

**PALEONTOLOGICAL EVALUATION REPORT  
FOR THE FULTON-FITCH MOUNTAIN  
RECONDUCTORING PROJECT  
IN SONOMA COUNTY, CALIFORNIA**

*Prepared for:*

**Pacific Gas and Electric Company**  
1919 Webster Street  
Oakland, CA 94612

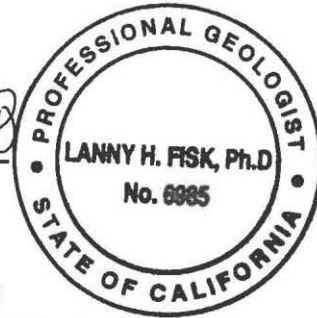
*and*

**TRC Companies, Inc.**  
101 2nd Street, Suite 300  
San Francisco, CA 94105

*Prepared by:*



Dr. David M. Haasl, PhD  
Senior Paleontologist  
Dr. Lanny H. Fisk, PhD, PG  
Principal Paleontologist and Professional Geologist



**PaleoResource Consultants**  
**F & F GeoResource Associates, Inc.**  
550 High Street, Suite #215  
Auburn, CA 95603  
888-887-9745  
Lanny@PaleoResource.com  
David@PaleoResource.com

24 September 2015

## TABLE OF CONTENTS

<b>SECTION 1</b>	<b>Summary of Findings</b> .....	<b>1</b>
<b>SECTION 2</b>	<b>Introduction</b> .....	<b>2</b>
	2.1 Project Location .....	2
	2.2 Project Description .....	2
	2.3 Purpose of Investigation .....	4
<b>SECTION 3</b>	<b>Regulatory Framework</b> .....	<b>5</b>
	3.1 Federal Regulations .....	5
	3.2 State Regulations .....	5
	3.3 Local Regulations .....	7
<b>SECTION 4</b>	<b>Methods</b> .....	<b>9</b>
	4.1 Professional Standards .....	9
	4.2 Literature Review and Records Search .....	9
	4.3 Field Inspection .....	10
	4.4 Key Personnel .....	10
<b>SECTION 5</b>	<b>Results</b> .....	<b>12</b>
	5.1 Project Geology .....	12
	5.2 Known Paleontological Resources .....	18
	5.3 Museum Records Search .....	20
	5.4 Field Inspection .....	20
<b>SECTION 6</b>	<b>Paleontological Significance and Sensitivity</b> .....	<b>25</b>
	6.1 Definitions of Significance and Significance Criteria .....	25
	6.2 Definitions of Sensitivity and Sensitivity Criteria .....	26
	6.3 Determination of Sensitivity for Geologic Units within Study Area .....	27
<b>SECTION 7</b>	<b>Findings and Recommendations</b> .....	<b>33</b>
	7.1 Findings .....	33
	7.2 Recommendations .....	33
<b>SECTION 8</b>	<b>Acronyms</b> .....	<b>35</b>
<b>SECTION 9</b>	<b>References</b> .....	<b>36</b>

## LIST OF FIGURES

<b>Figure 1</b>	Satellite photograph of the proposed Fulton-Fitch Mountain Reconductoring Project area .....	4
<b>Figure 2</b>	Geologic map showing the location of the proposed Fulton-Fitch Mountain Reconductoring Project .....	14
<b>Figure 3</b>	Road cut exposure of water-lain tuffs in the Sonoma Volcanics along Chalk Hill Road approximately one mile east of the Project ROW .....	16
<b>Figure 4</b>	Road cut exposure of Glen Ellen Formation along Chalk Hill Road approximately one-quarter mile west of the Project ROW .....	17
<b>Figure 5</b>	Geologic map showing PFYC ratings for geologic units potentially impacted by the proposed Fulton-Fitch Mountain Reconductoring Project .....	31

**LIST OF TABLES**

**Table 1** Project components involving significant potential ground disturbance ..... 22  
**Table 2** Paleontological sensitivities of geologic formations that may be impacted by the  
proposed Fulton-Fitch Mountain Reconductoring Project ..... 30

**LIST OF APPENDICES**

**Appendix A** Records Search Results: UCMP Data..... 42  
**Appendix B** Staff Resumes ..... 44

## SECTION 1

### **SUMMARY OF FINDINGS**

The purpose of this report is to provide an assessment of potential adverse impacts on scientifically significant paleontological resources (fossils – the remains of prehistoric plants and animals) resulting from earth-moving activities related to the Fulton-Fitch Mountain Reconductoring Project (hereinafter Project). The proposed Project by Pacific Gas and Electric (PG&E) consists of the reconductoring the Fulton-Hopland 60kV transmission line between the Fulton and Fitch Mountain Substations as well as reconductoring of small segments of adjacent transmission lines. The purpose of the Project is to ensure that safe and reliable electric service will remain available to existing and future development. Proposed Project activities include the replacement of wood transmission poles with either light duty steel poles (LDSP) or tubular steel poles (TSPs); the installation of new cables; and the repairing or upgrading of insulators, switches, and other associated equipment.

PaleoResource Consultants (PRC) was retained by Tremaine & Associates, Inc., subcontracted to TRC Companies, Inc. (TRC) to complete the Paleontological Evaluation Report (PER) presented below. This PER presents the results of the impact assessment and makes recommendations for mitigating potential adverse impacts of Project construction on known and suspected paleontological resources. Five (5) geologic units may be impacted by the proposed Project. From oldest to youngest, these units are the Mio-Pliocene Sonoma Volcanics, Plio-Pleistocene Glen Ellen Formation (Quaternary/Tertiary Gravels), Pleistocene older alluvial fan deposits, Quaternary landslide deposits, and younger alluvial fan deposits. However, the Quaternary landslide deposits and younger alluvial fan deposits are not paleontologically significant due to their young age and because any fossils they contain would be displaced and no longer found *in situ*. Only the older three (3) units will be considered further in this report.

Based on the Bureau of Land Management (BLM) Potential Fossil Yield Classification (PFYC) rating system three of the geologic units, the Sonoma Volcanics, the Glen Ellen Formation, and the older alluvial fan deposits, have a high sensitivity (Class 4) with respect to paleontological resources. Using the same criteria, the Great Valley Sequence is assigned a moderate paleontological sensitivity (Class 3). The younger alluvial fan deposits are assigned a low paleontological sensitivity (Class 1 and 2).

Actual impacts on paleontological resources will be related closely to the location and depth of excavations (e.g., access road cuts, boring, and grading) in paleontologically sensitive geologic units within the Project area. Units identified as having a Class 4 potential (Sonoma Volcanics, Glen Ellen Formation, and older alluvial fan deposits) should receive part-time monitoring by a qualified paleontologist, while those identified as having a Class 1 or 2 potential (Quaternary landslides and younger alluvial fan and fluvial deposits) should require no monitoring.

## SECTION 2

### INTRODUCTION

#### **2.1 Project Location**

The proposed Project by PG&E consists of the reconductoring of a 9.9-mile (15.8 km) long segment of the Fulton-Hopland 60kV transmission line between the Fulton and Fitch Mountain Tap and 1.3 miles (2.1 km) of the Geysers #12-Fulton Line. The Project is located to the east of Highway 101 on the east side of the Santa Rosa Valley between the cities of Windsor and Healdsburg in Sonoma County, California (Figure 1). The Project originates at the Fulton Substation located in Fulton, a census-designated place within the Santa Rosa Valley and extends more or less northwards to terminate at the Fitch Mountain Tap located on a ridge on the Minaglia Ranch to the south of the Russian River and Healdsburg, CA.

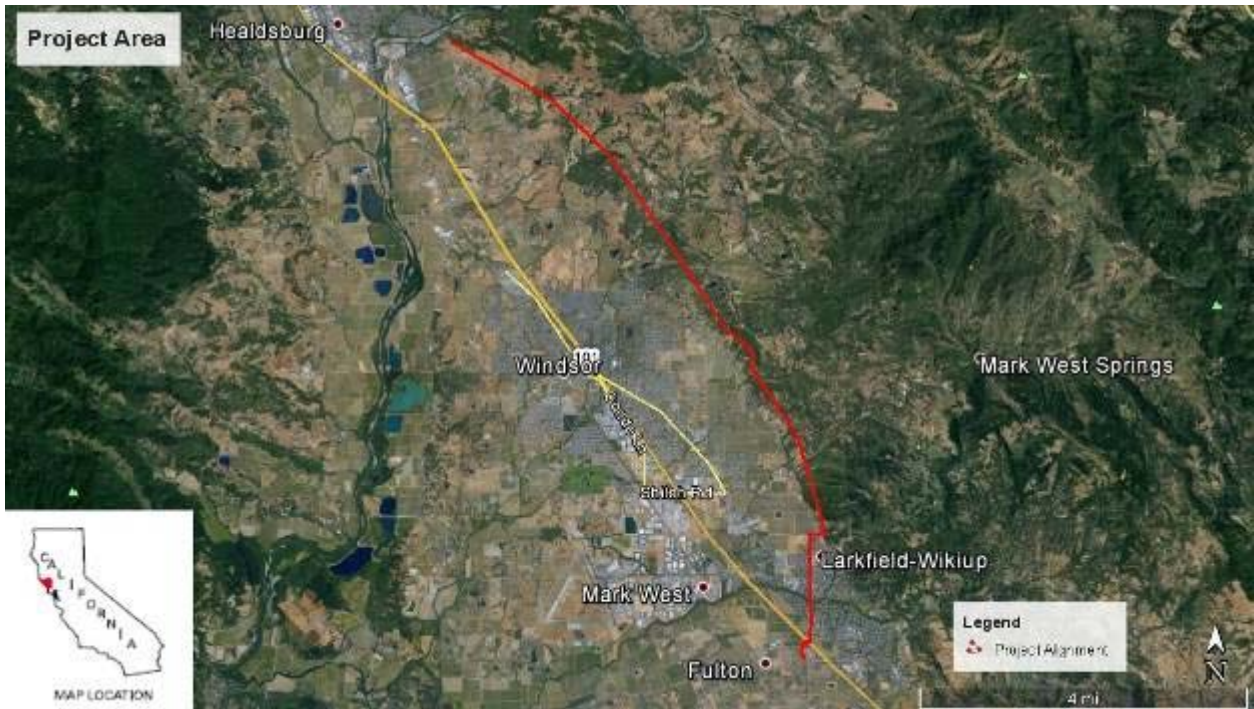
#### **2.2 Project Description**

PG&E proposes to reinforce the electric transmission system in Sonoma County by replacing conductor (reconductoring) and poles on portions of the Fulton-Hopland 60 kilovolt (kV) Power Line (Fulton-Hopland Line). The Project will also include the reconductoring of a minor segment of the #12 circuit of the existing double-circuit Geysers-Fulton 230 kV Transmission Line (Geysers #12-Fulton Line) and minor modifications to Fitch Mountain Substation. The following project details may be subject to minor modifications once project construction and engineering are finalized.

The Project will consist of the following components:

- **Fulton-Shiloh segment.** The existing, single-circuit Fulton-Hopland Line is primarily underbuilt (supported on the same structures) on tubular steel poles (TSPs) that also support the double-circuit Geysers-Fulton 230 kV Transmission Line for the first 1.8 miles (2.9 km) of the Project. Although the existing TSPs will remain, conductors on both the existing Fulton-Hopland 60 kV Line and the Geysers #12-Fulton circuit of the Geysers-Fulton 230 kV Line will be replaced.
- **Shiloh-Fitch segment.** The existing Fulton-Hopland Line between the Geysers-Fulton 230 kV Transmission Line takeoff pole and the Fitch Mountain Tap is supported primarily by wood poles for the remaining 8.1 miles (13 km) of the proposed Project. To support the new conductor, these poles (approximately 68 pole structures) will be replaced either with LDSPs or TSPs (at locations with large spans).
- **Substation modifications.** Minor modifications to substation equipment at Fitch Mountain Substation will be completed to tie the upgraded line into the existing system.

Potential impacts to paleontological resources can arise due to project activities that impact potentially fossiliferous geologic units (i.e., earth disturbance activities). For this Project, the following is a description of Project earth disturbance activities.



**Figure 1.** Satellite photograph of the proposed Fulton-Fitch Mountain Reconductoring Project area.

**Pole Replacement:** Approximately 68 of the 71 current poles within the Shiloh-Fitch segment will be replaced with a combination of LDSPs and TSPs. Replacement LDSPs will be approximately 3 feet (0.9 meters) at the base and range in height from 58-73 feet (17.7-22.3 meters). Each pole will be embedded in the ground to a depth of approximately 14 feet (4.3 meters). Replacement TSPs will be approximately 2 feet (0.6 meters) wide at the base and reach heights of approximately 60-75 feet (18.3-22.9 meters). All TSPs will have concrete foundations approximately 5 feet (1.5 meters) in diameter reaching depths of approximately 20 feet (6.1 meters). Pole installation will be accomplished by a combination of auguring and hand tools and will require the excavation of a hole 3 to 6 feet (0.9-1.8 meters) in diameter and 14-30 feet (4.3-9.1 meters) deep.

**Staging Areas:** Staging areas for workers, vehicle parking, helicopter landing and refueling, and equipment and construction material storage will be prepared at least at the following locations:

- River Road Park and Ride, located south of Fulton Substation;
- an undeveloped area along the existing alignment on the north side of Shiloh Ridge Road;
- an undeveloped area 200 feet (70 meters) southeast of Brooks Road;
- an undeveloped area approximately 500 feet (152 meters) east of Foothill Regional Park;
- an area at Minaglia Ranch; and
- other PG&E facilities, such as Airport Yard, located near the Santa Rosa Airport, and Fulton Substation.

Staging areas are expected to range in size from 1-5 acres (0.4-2.0 hectares). Preparation of these areas will involve placement of geotextile fabric and gravel, but no grading will be required.

**Access Roads:** Project work areas will be accessed using a combination of public and private roads, existing unpaved access roads, and overland travel routes that are currently used for operation and maintenance. No new roads are proposed. A width of approximately 16 feet (4.9 meters) will be required to allow the passage of construction vehicles. Most existing dirt and gravel access roads will require vegetation trimming and removal, and several will require improvements consisting of minor grading and laying of gravel to improve traction and all-weather access. Turnarounds, requiring minor grading to prepare, are proposed for seven (7) locations along the Shiloh-Fitch segment.

**Vegetation Clearance:** Approximately 30 acres (12.1 hectares) of vegetation trimming and tree and shrub removal is proposed. About 200 trees are expected to be removed. Vegetation trimming and removal will be accomplished by hand crews with hand and chain saws, driving line trucks with pull-behind chippers.

**Pull Sites:** Pull sites are required to install the new conductor onto poles. Six (6) pull sites will be needed along the Fulton-Fitch segment where the alignment changes, approximately one (1) pull site every mile. The footprint of each pull site will vary depending on local conditions and will range in size from 0.6 to 0.8 acres (0.2 to 0.3 hectares). Pull sites outside of paved areas will require minor ground disturbance to ensure a flat working surface, namely minor blading, grading, and filling.

### **2.3 Purpose of Investigation**

PaleoResource Consultants (PRC) was retained by Tremaine & Associates, Inc., subcontracted to TRC Companies, Inc. (TRC) to complete the PER presented below. This PER presents the results of the impact assessment and makes recommendations for mitigating potential adverse impacts of Project construction on known and suspected paleontological resources. This PER meets all requirements of the National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and the standard procedures for mitigating adverse construction-related environmental impacts on paleontological resources established by the Society of Vertebrate Paleontology (SVP 2010, see Appendix A). This PER was prepared by Dr. David Haasl, PhD, Senior Paleontologist; Dr. Lanny H. Fisk, PhD, PG, a California registered Professional Geologist (PG) and Principal Paleontologist, and Brendan J. Pfeiffer, Staff Paleontologist, all with PRC. This report and its identification and analysis of the paleontological sensitivity of geologic units located within the Project area is based on a field survey of the Project area and a review of the available geological and paleontological literature and museum records of the University of California Museum of Paleontology (UCMP), summarized in an earlier report on the Project area (Pratt et al. 2011).

## SECTION 3

### **REGULATORY FRAMEWORK**

Paleontological resources are classified as non-renewable scientific resources and are protected by several federal and state statutes (California State Historic Preservation Office 1983; Marshall 1976; West 1991; Fisk and Spencer 1994; Gastaldo 1999), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies and by the State of California's environmental regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the SVP (2010). Design, construction, and operation of the proposed Project needs to be conducted in accordance with regulations applicable to paleontological resources. Therefore, the LORS applicable to paleontological resources are briefly summarized below.

