

## **APPENDIX D2**

### Paleontological Review Memorandum





# Memorandum

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Date: March 24, 2023  
To: Robert Sarkissian, Patriot Developments  
From: Brian Kussman, VCS Environmental  
Subject: Paleontological Review of Records for the PBP Industrial Project

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This memorandum documents the results of a search for relevant paleontological records in the San Bernardino County Museum (SBCM) paleontology database, a review of literature concerning paleontology and geology of the project area, and a review of geologic maps for the region.

## PROPOSED DEVELOPMENT AND LOCATION

This project proposes to build a commercial development within the northern portion of the City of Palmdale, in the Antelope Valley, California. The project is bounded on the north by Blackbird Drive, on the west by Lockheed Way, on the east by 10th Street E, and on the south by East Avenue P. State Route 14 trends north-south approximately 1.5 miles to the west of the project site and Pearblossom Highway is less than 2 miles to the south. A Lockheed Martin aerospace facility sits to the immediate north of the site (Figure 1).

## GEOLOGIC SETTING

### Regional

The proposed project sits in the Antelope Valley immediately northeast of Palmdale, California. The Antelope Valley is the westernmost portion of the Mojave Desert. The San Andreas Fault trends south of the project site, within the foothills of the San Gabriel Mountains. This fault has shaped the valley for millions of years. As the Antelope Valley drops due to tectonics associated with the fault, sediments are shed from the mountains and deposited in the Antelope Valley below. The sedimentary units discussed in this memorandum were derived from this sedimentation process. These processes continue to today with the most recent sedimentation represented by *Qoa*, *Qya* and most recently, *Qf*.

### Project Area

Two geologic formations are exposed on the surface of the project site according to geologic mapping (Dibblee 1967, Hernandez 2009, Olsen and Hernandez 2013), as well as the record search from SBCM (Kottkamp, 2022). The youngest unit, *Qf* map symbol (Figure 1), is composed of recent unconsolidated sands and gravels. *Qf* is present at the southern end of the property near E. Avenue P. Quaternary younger fan deposits, map symbol *Qyf*, is the other geologic unit present on the property. The majority of the site has been mapped as these younger fan deposits which are estimated to be of Middle Holocene age.

Quaternary older alluvium (*Qoa*) is likely to underlie the *Qyf* in the project area, as this unit can be found throughout the basin that Palmdale sits in (Dibblee 1967, Hernandez 2009, Olsen and Hernandez 2013).

The older alluvium is generally dated to the Late Pleistocene and can be very fossiliferous (Kottkamp 2022). Despite a lack of surface exposures, this unit is likely present on the project site at depth, between 3 - 5 feet bgs (below ground surface).

Older geologic units with the potential for paleontological resources are present within 5 miles of the project site (Hernandez 2009, Olsen and Hernandez 2013). The Harold Formation (*Qh*) underlies the unnamed units listed above, in the Palmdale area. It has been dated to the Middle to Late Pleistocene and is potentially fossiliferous, despite no localities found in the SBCM database. Below the Harold Formation is the Ritter Formation (*TQr*), which temporally spans the Pliocene - Pleistocene boundary, approximately 2 million years ago. The Ritter Formation is usually exposed more toward the south, in the foothills of the San Gabriel Mountains. The Pliocene to Miocene Anaverde Formation (*Ta*), and its clay-dominant member called the Clay Shale Member (*Tac*), are also exposed in the foothills to the south. The Clay Shale Member has produced a plant fossil assemblage dating to the late Miocene/early Pliocene time periods (Kottkamp 2022).

Older units are present in the vicinity of the project site, but due to their igneous and metamorphic origins are considered to have no paleontological sensitivity (Kottkamp 2022).

## REGULATORY SETTING

### State of California

In addition to meeting the Conditions of Approval developed by the City of Palmdale and the U.S. Army Corps of Engineers (USACE), this study satisfies the requirements of the California Environmental Quality Act (CEQA) regulations (*California Public Resources Code* [PRC] §21083.2) and the State CEQA Guidelines (14 *California Code of Regulations* [CCR] §15064.5).

CEQA requires a lead agency to determine whether a project would have a significant effect on historical resources. According to Section 15064.5(a) of the State CEQA Guidelines, a “historical resource” is defined as a resource listed in or determined to be eligible for listing in the California Register of Historical Resources (CRHR) (PRC §21084.1); a resource included in a local register of historical resources (14 CCR §15064.5[a][2]); or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be historically significant (14 CCR §15064.5[a][3]).

Section 5024.1 of the PRC, Section 15064.5 of the State CEQA Guidelines (14 CCR), and Sections 21083.2 and 21084.1 of the CEQA Statutes are the basic guidelines supporting the work. PRC 5024.1 requires evaluation of historical resources to determine their eligibility for listing in the California Register of Historical Resources (CRHR). The purposes of the CRHR are to maintain listings of the State’s historical resources and to indicate which properties are to be protected from substantial adverse change. The criteria for listing resources in the CRHR, which were expressly developed to be in accordance with previously established criteria developed for listing in the National Register of Historic Places (NRHP) (per the criteria listed at 36 CFR §60.4) are stated below.

The quality of significance in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California is present in any object, building, structure, site, area, place, record, or manuscript that possesses integrity of location, design, setting, materials, workmanship, feeling and association and that:

- (a) Is associated with events that have made a significant contribution to the broad patterns of California’s history and cultural heritage; or
- (b) Is associated with the lives of persons important in our past; or

- (c) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
- (d) Has yielded, or may be likely to yield, information important in prehistory or history.

