down or cut off without any major damage or mishap. However, at that period in time it was not uncommon to have major blow-ups, causing extensive damage to engine hardware and test stands and equipment. Many of those malfunctions, though not all, were caused by human error, poor judgment, inadequate test procedures, some hardware that arrived on the scene processed and assembled improperly at the main plant or any of many other reasons. This continuing and seemingly endless string of screw-ups were causing no end of chagrin and consternation to even our Congress where they have strings of their own booboos going on with a remarkable consistency themselves.

In an effort to stem the tide, so to speak, an all-out effort by management brought forth edicts and standard operating procedures, which when boiled down, amounted to "Look before you leap" or "Think" or "Use common sense"—that kind of concept. Which, even though they went against human nature and were painful to adhere to, sure made a difference. I'm sure a lot of the successes, like putting a man on the moon, the space shuttle, satellites, etc., have resulted despite opinions to the contrary.

With the blow-ups early on, before testing got down to a more exacting and predictable science, building and rebuilding test stands and related equipment was just about standard fare. Personnel became quite adept at pulling in and terminating control and instrumentation, wiring, ducting and valving installation, and plumbing and running stainless steel tubing.

During my first few years at SSFL I worked almost exclusively on test of the Atlas system. One special project I worked on was called the FLOX program, FLOX being pre-mix of liquid oxygen and liquid fluorine. Fluorine is the most powerful oxidizer known; however, it is also the most toxic and corrosive and the least forgiving of them all and requires much special handling. We ran the tests using a standard and slightly modified Atlas Sustainer engine. Predictably the FLOX improved the engine's performance. The first tests at the lower FLOX mixture ratio worked fine; however, an increase in fluorine caused a bad scene, melting the engine and damaging the test stand. Further testing was contemplated but never did come about for some reason.

It was not uncommon during slack periods, to be assigned temporarily to help out in other test areas. One evening, another mechanic and I were sent to the Delta 11 test stand and were to told to assemble a turbine and turbo-pump on an experimental engine while the regular crew prepared the stand for test. My partner and I had second thoughts as we had never actually done this type work before. It was pretty straightforward and uncomplicated for the most part and we had several



The House of the Book has a 360-degree view of the surrounding landscape at the Brandeis-Bardin Institute located in Sycamore Canyon on the south side of Simi Valley. The floor plan, created by distinguished AIA architect Sidney Eisenshtat, is flexible, with rooms used independently or in combination according to the size of the assembly. (Photo by Hannah Kuhn.)

times observed the turbo-machinery specialists work on our test stands, so we had it ready to go in no time. The test was the first really successful run on that engine to date. It was not until after the test and the turbo-machinery troops arrived that our true identities were discovered. Do you know, not a word was said. I'd bet plenty would have been said if it had blown up.

The years that followed brought about many changes, not only in the world at large, but in the requirements of the rocket propulsion industry as well. With the "Man on the Moon" project announced by our President in the early 1960s it meant a decade of all-out effort by many in the industry, Rocketdyne included.

One such effort was the requirement to develop a booster engine of such magnitude that it had to be tested on the Mojave Desert at the Edwards Test Site. Initial ignition testing at SSFL proved this point. This engine designated the F-1 produced over 1.5 million lbs. of thrust and when clustered together in its configuration of 5 engines, produced over 8 million lbs. of thrust. These being RP-1 or kerosene and liquid oxygen burning engines were fine for the booster phase of flight; however they were weight-prohibitive for the other three phases of moon flight. An alternative fuel, Liquid Hydrogen was the answer. Kerosene or RI (Rocket Propellant One) weighing in at near eight lbs. and Liquid Hydrogen the lightest element at a fraction of 1 lb., it takes no real genius to see the advantage. This meant the development of a hydrogen-fueled engine. It just happened that such an engine as well as the above-mentioned booster engine were almost to the production stage already, and all on the company's money to that point.

All of this was well and good from the political and world news standpoint, but what did it meant to the test stand "Grunt"?

Having been raised on the old, conventional test stands, where Liquid Oxygen was the only cryogenic we dealt with, though requiring its due respects as to cleanliness, impact sensitivity, combustion support etc., we had grown used to it. Now Hydrogen was another matter, mostly due to its combustible nature and the fact its flame was almost invisible, especially in the daytime. However with time and experience and several engineering innovations, all this was overcome. One still hears of isolated cases from time to time reminding us of the dangers inherent in propellant handling, or with any potential explosive for that matter.

Having gone to the moon, and for whatever reason, probably political, NASA set out on another project of some import, the implementation of a reusable space ship or launch vehicle. The Space Shuttle Program, for which Rocketdyne got the Space Shuttle Main Engine contract. Though very successful, the SSME was to have implemented the chamberless, segmented Aerospike or segmented teroital engine our company had

already developed and tested extensively. The early designs of the Shuttle were to have used a liquid first-stage booster which would have avoided the solid booster tragedy which befell the Challenger and all aboard.

When I went to work for Rocketdyne in 1957, I never thought I'd be a "lifer," but sure enough 33 years later I retired, the better for it, I hope. In retrospect I'm sure I didn't realize what an advantage we'd reap later, being employed by a division of a very large corporation, Rockwell International. It paid off in some very fair employee benefits such as saving plans, medical plans, retirement plans, etc.