#### **3.1 Federal Regulations**

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (Public Law [P.L.] 59-209; 16 United States Code [U.S.C.] 431 *et seq.*; 34 Statute 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal land. The Antiquities Act of 1906 forbids disturbance of any object of antiquity on federal land without a permit issued by the responsible managing agency. This act also establishes criminal sanctions for unauthorized appropriation or destruction of antiquities. The Federal Highways Act of 1958 specifically extended the Antiquities Act to apply to paleontological resources and authorized the use of funds appropriated under the Federal-Aid Highways Act of 1956 to be used for paleontological salvage in compliance with the Antiquities Act and any applicable state laws (Fisk and Spencer 1994). The language in the Highways Act makes it clear that Congress intended that, to be in compliance with the Antiquities Act, highway construction projects must protect paleontological resources. Federal protection would apply to this Project if it is federally funded or located on federal lands. Paleontological resources on federal lands are also explicitly protected under the Paleontological Resources Preservation Act of 2009 (16 U.S.C. 470aaa). This act, signed into law on 30 March 2009, criminalizes the unauthorized removal of fossils from federal land.

In addition to the Antiquities Act and the Paleontological Resources Preservation Act, other Federal statutes protecting fossils include the following. The National Environmental Policy Act of 1969 (P.L. 91-190, 31 Statute 852, 42 U.S.C. 4321-4327) requires that important natural aspects of our national heritage be considered in assessing the environmental consequences of any proposed project. The Federal Land Policy Management Act of 1976 (P.L. 94-579; 90 Statute 2743, U.S.C. 1701-1782) requires that public lands be managed in a manner that will protect the quality of their scientific values. Paleontological resources are also afforded federal protection under Code of Federal Regulations Title 40, Section 1508.27 as a subset of scientific resources.

#### **3.2 State Regulations**

The primary California state environmental law protecting fossils is the California Environmental Quality Act (CEQA; Public Resources Code Section 21000 *et seq.*). CEQA requires that public agencies and private interests identify the environmental consequences of



their proposed projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code, Section 5020.1 [b]). Administrative regulations for the implementation of CEQA are set forth in the California Code of Regulations (CCR) Section 15000 *et seq.*, commonly known as the “CEQA Guidelines”. The Guidelines define procedures, types of activities, persons, and public agencies required to comply with CEQA. Appendix G of the Guidelines also contains an Environmental Checklist of questions that a lead agency should normally address if relevant to a project’s environmental impacts. One of the questions to be answered in this Environmental Checklist (CCR Section 15063; Appendix G, Section V, Part c) is the following: “*Would the project directly or indirectly destroy a unique paleontological resource or site...?*”

Although neither CEQA nor the Guidelines define “*a unique paleontological resource or site*”, CEQA Section 21083.2 defines “*unique archaeological resources*” as “*...any archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:*

- 1) *Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.*
- 2) *Has a special and particular quality such as being the oldest of its type or the best available example of its type.*
- 3) *Is directly associated with a scientifically recognized important prehistoric or historic event.*”

With only slight modification, this definition is equally applicable to recognizing “*a unique paleontological resource or site*”. Additional guidance is provided in CEQA Guidelines Section 15064.5 (a)(3)(D), which indicates “*generally, a resource shall be considered historically significant if it has... yielded, or may be likely to yield, information important in prehistory or history*”, including fossils that yield “*information important in prehistory...*”

CEQA Guidelines Section XVII, Part a, of the Environmental Checklist asks a second question equally applicable to paleontological resources: “*Does the Project have the potential to...eliminate important examples of the major periods of California history or pre-history?*” Fossils are important examples of the major periods of California prehistory. To be in compliance with CEQA, environmental impact assessments, statements, and reports must answer both these questions in the Environmental Checklist. If the answer to either question is yes, a mitigation must be considered or implemented to protect significant paleontological resources.

The State of California Public Resources Code (Chapter 1.7), Sections 5097.5 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, define the removal of paleontological sites or features from state lands as a misdemeanor, and prohibit the removal of any paleontological site or feature from state land without permission of the applicable jurisdictional agency. Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

### **3.3 County Regulations**

California Planning and Zoning law requires each county and city jurisdiction to adopt a comprehensive, long-term general plan for its development. Cities and county general plans may include objectives, policies, and actions for the identification and protection of paleontological resources. However, because the CPUC has exclusive jurisdiction over utility project siting, design, and construction, PG&E is not subject to local discretionary regulations. A description of regulations that designate local paleontological resources is provided below for informational purposes and to assist with CEQA review.

The Open Space and Resource Conservation (OSRC) Element of the Sonoma County General Plan 2020 (2008) contains the following provision regarding paleontological resources:

Policy OSRC-19j: Develop an archaeological and paleontological resource protection program that provides:

- (1) Guidelines for land uses and development on parcels identified as containing such resources,
- (2) Standard project review procedures for protection of such resources when discovered during excavation and site disturbance, and
- (3) Educational materials for the building industry.

## **SECTION 4**

### **METHODS**

#### **4.1 Professional Standards**

PG&E has adopted the Bureau of Land Management (BLM) classification system for ranking areas according to their potential to contain significant fossils (BLM 1998, PG&E 2014). This ranking system, known as the Potential Fossil Yield Classification (PFYC), ranks areas according to their potential to contain significant fossils. These rankings are used in land-use planning, as well as to identify areas that may warrant special management and/or special designation such as Areas of Critical Environmental Concern.

The SVP, a national scientific organization of professional vertebrate paleontologists, has established standard procedures (SVP 2010) that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing professional paleontologists in the nation adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically spelled out in its standard procedures. The SVP's standard procedures were approved by a consensus of professional paleontologists and are the standard against which all paleontological monitoring and mitigation programs are judged. Many federal and state regulatory agencies have either formally or informally adopted the SVP's standard procedures for the mitigation of construction-related adverse impacts on paleontological resources, including both federal (FERC, USFS, BLM, NPS, etc.) and state agencies (CEC, CPUC, Caltrans, etc.).

Briefly, SVP standard procedures require that each project have literature and museum archival reviews, a field survey, and, if there is a high potential for disturbing significant fossils during project construction, a mitigation plan that includes monitoring by a qualified paleontologist to salvage fossils encountered, identification of salvaged fossils, determination of their significance, and placement of curated fossil specimens into a permanent public museum collection (such as the designated California state repository for fossils, UCMP).

As it has been adopted by PG&E, the PFYC system will be used and discussed in this report.

#### **4.2 Literature Review and Records Search**

A paleontological resource inventory report (Pratt et al. 2011) was previously prepared for this project by PRC. Much of this earlier report forms the basis of this PER. The findings of Pratt et al. (2011) were based on the compilation, synthesis, and review of the available published and unpublished literature, geologic maps, and a records search of the UCMP specimen and locality database. In addition to the literature and locality search, the following paleontologists and geologists with knowledge of the geology and paleontology of the Project area were consulted: Dr. Pat Holroyd, PhD (UCMP), and Mr. James Allen, MSc, consulting paleontologist.

### **4.3 Field Inspection**

Two field surveys, which included visual inspection of exposures of potentially fossiliferous strata in the Project area, were conducted to document the presence of sediments suitable for containing fossil remains at areas of proposed ground disturbance within the Project area and the presence of any previously unrecorded fossil sites. The first field survey was conducted 08 and 09 November 2012 by Dr. Lanny H. Fisk, PhD, Principal Paleontologist, and Dr. David M. Haasl, PhD, Senior Paleontologist, both with PRC. A second survey was conducted from 16-20 August 2015 by PRC Staff Paleontologists Stephen J. Blakely and Brendan J. Pfeiffer. Dr. David Haasl, PhD, joined the survey team on 20 August 2015 to resolve stratigraphic questions and review the results of the survey.

### **4.4 Key Personnel**

Project Paleontologist Dr. Lanny H. Fisk, PhD, PG, has over 30 years experience as a professional paleontologist and 25 years as a paleontological consultant doing paleontological resource impact assessments and surveys, preparing CEQA and NEPA environmental documents and mitigation measures, designing and managing environmental compliance monitoring programs, and coordinating and consulting with state and federal resource agencies to resolve environmental concerns regarding paleontological resources. He has been a consulting paleontologist on numerous large earth-moving construction projects in California, including pipelines, power plants, highways, tunnels, dams, fiber-optic cables, landfills, and housing developments. These projects have involved extensive coordination and consultation with project sponsors, other consulting firms, and permitting agencies; adherence to strict delivery schedules; and completion within specified budget limits. Dr. Fisk has also taught paleontology courses at the university/college level and authored or co-authored scientific research contributions on paleontological resources. His experience includes preparing paleontological resource impact assessments or paleontological resource monitoring and mitigation programs. Dr. Fisk has a PhD degree with emphasis in paleobiology, plus all the coursework and research for a PhD in Geology. He holds a Bureau of Land Management Scientific Paleontological Collecting Permit, which demonstrates the qualification to do Federal Antiquities Act studies.

Dr. David M. Haasl, PhD, has five (5) years experience as a museum scientist at UCMP and is the author of several scientific papers on paleontology, specifically on Cenozoic marine molluscs. He has a PhD in paleobiology from the University of California at Davis and a MSc in paleontology from Western Washington University. Dr. Haasl has five (5) years experience in paleontological mitigation and has contributed to the preparation of numerous paleontological resource impact assessments, field surveys, and paleontological mitigation and monitoring plans.

Brendan J. Pfeiffer has a BSc in Geology from University of Northern Colorado. He is a staff paleontologist with PRC and has experience with field assessments, fossil recovery and cataloging, daily report generation, and laboratory preparation and identification of micro- and macrofossils.

Stephen J. Blakely has several years experience working in the construction industry and geological experience working at the University of California at Davis' sedimentology laboratory. He has a background in geology from study at the University of California at Davis.

He has contributed on the preparation of numerous paleontological resource impact assessments and surveys, as well as on the preparation of paleontological mitigation and monitoring plans.

## SECTION 5

### RESULTS

**5.1 Project Geology:** Regional geologic mapping in the vicinity of the proposed Project has been provided by Jenkins (1938), Bailey (1946), Gealey (1951), Cardwell (1965), Fox et al. (1973), Jennings et al. (1977), Huffman and Armstrong (1980), Fox et al. (1985b), Blake et al. (2000, 2002), and Delattre (2011). These geologic maps were reviewed to determine the stratigraphic units that might be impacted by Project-related excavations. During the field surveys for this proposed Project, these geologic maps were “ground-truthed” and determined to be reasonably accurate, given the limited exposures and extensive vegetation cover. Stratigraphy was observed primarily in natural exposures, road cuts, and drainage ditches.

The proposed Project is located within the Coast Ranges Physiographic Province, which is positioned south of the Klamath Mountains Physiographic Province, north of the Transverse Ranges Physiographic Province, west of the Great Valley Physiographic Province, and east of the Pacific Ocean. The Coast Ranges Physiographic Province generally consists of folded and faulted, northwest trending mountain ranges separated by narrow valleys underlain by thick, highly deformed Mesozoic and Cenozoic rock units that are in places overlain by younger volcanic and sedimentary deposits (Blake et al. 2002). Both mountains and valleys are composed of three major pre-Tertiary rock groups: the Franciscan Complex, the Coast Range ophiolite, and the Great Valley Sequence (Gealey 1951).

All three pre-Tertiary rock groups, which overlap in age, were tectonically accreted to the continental margin of California during Mesozoic to early Cenozoic time (Wakabayashi and Unruh 1995, Graymer et al. 2006). During and after accretion, the rocks were folded and faulted into mountain ranges and intervening valleys (Taliaferro 1943). Most of the valleys and ridges have formed in response to regional tectonic stresses which produced northwest-trending, right-lateral, strike-slip faults, high-angle reverse faults, and normal faults. These faults are part of the San Andreas Fault system that occupies a wide strip of coastal California north of the San Francisco Bay (Fox 1983).

Basement rocks in the vicinity of the Project area consist of the largely Mesozoic age metamorphosed Franciscan Complex and Late Jurassic to Early Cretaceous age sedimentary rocks of the Great Valley Sequence. These units crop out intermittently to the west of the proposed Project in places where overlying rocks have been removed by erosion and northeast of the Project area where they form the core of the Mayacamas Mountains (Blake et al. 2002, Delattre 2011). The Franciscan Complex consists of deformed, metamorphosed, marine sedimentary rocks intercalated with pillow basalts and basic igneous rocks. However, the Franciscan rocks do not outcrop within the immediate Project area and will not be discussed further in this report. The Great Valley Sequence consists of interbedded marine clastic sediments that were deposited on submarine fans or other deeper marine environments. In the study area, the units that overlie the Franciscan and Great Valley rocks are the Mio-Pliocene Sonoma Volcanics, Plio-Pleistocene Glen Ellen Formation, Pleistocene older alluvial fan deposits, latest Pleistocene and Holocene younger alluvial fan and fluvial deposits, and

Quaternary landslide deposits. The Great Valley Sequence and the overlying geologic units will be discussed separately below.

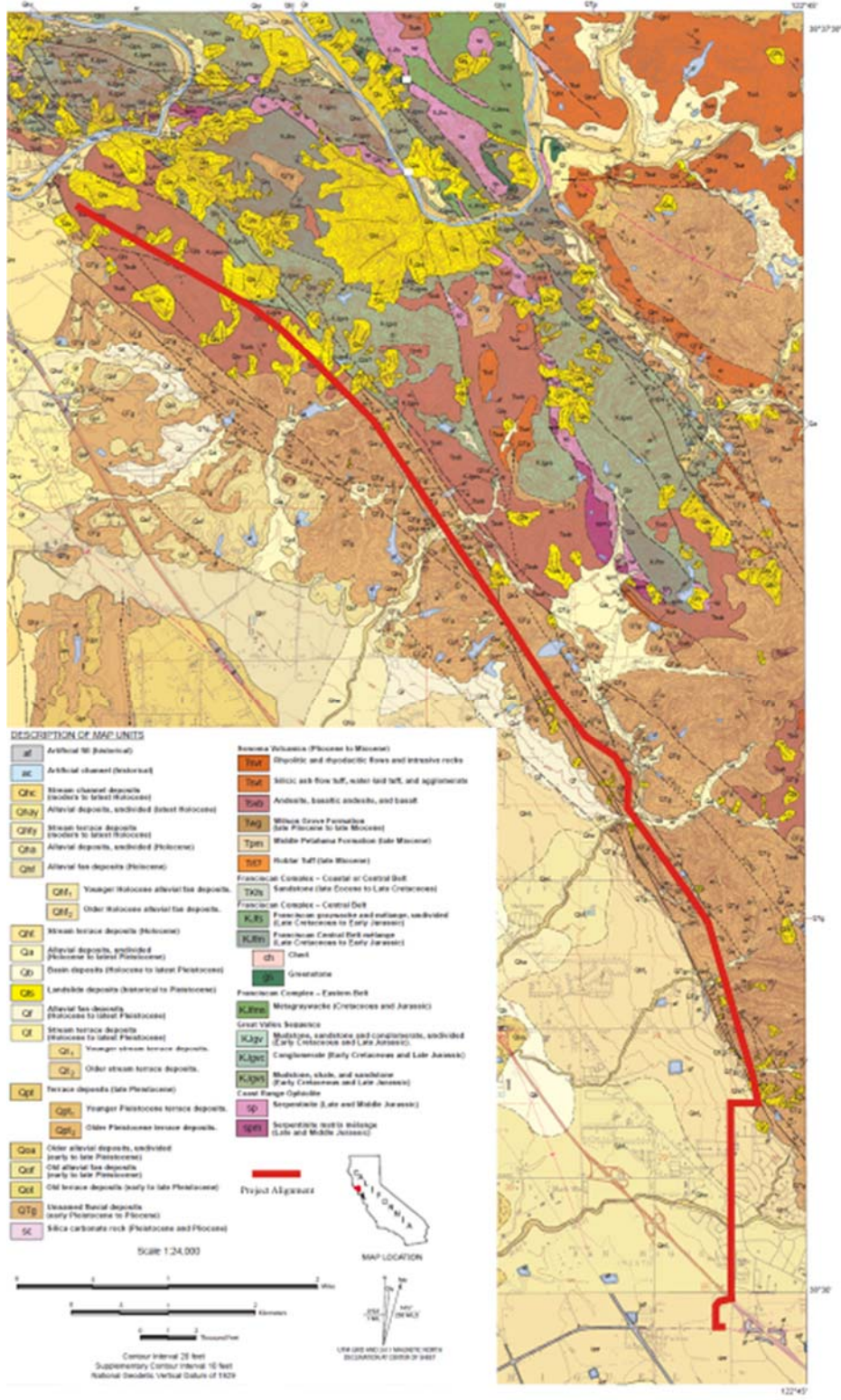
Blake et al. (2002) described the geological environment in the Project vicinity during the late Tertiary as one of low-lying coastal hills (likely underlain by Franciscan Complex rocks) and shallow marine embayments flanked on the east by active volcanic centers which produced the Sonoma Volcanics. Episodic volcanic ash eruptions spilled across the west-facing alluvial fans to produce the interbedded alluvial and tuffaceous deposits of the Glen Ellen Formation.