According to Section 15064.5(a)(3)(A–D) of the State CEQA Guidelines (14 CCR), a resource is considered historically significant if it meets the criteria for listing in the CRHR (per the criteria listed at PRC 5024.1). Impacts that would adversely alter the significance of a resource listed in or eligible for listing in the CRHR are considered to have a significant effect on the environment. Impacts to cultural resources from a proposed project are thus considered significant if the project (1) physically setting of the resource that contributes to its significance; or (3) introduces visual, atmospheric, or audible elements that diminish the integrity of significant features of the resource.

#### City of Palmdale

**Objective ER7.1:** *“Promote the identification and preservation of historic structures, historic sites, archaeological sites, and paleontological resources in the City.”*

**Policy ER7.1.3:** *“Require that new development protect significant historic, paleontological, or archaeological resources, or provide for other appropriate mitigation.”*

**Policy ER7.1.4:** *“Develop and maintain a cultural sensitivity map. Require special studies/surveys to be prepared for any development proposals in areas reasonably suspected of containing cultural resources, or as indicated on the sensitivity map.”*

**Policy ER7.1.6:** *“Cooperate with private and public entities whose goals are to protect and preserve historic landmarks and important cultural resources.”*

#### SCOPE OF STUDY AND PERSONNEL QUALIFICATIONS

This paleontological search of records and review of literature was compiled by Brian Kussman, B.A. The qualifications of the author have been provided in Attachment A.

#### PALEONTOLOGICAL RESOURCES

##### Review of Literature

A review of literature was conducted concerning paleontological resources recovered in the vicinity of the project as well as a review of geological maps of the region.

Geologic mapping for the region was first performed by Dibblee in 1967, then in 2009 the Ritter Ridge Quad was mapped by Hernandez, and finally in 2013 the Palmdale East Quad was mapped by Olsen and Hernandez.

In 1990, Reynolds completed a paleontological record search for the Palmdale General Plan, including a search of the Natural History Museum of Los Angeles County paleontology database. Reynolds identified twelve rock units during the initial study. These rock units were further categorized into three classifications: high sensitivity, unknown sensitivity, and low sensitivity. According to the paleontological sensitivity map provided in the City of Palmdale General Plan, the project area is situated within an unknown paleontological sensitivity area (City of Palmdale 1993). The Palmdale General Plan, showed that paleontological localities have been recorded between the intersection of Pearblossom Highway and the California Aqueduct and Little Rock Wash. The sites produced fossil horse teeth, mammoth tooth fragments, and rabbit, bird, carnivore, and rodent tooth and bone fragments. The Ana Verde formation along the San Andreas rift zone was found to be an ancient lake deposit containing fossil plants. The City’s

low-lying areas consist of Quaternary alluvium which is known to contain numerous vertebrate fossils (City of Palmdale 1993).

### Search of Records

The paleontological records search associated with the Palmdale General Plan, compiled by Reynolds in 1990, showed that paleontological localities have been recorded between the intersection of Pearblossom Highway and the California Aqueduct and Little Rock Wash. The sites produced fossil horse teeth, mammoth tooth fragments, and rabbit, bird, carnivore, and rodent tooth and bone fragments. The Ana Verde formation along the San Andreas rift zone was found to be an ancient lake deposit containing fossil plants. The City's low-lying areas consist of Quaternary alluvium which is known to contain numerous vertebrate fossils (City of Palmdale 1993).

Following a consultation concerning the PBP Industrial Project with Scott Kottkamp, curator of Earth Sciences at the SBCM, it was determined that a record search of the SBCM database would be the most productive for this memorandum. A paleontological record search was then conducted for the PBP Industrial Project using the SBCM database. The results of this record search were received at VCS on August 25, 2022 and can be referenced in Attachment B of this memorandum.

Several fossil localities are present within 5 miles of the project site. The closest locality is approximately 1.3 miles west-southwest of the project site. Twenty-two fossil sites are associated with this locality and the furthest locality from the project site is only 1.75 miles away. These sites are derived from the unnamed Quaternary units (*Qf*, *Qya*, and *Qoa*) discussed above. The bulk of the fossils from these localities are microfossils, obtained through the wet screening of paleosols (buried ancient soils) present in the units (SVP 2019, Kottkamp 2022).

Approximately 3.9 miles from the project site, several localities have been collected from exposures of the Ritter Formation, as well as all three members of the Anaverde Formation. The fossils recovered include plant material such as leaves (Kottkamp 2022).

A molar and limb bone from *Mammuthus columbi*, the Columbian Mammoth, were found 3.1 miles south-southwest of the project site. This locality is recorded from the Miocene Anaverde Formation. As *Mammuthus columbi* had not developed yet, it is likely this locality was deposited in an eroded channel within the Anaverde Formation. This channel would likely have been deposited contemporaneously with the *Qoa*, but within a channel cut into the Anaverde Formation (Kottkamp 2022).

Finally, the geologic type-section of the Anaverde Formation, which hosts the Anaverde Flora, is approximately 4.5 miles southwest of the project site. The Anaverde Flora fossils, featuring 19 species of plants, come from the Clay Shale Member of the Anaverde Formation (Kottkamp 2022).

No fossils have been found to date within the proposed project site.

### CONCLUSIONS

The units exposed (*Qa* and *Qya*) and the one likely present on the project site (*Qoa*) have varying degrees of paleontological sensitivity. Recommendations regarding monitoring of the units onsite can be found in Table 1 (Scott and Springer 2003, SVP 2019). Should the Harold Formation (*Qh*), the Ritter Formation (*TQr*), or any of the four members of the Anaverde Formation (*Ta*, *Tar*, *Tac*, or *Tag*) be exposed during grading efforts, they should be regarded as having the same high sensitivity level as the "Quaternary older alluvium" (*Qoa*).