Rocketdyne engines have powered over 90% of the vehicles launched, civilian or military, since the U.S. has been in the aerospace business. So we were plenty busy at SSFL, Kennedy Space Center, Stennis Space Center, Huntsville, Alabama not to mention the main plant at Canoga Park. I had the pleasure of working at all those locations as well as Vandenberg AFB, California and Reno Test, Nevada.

Though the Santa Susana test site is being crowded out by the encroachment of civilization, Rocketdyne is still alive and very much looking forward to business in the 21st century with a long list of ventures. Continued Space Shuttle Main Engine development and support, Space Station power work, Aerospace Plane Propulsion and Kinetic Kill Vehicle to name a few.

In looking back I'd have to say all in all Rocketdyne was more than fair to me, and I'm proud to have been a part of their operation.

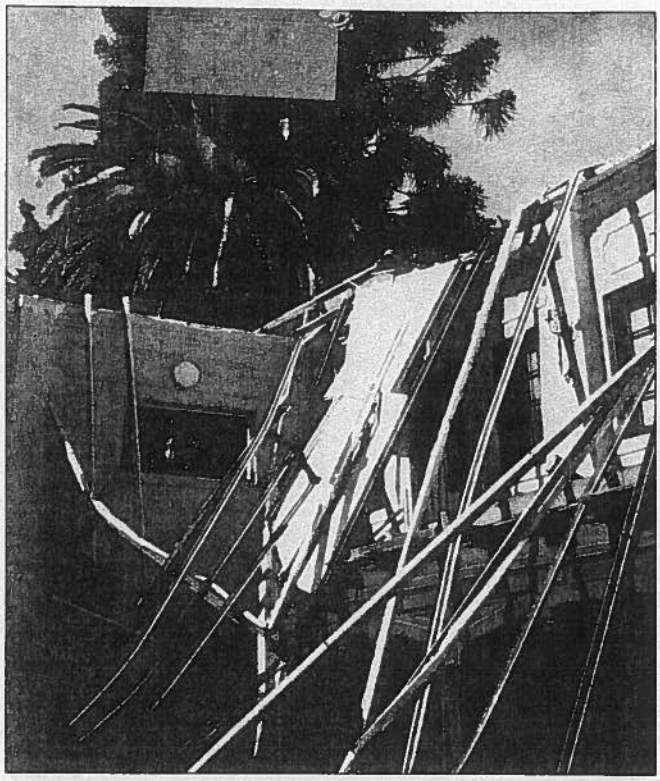
Northridge Earthquake

Michael W. Kuhn, Ph.D

January 17, 1994 was a national holiday–Martin Luther King Day. Few people had to work. At 4:30 a.m. nearly everyone was at home in bed.

No one will ever forget what happened to them. Nor will they forget the date and the time. All awoke and rose at the same time. Few went back to sleep. For thousands of our residents that less than 15 seconds period of violent motion began with terror that shattered the psyches and dreams of many. Southeastern Simi Valley, along with portions of the San Fernando Valley and Santa Monica experienced the strongest ground accelerations ever recorded in an urban area. In eastern and central Simi Valley we "saw the elephant" and lived to tell about it. This was not a "did you feel the earthquake?" kind of event. Rather, it was a "we're going to die!" kind of event. Thousands of our residents suffered serious psychological disturbance. Many would have trouble sleeping again for many months. Some would not sleep in their homes, preferring the discomfort of their cars or tents. Those with motor homes were lucky. Many neighbors formed a new bond–forged in the terror and uncertainty of disaster. Some would abandon homes and jobs and flee the state.

Virtually every household suffered financial losses. For many, their losses were limited to broken dishes, keepsakes, furniture and heirlooms. Most homeowners experienced block wall damage. Many others, especially in the eastern half of the valley, suffered major property losses, often exceeding 50 percent of the pre-earthquake value of their homes. Many, many homes would eventually have to be torn down–their owners or their mortgage holder to begin again from the ground up. Slabs were cracked and knocked off of foundations. Wallboard was damaged. Shattered beams, studs and stucco compounded the destruction. Chimneys cracked and hundreds fell to the ground–often causing additional property loss in the process. Severe shaking caused differential settlement beneath homes, businesses and streets, liquefaction in isolated areas, primarily in the southeastern portion of the City near Arroyo Simi, and lateral spreading along Arroyo Simi east of Ralston Avenue, some of which may have been liquefaction induced. Much of the public infrastructure in the eastern portion of the City, including streets, gutters, curbs, sidewalks, water lines and water tanks, and sewers were badly damaged. Southern California Water Company lost five of their eight water tanks. Ventura County Waterworks District No. 8 incurred damage to ten of its water tanks. The cost of repairs to sewers exceeded $800,000 by year's end. Nearly every street, both those running east-west and north-south, were cracked every 50-150 feet. (Those cracks generally reappeared after streets were slurry sealed.) Mildred Street, having recently been overcapped, experienced differential settlement, shattered sewer and water lines and broken



Roof of the central patio of the "Main House" at Brandeis-Bardin Institute. The building was originally built by Eddie Maier c. 1912. The 1994 Northridge Earthquake damaged the structure beyond repair and it had to be demolished. (Photo by Michael Kuhn.)