During the Pleistocene, beginning about 2.6 million years ago, glaciation resulted in a marine regression. River gradients were greatly steepened from the combined effects of lowered sea level and tectonic uplift of the still emerging Coast Ranges. These effects resulted in deep incision of river canyons through the stratigraphic succession, including the underlying Franciscan Complex bedrock. At the end of Pleistocene glaciation, as sea level rose, the mouths of rivers were flooded and sediment spilled out across the valley floor, forming the older alluvial deposits, which were subsequently tectonically uplifted and preserved. In the latest Pleistocene and Holocene time, younger alluvial deposits were deposited as fans near the mouths of streams and across the valley floor. Some of these sediments have been locally displaced, forming landslide deposits.

The geology exposed in the Project vicinity consists largely of Tertiary and Quaternary age sedimentary and volcanic rocks, overlying older sedimentary and metamorphic rocks in a highly structurally complex area with numerous active and inactive faults. Geologic mapping in the vicinity of the proposed Project has been provided by Jennings et al. (1977, 1:750,000), Jenkins (1938, 1:500,000), Koenig (1963, 1:250,000), Wagner and Bortugno (1982, 1:250,000), Fox et al. (1985b, 1:125,000), Blake et al. (2000, 2002; 1:100,000), Bailey (1946, 1:62,500), Gealey (1951, 1:62,500), Cardwell (1965, 1:62,500), Blake et al. (1971, 1:62,500), Fox et al. (1973, 1:62,500), Huffman and Armstrong (1980, 1:62,500), and Delattre (2011, 1:24,000). The geologic maps listed above were reviewed to determine the stratigraphic sequence of rocks that might be impacted by Project-related excavations. Unfortunately, in their geologic maps of the middle to late Cenozoic deposits of the study area, geologists have not always used formally named stratigraphic units and have not consistently used the same map units. The mapping by Delattre (2011) is the most recent, high resolution geological mapping of the study area and its nomenclature is largely adopted in this report.

The information in the geological maps listed above and the available geological literature form the basis of the following discussion. Individual maps and publications are incorporated into this report and referenced where appropriate. The aspects of geology pertinent to this report are the types, distribution, and age of the rocks and sediments immediately underlying the Project area and their probability of producing fossils during Project construction. The site-specific geology in the immediate vicinity of the Project ROW is discussed separately below.

The anticipated excavation activities in support of the proposed Project have the potential to affect a number of Pliocene, Plio-Pleistocene, Pleistocene, and Holocene age stratigraphic units, including from oldest to youngest, the Sonoma Volcanics, Glen Ellen Formation, older alluvial



**Figure 2.** Geologic map showing the location of the proposed Fulton-Fitch Mountain Reconductoring Project. Modified from the 1:24,000 scale geologic map by Delattre (2011).



fan deposits, younger alluvial fan and fluvial deposits, and Quaternary landslide deposits (Delattre 2011 see Figure 2).

**Cretaceous Great Valley Sequence (Undivided):** The Jurassic to Late Cretaceous Great Valley Sequence is composed of interbedded sandstones, mudstones and shales originally deposited on a submarine fan along the continental margin (Graymer et al. 2002). To the east of the Project, along the western margin of the Sacramento Valley, the Great Valley Sequence has been subdivided into six formations (Kirby 1943). However, towards its western extent (including the area of the proposed Project), much of the unit remains undivided with only poor age controls.

Within the Project vicinity, the Great Valley Sequence consists of Upper Jurassic to Lower Cretaceous marine sandstones and mudstones (Fox 1983, Blake et al. 2002, Dellattre 2011). Concretionary carbonate interbeds within this unit have produced invertebrate fossils, including *Buchia*, belemnites, and radiolarians (Delattre 2011). This unit is not exposed at the surface in the Project right-of-way (ROW) but could be present at an unknown depth underneath the Sonoma Volcanics. These rocks are, in turn, underlain at an unknown depth by the Franciscan Complex and the Coast Range Ophiolite (McLaughlin et al. 2004). It is highly unlikely that rocks of either the Franciscan Complex or Coast Range Ophiolite will be impacted by Project construction. However, it is possible that rocks of the Great Valley Sequence could be impacted.

**Sonoma Volcanics:** The volcanic and volcanoclastic rocks now recognized as the Sonoma Volcanics were first described by Osmond (1905) who subdivided them, in ascending order, into the Mark West Andesite, Sonoma Tuff, and St. Helena Rhyolite. Later workers (e.g., Morse and Bailey 1935, Weaver 1949) combined Osmond's units into the Sonoma Volcanics. This nomenclature has been followed by later workers and will be used in this report. The Sonoma Volcanics are widely distributed throughout Sonoma and Napa Counties. In the Project area, the Sonoma Volcanics unconformably overlie the Great Valley Sequence, and are conformably underlain by and are in part coeval with the Glen Ellen Formation. Where not overlain by the Glen Ellen Formation, the Sonoma Volcanics are overlain by Pleistocene older alluvial fan deposits. The Sonoma Volcanics include tuff, obsidian, lava flows, pyroclastic breccia, and mud flows which range in composition from rhyolite to basalt, along with interbedded volcanoclastic sedimentary rocks. This volcanic material originated from numerous vents and fissures that intermittently erupted material of variable chemical and lithologic composition forming a complex assemblage of flows, dikes, plugs, mudflows, breccias, pumice beds, and intercalated bodies of stratified material, essentially volcanic in composition, but largely sedimentary in deposition (Fox et al. 1985a). These rocks have been folded, faulted, and eroded so that they now form a series of elongate ridges separated by narrow alluvial valleys. Andesitic and basaltic flows form the most prominent outcrops of the Sonoma Volcanics because of their hard, erosionally resistant qualities (Gealey 1951). According to Weaver (1949), lava flows constitute more than 60 percent of the entire sequence. However, water-lain tuffs and tuffaceous diatomites may be several hundreds of feet thick (Kunkel and Upson 1960, see Figure 3).

On the basis of their stratigraphic position, the Sonoma Volcanics are interpreted to be Miocene to Pliocene in age (Delattre 2011). Additional evidence supporting this age



**Figure 3.** Road cut exposure of water-lain tuffs in the Sonoma Volcanics along Chalk Hill Road approximately one mile east of the Project ROW.

assignment is provided by plant fossils found in diatomaceous deposits in the middle part of the Sonoma Volcanics and identified by Axelrod (1944, 1950). Radiometric ages from the Sonoma Volcanics range from  $6.95 \pm 0.2$  Ma to  $2.9 \pm 0.2$  Ma (Fox 1983; Fox et al. 1985a). The Sonoma Volcanics are thought to have formed as part of a northward younging series of volcanic centers related to initiation of the San Andreas Fault system (Fox et al. 1985b).

**Glen Ellen Formation:** The Glen Ellen Formation and equivalents (Sweetkind et al. 2010, Wagner et al. 2011, "Fluvial and Lacustrine Deposits" of McLaughlin et al. 2004, "unnamed fluvial deposits" [QTg] of Delattre 2011 and Figure 2 of this report) are composed of a heterogeneous mixture of partially cemented, interstratified, buff to yellowish-brown clay, silt, sand, and gravel (see Figure 4). These deposits are largely fluvial in origin and consist of beds and lenses of alluvial fan and piedmont deposits interbedded with conglomerate and silicic tuffs (Cardwell 1958). Some of the deposits adjacent to and beneath the Santa Rosa Valley may have been laid down in shallow bays or lagoons and may grade westward into marine deposits (Kunkel and Upson 1960). Locally, the Glen Ellen Formation contains abundant interbeds of reworked tuff that have been mapped as a separate member by Blake et al. (2002). The reworked tuffs, along with most other clasts in the Glen Ellen Formation, appear to be derived primarily from the Sonoma Volcanics, though pebbles of Franciscan Complex rocks are common.

Obsidian pebbles are characteristic of this unit (Fox 1983, Ford 1975, Jackson 1989, Allen 2003, Delattre et al. 2007).



**Figure 4.** Road cut exposure of Glen Ellen Formation long Chalk Hill Road approximately one-quarter mile west of the Project ROW.

In the Project area, the Glen Ellen Formation conformably overlies the Sonoma Volcanics, with the basal portion possibly being coeval and interfingering with the upper part of the Sonoma Volcanics, and is unconformably overlain on the margin of the Santa Rosa Valley by older alluvial fan deposits. The Glen Ellen Formation is Plio-Pleistocene in age (Gealey 1951) based on stratigraphic relationships with other stratigraphic units of Pliocene and Pleistocene age (Cardwell 1958). Radiometric dates from interbedded tuffs suggest that the Glen Ellen Formation is as old as 3.1 Ma (McLaughlin and Nilsen 1982) and as young as 0.8 Ma (Allen 2007).

**Older alluvial fan deposits:** Older alluvial fan deposits, where exposed, consist principally of alluvium but are probably contemporary with and also include some terrace deposits and old valley fill. The older alluvial fan deposits are generally slightly to moderately dissected and consist of roughly horizontal beds of buff siltstone and claystone, with gray, fine- to coarse-grained pebbly sandstone, pebbly mudstone, and pebble to cobble conglomerate (see Figure 4). Clasts include silicic to intermediate volcanics, obsidian, varicolored chert, graywacke, quartzite, quartz, charcoal, and petrified wood (Blake et al. 2002). The older alluvial fan deposits within

the Project area were previously mapped as Glen Ellen Formation (Blake et al. 1971), but have been reclassified based on three factors: 1) they are much less deformed than the Glen Ellen Formation, 2) they are not as lithified as sediments in the Glen Ellen Formation, and 3) they lack the tuffaceous sediments that are widespread in much of the Glen Ellen Formation (Blake et al. 2002). The older alluvial fan deposits are unconformably overlain by younger alluvial deposits, except locally where deposition may have been continuous. The older alluvial fan deposits are probably Late Pleistocene in age and unconformably overlie older deposits.

**Alluvial fan and fluvial deposits:** This stratigraphic unit is latest Pleistocene to Holocene in age and composed of interbedded deposits of unconsolidated gravel, sand, silt, clay, and peat (Kunkel and Upson 1960). Although similar in composition to the older alluvial fan deposits, the younger alluvial fan deposits can be recognized as distinct deposits on the basis of the degree of consolidation, cementation, and geomorphic expression. The younger alluvial deposits underlie modern stream channels and form flood plains on the valley floor in broader valleys. Younger alluvium forms a relatively thin veneer, unconformably overlying older stratigraphic units and is generally less than 30 feet (9.1 meters) thick (Kunkel and Upson 1960).

**Landslide deposits:** The Quaternary landslide deposits exposed within the Project study area consist of poorly sorted clay, silt, sand, gravel, and boulders. These deposits are not considered paleontologically sensitive due to their young age and because any fossils they contain would be displaced. Therefore, they will not be discussed further in this report.

**5.2 Known Paleontological Resources:** An inventory of known paleontological resources discovered in the vicinity of the proposed Project is presented below. The inventory that follows is largely based on a review of the available literature, two searches of the UCMP database, performed by Dr. Diane Erwin, PhD, on 24 June 2011, and Dr. Ken Finger, PhD, on 17 August 2015, both museum scientists at UCMP, and is supported by the results of the field survey. These searches found no known fossil localities within the Project ROW. However, some of the geologic units exposed within the Project ROW have produced numerous fossils from localities elsewhere in Sonoma County

**Great Valley Sequence (Undivided):** The sandstones of the Great Valley Sequence are generally poorly fossiliferous in the general Project area. Late Jurassic and Early Cretaceous molluscs such as *Buchia*, belemnites, and radiolarians have been reported (Delattre 2011). No vertebrate fossils have been reported from the Great Valley Sequence in Sonoma County, but marine reptile and dinosaur fossils have been reported from Jurassic age Great Valley units from the western side of the Sacramento Valley and in Shasta County (Hilton 2003) and marine reptile fossils have been collected from Late Cretaceous units within the Great Valley Sequence to the south of the Bay Area.

**Sonoma Volcanics:** The Sonoma Volcanics consist of a diverse assortment of continental volcanic and volcanoclastic rocks including basalt, andesite, and rhyolite lavas interbedded with tuffs, lahar deposits, debris avalanche deposits, mudflow units, reworked tuffs, sedimentary breccia deposits derived from volcanic rocks, and diatomaceous lacustrine deposits. The lavas were emplaced as high-temperature flows and are non-fossiliferous. However, the volcanoclastic sedimentary units, such as the lacustrine and fluvial deposits, and some of the tuffs are

fossiliferous and have previously produced highly significant fossil floras (Axelrod 1944, 1950), including a spectacular petrified forest near Calistoga (Dorf 1930, Axelrod 1944, Fisk et al. 2013), and horse (*Equus*) fossils (Woodburne 1966, Fisk and others 2013, UCMP records for locality V6317). Kunkel and Upson (1960) reported finding fossils of snails and clams in the lower portion of the Sonoma Volcanics. Microfossils have also been reported from the Sonoma Volcanics. Kunkel and Upson (1960) listed diatoms identified from the middle or “diatomaceous member” (= Sonoma Tuff Member) and Zeeb et al. (1996) reported twenty-one taxa of silicified chrysophycean algal cysts also from the “diatomaceous member”. More recently, Fisk et al. (2013) reported palynomorphs (pollen, spores, algal cysts, and dinoflagellates) from both the Sonoma Tuff Member and the overlying St. Helena Rhyolite Member of the Sonoma Volcanics.

**Glen Ellen Formation:** This unit is composed of stratified, fluvial, clay-rich deposits of poorly sorted, loosely consolidated sand, silt and gravel, interbedded with minor beds of matrix-supported conglomerate and silicic tuffs. Our search of the UCMP database produced only a single fossil locality (UCMP locality V90056) from the Glen Ellen Formation. However, fossils from this locality, consisting of *Equus* (horse) teeth, are only tentatively assigned to the Glen Ellen Formation and are listed in the UCMP database as being Rancholabrean in age (Late Pleistocene). If correct, this age assignment suggests that these fossils are too young to be from the Glen Ellen Formation and instead may be from the overlying older alluvial fan deposits. However, the UCMP locality is known as "Rincon Valley West" and the Glen Ellen Formation is mapped on the western Rincon Valley (Sowers 1998, Graymer et al. 2007) while the Rancholabrean-age older alluvial fan deposits are not. McLaughlin et al. (2004) indicate that the Glen Ellen Formation contains both fossil diatoms, sponge spicules, and fresh-water molluscs (see also Starratt et al. 2005). Cardwell (1958) also reported "*clam shells*" in a "*tongue*" of the Glen Ellen Formation and Charles L. Powell, II (USGS paleontologist, personal communication 01 September 2015) stated that fresh-water molluscs are known from the Glen Ellen "*or closely related units*". Equivalent stratigraphic units informally known as the "*Russian River gravels*", "*sands and gravel of Cotati*", and "*Little Lake gravels*" are also fossiliferous (Cardwell 1965, McLaughlin et al. 2004, Graymer et al. 2007).

**Older alluvial fan deposits:** Numerous Pleistocene vertebrate fossil localities have been reported from the older alluvial fan deposits within Sonoma County (Hay 1927, Savage 1951, Jefferson 1991, UCMP online database). These localities have produced a diverse assemblage of vertebrates including a turtle (*Clemmys*), horse (*Equus*), ground sloth (*Glossotherium*), bison (*Bison*), mastodon (*Mammut*), and deer (*Odocoileus*). In addition to vertebrate fossils, Blake et al. (2002) and Haydon (2007) mention petrified and charcoaled wood in this stratigraphic unit. None of these fossil localities are within the Project ROW; however, the presence of fossils elsewhere in the local area from sediments of similar age and origin to those found in the Project area suggests that additional Pleistocene fossils could be encountered during Project earth disturbance.

**Alluvial fan and fluvial deposits:** The younger alluvial fan and fluvial deposits in the Project area are not known to have produced fossils in the past.

### **5.3 Museum Record Search**

An inventory of known fossil localities in proximity of the Project area was accomplished by a museum records search of the UCMP, supplemented by a search of the available literature. UCMP records 166 known fossil localities from Sonoma County. The vast majority of these localities are from the Wilson Grove and Petaluma Formations, marine units exposed elsewhere in Sonoma County, but not near the Project ROW. There are ten (10) UCMP vertebrate localities known from the older alluvial fan deposits and nine (9) fossil plant localities known from the Sonoma Volcanics (see Appendix B). None of these localities are within the Project ROW, but these museum records support the determination that both the Sonoma Volcanics and older alluvial fan deposits have a high potential to produce additional fossils.