Field personnel will be able to determine the presence of Quaternary recent sediments (*Qf*). Excavations into the recent sediments (*Qf*), should be monitored on a spot-check basis, in order to recognize the more sensitive units which may grade into each other below. Due to their low sensitivity, the younger fan deposits

should be monitored on a part-time basis. The older alluvium and the sensitive named formations (encountered 3-5 feet bgs) discussed above should be monitored full-time (City of Palmdale 1993, Scott and Springer 2003, SVP 2019).

Table 1  
Paleontological Sensitivity for Units Present on the PBP Industrial Project Site

Geologic Unit	Map Symbol	Age	Sensitivity
Quaternary recent sediments	<i>Qf</i>	Recent	None
Quaternary younger fan deposits	<i>Qyf</i>	Middle Holocene	Low
Quaternary older alluvium	<i>Qoa</i>	Late Pleistocene	High

Therefore, it is recommended that any excavations in excess of 3-Feet on the project site should be closely monitored to quickly and professionally recover any fossil remains while not impeding development. Monitors should be equipped to salvage fossils, as they are unearthed, to avoid construction delays and to remove samples of sediments that are likely to contain the remains of small fossil invertebrates and vertebrates. Monitors must be empowered to temporarily halt or divert equipment to allow removal of abundant or large specimens. Monitoring may be reduced if the potentially fossiliferous units described are not present, or, if present, are determined upon exposure and examination by qualified paleontological personnel to have low potential to contain fossil resources. With implementation of Mitigation Measures PALEO-1, PALEO-2, and PALEO-3, potential impacts to paleontological resources would be less than significant.

#### MITIGATION MEASURES:

- PALEO-1: Once earthmoving reaches 3-Feet below the original ground surface, excavation shall be monitored under the direct guidance of a qualified paleontologist.
- PALEO-2: The project paleontologist retained shall review the approved development plan and shall conduct any pre-construction work necessary to render appropriate monitoring and mitigation requirements as appropriate. These requirements shall be documented by the project paleontologist in a Paleontological Resource Impact Mitigation Program (PRIMP). This PRIMP shall be submitted to the City's Community Development Department for review and approval prior to issuance of a Grading Permit. Information to be contained in the PRIMP shall meet the Society of Vertebrate Paleontology standards.
- PALEO-3: If paleontological resources are detected and recovered during monitoring, a report must be prepared. The following items must be presented in the report: recovered specimens must be prepared to a point of identification and permanent preservation, including washing of sediments to recover small invertebrates and vertebrates. The recovered fossils must be identified and curated into a professional, fully accredited museum repository with permanent retrievable storage (e.g., NHMLAC). The paleontologist must have a written repository agreement in hand prior to the initiation of mitigation activities. The report and inventory, when submitted to the Lead Agency, will signify completion of the program to mitigate for impacts to paleontological resources.

Paleontological Review  
March 24, 2023

Sincerely,

A handwritten signature in black ink that reads "Brian Kussman". The signature is written in a cursive, flowing style.

Brian Kussman  
Senior Paleontologist  
VCS Environmental

CC: Pat Maxon  
Dan Bott

Attachments (2):

- A. Personnel Qualifications
- B. Paleontological Search of Records from SBCM, Redlands, California



## CITATIONS

### City of Palmdale

1993 Palmdale General Plan.

### Hernandez, J.L.

2009 Preliminary geologic map of the Ritter Ridge 7.5' quadrangle, Los Angeles County, California: A Digital Database. California Geologic Survey. Preliminary Geologic Maps. Scale 1:24,000.

### Kottkamp, S.

2022 Results of Paleontological Search of Records in the San Bernardino County Museum (SBCM) database. Received 8/25/2022.

### Olsen, B.P.E., and J.L. Hernandez

2013 Preliminary geologic map of the Palmdale 7.5' quadrangle, Los Angeles County, California: A Digital Database. California Geologic Survey. Preliminary Geologic Maps. Scale 1:24,000.

### Scott, E., and K. Springer

2003 CEQA and Fossil Preservation in California. 10 pp. *The Environmental Monitor* 2003: 1-10.

### Society of Vertebrate Paleontologists (SVP)

2019 Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources. 11 pp.  
[http://vertpaleo.org/TheSociety/Governancedocuments/SVP\\_Impact\\_Mitigation\\_Guidelines.aspx](http://vertpaleo.org/TheSociety/Governancedocuments/SVP_Impact_Mitigation_Guidelines.aspx)

### Stewart, J. D., and M. E. Hakel

2016 Pleistocene paleosol developed on ancestral Mojave River sediments near Hinkley, California. *Paleobios* 33 Supplement: 15.

### Stewart, J. D., M. Williams, M. Hakel, and S. Musick

2012 Was it washed in? New evidence for the genesis of Pleistocene fossil vertebrate remains in the Mojave Desert of southern California. *California State University Desert Symposium Proceedings* 2012: 140-143.

## LIST OF FIGURES

Figure 1 Map of Project Vicinity including geology (from *Palmdale East* and *Ritter Ridge* USGS 7.5-minute Topographic Maps)

## LIST OF TABLES

Table 1 Paleontological Sensitivity for Units Present on the Patriot Business Park Project Site

# BRIAN KUSSMAN

Senior Paleontologist



## ABOUT

Brian began working for VCS Environmental in 2018 and has over 27 years of experience conducting paleontological research, field survey, fossil salvage, fossil preparation, laboratory identification, report preparation, and curatorial experience throughout Southern California. This includes background research, project proposals and reports, field surveys and monitoring, lab preparation and storage, identification and analysis, and curation of paleontological materials in repositories. Project experience includes housing construction, business construction, highway construction, and public utilities development throughout Southern California. He is also responsible for field monitoring, and has assisted with archaeological surveying, monitoring, and the preparation of paleontological monitoring reports.

## EDUCATION

B.A., Earth Science, California State University Fullerton

## CERTIFICATIONS/TRAINING

AEP CEQA Basics Training, October 2021

## PROFESSIONAL AFFILIATIONS

South Coast Geologic Society Member  
Society of Vertebrate Paleontology  
Association of Environmental Professionals

## SELECT EXPERIENCE

### PALEONTOLOGY

- Led and worked alongside Mark Roeder on many salvage excavations with L&L, PEA, and VCS. Also led salvage excavations with LSA. Led excavation for a mostly complete Mastodon skeleton at Majestic in California.
- Volunteer experience since 1989 at Clark Regional Park Interpretative Center, including several research projects.
- Monitoring experience on southern California sites, since 1994.
- Pleistocene fossil mammal identification expert.
- Familiarity with other fossil types found in local rock units.
- Volunteer at Rancho La Brea during the 1991 summer volunteer session.
- Sampled carbon, using proper field protocols for contamination prevention, for radiometric dating.
- Briefly assisted with curation at the John Cooper Center in 2016.

### GEOLOGY

- Led drilling efforts utilizing hollow stem auger, sonic, reverse mud rotary (800 foot + boreholes), standard mud rotary (130 feet to 325 feet boreholes) and direct push.
- Logged soil cuttings, from both conventional and mud drill rigs.
- Utility clearance oversight: utility company record searches, metal detection, ground penetrating radar, hand auger, and air knife.
- Groundwater and soil sampling for pollutants, GW sampling includes use of all types of pumps commonly used and interface probes for sounding (lead on those projects).
- Borehole geological description entry and creation of diagrams using LogPlot software, and report QA.
- Hazwoper 40 taken but would need to retake, TWIC card clearance.
- Familiar with rock and mineral identification.

### ARCHAEOLOGY

- Found numerous hearth features in Orange County with Psomas and LSA, as well as lithic artifacts associated with these features. One complete hearth feature excavated with LSA.
- Sampled carbon, for radiometric dating, from these features.
- Archaeological monitoring for both prehistoric and historic resources.
- Excavation experience recently at a central California coastal site extremely rich in lithics.

# BRIAN KUSSMAN

Senior Paleontologist

VCS Environmental

- Have worked alongside monitors from almost all tribal affiliations in central and southern California.

## BIOLOGY

- Twice, verified for authorities, that remains were not human. Very familiar with differences between human and other mammalian osteology.
- Familiar with local endangered/threatened animals and plants.
- Familiar with taxonomy and field identification of cacti and succulents of the Southwest.

## INSTITUTIONAL AFFILIATIONS

### Ralph B. Clark Regional Park Interpretive Center

Ralph B. Clark Regional Park includes an interpretive center with an extensive fossil collection. It displays marine fossils dating from about one million years ago, to more recent terrestrial mammals that walked the earth tens of thousands of years ago. These specimens were recovered inside the boundaries of Clark Park, and from the development of the Coyote Hills area in northern Orange County. Brian has volunteered at the park since 1989 and his experience includes the following:

- Worked extensively with modern comparative collections at the Interpretive Center, for identification purposes.
- Learned fossil preparation techniques (Pleistocene predominantly, but also Miocene terrestrial fossils of the Sespe-Vaqueros Formation as well as marine vertebrates from throughout Orange County).
- Acted as unofficial collections manager at the Ralph B. Clark Interpretive Center.
- From late 1990's, began with research, primarily focused on the Pleistocene terrestrial fossils from the Ralph B. Clark Park.
- In 2014, presented a poster at SVP pinpointing the age of the terrestrial fossils in the park. Also coauthored a poster concerning the age of the Oso Member (primarily exposed in Orange County), of the Capistrano Formation.
- Beginning of 2020, began a research project with paleontologists from Anza-Borrego State Park, concerning a rare animal only found in sufficient numbers for research, at these 2 institutions.
- Worked on several other research projects for Ralph B. Clark Interpretive Center, including a collaborative project with paleontologists at Anza-Borrego State Park, concerning a rare fossil animal found at both localities.

### George C. Page Museum - Rancho La Brea

Rancho La Brea represents the largest collection of late Pleistocene asphaltic fossils in the world, and uses this opportunity to train students, build collections through excavation, prepare and conserve fossils in our public viewing Fossil Lab and curate this massive collection onsite. Rancho La Brea staff also use these collections to study scientific questions with visiting academics. Brian volunteered at Rancho La Brea in 1991 and his experience includes the following:

- Preparation and reconstruction of Mammoth and Mastodon limb bone specimens.
- Separation and initial sorting of microfossils from matrix.
- Sorting and identification of fossils returned to Rancho La Brea from the California Academy of Sciences, San Francisco, CA.
- cursory observation of Western Camel vertebrae, as part of a potential research project.

## SPEAKER AT THE SOCIETY OF VERTEBRATE PALEONTOLOGY 75TH ANNUAL MEETING | OCTOBER 14-17, 2015

VERTEBRATE FAUNA AND UNGULATE BIOSTRATIGRAPHY OF THE HIGHLY FOSSILIFEROUS OSO SAND MEMBER, CAPISTRANO FORMATION, ORANGE COUNTY, CA.