### **5.4 Field Inspection**

The initial field survey in 2012 documented the general geology of the Project area, and confirmed that the existing geologic mapping was accurate. Immediately following this field survey, new geologic mapping (Delattre 2011) became available showing the geology in greater detail. During the second, more in-depth survey in 2015, the location of each Project feature (pole location, pull-site, access roads, etc.) was visited to determine the specific geology at each site. At each site, any surficial sediment exposures, spoils from existing electrical poles or towers, or nearby geological outcrops were examined to determine the geologic formation and specific facies present at that site. In addition, attempts were made to locate any paleontological resources near each site. As a result of the 2015 survey, data were collected from each area of proposed ground disturbance and are included as Table 1.

Based on available geological exposures, five (5) geologic units will be impacted by Project construction. These are: Holocene alluvial fan deposits (Qhf), Quaternary landslide deposits (Qls), Pleistocene older alluvial fan deposits (Qof), the Glen Ellen Formation (QTg), and Sonoma Volcanics (Tsv) (Delattre 2011). Additionally, where it was clear that the surficial geology was different from the underlying geology at shallow depth, inferences were made as to which geologic unit should underlie the surficial exposures (see Table 1). These inferences were made based upon geologic maps, local topography, and personal observations.

Approximately the southern two-thirds of the Project ROW is underlain by either Holocene alluvial fan deposits, Quaternary landslide deposits, older alluvial fan deposits, or the Glen Formation (see Figure 2). Where observed, the younger Holocene alluvial fan deposits occur as modern valley fill, which is not potentially fossiliferous, and will not be discussed further here. The Quaternary landslide deposits, while also having a low potential for paleontological resources, occur as a surficial deposit that overlies other geological formations with variable thickness. Where Project features were located within landslide deposits, inferences were made as to what underlies the Qls at that specific location (Table 1).

During the field survey, Pleistocene older alluvial fan deposits were only observed overlying the Glen Ellen Formation. These older alluvial fan deposits were observed as poorly to moderately indurated, very poorly sorted silt-cobbles with a reddish matrix. This alluvium is approximately 1 to 6 feet (0.3 to 1.8 meters) in thickness, and does not appear on the latest geologic map (Delattre 2011) at many of the locations where it was observed. Although it does not appear on the map, the description matches that of the older alluvial fan deposits described in Delattre

(2011). This alluvium appears to be thicker on the hilltops, and decreases in thickness on the slopes. The cobble component is apparent in drainages, although this is undoubtedly reworked material from erosion of the topographic highs. The alluvium is also inferred to be present in other areas where cobbles were observed at the surface but there was no access to vertical exposures.

The Glen Ellen Formation underlies most of the Project ROW. This geologic unit was identified and differentiated from overlying alluvium by degree of induration, facies represented (fluvial vs. alluvial), and attitude of strata. The clasts of the Glen Ellen Formation are dominated by volcanics (andesite and basalt cobbles, obsidian pebbles, and gravel) with a minor component of chert and metamorphic clasts. The clast size varies from fine grained (silt and sand) to very coarse (cobbles), and is indicated in Table 1.

The Sonoma Volcanics occur at or near the surface in the northern Project area. During the field survey, a diverse range of lithologies were observed including lava flows, mud flows, and volcanoclastic sediments (both air-fall and fluvially deposited), the latter being potentially fossiliferous facies. An approximately 3 foot (1 meter) thick volcanic mudflow was identified near pole 8/7, and fluvial facies within the Sonoma Volcanics were observed approximately one mile east of the Project ROW (see Figure 3). Directly underlying the Project ROW the topography is quite steep, with lava flows forming dominant outcrops on the topographic highs. The vegetation-covered topographic lows probably represent volcanoclastic facies and the presence of these volcanic mudflows, volcanoclastics, and fluvial/lacustrine facies in the Project vicinity make it likely that these facies will be encountered at a shallow depth.

**Table 1. Project Components Involving Significant Potential Ground Disturbance** that may disturb stratigraphic units with Class 3 or 4 potential to impact significant paleontological resources (fossils).

<b>Component Types</b>	<b>Specific Components</b>	<b>Potential Ground Disturbance</b>	<b>Geologic Formation</b>	<b>Recommended Mitigation</b>
<b>Poles</b>  (Light-Duty Steel Poles = LDSP)  (Tubular Steel Poles = TSP)	<b>TSP 1/7</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 1/8	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 1/9	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/0	grading of small pad, 3' x 14' augered hole	fine-grained Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/1	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/2	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/3	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/4	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/5	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 2/6	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/0	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/1	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/2	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/3	grading of small pad, 3' x 14' augered hole	fine-grained Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/4	grading of small pad, 3' x 14' augered hole	fine-grained Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/5	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	<b>TSP 3/6</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	<b>TSP 3/7</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/8	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/9	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 3/10	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 4/1	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 4/2	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 4/3	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 4/4	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
	LDSP 4/5	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils
<i>(continued)</i>				



Component Types	Specific Components	Potential Ground Disturbance	Geologic Formation	Recommended Mitigation	
<b>Poles (cont.)</b>	LDSP 4/5A	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 4/6	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/0	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/1	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/2	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/3	grading of small pad, 3' x 14' augered hole	Older alluvial fan deposits over Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/4	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/5	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/6	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 5/7	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	<b>TSP 6/0</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	<b>TSP 6/1</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/2	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/3	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/4	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/5	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/6	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 6/7	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	<b>TSP 7/0</b>	grading of large pad, 5' x 20' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 7/1	grading of small pad, 3' x 14' augered holes	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 7/2	grading of small pad, 3' x 14' augered hole	Quaternary landslide deposits derived from Sonoma Volcanics	spot check grading, spot check spoils	
	LDSP 7/3	grading of small pad, 3' x 14' augered hole	Quaternary landslide deposits derived from Sonoma Volcanics	spot check grading, spot check spoils	
	LDSP 7/4	grading of small pad, 3' x 14' augered hole	Glen Ellen Formation	spot check grading, spot check spoils	
	LDSP 7/5	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics with minor Quaternary landslide deposits near site	spot check grading, spot check spoils	
	LDSP 7/6	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics with minor Quaternary landslide deposits near site	spot check grading, spot check spoils	
	LDSP 7/7	grading of small pad, 3' x 14' augered hole	landslide deposits over Sonoma Volcanics	spot check grading, spot check spoils	
	LDSP 8/0	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils	
	LDSP 8/1	grading of small pad, 3' x 14' augered hole	landslide deposits over Sonoma Volcanics	spot check grading, spot check spoils	
	<i>continued)</i>				

<b>Component Types</b>	<b>Specific Components</b>	<b>Potential Ground Disturbance</b>	<b>Geologic Formation</b>	<b>Recommended Mitigation</b>
<b>Poles (cont.)</b>	LDSP 8/2	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 8/3	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 8/4	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 8/5	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 8/6	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 8/7	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/0	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/1	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/2	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/3	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/4	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 9/5	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	<b>TSP 9/5A</b>	grading of large pad, 5' x 20' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 0/1	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
	LDSP 0/2	grading of small pad, 3' x 14' augered hole	Sonoma Volcanics	spot check grading, spot check spoils
<b>Pull Sites</b>	PS-01	minor grading	Younger alluvial fan deposits	none
	PS-02	minor grading	Younger alluvial fan deposits	none
	PS-03	no ground disturbance	N/A	none
	PS-04	minor grading	Younger alluvial fan deposits	none
	PS-05	no ground disturbance	N/A	none
	PS-06	major grading	Glen Ellen Formation	spot check grading
	PS-07 thru -12	only minor leveling	N/A	none
<b>Staging/Work Areas</b>	all staging areas	no ground disturbance	N/A	none
	all work areas	only minor leveling	N/A	none
<b>Existing Access Roads</b>	from PS-01 to -02	minor grading	Younger alluvial fan deposits	none
	to LZ-02	minor grading	Younger alluvial fan deposits	none
	to PS-05	widening & grading	Quaternary landslide deposits derived from Sonoma Volcanics	spot check grading
	Faught Road to PS-05	widening & grading	Younger alluvial fan deposits	none
	all other roads	no ground disturbance	N/A	none
<b>Overland Roads</b>	all other roads	no ground disturbance	N/A	none
<b>Landing Zones</b>	LZ-01 thru -06	only minor leveling	N/A	none
<b>Turnarounds</b>	all turnarounds	only minor grading	N/A	none

## SECTION 6

### **PALEONTOLOGICAL SENSITIVITY AND SIGNIFICANCE**

#### **6.1 Definitions of Significance and Significance Criteria**

Paleontological resources (fossils) are the remains or traces of prehistoric plants and animals. Fossils are important scientific and educational resources because of their use in (1) documenting the presence and evolutionary history of particular groups of now extinct organisms, (2) reconstructing the environments in which these organisms lived, and (3) in determining the relative ages of the strata in which they occur and of the geologic events that resulted in the deposition of the sediments that entombed them.

Existing technical guidance such as the PFYC (BLM 2007, PG&E 2014) considers individual fossil specimens to be scientifically important if they are:

- type specimens (i.e., individual(s) from which a taxon has been described),
- members of a rare species,
- members of a species that is part of a diverse assemblage wherein other species are also identifiable, and important information regarding life histories of individuals can be drawn,
- element(s) different from, or more complete than, those now available for their species, or
- complete specimens.

More specifically, fossils may be considered significant if they meet the following criteria:

- They are scientifically judged to be important for representing rare or unknown taxa, such as defining a new species.
- They are scientifically judged to represent important states in evolutionary relationships, to fill gaps or enhance under-represented intervals in the stratigraphic record.
- They are scientifically judged to be important for determining or constraining relative geologic age, or for use in regional to interregional stratigraphic correlation.
- They are scientifically judged to be important for reconstructing ancient organismal community structure and interpretation of ancient sedimentary environments.
- They are scientifically judged to be exceptionally well or unusually or uniquely preserved, or are relatively rare in the stratigraphy.

Identifiable land mammal fossils are often considered scientifically important because of their potential use in providing age determinations and paleoenvironmental reconstructions for the sediments in which they occur. Moreover, vertebrate remains are comparatively rare in the fossil record. Although fossil plants are usually considered of lesser importance because they are less helpful in age determination and more abundant, they are actually more sensitive indicators of their environment and, thus, as sedentary organisms, more valuable than mobile animals for paleoenvironmental reconstructions. For marine sediments, invertebrate and marine algal fossils, including microfossils, are scientifically important for the same reasons that land mammal and/or land plant fossils are valuable in terrestrial deposits. The value or importance of different fossil groups varies depending on the age and depositional environment of the stratigraphic unit that contains the fossils.

## 6.2 Definition of Sensitivity and Sensitivity Criteria

**Potential Fossil Yield Classification (PFYC):** The Bureau of Land Management (BLM) uses a classification system for ranking areas according to their potential to contain significant fossils. In 2007, the BLM introduced the Potential Fossil Yield Classification (PFYC) System which is intended to classify geologic units by identifying the potential for the occurrence of significant paleontological resources in a geologic unit and the associated risk for impacts within that unit. The class rankings listed below attempt to classify geologic units based upon the relative abundance of paleontological resources found within, and therefore the risk of adversely impacting those resources. Geologic units are classified under the PFYC based upon the following criteria:

***Class 1 – Very Low.*** Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

***Class 2 – Low.*** Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

***Class 3 – Moderate or Unknown.*** Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.  
(or)
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

***Class 3a – Moderate Potential.*** Units are known to contain vertebrate fossils or scientifically significant non-vertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

***Class 3b – Unknown Potential.*** Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The

unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

**Class 4 – High.** Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases.

*Class 4a* – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

*Class 4b* – These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres. • Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions. • Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

**Class 5 – Very High.** Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

*Class 5a* – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

*Class 5b* – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

### **6.3 Determination of Sensitivity for Geologic Units Within Study Area**

A stratigraphic unit (such as a formation, member, or bed) known to contain significant fossils is considered to have a high potential to yield additional significant fossils. These paleontological resources could be adversely impacted by earth-moving or ground-disturbing activities. The resource could be disturbed or destroyed.

Fossils are an integral component of the rock unit below the ground surface, and, therefore, are not observable unless exposed by erosion or human activity. Thus, a paleontologist cannot know either the quality or quantity of fossils present before the rock unit is exposed as a result of natural erosion processes or earth-moving activities. The paleontologist can only make conclusions on sensitivity to impact based upon what fossils have been found in the rock unit in the past, along with a judgment on whether or not the depositional environment of the sediments that compose the rock unit was likely to result in the burial and preservation of fossils.

Fossils are seldom uniformly distributed within a rock unit. Most of a rock unit may lack fossils, but at other locations within the same rock unit concentrations of fossils may exist. Even within a fossiliferous portion of the rock unit, fossils may occur in local concentrations. For example, Shipman (1977, 1981) excavated a fossiliferous site using a three dimensional grid and removed blocks of matrix of a consistent size. The site chosen was known prior to excavation to be richly fossiliferous, yet only 17% of the excavated blocks actually contained fossils. These studies demonstrate the physical basis for the difficulty in predicting the location and quantity of fossils in advance of actual Project-related ground disturbance.

The non-uniform distribution of fossils within a rock unit is essentially universal and many paleontological resource assessment and mitigation reports conducted in support of environmental impact documents and mitigation plan summary reports document similar findings (see for instance Lander 1989, 1993; Reynolds 1987, 1990; Spencer 1990; Fisk et al. 1994; and references cited therein). In fact, most fossil sites recorded in reports of impact mitigation (where construction monitoring has been implemented) had no previous surface expression. Because the presence or location of fossils within a rock unit cannot be known without exposure resulting from erosion or excavation, an entire rock unit is assigned the same level of sensitivity based on recorded fossil occurrences.

Using PFYC criteria, the paleontological potential of a rock unit is the measure most amenable to assessing the significance of paleontological resources because the areal distribution of that rock unit can be delineated on a topographic or geologic map. The paleontological importance of a stratigraphic unit reflects: (1) its potential paleontological productivity (and thus sensitivity), and (2) the scientific significance of the fossils it has produced. This method of paleontological resource assessment is the most appropriate because discrete levels of paleontological importance can be delineated on a topographic or geologic map.

The potential paleontological productivity of a stratigraphic unit exposed in a project area is based on the presence of fossil specimens and/or previously recorded fossil sites in exposures of the unit in and near a project site. The underlying assumption of this assessment method is that exposures of a stratigraphic unit in a project site are most likely to yield fossil remains both in

quantity and density similar to those previously recorded from that stratigraphic unit in and near the project site.