Barboza, Michelle, California State University, Fullerton, CA, United States of America

Parham, James F., John D. Cooper Archaeology and Paleontology Center, California State University, Fullerton, CA, United States of America

Kussman, Brian N., California State University, Fullerton, CA, United States of America

The Oso Sand Member is the highly fossiliferous, nearshore facies of the Capistrano Formation, which spans the southwestern rim of the Los Angeles Basin in Orange County, California. Over 20 vertebrate taxa have been identified from this unit, including well preserved fossils of marine taxa, such as a nearly complete skull of a blue marlin and the most complete fossil walrus found to date. In addition to other marine

mammals (whales and sea cows), terrestrial mammals are also known from the Oso Sand Member including gomphotheriids, rhinocerotids, antilocaprids, canids, cricetids, and lagomorphs. Despite the abundance of material from Oso Sand Member sites, just three papers have reported on this unit: one paper focused on the skull of the blue marlin mentioned above, the other two mentioned mammal fossils in passing. We provide an overview of all known vertebrate fossils from Oso Sand Member, and establish a more refined age for the Oso Sand Member, which will help provide a temporal framework for ongoing paleontological studies. Based on stratigraphic correlation, the Capistrano Formation is reported as Upper Miocene to Lower Pliocene. Previous workers have referred to undescribed specimens to place the Oso Sand Member in the Hemphillian North American Land Mammal Age. Partial camelid teeth are identified as *Alforjas*, known from the late early to latest Hemphillian (Hh2 to Hh4). Horse teeth previously referred to *Pliohippus* (Barstovian to Hemphillian) are reidentified as *Dinohippus interpolatus*, which is characteristic of the early late Hemphillian (Hh3). Based on these identifications, we can constrain the age of the Oso Sand Member to the early late Hemphillian (Hh3). By better defining the age of the Oso Sand Member, we can place the marine and terrestrial vertebrate fossils from this unit into a more precise chronostratigraphic framework that allows us to make more detailed comparisons to other late Neogene faunas in California.

## BIOSTRATIGRAPHIC ANALYSIS OF MAMMALIAN TAXA REVISES THE AGE OF RICH PLEISTOCENE SITES FROM THE LA HABRA FORMATION (ORANGE COUNTY, CALIFORNIA) FROM RANCHO LA BREA TO IRVINGTONIAN

Kussman, Brian N., California State University, Fullerton, CA, United States of America

Parham, James F., John D. Cooper Archaeology and Paleontology Center, California State University, Fullerton, CA, United States of America

Babilonia, Lisa C., Clark Paleontology Museum, Buena Park, CA, United States of America

This study provides a new age assessment for the La Habra Formation at the Emery Borrow Pit, Ralph B. Clark Regional Park, Orange County, California, which contains one of the richest non-asphalt Pleistocene sites in California. Over 35 species of mammal, 19 species of birds, and 16 species of amphibians and reptiles have been identified from this site, although it remains poorly represented in the literature. Although Pleistocene terrestrial fossils from the Emery Borrow Pit have been mentioned occasionally, to date only a single fossil, a tapir tooth (*Tapirus merriami*), has been described and figured from the La Habra Formation. The La Habra Formation has been assigned to the Rancholabrean North American Land Mammal Age largely due to its proximity to another site, La Mirada. However, unlike La Mirada and other Rancholabrean sites, no *Bison* (a hallmark taxon for the Rancholabrean) have been found at the Emery Borrow Pit. This is despite an abundance of grazers such as *Camelops* and *Equus* have been found. Furthermore, the *Microtus* from the La Habra Formation most closely resemble *Microtus meadensis* (an Irvingtonian taxon). Combined with the presence of *Megalonyx jeffersonii* (known from the Late Irvingtonian to Rancholabrean), the *Microtus* and the lack of *Bison* suggest a late Irvingtonian age for the La Habra Formation. Faunas from the Irvingtonian are relatively rare compared to those from the Rancholabrean, increasing this site's importance for interpreting other Pleistocene faunas in the region. The high diversity and antiquity of the fauna from La Habra Formation present an excellent opportunity to characterize the fauna of the Los Angeles Basin just prior to the well-known asphalt site of Rancho La Brea, less than 40 km away.

## PUBLICATION

Barboza, M.M., J.F. Parham, G-P. Santos, B.N. Kussman, J. Velez-Juarbe. 2017. The age of the Oso Member, Capistrano Formation, and a review of fossil crocodylians from California. *PaleoBios*, 34. ucmp\_paleobios\_33797.

## SELECT PROJECTS

### SUMMERLY PROJECT | LAKE ELSINORE, CA

Summerly is a 706-acre master-planned golf community in the Lake Elsinore Back Basin. The development consists of approximately 1,955 residential units, 40 acres of roads, and 329 acres of open space, including an 18-hole golf course. This project included grading for a drainage channel, a large sewer line, the subsequent residential development, and a 71-acre detention basin which required cultural monitors on the project and ensured that any discovery of cultural or paleontological resources was handled appropriately. No archaeological resources were observed or collected during monitoring activities; however, a large, important assemblage of Pleistocene fossils (bison, camel, mammoth, et al.) was recovered from the lake sediments and recently curated at the Western Science Center in Hemet. Brian identified fossil remains during the course of salvage excavation efforts so as to prevent damage to adjacent fossils not yet uncovered.

### YORBA LINDA ESTATES - LAKEVIEW AVENUE | YORBA LINDA, CA

Shea Homes retained VCS Environmental (VCS) to provide cultural and paleontological resources monitoring pursuant to Mitigation Measures 122, 129, 130, and 131, of the Yorba Linda Estates Mitigation Monitoring Program developed in the project's Initial Study, govern the mitigation of impacts to paleontological, archaeological, and Tribal Cultural resources. Due to the project's location near a waterway and former existence as a nursery, it required monitoring for cultural and historic

resources, as well as paleontological. Monitoring occurred on 80 separate days beginning in April 2018 and extending through October 17, 2018. The Lead Monitor for the project was VCS Archaeologist/Paleontologist, Brian Kussman. Brian monitored for paleontological and cultural resources during soil removal as part of remediation, mass excavation, and deep utility trenching.

## LANDMARK | CHINO, CA

The construction project includes grading of lots for the development of 38 single family homes and trenching for the installation of sewer, water, and utilities. Monitoring of this work was required pursuant to the Mitigation Monitoring and Reporting Program, Mitigation Measures (MMs) CUL-1 through CUL-3 developed in the Initial Study/Mitigated Negative Declaration (IS/MND) for the project (Dudek 2017). Monitoring occurred on 90 separate days beginning on February 11, 2019, with grubbing and clearing and extending through December 20, 2019. Brian monitored for both paleontological and cultural resources on this project.

## RANCHO DIAMANTE PROJECT | HEMET, CA

The 244.9-acre Rancho Diamante Project site is located south of the Hemet-Ryan Airport in the City of Hemet. The proposed Project is a subdivision of 294 residential lots with paseos and open space consisting of residences, roadways, a stormwater drainage system, and associated infrastructure. To achieve said development, grading operations are required to obtain finished grade elevations. The grading operation will consist of 370,000 cubic yards of excavation and embankment of native soil. Brian monitored for both paleontological and cultural resources.

## PACIFIC MAYFIELD CULTURAL MONITORING | MENIFEE, CA

The current project site consists of approximately the southern half (Parcels 5-10) of the 2001 site boundaries. La Piedra Road defines the northern end of the current Project site, and Holland Road defines its southern boundary. Brian has conducted both paleontological and cultural resource monitoring at Pacific Mayfield.

## STATE ROUTE 210 MIXED FLOW LANE ADDITION FROM HIGHLAND AVENUE TO SAN BERNARDINO AVENUE PROJECT | CITIES OF HIGHLAND, SAN BERNARDINO, AND REDLANDS, CA

The San Bernardino Associated Governments (SANBAG), in cooperation with the California Department of Transportation (Caltrans) District 8 and the City of Highland, proposes to widen State Route 210 (SR-210) from Sterling Avenue to San Bernardino Avenue in the cities of Highland, San Bernardino, and Redlands, as well as a portion of unincorporated San Bernardino County, California. The land uses surrounding the proposed project corridor are urban and moderately densely developed primarily with residential, public facilities, open space, and general commercial uses. The widening would occur between post miles (PM) Revised (R) 26.3 and R32.4, for a total distance of 6.1 miles. The total length of the proposed project limits is approximately 8.2 miles (PM R25.0 to R33.2), which includes transition striping and signage. Within the limits of the proposed project, SR-210 is a four-lane divided freeway with two 12-foot-wide lanes in each direction, which are flanked by five foot-wide left and right shoulders. The purpose of the proposed project is to reduce congestion and improve operational efficiency by providing lane continuity with existing segments of freeway west and east of the proposed project limits. Brian monitored excavations into native alluvium for new bridge foundations. Excavations took place along a several mile section of SR-210 in Highland, CA.

## BANNING DISTRIBUTION CENTER PROJECT | BANNING, CA

The project property encompasses 108 acres, with 64.1 acres onsite and 43.9 acres for offsite improvements. The project is located south of Interstate 10 and the Southern Pacific Railroad and north of the Banning Municipal Airport at the eastern edge of the City of Banning. Ground disturbance is estimated to reach a maximum depth of 33 feet below the current grade. The offsite improvements to the project include a road, fire access road, sewer, and water lines. The proposed project's offsite roadways include a 5,688 linear foot extension of John Street from the project's west property line to Lincoln Street and a 3,871 linear foot emergency fire access roadway at the southwestern corner of the property, across a creek that flows to Smith Creek, and onto Banning Airport property. The offsite utility improvements include a sewer line and an associated lift station; the lift station is approximately 0.4 miles from the southern edge of the project. A water line will start where the line will tie into the existing water line at the intersection of South Hathaway Street and East Barbour Street, then north on Hathaway and east on the extension of John Street. The remaining water line will be located east and south of the project site, terminating at the intersection of Scott Street and East Westward Avenue. Brian monitored for paleontological and cultural resources during all stages of construction.

## ONTARIO GATEWAY PROJECT | ONTARIO, CA

The approximately 21-acre project site, located within the City of Ontario, is situated on the east side of Mill Creek Avenue, south of Ontario Ranch Road, and west of vacant/undeveloped land. The project site is located within the Standalone Residential land use district of the Rich-Haven Specific Plan and consists of Assessor Parcel Number (APN): 0218-652-27. Brian monitored for paleontological and cultural resources due to the project's proximity to a very fossiliferous site immediately east of Ontario Gateway, made it of high sensitivity.

## TIERRA DEL SOL BENTON PARCEL | RIVERSIDE COUNTY, CA

The 16.6-acre project site is located within the Southwest Area Plan (SWAP) of unincorporated Riverside County, approximately 1.2 miles east of the City of Murrieta and approximately 2.8 miles north of the City of Temecula. Tentative Tract Map No. 37715 proposes to subdivide the 16.6-acre lot into 141 residential lots with a minimum lot size of 2,700 square feet and a density of 8.75 dwelling units per acre. Access into the subdivision will be provided from San Remo Drive and Benton Road. Two detention basins will be constructed within the project site; one located along the northwestern corner of the project site and the other to the east of the main entrance along Benton Road. Brian monitored for paleontological and cultural resources, including historic, during the initial ground disturbances through to completion of mass excavation.