The following tasks were completed to establish the paleontological significance and potential of each stratigraphic unit exposed in or near the Project site:

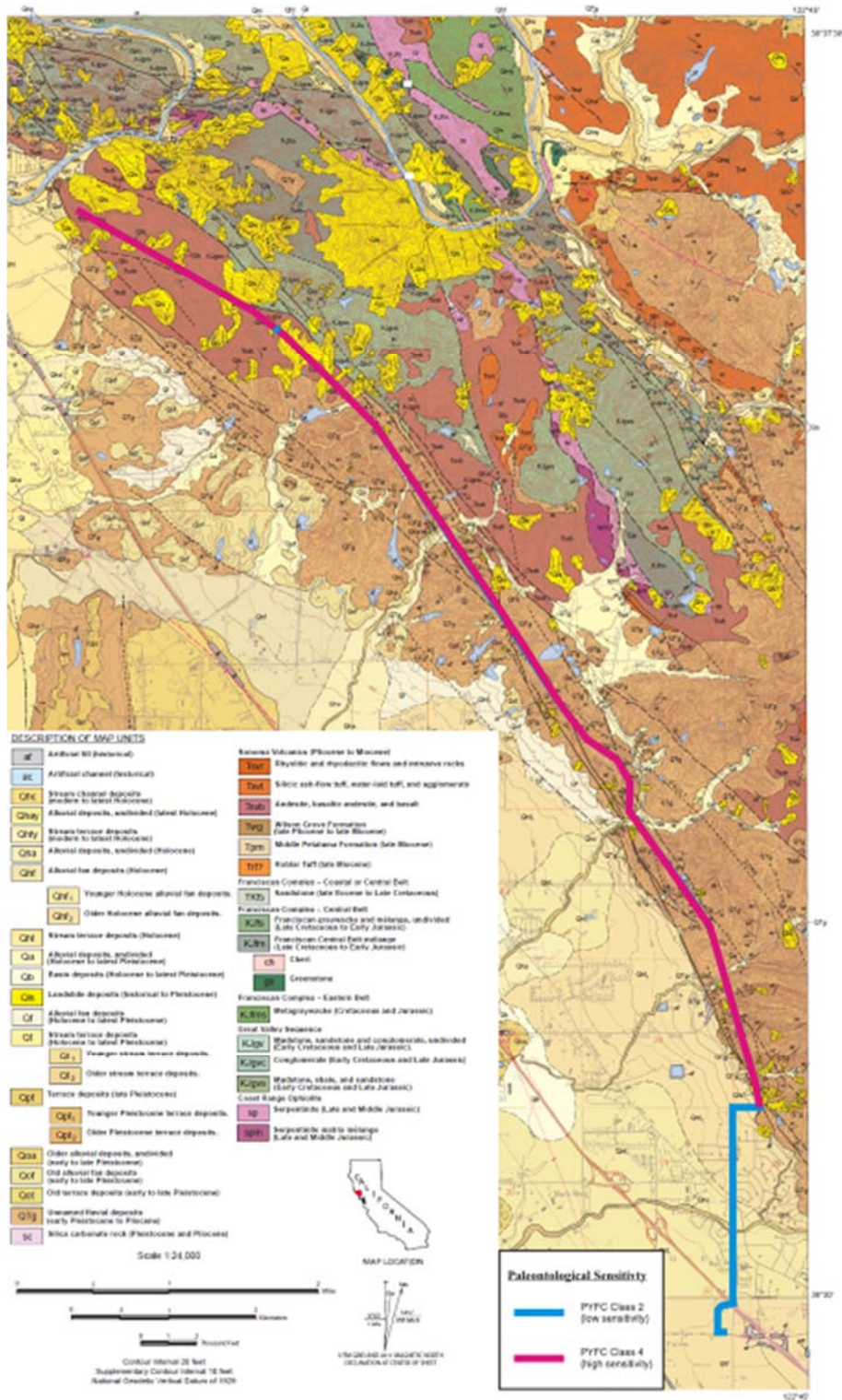
- The potential paleontological productivity of each rock unit was assessed based on previously recorded and newly documented fossil sites it contains at and/or near the Project site.
- The scientific importance of fossil remains recorded from a stratigraphic unit exposed at and/or near the Project site was assessed.
- The paleontological importance of a rock unit was assessed, based on its documented and/or potential fossil content in the area surrounding the Project site.

The following is a determination of the paleontological sensitivity for each geological unit potentially impacted by Project ground disturbance and a discussion of the rationales used to assign each unit's sensitivity rating. The PFYC rating system was used in assessing each geologic unit's potential or sensitivity. Table 2 presents a summary of the age, lithology, known paleontological resources, and potential or sensitivity rating for each potentially impacted geologic unit. Figure 5 presents a map of the Project area illustrating the PFYC rating for each impacted geologic unit.

**Table 2.** Paleontological sensitivities of stratigraphic units that may be potentially impacted by construction of the Fulton-Fitch Mountain Reconductoring Project in Sonoma County, California.

Map Symbol (Delattre 2011)	Age	Stratigraphic Unit	Lithology	PFYC Rating
Qa, Qhf	Latest Pleistocene and Holocene	Alluvial fan and fluvial deposits	Unconsolidated gravel, sand, silt, and clay	2
Qof	Pleistocene	Older alluvial fan deposits	Buff siltstone and claystone with buff to gray, fine- to coarse-grained lithic sandstone, pebbly sandstone, pebbly mudstone, and pebble to cobble conglomerate	4a
QTg	Plio-Pleistocene	Glen Ellen Formation	Brown- to buff-weathering, interbedded siltstone, fine- to coarse-grained sandstone, pebbly and cobbly sandstone, conglomerate, and tuff	4a
Tsb	Mio-Pliocene	Sonoma Volcanics	Basalt, andesite, and rhyolite lavas interbedded with tuffs, lahar deposits, debris avalanche deposits, mudflow deposits, reworked tuffs, sedimentary breccia deposits, diatomites, and lacustrine deposits	4b
KJgvs	Jurassic and Cretaceous	Great Valley Sequence	Marine turbidite sandstones, siltstones, and shales	3a





**Figure 5.** Geologic map showing PFYC ratings for geologic units potentially impacted by the proposed Fulton-Fitch Mountain Reconductoring Project. Modified from the 1:24,000 scale geologic map by Delattre (2011).

**Great Valley Sequence:** The Great Valley Sequence does not outcrop within the Project ROW but does appear at the surface less than 100 yards (meters) from the Project ROW. It is overlain within the Project area by an unknown thickness of Sonoma Volcanics and Glen Ellen Formation. Deeper excavations could impact Great Valley sediments. Great Valley Sequence sediments of the age exposed near the Project have yielded invertebrate and microfossils from Sonoma County and rare vertebrate fossils from elsewhere in California. Based on these findings, the Great Valley Sequence in the vicinity of the Project is assigned a Class 3a (moderate potential yield) using the PFYC system.

**Sonoma Volcanics:** The Sonoma Volcanics comprises a wide range of volcanic and volcanoclastic facies. Some facies, such as the basaltic and andesitic lava flows as well as pyroclastic flow breccias are extremely unlikely to produce fossils; while others such as tuffs, mudflows, and lacustrine facies have yielded fossils, some of which are highly significant. Within the Project area, lava flows are found at the surface, but the field survey found evidence that tuffaceous beds and mudflows are likely present at depth. Because sedimentary strata in the Sonoma Volcanics have produced significant plant fossils, microfossils, vertebrate fossils, and invertebrate fossils in the past and might produce additional important specimens in the future and because facies conducive to the preservation of fossils are likely present in the subsurface of the Project area, therefore, the entire Sonoma Volcanics as a stratigraphic unit is assigned a PFYC Class 4b (high potential yield).

**Glen Ellen Formation:** This sedimentary unit consists largely of fluvial deposits interbedded with volcanic tuffs. These deposits have not produced fossils from the project area but have produced fossils elsewhere in Sonoma County. Diatoms, freshwater molluscs, and plant remains have been reported (Cardwell 1958, McLaughlin et al. 2004). Several horse teeth (UCMP locality V90056) have also been tentatively assigned to the Glen Ellen Formation. Stratigraphically equivalent beds outcropping to the north and west are also fossiliferous (Cardwell 1965, McLaughlin et al. 2004, Graymer et al. 2007). Because this geologic unit has produced fossils elsewhere in Sonoma County and because sedimentary facies conducive to the preservation of fossils (fine-grained deposits, sands, and gravels similar to fossil-bearing facies elsewhere in Sonoma County) were observed during the field survey of the project area, the Glen Ellen Formation is assigned a high sensitivity (Class 4a) using the PFYC system.

**Older Alluvial Fan Deposits:** Pleistocene-age alluvial fan deposits have yielded vertebrate fossils in Sonoma County. For this reason, these deposits are assigned a PFYC Class 4a (high potential yield).

**Alluvial Fan and Alluvial Deposits:** These deposits are not known to have produced fossils in the general Project area and also include sediments too young to produce significant fossils. Because these criteria, these sediments are assigned a PFYC Class 2 (low potential yield).

## SECTION 7

### **FINDINGS AND RECOMMENDATIONS**

#### **7.1 Findings**

Project earth disturbance activities have the potential to impact two geologic units with a high potential paleontological yield (PFYC Class 4) (see Table 2). These units are the Sonoma Volcanics and the (Pleistocene) older alluvial fan deposits. Both of these geologic units have produced significant fossils from Sonoma County and elsewhere and there remains a good potential that they will yield additional significant fossils within the Project area. Two additional geologic units have a moderate or undetermined potential paleontological yield (PFYC Class 3): the Great Valley Sequence and the Glen Ellen Formation. Of these two, Project activities are unlikely to affect the sediments of the Great Valley Sequence even at depth but will impact the Glen Ellen Formation.

Project activities that involve ground disturbance include: grading of pull sites, excavations for pole replacement, and grading to improve access roads (see Table 1). If these activities occur within geologic units of high or undetermined paleontological sensitivity, they could adversely impact significant paleontological resources and would require some level of appropriate mitigation.

#### **7.2. Recommendations**

This section describes proposed mitigation measures that could be implemented to reduce potential adverse impacts to significant paleontological resources resulting from Project construction (see Table 1 for a summary). Mitigation measures are necessary because of potential adverse impacts of Project construction on significant paleontological resources within the Sonoma Volcanics and older alluvial deposits. These units occur at or near the surface along the Project alignment as shown in Figure 2. As proscribed in the PG&E's Paleontological Resources Standards and Procedures (PG&E 2014), excavation activities that will impact geologic units with a high potential rating require spot checking and mitigation. In addition, because the field survey demonstrated that sediments of the Glen Ellen Formation were conducive to the burial and preservation of fossils, periodic spot checking of Project excavations within the Glen Ellen Formation is recommended to insure that fossils are not being impacted .

In order to reduce potential adverse impacts to significant paleontological resources resulting from Project activities, the following Applicant Proposed Measures are proposed:

#### **PAL-1 Unanticipated Discovery**

If significant paleontological resources are discovered during construction activities, the following procedures will be followed:

- Stop work immediately within 100 feet;
- Contact the designated project inspector and Cultural Resource Specialist (CRS) immediately;
- Protect the site from further impacts, including looting, erosion or other human or natural damage;

- The project CRS will arrange for a Principal Paleontologist to evaluate discovery. If the discovery is determined to be significant PG&E will implement measures to protect and document the paleontological resource. Such measures may include preservation in place, excavation, documentation, curation, or other appropriate measures. Permission from the landowner must be secured before treating the fossil;

Work may not resume within 100 feet of the find until approval by the Principal Paleontologist and Cultural Resource Specialist.

### **PAL-2 Workers Environmental Awareness Training**

If moderate, high or very high sensitivity formations are identified within the project area, PG&E (or contractor) will provide environmental awareness training on paleontological resources protection. For this Project, the Sonoma Volcanics, the Glen Ellen Formation, and older alluvial fan deposits all have moderate or high paleontological sensitivities. This training may be administered by the project paleontologist as a stand-alone training or included as part of the overall environmental awareness training as required by the project.

The training will include at minimum, the following:

- The types of fossils that could occur at the project site;
- The types of lithologies in which the fossils could be preserved;
- The procedures that should be taken in the event of a fossil discovery;
- Penalties for disturbing paleontological resources.

### **PAL-3 Monitoring**

Monitoring should be required all Project excavation activities that impact the Sonoma Volcanics, the Glen Ellen Formation, and the older alluvial fan deposits (see Table 1 for summary). However, since fossils do not predictively occur within these formations and the amount of earth disturbance in relatively small, fulltime monitoring is not required, barring the occurrence of an unanticipated, highly-fossiliferous bed. Instead, monitoring will consist of periodic spot checking of grading and pole installation to check for the occurrence of fossils or facies highly likely to produce fossils. In the event that a highly fossiliferous bed is encountered, monitoring shall be fulltime until excavations within that bed are complete.

Monitoring shall be done only by qualified field paleontologists. These field paleontologists will document monitoring activities on daily logs. Monitoring logs and reports should include the activities observed, geology encountered, description of any resources encountered, and measures taken to protect or recover discoveries. Photographs and other supplemental information should be included as necessary.

### **PAL-4 Fossil Recovery**

In the event that significant paleontological resources are encountered during the project, protection and recovery of those resources may be required. On public lands, treatment and curation of fossils will follow procedures outlined by the land managing agency. On private property, treatment and curation of fossils will be conducted in consultation with the landowner, PG&E and the lead agency. Procedures for recovering significant fossils are typically outlined in the Paleontological Resource Monitoring and Mitigation Program. A Principal Paleontologist is

responsible for developing the recovery strategy and will lead the recovery effort, which will include establishing recovery standards, preparing specimens for identification and preservation, documentation and reporting, and securing a curation agreement from the approved agency. A Paleontological Monitor or other qualified individual may conduct the recovery of fossil discoveries under the direction of the Principal Paleontologist.

The proposed mitigation program would reduce to an insignificant level the direct, indirect, and cumulative adverse environmental impacts on paleontological resources that could result from Project construction. The mitigation measures proposed are consistent with PG&E (2014) standard guidelines and procedures for mitigating adverse construction-related impacts on paleontological resources.

**SECTION 8**  
**ACRONYMS**

BLM	Bureau of Land Management
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CRS	Cultural Resource Specialist
FERC	Federal Energy Regulatory Commission
LDSP	Light Duty Steel Poles
LORS	Laws, Ordinances, Regulations, and Standards
Ma	Millions of years
NCRM	North Coast Resource Management
NEPA	National Environmental Protection Act
NPS	National Park Service
OSRC	Open Space and Resource Conservation
PG	Professional Geologist
PG&E	Pacific Gas and Electric
P.L.	Public Law
PRC	PaleoResource Consultants
SVP	Society of Vertebrate Paleontology
TSP	Tubular Steel Poles
UCMP	University of California Museum of Paleontology
U.S.C.	United States Code
USFS	United States Forest Service
USGS	United States Geological Survey

**SECTION 9**  
**REFERENCES**

Allen, J.R., 2003, Stratigraphy and tectonics of Neogene strata, northern San Francisco Bay Area: unpublished Master's Thesis, San Jose State University, 378 p.

Allen, J.R., 2007, Composition, age and geographical extent of the Glen Ellen, Huichica and Petaluma formations, Sonoma and Napa counties, California: Geological Society of American Annual Meeting Abstracts, Denver, CO, p. 114.

Axelrod, D.I., 1944, Pliocene floras of California and Oregon: the Sonoma flora: Carnegie Institute Washington Publication 553, p. 162-206.

Axelrod, D.I., 1950, A Sonoma florule from Napa, California: Carnegie Institute Washington Publication 590, p. 23-71.

Bailey, E.H., 1946, Geological map and sections of the Mayacamas quicksilver district, Sonoma, Lake, and Napa Counties, California: California Journal of Mines and Geology, State Mineralogist's Report, vol. 42, no. 3, pl. 29, scale 1:62,500.

Blake, M.C., Jr., Smith, J.T., Wentworth, C.M., and Wright, R.H., 1971, Preliminary geologic map of western Sonoma County and northernmost Marin County, California: U.S. Geological Survey Open-File Report 71-44, 5 sheets, scale 1:62,500.

Blake, M.C., Jr., Graymer, R.W., and Jones, D.L., 2000, Digital geologic map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2337, 29 p., 2 sheets, scale 1:100,000.

Blake, M.C., Jr., Graymer, R.W., and Stamski, R.E., 2002, Geologic map and map database of western Sonoma, northern Marin, and southern Mendocino counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-2402, 42 p, scale 1:100,000.

Bureau of Land Management (BLM), 1998, General procedural guidance for paleontological resource management: BLM Handbook H-8270-1.

Bureau of Land Management (BLM), 2007, The potential fossil yield classification (PFYC) system: BLM IM2008-009\_att1.

California State Historic Preservation Office, 1983, Summary of state/federal laws protecting cultural resources: California State Historic Preservation Office, Sacramento, CA, 10 p.

Cardwell, G.T., 1958, Geology and ground water in the Santa Rosa and Petaluma Valley areas, Sonoma County, California: U.S. Geological Survey Water-Supply Paper 1427, 270 p.

Cardwell, G.T., 1965, Geology and ground water in Russian River Valley areas and in Round, Laytonville, and Little Lake Valleys, Sonoma and Mendocino Counties, California: U.S. Geological Survey, Water-Supply Paper 1548, scale 1:62,500.

Delattre, M.P., 2011, Preliminary geologic map of the Healdsburg 7.5' Quadrangle, Sonoma County, California – a digital database: California Geological Survey, accessed at [http://www.conservation.ca.gov/cgs/rghm/rgm/preliminary\\_geologic\\_maps.htm](http://www.conservation.ca.gov/cgs/rghm/rgm/preliminary_geologic_maps.htm), scale 1:24,000.

Delattre, M.P., Wagner, D.L., Higgins, C.T., Witter, R.C., and Sowers, J.M., 2007, Geologic map of the Kenwood 7.5' Quadrangle, Sonoma and Napa counties, California -- a digital database: California Department of Conservation, California Geological Survey, scale 1:24,000.

Dorf, E., 1930, Pliocene floras of California: Carnegie Institute Washington Publication 412, p. 1-112.

Fisk, L. H., Erwin, D.M., and Elder, W., 2013, Fieldtrip guide to the Napa Valley, Calistoga Petrified Forest, Muir Redwoods, and Golden Gate Bridge headlands in northern California: AASP-The Palynological Society 46<sup>th</sup> Annual Meeting Pre-Conference Field Trip, 20 October 2013, San Francisco, CA, 21 p.

Fisk, L.H., and Spencer, L.A., 1994, Highway construction projects have legal mandates requiring protection of paleontologic resources (fossils): p. 213-225 *in* Burns, S.F. (editor), Proceedings of the 45<sup>th</sup> Highway Geology Symposium, Portland, OR, 258 p.