## HEIRLOOM FARMS/HARVESTON CULTURAL RESOURCES MONITORING | TEMECULA, CA

The project consists of a Development Plan to allow for the construction of a 321 unit, single-family residential community built on 27.86 acres consisting of detached homes and attached townhomes and a Tentative Tract Map (TTM 37509) for the creation of 111 single family residential lots, 31 condominium lots and 9 open space lots. VCS provided archaeological and paleontological resources monitoring, Tribal Coordination to develop a Monitoring Agreement with Pechanga, Sensitivity Training at the pre-grade meeting, preparation of a Cultural Resources Treatment Plan, and a Phase IV Negative Findings Monitoring Report. Brian provided paleontological and cultural resources monitoring, during mass excavation, on this project.

## ORCHARD HILLS | TUSTIN, CA

Found numerous sites of cultural significance including numerous hearth features, and lithic sites. Participated in the gridded excavation and documentation of a hearth Feature. Multiple carbon samples taken, from hearths, for radiometric dating. Both terrestrial and marine fossil locations were also recovered on this project.

## OLINDA LANDFILL | BREA, CA

Brian served as paleontological field technician to perform monitoring at the Brea-Olinda Landfill. He monitored and reported compliance with mitigation measures. He also prepared and identified fossil remains recovered from the excavations into a very fossiliferous marine unit, the Puente Formation.

## SANTIAGO CANYON LANDFILL | UNINCORPORATED ORANGE COUNTY, CA

Paleontological field technician at Santiago Canyon Landfill. Brian monitored for compliance with mitigation measures, screenwashed sediments for microfossils, in addition to preparing and identifying fossil remains from the project site.

## SIMI VALLEY LANDFILL | SIMI VALLEY, CA

Brian served as paleontological field technician monitoring at several construction projects. He monitored and reported compliance with mitigation measures. He also prepared and identified fossil remains recovered from numerous sites on the project area.

## PRIMA DESHECHA LANDFILL | SAN JUAN CAPISTRANO, CA

Brian monitored for both paleontological and archaeological resources at the Prima Deshecha Landfill. Archaeological resources consisted of both Native American and historic features. He also participated in the recovery excavations of 2 different whale fossils approximately 10 years apart.

## LA PATA ROAD EXTENSION | SAN JUAN CAPISTRANO/SAN CLEMENTE, CA

Brian performed paleontological and archaeological monitoring for the La Pata Road Extension. Archaeological resources consisted of both Native American and historic features. Paleontological resources were derived from the marine Capistrano Formation outcrops on the project.

# BRIAN KUSSMAN

Senior Paleontologist

VCS Environmental

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## EMPLOYMENT EXPERIENCE

### VCS Environmental

30900 Rancho Viejo Road, Suite 100, San Juan Capistrano, CA 92675  
Paleontologist/Cultural Resources Monitor | Date of Employment: April 2018 to Present

### Dudek

605 Third Street, Encinitas, CA 92024  
Paleontologist/Cultural Resources Monitor | Date of Employment: July 2021 to Present

### LSA and Associates

20 Executive Park, Suite 200, Irvine, CA 92614  
Paleontology/Cultural Resources Monitor | Date of Employment: July 2014 to May 2021

### Psomas

5 Hutton Centre Drive, Suite 300, Santa Ana, CA 92707  
Paleontology/Cultural Resources Monitor | Date of Employment: 2015

### Ultrasystems Environmental Inc.

16431 Scientific, Irvine, CA 92618  
Paleontology/Cultural Resources Monitor | Date of Employment: April 2015 to September 2015

### L&L Environmental, Inc.

721 Nevada Street, Suite 307, Redlands, CA 92373  
Paleontology Monitor | Salvage excavation only, 2014

### Paleo Environmental Associates, Inc.

2248 Winrock Avenue, Altadena, CA 91001  
Paleontology Monitor | Date of Employment: May 1993 to November 2010



**Museum**  
Division of Earth Science

**Scott Kottkamp**  
Curator of Earth Science

23 August, 2022

VCS Environmental  
Attn: Brian Kussman  
30900 Rancho Viejo Road, Suite 100  
San Juan Capistrano, CA 92675

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PALEONTOLOGY RECORDS REVIEW for proposed site of Patriot Business  
Development, Palmdale, Los Angeles County, California

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Dear Mr. Carson,

The Division of Earth Science of the San Bernardino County Museum (SBCM) has completed a records search for the above-named project in Los Angeles County, California. The proposed project site (Patriot Business Development) is in the City of Palmdale, California as shown on the United States Geological Survey (USGS) 7.5 minute Palmdale East, California quadrangle.

Geologic mapping of that region done by Olson and Hernandez (2013) indicates almost the entire project area is located atop alluvial fan surficial deposits of Middle Holocene age (Qyf). Qyf is an unconsolidated to weakly consolidated, dark yellow-brown, fine to medium grained arkosic sand intermixed with fine granitic gravel (Hernandez 2009; Olson and Hernandez 2013). One small area in the southeast of the project area is covered with an unconsolidated and poorly sorted mixture of gravel, sand, and silt deposits of even younger, recent age (Qf). These Holocene age alluvial fan deposits are unlikely to be fossiliferous, though they sometimes yield recent and subfossil plant and animal remains.

Though not exposed at the surface of the project site, older Pleistocene age alluvium (Qoa) directly underlies younger surficial alluvium throughout much of southern California and in the Palmdale region (Hernandez 2009; Olson and Hernandez 2013). In the Palmdale area,

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surface exposures of Qoa occur around the foot of the San Gabriel Mountains, as well as in excised canyons, valleys, and alluvial channels. Qoa in the Palmdale area is most frequently represented by unconsolidated to moderately consolidated, usually strong brown in color, pebbly coarse-grained sand and silt (Olson and Hernandez 2013). Qoa ranges from massive to poorly bedded with units divided by moderately developed soil surfaces. Weathering can turn Qoa red. However, other variations of Qoa exist in the region, either resembling more consolidated Qf or containing a higher density of igneous or metamorphic clasts (Hernandez 2009). These older alluvial deposits are frequently highly fossiliferous, yielding the remains of mastodons, mammoths, *Smilodon*, camels, horses, bison, and ground sloths, as well as microfossils including rodents.