Fisk, L.H., Spencer, L.A., and Whistler, D.P., 1994, Paleontologic resource impact mitigation on the PGT-PG&E Pipeline Expansion Project, Volume II: PG&E Section, California: unpublished report prepared for the Federal Energy Regulatory Commission, California Public Utilities Commission, Pacific Gas and Electric Company, and Bechtel Corporation by Paleo Environmental Associates, Inc., Altadena, CA, 123 p.

Ford, R., 1975. Evaluation of ground water resources: Sonoma County Volume 1 -- geologic and hydrologic data: State of California Resources Agency, Department of Water Resources, 322 p.

Fox, K.F., Jr., 1983, Tectonic setting of late Miocene, Pliocene, and Pleistocene rocks in part of the Coast Ranges north of San Francisco, California: U.S. Geological Survey Professional Paper 1239, 33 p.

Fox, K.F., Jr., Sims, J.D., Bartow, J.A., and Helley, E.J., 1973, Preliminary geologic map of eastern Sonoma County and western Napa County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-483, 4 sheets, scale 1:62,500.

Fox, K.F., Jr., Fleck, R.J., Curtis, G.H., and Meyer, C.E., 1985a, Implications of the northwestwardly younger age of the volcanic rocks of west central California: Geological Society of America Bulletin, vol. 96, p. 647-654.

Fox, K.F., Jr., Fleck, R.J., Curtis, G.H., and Meyer, C.E., 1985b, Potassium-argon and fission track ages of the Sonoma Volcanics in an area north of San Pablo Bay, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1753, 9 p., 1 sheet, scale 1:125,000.

Gastaldo, R.A., 1999, International laws: collecting, transporting and ownership of fossils – USA: p. 330-338, *in* Jones, T. P. and Rowe, N. P. (editors), Fossil plants and spores, The Geological Society, London, England, 396 p.



Gealey, W.K., 1951, Geology of the Healdsburg Quadrangle, California: California Division of Mines Bulletin 161, 50 p., scale 1:62,500.

Graymer, R.W., Jones, D.L., and Brabb, E.E., 2002, Geologic map and map database of northeastern San Francisco Bay region, California -- most of Solano County and parts of Napa, Marin, Contra Costa, San Joaquin, Sacramento, Yolo, and Sonoma Counties: U.S. Geological Survey Miscellaneous Field Studies Map MF-2403, scale 1:100,000.

Graymer, R.W., Brabb, E.E., Jones, D.L., Barnes, J., Nicholson, R.S., and Stamski, R.E., 2007, Geologic map and map database of eastern Sonoma and western Napa counties, California: U.S. Geological Survey Scientific Investigations Map 2956, scale 1:100,000.

Hay, O.P., 1927, The Pleistocene of the western region of North America and its vertebrate animals: Carnegie Institute of Washington Publication 322, p. 1-346.

Hilton, R.P., 2003, Dinosaurs and other Mesozoic reptiles from California: University of California Press, Berkeley, CA, 356 p.

Huffman, M.E., and Armstrong, C.F., 1980, Geology for planning in Sonoma County: California Division of Mines and Geology Special Report 120, scale 1:62,500.

Jackson, T.L., 1989, Late prehistoric obsidian production and exchange in the north Coast Ranges, California: Contributions of the Archaeological Research Facility Number 48, 79-94.

Jefferson, G.T., 1991, A catalogue of late Quaternary vertebrates from California: Part Two, Mammals: Natural History Museum of Los Angeles County Technical Report No. 7, 129 p.

Jenkins, O.P., 1938, Geologic map of California: California Division of Mines and Geology, Sacramento, CA, scale 1:500,000.

Jennings, C.W., Strand, R.G., Rogers, T.H., Boylan, R.T., Moar, R.R., and Switzer, R.A., 1977, Geologic map of California: California Division of Mines and Geology, scale 1:750,000.

Kirby, J.M., 1943, Upper Cretaceous stratigraphy of the west side of the Sacramento Valley south of Willows, Glenn County, California: American Association of Petroleum Geologists Bulletin, vol. 27, p. 279-305.

Koenig, J.B., 1963, Walker Lake sheet, Geologic map of California: California Division of Mines and Geology, scale 1:250,000.

Kunkel, F., and Upson, J.E., 1960, Geology and ground water in Napa and Sonoma Valleys, Napa and Sonoma Counties, California: U.S. Geological Survey Water-Supply Paper 1495, 252 p.

Lander, E.B., 1989, Interim paleontological resource technical report, Eastside Reservoir Project Study -- Phase 1, Riverside County, California: unpublished report prepared for Metropolitan Water District of Southern California by Paleo Environmental Associates, Inc., Altadena, CA, 20 p.

Lander, E.B., 1993, Paleontologic/cultural resource impact mitigation program final report: unpublished report prepared for Midway Sunset Cogeneration Company, Mojave Natural Gas Pipeline, and Kern County, California by Paleo Environmental Associates, Inc., Altadena, CA, 57 p.

Marshall, L.G., 1976, Paleontological salvage and federal legislation: *Journal of Paleontology*, vol. 50, p. 346-348.

McLaughlin, R.J., and Nilsen, T.H., 1982, Neogene non-marine sedimentation and tectonics in small pull-apart basins of the San Andreas Fault system, Sonoma County, California: *Sedimentology*, vol. 29, no. 6, p. 865-876.

McLaughlin, R.J., Sarna-Wojcicki, A.M., Fleck, R.J., Wright, W.H., Levin, V.R.G., and Valin, V.C., 2004, Geology, tephrochronology, radiometric ages, and cross sections of the Mark West Springs 7.5' Quadrangle, Sonoma and Napa counties, California: U.S. Geological Survey Scientific Investigations Map 2858, 16 p., scale 1:24,000.

Morse, R.R., and Bailey, T.L., 1935, Geological observations in the Petaluma district, California: *Geological Society of America Bulletin*, vol. 46, p. 1437-1456.

Osmont, V.C., 1905, A geological section of the Coast Ranges north of the Bay of San Francisco: *California University, Department of Geology Bulletin*, vol. 4, p. 39-87.

Pacific Gas and Electric (PG&E), 2014, Paleontological Resources Standards and Procedures: Pacific Gas and Electric Company, San Ramon, CA, 44 p.

Pratt, L.R., Haasl, D.M., and Fisk, L.H., 2011, Paleontological resources inventory report for the Fulton-Fitch Mountain 60kV Reconductoring Project in Sonoma County, California: unpublished report prepared for PG&E and North Coast Resource Management by PaleoResource Consultants, Auburn, CA, 40 p.

Reynolds, R.E., 1987, Paleontologic resource assessment, Midway-Sunset Cogeneration Project, Kern County, California: unpublished report prepared for Southern California Edison Company by San Bernardino County Museum, San Bernardino, CA, 15 p.

Reynolds, R.E., 1990, Paleontological mitigation program, Midway-Sunset Cogeneration Project, Kern County, California: unpublished report prepared for Midway-Sunset Cogeneration Company, by San Bernardino County Museum, San Bernardino, CA, 45 p.

Savage, D.E., 1951, Late Cenozoic vertebrates of the San Francisco region: *University of California Publications, Bulletin of the Department of Geological Sciences*, vol. 28, p. 215-314.

Shipman, P., 1977, Paleocology, taphonomic history and population dynamics of the vertebrate assemblage from the middle Miocene of Fort Turnan, Kenya: unpublished PhD dissertation, New York University, New York, NY, 193 p.

Shipman, P., 1981, Spatial distribution of fossils in sediments: p. 65-98, in Shipman, P. (editor), *Life history of a fossil, an introduction to taphonomy and paleocology*, Harvard University Press, Cambridge, MA, 222 p.

Society of Vertebrate Paleontology (SVP), 2010, Standard procedures for the assessment and mitigation of adverse impacts to paleontological resources: Society of Vertebrate Paleontology, 11 p., accessed online at: <http://vertpaleo.org/PDFS/24/2482305f-38f8-4c1b-934c-1022d264e621.pdf>.

Sonoma County Permit and Resource Management Department, 2008, Sonoma County General Plan 2020 Open Space and Resource Conservation Element: Accessed online: <http://www.sonoma-county.org/prmd/gp2020/index.html>.

Spencer, L.A., 1990, Paleontological mitigation program, Midway-Sunset Cogeneration Project, natural gas pipeline, Kern County, California: unpublished report prepared for Midway-Sunset Cogeneration Company by Paleo Environmental Associates, Inc., Altadena, CA, 12 p.

Sowers, J.M., Noller, J.S., and Lettis, W.R., 1998, Quaternary geology and liquefaction susceptibility, Napa, California 1:100,000 quadrangle – a digital database: U.S. Geological Survey Open-File Report 98-460, scale 1,100,000.

Starratt, S.W., Allen, J.R., Powell, C.L., Peterson, D.E., Ruck, E., et al., 2005: Geological Society of America Abstracts with Programs, vol. 37, p. 69.

Sweetkind, D.S., Taylor, E.M., McCabe, C.A., Langenheim, V.E., and McLaughlin, R.J., 2010, Three-dimensional geologic modeling of the Santa Rosa Plain, California: *Geosphere*, vol. 6, p. 237-274.

Taliaferro, N.L., 1943, Geologic history and structure of the central Coast Ranges of California: California Division of Mines Bulletin 118, p. 119-163.

Wagner, D.L., and Bortugno, E.J., 1982, Geologic map of the Santa Rosa Quadrangle, California: California Division of Mines and Geology, Regional Geol Map Series, Map #2A scale 1:250,000.

Wakabayashi, J., and Unruh J.R., 1995, Tectonic wedging, blueschist metamorphism, and exposure of blueschists - are they compatible?: *Geology*, vol. 23, p. 85-88.

Weaver, C.E., 1949, Geology of the Coast Ranges immediately north of the San Francisco Bay region, California: Geological Society of America Memoir 35. 78 p.

West, R.M., 1991, State regulation of geological, paleontological, and archaeological collecting: *Curator*, vol. 34, p. 199-209.

Woodburne, M.O., 1966, Equid remains from the Sonoma Volcanics, California: *Bulletin of the Southern California Academy of Science*, vol. 65, p. 185-189.

Zeeb, B.A., Smol, J.P. and VanLandingham, S.L.. 1996, Pliocene chrysophycean stomatocysts from the Sonoma Volcanics, Napa County, California: *Micropaleontology*, vol. 42, no. 1, p. 79-91.

**APPENDIX A**

**RECORDS SEARCH RESULTS:**

**UCMP DATA**

Appendix B. Confidential table of UCMP fossil localities within Sonoma County from stratigraphic units which will be potentially impacted by the proposed Fulton-Fitch Mountain Reconductoring Project.

<b>UCMP Locality Number</b>	<b>Locality Name</b>	<b>Age</b>	<b>Formation</b>	<b>Specimens</b>	<b>Published</b>
PA1380	Aqua Rico Ranch	Pleistocene	Older Alluvium	2 specimens: Turtle, Horse	
PA3023	McGrew's Ranch	Pleistocene	Older Alluvium	1 specimen: Ground Sloth	
V3646	Eureka School	Pleistocene	Older Alluvium	1 specimen: Bison	
V3650	Crandall	Pleistocene	Older Alluvium	1 specimen: Ground Sloth	
V5213	Five Oaks Ranch	Pleistocene	Older Alluvium	1 specimen: Mastodon	
V6517	Ducker Ranch	Pleistocene	Older Alluvium	1 specimen: Mastodon	
V6775	Petaluma	Pleistocene	Older Alluvium	1 specimen: Proboscidean	
V72107	Ebacias Creek	Pleistocene	Older Alluvium	2 specimens: Horse, Bison	
V80005	Cardinaux	Pleistocene	Older Alluvium	1 specimen: Bison	
V90056	Rincon Valley West	Pleistocene	Glen Ellen?	1 specimens: Horse	
91	Calistoga Petrified Forest I	Pliocene	Sonoma Tuff		
150	Calistoga Petrified Forest II	Pliocene	Sonoma Tuff	45 specimens: Conifers, Magnoliopsids, Type Specimens	Axelrod 1944
539	Calistoga Petrified Forest III	Pliocene	Sonoma Tuff		
P3845	Calistoga Petrified Forest IV	Pliocene	Sonoma Tuff		
151	Monarch Tree	Pliocene	Sonoma Tuff	4 specimens: Sequoia, Oak, Bay Laurel, Type Specimens	Dorf 1930
152	Matanzas Creek	Pliocene	Sonoma Tuff	16 specimens: Sequoia, Magnoliopsids, Type specimens	Dorf 1930
153	Taylor Mountain	Pliocene	Sonoma Tuff	3 specimens: Chain Fern, Sequoia, Oak, Type Specimens	Dorf 1930
154	Neers Hill	Pliocene	Sonoma Tuff	86 specimens: Conifers, Magnoliopsids, Type Specimens	Axelrod 1944
PA250	Mantanzas Dam	Pliocene	Sonoma Volcanics		

**APPENDIX B**  
**STAFF RESUMES**



**PaleoResource Consultants**  
**F & F GeoResource Associates, Inc.**  
**550 High Street, Suite 108, Auburn, CA 95603**  
**Phone: (530) 885-9696 ~ Fax: (530) 887-2274**  
**info@paleoresource.com**



**Dr. Lanny H. Fisk, PhD, PG**  
Principal Paleontologist

### **Experience Summary**

Over 30 years experience as a professional geologist/paleontologist and 25 years as a paleontological consultant doing paleontological resource impact assessments and surveys, preparing CEQA and NEPA environmental documents and mitigation measures, managing environmental compliance monitoring programs, and coordinating and consulting with city, county, state, and federal resource agencies to resolve environmental concerns regarding paleontological resources. Supervised paleontological resource impact mitigation programs requiring monitoring of major earth-moving projects, recovery and collection of fossil remains and fossiliferous rock samples, supervision of field personnel, and preparation of progress and final reports. Projects involved extensive coordination and consultation with project sponsors, other consulting firms, and permitting agencies; adherence to strict delivery schedules; and completion within specified budget limits. Supervised paleontological monitoring and salvaging of fossils, evaluated fossiliferous rock samples to determine need for microfossil processing, and identified fossil remains as part of paleontological monitoring and resource recovery programs for such major projects as the Corninco American Resources Buckhorn Mine; Pacific Gas and Electric Company-Pacific Gas Transmission Company Pipeline Expansion Project from Alberta, Canada, to Southern California; Chemical Waste Management of the Northwest Landfill; 360networks Northern California Fiber Optic Cable Project; Los Angeles Metro Rail Project; Eastern Transportation Corridor Tollway Project; Foothills Transportation Corridor Oso Tollway Project; Prima Deshecha Landfill; Kettleman Hills Landfill; Sutter Energy Center Project; Newark Power Plant Project; Delta Energy Center Project; Los Medanos Energy Center Project; Blythe Energy Project; Gilroy Energy Center; Metcalf Energy Center; King City Energy Center; Pastoria Energy Facility; Otay Mesa Generating Project; Contra Costa Power Plant; Woodland Generating Station; Granite-Fox Power Plant; Caltrans Highway 41 Reef Ridge Project; and Caltrans Highway 50 Sacramento Project. Extensive research in paleobotany, palynology, paleomithology, biostratigraphy, and paleoecology of Cretaceous, Tertiary, and Quaternary formations of the western United States, including research in eight national parks and monuments. Research interests in and numerous scientific publications on fossil floras of the Western U. S. and Mexico. Developed laboratory research facilities at two universities for studying fossil floras, processing fossiliferous rock samples to recover plant microfossils, and interpreting their age and paleoenvironment.

### **Experience Record**

1982-present Paleontological and Geological Consultant. PaleoResource Consultants., Auburn, CA. Conducted geological investigations, natural resource assessments, and paleontological resource impact assessments and surveys for environmental, engineering, petroleum, mining, and manufacturing firms, and government agencies. Prepared and supervised paleontological monitoring and mitigation programs for such large projects as the Delta Energy Center, Los Medanos Energy Center, King City Energy Center, Gilroy Energy Center, Magnolia Power Project, Metcalf Energy Center, Pastoria Energy Facility, Otay Mesa Generating Project, Blythe Energy Project, Woodland Generating Station, Kettleman Hills Landfill, and 360networks Fiber Optic Cable Project. Identified fossils (including microfossils) and provided age and paleoenvironmental interpretations for Los Angeles Metro Rail Project, Los Angeles Metropolitan Water District Project, Santiago Canyon Estates Project, and Puente Landfill Project.

1997-2006 Adjunct Professor. Department of Earth Sciences, American River College, Sacramento, CA. Taught undergraduate courses in physical and historical geology, marine environment, and physical science.