Three older sedimentary units found within 5 miles of the project are of paleontological interest. The Harold Formation (Qh) underlies the unnamed Quaternary sediments in the Palmdale region, and has been dated to the Early and Middle Pleistocene. This formation is comprised of light brown, gray, and reddish-brown, poorly to moderately consolidated, gravelly alluvial fan and playa deposits (Olson and Hernandez 2013). The Harold Formation frequently contains caliche nodules and crack-infillings, though one particular member is known for its inclusions of Pelona Schist. There are no SBCM localities within the Harold Formation, but it is potentially fossiliferous. Underlying the Harold Formation is the Ritter Formation (TQr); this formation is normally only exposed in the low slopes and foothills of the San Gabriel Mountains. Plio-Pleistocene in age, it is comprised of a dark-yellowish brown to light-grey, moderately indurated, arkosic coarse sandstone and siltstone with coarse gravel up to 0.5 m in diameter (Hernandez 2009). Finally the Anaverde Formation (Ta) underlies the Ritter Formation, and occurs in the San Gabriel Mountains at lower elevation. Ta is a Middle Pliocene aged unit with several members, ranging from red, buff, and grey arkosic bedded sandstones to a grey gypsiferous and argillaceous to silty shale. The Clay Shale Member (Tac) is of especial paleontological interest, as it frequently preserves plant fossils dating to the Hemphillian North American Land Mammal Age (Wallace 1949; Dibblee 1967). Nearby units older than these are volcanic and metamorphic in origin, and are not known to be fossiliferous (Hernandez 2009; Olson and Hernandez 2013).

For this review, I conducted a search of the Regional Paleontological Locality Inventory (RPLI) at the SBCM. The results of this search indicate that no paleontological resources have been discovered within the proposed project site. The nearest fossil locality, SBCM 9.2.24, is approximately 1.3 miles west-southwest of the proposed project site. This site is part of a larger area of 22 fossil localities, SBCM 9.2.3 – 9.2.7 and SBCM 9.2.15 – 9.2.31, situated between 1.3 – 1.75 miles west-southwest and 1.7 miles southwest of the project site. These localities all occur within Qf, Qyf, and underlying Qoa; SBCM 9.2.3 – 9.2.7 can be dated to the late Pleistocene based

on matrix sedimentology (matches typical Qoa) and the diagenetic alteration of the fossils, but SBCM 9.2.15 – 9.2.31 include mostly unaltered bones of extant taxa and are dated to generalized late Quaternary. Taxa present at SBCM 9.2.3 – 9.2.7 include: Bivalvia indet.; Gastropoda indet.; Mammalia indet.; Leporidae indet.; Rodentia indet.; coprolites; and root casts. Specimens occur as isolated elements and are often poorly preserved, either as lightly permineralized bone, unaltered shells, or molds/casts. Taxa present at SBCM 9.2.15 – 9.2.31 include: Chordata indet.; Lacertilia indet.; Aves indet.; Mammalia indet.; Cricetidae indet.; *Thomomys bottae*, *Thomomys* sp.; *Dipodomys* sp.; *Perognathus* sp.; animal burrow casts; petrified wood, and root casts. Specimens are unaltered to lightly permineralized bone, permineralized wood, and casts, occurring as fragments or isolated partial to complete skeletal elements.

The next closest major fossil localities, SBCM 9.2.8 – 9.2.13, are 3.9 miles southwest of the project site. These localities occur within a geologically complex area amidst the foothills of the San Gabriel Mountains. The immediate vicinity of the localities exhibits exposures of the Ritter Formation, Red Arkose Member of the Anaverde Formation (Tar), Clay Shale Member of the Anaverde Formation (Tac), and the Grey Arkose Member of the Anaverde Formation (Tag) as well as Qf and several units of Qoa (Hernandez 2009). Fossils recovered from the sites were mostly unidentified leaves, with *Pinus* sp. needles as the only specimen identified to lower taxonomy. Records do not specify the unit nor depth the fossils were recovered from, but the matrix of specimens found in SBCM collections matches the description of Tac.

The RPLI records several other paleontological sites located within a 5 mile radius of the project site. SBCM 9.2.2 is 3.1 miles south-southwest of the project site. A molar and a limb bone of *Mammuthus columbi* was recovered from this locality from an unspecified unit of the Anaverde Formation. SBCM 9.2.1 is approximately 4.5 miles southwest of the project site within the Upper Anaverde Formation, specifically within the basal portion of Tac. This locality is the type section of the Anaverde Flora, with 19 species of plants identified. See Wallace (1949) for more information.

This records search covers only the paleontological records of the San Bernardino County Museum. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Please do not hesitate to contact us with any further questions that you may have.

Sincerely,

A handwritten signature in black ink that reads "Scott Kottkamp". The signature is written in a cursive, slightly slanted style.

Scott Kottkamp, Curator of Earth Science  
Division of Earth Science  
San Bernardino County Museum

### **Literature Cited**

- Dibblee, T.W., Jr. 1967. Areal geology of the western Mojave Desert, California. U.S. Geological Survey. Professional Paper 522: 153 p.
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- Wallace, R.E. 1949. Structure of a portion of the San Andreas rift in southern California. Geological Society of America Bulletin, 60, (4): p. 781-806.