1991-1999 Senior Paleontologist, Field Supervisor, and Project Paleontologist. Paleo Environmental Associates, Inc., Altadena, CA. Supervised paleontological monitoring, salvaging of fossils, and processing of rock samples; identified plant fossil remains, including plant microfossils and provided paleoenvironmental analyses and age interpretations; prepared stratigraphic columns of fossil-bearing strata, and prepared monthly and final reports as part of the paleontological impact mitigation programs for the PG&E-PGT Pipeline Expansion Project, Los Angeles Metro Rail Project, Eastern Transportation Corridor Tollway Project, Sutter Power Plant Project, Texaco Sunrise Cogeneration and Power Project, Prima Deshecha Landfill Project, Elk Hills Power Plant Project, Eagle Glen Development Project, and Amerige Heights Development Project.

1979-1989 Associate Professor. Department of Geological Sciences, Loma Linda University, Loma Linda, California. Taught both undergraduate and graduate courses in paleontology, geology, and philosophy of science; directed undergraduate and graduate student research and theses; conducted research in paleobotany, paleopalynology, and stratigraphy and presented and published the results; administered the department (1980-1986), and served as president of the faculty (1987-1988).

1973-1979 Assistant to Associate Professor. Department of Biological Sciences and School of Engineering, Walla Walla College, College Place, Washington. Taught both undergraduate and graduate courses in paleontology, physical and historical geology, environmental science, ecology, and philosophy of science; directed undergraduate and graduate student research and theses;



conducted research in paleobotany, paleopalynology, and biostratigraphy and presented and published the results. Also Visiting Professor 1996-97 and 2003 teaching engineering geology, paleobotany, and environmental science.  
1967-1969 U. S. Army Medical Specialist, Pentagon, Washington, DC. Performed medical testing and administered medical services to White House and Pentagon staffs and visiting foreign dignitaries.

## Education

---

Post-Doctoral Research and ABD in Geology, 1979-1986, Michigan State University, East Lansing, Michigan  
Ph.D., Paleobiology, 1976, Loma Linda University, Loma Linda, California  
B.A. with Honors, Biology, 1971, Andrews University, Berrien Springs, Michigan

## Professional Registrations

---

Professional Geologist #6985, State of California  
Certified Professional Paleontologist, Orange County, California  
Registered Geologist #G1390, State of Oregon

## Professional Organizations - Selected

---

AASP – The Palynological Society (symposium organizer 1983, 2009, 2013; North American Paleontological Convention Committee 1986; Board of Directors 2010-2015; President Elect 2013-2014; President 2014-2015)  
Paleontological Society  
Society of Vertebrate Paleontology (Co-Chairman, Ad Hoc Standard Guidelines Revision Committee 2009-2010; symposium proposer 2010)  
Western Association of Vertebrate Paleontologists (field trip co-leader 2010)  
Society of Economic Paleontologists and Mineralogists (Rocky Mountain Section session chairman 1985)  
Paleobotanical Section of the Botanical Society of America (convention session chairman 1981)  
International Organisation of Palaeobotanists  
National Association of Geology Teachers  
National Association of State Boards of Geology (National Examination Committee 1994-1999)  
Geological Society of America (Central Oregon representative 1990-1995; Partners for Excellence 1992-1998; symposium organizer 2010)  
American Association of Petroleum Geologists (Rocky Mountain Section field trip leader 1987, member of the House of Delegates 1990-1996)  
Association of Environmental Professionals  
Southern California Academy of Sciences

## Professional Activities

---

2009-2010	Co-Chairman, Society of Vertebrate Paleontology Ad Hoc Standard Guidelines Revision Committee
2009	Convener and Chairman, Ronald O. Kapp Symposium, 42nd Annual Meeting of AASP – The Palynological Society
1994-1999	National Examination Committee, National Association of State Boards of Geology
1993-1998	Member and Vice Chairman, Oregon State Board of Geologist Examiners
1992-1999	Member, Oregon State Geologic Mapping Advisory Committee
1990-1991	President, Northwest Energy Association
1986	Representative to the Organizing Committee for North American Paleontological Convention IV
1983-1985	Founding Member, Program Chairman, and Vice President, Inland Geological Society
1983	Convener, Chairman, and Editor, Harry D. MacGinitie Symposium on Palynology of Tertiary Fossil Floras

## Publications - Selected

---

Fisk, L. H., 1976, Paleogeological investigations of the Eocene Fossil Forest: p. 436-437 *in*: Annual Report of the Chief Scientist of the National Park Service, CY 1975. U. S. Department of Interior, National Park Service, Washington, D.C., 556 p.  
Fisk, L. H., 1976, The Gallatin "Petrified Forest" -- a Review: p. 53-72 *in*: Montana Bureau of Mines and Geology Special Publication 73, Butte, Montana, 165 p.  
Fisk, L. H., 1976, Palynology of the Amethyst Mountain "Fossil Forest", Yellowstone National Park, Wyoming: unpublished doctoral dissertation, Loma Linda University, Loma Linda, California, 340 p.  
Fisk, L. H., 1976, Paleoenvironmental interpretations of the Eocene "Fossil Forest", Yellowstone National Park, Montana and Wyoming: 25th International Geological Congress, Abstracts, vol. 1, p.303.  
Fritz, W. J., and Fisk, L. H., 1976, Paleogeology of petrified woods from Amethyst Mountain "Fossil Forest", Yellowstone National Park, Wyoming: First Conference on Scientific Research in the National Parks, Abstracts Volume, p. 92.  
Fisk, L. H., and Fritz, W. J., 1976, Reinvestigations of the Petrified Forest of Yellowstone National Park, Wyoming and Montana: First Conference on Scientific Research in the National Parks, Abstracts Volume, p. 93.  
Fisk, L. H., 1976, Palynology and paleogeology of the Eocene "Fossil Forest" of Yellowstone National Park, Wyoming, U.S.A.: Fourth International Palynological Conference, Abstracts, p. 52-53.

## **Publications – Selected (cont'd.)**

---

- Fisk, L. H., Christenson, M., and Biaggi, R. E., 1976, Pollen and spore distribution in the nearshore environment of Puget Sound, Washington, U.S.A., Fourth International Palynological Conference, Abstracts, p. 53-54.
- Biaggi, R., Fisk, L. H., and Martinez-Hernandez, E., 1977, Palinología y paleoecología de sedimentos de la Formación La Quinta (Oligo-Mioceno), Chiapas, Mexico, III Coloquio sobre Paleobotánica y Palinología, Programa y Resúmenes, Museo Nacional de Antropología, Chapultepec, Mexico, D.F., p. 19.
- Fritz, W. J., and Fisk, L. H., 1978, Eocene petrified woods from one unit of the Amethyst Mountain "Fossil Forest", *Northwest Geology* 7:10-19.
- Fritz, W. J., and Fisk, L. H., 1979, Paleocology of petrified woods from Amethyst Mountain "Fossil Forest", Yellowstone National Park, Wyoming, pp. 743-749 in: *Proceedings of the First Conference on Scientific Research in the National Parks*, Vol. II, U.S. Department of Interior, National Park Service Transactions and Proceedings Series, no. 5, 1325 p.
- Barnett, J., and Fisk, L. H., 1980, Palynology and paleoecology of a sedimentary interbed in the Yakima Basalt (Miocene), Palouse Falls, Washington, *Northwest Science* 54(4):259-278.
- Fisk, L. H., 1983, A survey of fossil plant biology: a review of Paleobotany--an Introduction to Fossil Plant Biology, *American Association of Stratigraphic Palynologists Newsletter* 15(3):4.
- Fisk, L. H. (Editor), 1983, Palynology of Tertiary Floras of Western North America -- Harry D. MacGinitie Symposium, *American Association of Stratigraphic Palynologists, 16th Annual Meeting, Program with Abstracts*, 21 p.
- Fisk, L. H., and Fritz, W. J., 1984, Pseudoborings in petrified wood from the Yellowstone "Fossil Forests": *Journal of Paleontology* 58:58-62.
- Fritts, S. G., and Fisk, L. H., 1985a, Tectonic model for formation of Columbia Basin -- implications for oil, gas potential of north-central Oregon: *Oil and Gas Journal*, vol. 83, no. 34, p. 84-88.
- Fritts, S. G., and Fisk, L. H., 1985b, Structural evolution of south margin -- relation to hydrocarbon generation: *Oil and Gas Journal*, vol. 83, no. 35, p. 85-90.
- Gilliland, D. S., and Fisk, L. H., 1986, Paleobotany of the Tell Hesbon, Jordan: p. 286-297 in *Hesban 2: Environmental Foundations*, Andrews University Press, Berrien Springs, Michigan, 538 p.
- Fisk, L. H., and Fritts, S. G., 1987, Field guide and roadlog to the geology and petroleum potential of north-central Oregon: *Northwest Geology* 16:105-125.
- Fisk, L. H., Spencer, L. A., Lander, E. B., Gustafson, E. P., and Wagner, H. M., 1994, Beneficial impacts of large construction projects on paleontologic resources -- results from construction of the PGT-PG&E Pipeline Expansion Project, WA-OR-CA: in *Proceedings of the Fourth Conference on Fossil Resources, "Partners in Paleontology: Protecting Our Fossil Heritage"*, Colorado Springs, CO, 276 p.
- Fisk, L. H., and Spencer, L. A., 1994, Highway construction projects have legal mandates requiring protection of paleontologic resources (fossils): p. 213-225, in *Proceedings of the 45th Highway Geology Symposium*, Portland, Oregon, 258 p.
- Fisk, L. H., Lander, E. B., Alderson, J. M., Anderson, E. S., Walker, S. I., Anderson, C. B., and Whistler, D. P., 2001, Late Oligocene and Early to Middle(?) Miocene land plants, upper Piuma Member, Sespe Formation, and Fernwood Member, Topanga Canyon Formation, central Santa Monica Mountains, Los Angeles County, California: *Geological Society of America 2001 Abstracts with Programs*, vol. 33, no. 3, p. 43.
- Fisk, L. H., and Peck, P. R., 2004, A large fossil flora from the Pleistocene older alluvium, Triple M Ranch, Corona, California: *Southern California Academy of Sciences Annual Meeting Abstracts*, p. 20-21.
- Fisk, L. H., 2004, [Review of the book] *In Quest of Great Lakes Ice Age Vertebrates*: *American Association of Stratigraphic Palynologists Newsletter*, vol. 37, no. 4, p. 7-9.
- Fisk, L. H., 2005, Paleoclimate and vegetation record in the Late Pleistocene Palos Verdes Formation ("Older Alluvium") in the San Fernando Valley, southern, California: *Southern California Academy of Sciences Abstracts of Papers*, vol. 104, Supplement to no. 2, p. 29.
- Fisk, L. H., 2005, [Review of the book] *History of Life*: *American Association of Stratigraphic Palynologists Newsletter*, vol. 38, no. 4, p. 6-7.
- Fisk, L. H., 2006, An unusual vegetation record in the Late Pleistocene Palos Verdes Formation ("Older Alluvium") at Burbank in the San Fernando Valley, southern, California, USA: *Palynology*, vol. 30, p. 221.
- Erwin, D. M., Schorn, H. E., Myers, J., Thompson, A., Kouwenberg, L., and Fisk, L. H., 2006, Flora of the northern Sierra Nevada -- past and present: [Field trip guidebook for] *Centennial Celebration of the Botanical Society of America*, Chico, CA, 44 p.
- Wagner, H. M., and Fisk, L. H., 2007, Revised temporal resolution of the late Irvingtonian age Fairmead Landfill fauna, Madera County, California: *Southern California Academy of Sciences Bulletin*, vol. 106, no. 2, p. 141-142.
- Fisk, L. H., and Roeder, M. A., 2007, Paleoenvironmental interpretations of Pleistocene deposits at the Pacific City Project site in Huntington Beach, southern California: *Southern California Academy of Sciences Bulletin*, vol. 106, no. 2, p. 143-144.

## Publications – Selected (cont'd.)

---

- Fisk, L. H., 2009, Paleontological resource protection – a critique of the California model: Proceedings of the 8<sup>th</sup> Conference on Fossil Resources, St. George, UT, p. 64-65.
- Fisk, L. H., and Reynolds, R. E., 2009, Status of the SVP Standard Guidelines for the assessment and mitigation of adverse impacts on paleontological resources: Proceedings of the 8<sup>th</sup> Conference on Fossil Resources, St. George, UT, p. 77-78.
- Fisk, L. H., Lucas-Clark, J., and Pratt, L. R., 2009, Marine dinoflagellates from the Oligocene Otay Formation, San Diego County, southern California: Southern California Academy of Sciences Bulletin, vol. 108, no. 2, p. 125-126.
- Fisk, L. H., Jaecks, G. J., Haasl, D. M., Maloney, D.F., and Roeder, M. A., 2009, Stratigraphic leakage of Tertiary palynomorphs into Bedford Canyon Formation limestone, Santa Ana Mountains, southern California: Southern California Academy of Sciences Bulletin, vol. 108, no. 2, p. 126.
- Davis, J. E., and Fisk, L. H., 2009, Ronald O. Kapp – the man: AASP – The Palynological Society, 42nd Annual Meeting Abstracts Volume, p. 21-22.
- Fisk, L. H., and Davis, J. E., 2009, Ronald O. Kapp – the scientist: AASP – The Palynological Society, 42nd Annual Meeting Abstracts Volume, p. 24-26.
- Fisk, L. H., Jaecks, G. J., Haasl, D. M., Maloney, D.F., and Roeder, M. A., 2009, Stratigraphic leakage of Tertiary palynomorphs into Jurassic Bedford Canyon Formation limestone, Santa Ana Mountains, southern California: AASP – The Palynological Society, 42nd Annual Meeting Abstracts Volume, p. 26.
- Lucas-Clark, J., Fisk, L. H., and Pratt, L. R., 2009, Marine dinocysts from the Oligocene Otay Formation, San Diego County, southern California: AASP – The Palynological Society, 42nd Annual Meeting Abstracts Volume, p. 32-33.
- Haasl, D. M., Fisk, L. H., Maloney, D. F., Perry, F. A., Boessenecker, R., Blakely, S. J., and Pratt, L. R., 2009, Paleontological resource mitigation at Santa Cruz, California: Geological Society of America Abstracts with Programs, vol. 41, no. 7, p. 454-455.
- Fisk, L. H., Kumar, A., Gee, C., and Röper, M., 2010, First report of palynomorphs from the Jurassic Solnhofen Limestone: 8<sup>th</sup> European Palaeobotany-Palynology Conference Program and Abstracts, p. 94-95.
- Powell, II, C. L., Fisk, L. H., Maloney, D. F., and Haasl, D. M., 2010, Biostratigraphy of the San Joaquin Formation in Borrow-Source Area B-17, Kettleman Hills Landfill, North Dome, Kettleman Hills, Kings County, California: U. S. Geological Survey Open-File Report 2010-1140, 32 p.
- Fisk, L. H., Kumar, A., Gee, C., and Röper, M., 2010, A small palynoflora from the Jurassic Solnhofen Limestone: 43<sup>rd</sup> Annual Meeting of AASP – The Palynological Society Program and Abstracts, p. 29-30.
- Fisk, L. H., 2010, Enhanced depth of focus for photomicrography of palynomorphs: 43<sup>rd</sup> Annual Meeting of AASP – The Palynological Society Program and Abstracts, p. 30-31.
- Fisk, L. H., and Reynolds, R. E., 2011, Update on the status of the SVP Standard Guidelines for the assessment and mitigation of adverse impacts on paleontological resources: Proceedings of the 9<sup>th</sup> Conference on Fossil Resources, Kemmerer, WY, Brigham Young University Geology Studies, vol. 49(A), p. 10.
- Fisk, L. H., and Lowenthal, D. J., 2011, CalPaleo 2011 Abstracts with Program: Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., and Pratt, L. R., 2011, Palynology of the early Pleistocene Turlock Lake Formation, Central Valley, California: p. 6 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., and Reynolds, R. E., 2011, Society of Vertebrate Paleontology standard procedures for the assessment and mitigation of adverse impacts to paleontological resources: p. 7 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., Kumar, A., Riding, J. B., and Röper, M., 2011, Preliminary observations and interpretations regarding the age, paleoenvironment, and depositional setting of the late Jurassic Solnhofen Formation – evidence from palynomorphs: p. 8 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., Maloney, D. F., and Haasl, D. M., 2011, Fossil algae and other plant remains from the Pliocene San Timoteo Formation in Riverside County, southern California: p. 9 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., Maloney, D. F., McDaniels, G. E., and Jefferson, G. T., 2011, Fossil mammoth remains from the Riverbank Formation of eastern Fresno: p. 10 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., Pratt, L. R., Haasl, D. M., and Maloney, D. F., 2011, Palynology and paleoecology of the Pleistocene Livermore Gravels, Livermore Valley, central California: p. 11 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.

## Publications – Selected (cont'd.)

- Fisk, L. H., Stewart, J. D., Haasl, D. M., and Maloney, D. F., 2011, Fossils salvaged from the Miocene Sobrante Formation during excavation of the Caldecott Tunnel 4<sup>th</sup> Bore, Contra Costa County, California: p. 12 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Haasl, D. M., Fisk, L. H., and Maloney, D. F., 2011, "Hey, I think we just found a mammoth": p. 14 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Haasl, D. M., Fisk, L. H., Maloney, D. F., Perry, F. A., Boessenecker, R. W., Blakely, S. J., and Pratt, L. R., 2011, Fossil assemblage salvaged from the Mio-Pliocene Purisima Formation, Santa Cruz, California: p. 15 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Wagner, H. M., Fisk, L. H., Lander, E. B., Haasl, D. M., and Maloney, D. F., 2011, Fossils salvaged from the late Miocene Orinda Formation during excavation of the Caldecott Tunnel 4<sup>th</sup> Bore, Contra Costa County, central California: p. 30 *in* Fisk, L. H., and Lowenthal, D. J., CalPaleo 2011 Abstracts with Program, Sierra College, Rocklin, CA, 32 p.
- Fisk, L. H., 2011, Palynology at the 2011 SVP meeting: AASP – The Palynological Society Newsletter, vol. 44, no. 4, p. 20-21.
- Fisk, L. H., 2012, Fossil Legends of the First Americans – a book review: AASP – The Palynological Society Newsletter, vol. 45, no. 1, p. 22-23.
- Clark, M., Lucas-Clark, J., and Fisk L. H. (editors), 2013, San Francisco 2013 Abstracts with Program: AASP-The Palynological Society, San Francisco, CA, 205 p.
- Fisk, L. H., Erwin, D.M., and Elder, W., 2013, Fieldtrip guide to the Napa Valley, Calistoga Petrified Forest, Muir Redwoods, and Golden Gate Bridge Headlands in northern California: AASP-The Palynological Society 46<sup>th</sup> Annual Meeting Pre-Conference Field Trip, San Francisco, CA, 21 p.
- Erwin, D.M., Fisk, L. H., Lawler, D., Gaponoff, S., Lucas-Clark, J., and Doyle, J.A., 2013, An excursion to California's Gold Country in the northern Sierra Nevada: AASP-The Palynological Society 46<sup>th</sup> Annual Meeting Post-Conference Field Trip, 24 October 2013, San Francisco, CA, 79 p.
- Fisk, L. H., Kumar, A., Riding, J. B., and Röper, M., 2013, Observations and preliminary interpretations regarding the age and depositional environment of the late Jurassic Solnhofen Formation – evidence from palynomorphs: p. 84-85 *in* Clark, M., Lucas-Clark, J., and Fisk, L. H. (editors), 2013, San Francisco 2013 Abstracts with Program, AASP-The Palynological Society, San Francisco, CA, 205 p.
- Fisk, L. H., and Pratt, L. R., 2013, Palynology and paleoecology of the early Pleistocene Turlock Lake Formation, Central Valley, California: p. 86 *in* Clark, M., Lucas-Clark, J., and Fisk, L. H. (editors), 2013, San Francisco 2013 Abstracts with Program, AASP-The Palynological Society, San Francisco, CA, 205 p.
- Fisk, L. H., Pratt, L. R., Haasl, D. M., and Maloney, D. F., 2013, Palynology and paleoecology of the Pleistocene Livermore Gravels, Livermore Valley, Central California: p. 87 *in* Clark, M., Lucas-Clark, J., and Fisk, L. H. (editors), 2013, San Francisco 2013 Abstracts with Program, AASP-The Palynological Society, San Francisco, CA, 205 p.
- Kumar, A., and Fisk, L. H., 2013, Recycled Carboniferous pollen and spores in the Panna Formation (Paleocene-Early Eocene) of the Mumbai Offshore Basin, India: possible mega-tsunami triggered turbidity current transport from the Arabian Peninsula to offshore Mumbai: p. 112 *in* Clark, M., Lucas-Clark, J., and Fisk, L. H. (editors), 2013, San Francisco 2013 Abstracts with Program, AASP-The Palynological Society, San Francisco, CA, 205 p.
- Whitlock, C., and Fisk, L., 2013, Estella Leopold, palynologist extraordinaire: p. 194-195 *in* Clark, M., Lucas-Clark, J., and Fisk, L. H. (editors), 2013, San Francisco 2013 Abstracts with Program, AASP-The Palynological Society, San Francisco, CA, 205 p.
- Fisk, L.H., Maloney, D.F., Wagner, H. M., and Haasl, D. M., 2014, Multi-year paleontological mitigation at the Kettleman Hills Landfill – challenges, opportunities, and preliminary results: Proceedings of the 10th Conference on Fossil Resources, Rapid City, SD, May 2014, Dakoterra, vol. 6, p. 40–41.
- Murphey, P.C., Knauss, G.E., Fisk, L.H., Deméré, T.A., Reynolds, R.E., Trujillo, K.C., and Strauss, J.J., 2014, A foundation for best practices in mitigation paleontology: Proceedings of the 10th Conference on Fossil Resources, Rapid City, SD, May 2014, Dakoterra, vol. 6, p. 155–197.
- Knauss, G.E., Fisk, L.H., and Murphey, P.C., 2014, The demographics of mitigation paleontology -- results of an online survey: Proceedings of the 10th Conference on Fossil Resources, Rapid City, SD, May 2014, Dakoterra, vol. 6, p. 269–273.
- Murphey, P.C., Knauss, G.E., Fisk, L.H., Deméré, T.A., Reynolds, R.E., Trujillo, K.C., and Strauss, J.J., 2014, A foundation for best practices in mitigation paleontology: Journal of Vertebrate Paleontology, Program and Abstracts, p. 193
- Fisk, L.H., O'Keefe, J., and Riding, J., 2015, AASP-The Palynological Society bestows upon Dr Thomas D. Demchuk the AASP Board of Directors Award: Palynology vol. 39, part 2, p. 145-146 .
- Fisk, L.H., and Maloney, D.F., 2015, Palynology of the "Slug Bed" in the middle Miocene Barstow Formation in the Mud Hills, Mojave Desert, southern California: p. 130-135 *in* Reynolds, R.E. (editor), Mojave Miocene, The 2015 Desert Symposium Field Guide and Proceedings, California State University Desert Studies Consortium, Fullerton, CA, 335 p.

## Reports - Selected

---

- Fisk, L. H., and Fritz, W. J., 1977, Paleocological investigations of the Eocene Fossil Forest: *in* Annual Report of the Chief Scientist of the National Park Service, U. S. Department of Interior, National Park Service, Washington, D. C., 580 p.
- Fisk, L. H., 1989, Report on the age of lacustrine rocks near Carlin, Nevada: report to Cominco American Resources, Carlin, Nevada, by F & F GeoResource Associates, Inc., Bend, OR, 10 p.
- Spencer, L. A., and Fisk, L. H., 1991, Paleontologic resource assessment/mitigation program, PGT-PG&E Pipeline Expansion Project, Volume I: PGT Section, Oregon, Washington, and Idaho: Report prepared for Federal Energy Regulatory Commission, Pacific Gas Transmission Company, and Bechtel Corporation by Paleo Environmental Associates, Inc., Altadena, CA, 102 p. Fisk, L. H., Spencer, L. A., and Whistler, D. P., 1994, Paleontologic resource impact mitigation on the PGT-PG&E Pipeline Expansion Project, Volume I: Idaho, Washington, and Oregon: Report prepared for Federal Energy Regulatory Commission, Pacific Gas Transmission Company, and Bechtel Corporation by Paleo Environmental Associates, Inc., Altadena, CA, 102 p.
- Fisk, L. H., Spencer, L. A., and Whistler, D. P., 1994, Paleontologic resource impact mitigation on the PGT-PG&E Pipeline Expansion Project, Volume II: California: Report prepared for Federal Energy Regulatory Commission, California Public Utilities Commission, Pacific Gas and Electric Company, and Bechtel Corporation by Paleo Environmental Associates, Inc., Altadena, CA, 123 p.
- Fisk, L. H., Spencer, L. A., and Whistler, D. P., 1994, Paleontologic resource impact mitigation on the PGT-PG&E Pipeline Expansion Project, Volume III: Maps of Fossil Sites: Report prepared for the Federal Energy Regulatory Commission, California Public Utilities Commission, Pacific Gas and Electric Company, and Bechtel Corporation, 22 p.
- Fisk, L. H., and Roeder, M. A., 1996, Paleontologic resource impact mitigation program for the Prima Deshecha Landfill, Orange County, California: Report prepared for the County of Orange, Orange, CA, 12 p.
- Fisk, L. H., and Roeder, M. A., 1996, Paleontologic resource impact mitigation program: Results of pregrading survey and recommendations for monitoring of grading, Foothill Transportation Corridor, Oso Segment, Orange County, California: Report prepared for the County of Orange and Raytheon Engineering Corporation, 11 p.
- Fisk, L. H., and Lander, E. B. 1999, Sutter Power Plant Project Worker/Employee Environmental Awareness Training Program for Paleontologic Resources: Report prepared for the California Energy Commission, Calpine Corporation, and Bechtel Enterprises, by Paleo Environmental Associates, Inc., Altadena, CA, 10 p.
- Fisk, L. H., 1999, Paleontologic resource section of the Newark Energy Center Application for Certification: Report prepared for the California Energy Commission, Foster Wheeler Environmental Corporation, Calpine Corporation, and Bechtel Enterprises, by PaleoResource Consultants, Sacramento, CA, 25 p.
- Fisk, L. H., 1999, Paleontological resource survey and impact assessment on portions of the Pacific Fiber Link Project in northern California: Report prepared for the California Public Utilities Commission, Foster Wheeler Environmental Corporation, and Worldwide Fiber Networks, by PaleoResource Consultants, Sacramento, CA, 34 p.
- Fisk, L. H., 2000, Paleontological resource impact assessment of the Pacific Gas & Electric Pipeline Project in Riverside and Imperial Counties, Southern California: Report prepared for Foster Wheeler Environmental Corporation and PG&E Corporation, by PaleoResource Consultants, Sacramento, CA, 28 p.
- Fisk, L. H., 2000, East Altamont Energy Center Application for Certification Paleontological Resource Section: Report prepared for the California Energy Commission, CH2M Hill Corporation, and Calpine Corporation, by PaleoResource Consultants, Sacramento, CA, 23 p.
- Fisk, L. H., 2000, Final Report on the Paleontological Resource Impact Mitigation Program for the Sacramento Municipal Utility District Sacramento Cogeneration Authority Peaker Project: Report prepared for the California Energy Commission and Sacramento Municipal Utility District, by PaleoResource Consultants, Sacramento, CA, 40 p.
- Fisk, L. H., 2001, Cosumnes Power Plant Project Application for Certification Paleontological Resource Section: Report prepared for the California Energy Commission, CH2M Hill Corporation, and Sacramento Municipal Utility District, by PaleoResource Consultants, Sacramento, CA, 29 p.
- Fisk, L. H., and Lander, E. B., 2001, Sutter Energy Center Project Final Paleontologic Resources Report on the Results of the Monitoring and Mitigation Program: Report prepared for the California Energy Commission, Calpine Corporation, and Bechtel Enterprises, by Paleo Environmental Associates, Inc., Altadena, CA, 50 p.
- Fisk, L. H., 2001, Paleontological resource assessment of the Big Break Regional Shoreline Preserve: Report prepared for East Bay Regional Park District and Basin Research Associates, by PaleoResource Consultants, Sacramento, CA, 23 p.
- Fisk, L. H., 2001, Central Valley Energy Center Project Application for Certification Paleontological Resource Section: Report prepared for the California Energy Commission, CH2M Hill Corporation, and Calpine Corporation, by PaleoResource Consultants, Sacramento, CA, 30 p.
- Fisk, L. H., 2001, Modesto Irrigation District Woodland Generation Station 2 Small Power Plant Exception Application Paleontological Resource Section: Report prepared for the California Energy Commission, CH2M Hill Corporation, and Modesto Irrigation District, by PaleoResource Consultants, Sacramento, CA, 21 p.
- Fisk, L. H., 2002, Paleontological Resource Impact Assessment for Kettleman Hills Landfill Borrow Source Area B-17: Report prepared for the Chemical Waste Management Corporation, by PaleoResource Consultants, Sacramento, CA, 41 p.
- Fisk, L. H., 2002, Salton Sea Geothermal Power Plant Project Application for Certification Paleontological Resource Section: report prepared for the California Energy Commission, URS Corporation, and CalEnergy Corporation, by PaleoResource Consultants, Sacramento, CA, 25 p.
- Fisk, L. H., 2002, A small Middle Miocene fossil flora from the Los Trancos Member of the Topanga Formation salvaged from the Anteatel Recreation Center Project on the campus of University of California, Irvine, California: Report prepared for Discovery Works, Long Beach, CA, by PaleoResource Consultants, Sacramento, CA, 8 p.

### Reports – Selected (cont'd.)

- Fisk, L. H., 2003, Delta Energy Center project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for the California Energy Commission and Calpine Corporation, by PaleoResource Consultants, Sacramento, CA, 43 p.
- Fisk, L. H., 2003, Gilroy Energy Center project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for the California Energy Commission and Calpine Corporation, by PaleoResource Consultants, Sacramento, CA, 35 p.
- Fisk, L. H., 2003, Paleontological resource impact assessment for General Holding, Inc.'s "The Canyons" Subdivision, Northeast Bakersfield, California: Report prepared for the City of Bakersfield, California, by PaleoResource Consultants, Sacramento, CA, 48 p.
- Fisk, L. H., 2003, San Francisco Energy Reliability Project Application for Certification Paleontological Resource Section: Report prepared for CH2M Hill and the San Francisco Public Utilities Commission, by PaleoResource Consultants, Sacramento, CA, 44 p.
- Fisk, L. H., 2003, Blythe Energy Project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for the California Energy Commission and Blythe Energy LLC, by PaleoResource Consultants, Sacramento, CA, 69 p.
- Fisk, L. H., 2004, Magnolia Power Project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for the URS Corporation, Southern California Public Power Authority, and California Energy Commission, by PaleoResource Consultants, Sacramento, CA, 70 p.
- Fisk, L. H., and Peck, P. R., 2004, A Middle Miocene fossil flora from the Los Trancos Member of the Topanga Formation salvaged from construction projects on the campus of University of California, Irvine, California: Report prepared for Chambers Group, Irvine, CA, by PaleoResource Consultants, Sacramento, CA, 15 p.
- Fisk, L. H., 2004, A small Pleistocene fossil flora from the Young Homes Cedar Ranch Project, Crestmore, California: Report prepared for Paleo Environmental Associates, Altadena, CA; Michael Brandman Associates, Irvine, CA; and Young Homes, Rancho Cucamonga, CA, by PaleoResource Consultants, Sacramento, CA, 16 p.
- Fisk, L. H., 2004, State Route 16 Excelsior Road Safety Project paleontological evaluation report: Report prepared for California Department of Transportation, District 3, Sacramento, CA, and URS Corporation, Oakland, CA, by PaleoResource Consultants, Sacramento, CA, 20 p.
- Fisk, L. H., 2004, A large Pleistocene fossil flora from the Quaternary Older Alluvium, Triple M at Chase Ranch Project, Corona, California: Report prepared for L & L Environmental, Corona, CA, by PaleoResource Consultants, Sacramento, CA, 15 p.
- Fisk, L. H., 2004, A small fossil flora from the Quaternary Older Alluvium, Amerige Heights Project, Fullerton, California: Report prepared for Paleo Environmental Associates, Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 9 p.
- Fisk, L. H., and Maloney, D. F., 2004, Woodland Generation Station Unit 2 Project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for the CH2M Hill Corporation, Modesto Irrigation District, and California Energy Commission by PaleoResource Consultants, Sacramento, CA, 112 p.
- Fisk, L. H., 2004, Final report on the results of the paleontological resources mitigation program for the State Route 41 widening project from kilopost 6.8 to 18.5 (post mile 4.2 to 11.5) through Reef Ridge near Kettleman City in southwestern Kings County, California: Report prepared for California Department of Transportation, District 6, Fresno, CA, by PaleoResource Consultants, Sacramento, CA, 137 p.
- Fisk, L. H., 2005, Metcalf Energy Center Project final report on the results of the paleontological resource monitoring and mitigation program: Report prepared for CH2M Hill Corporation, Calpine Corporation, and California Energy Commission, by PaleoResource Consultants, Sacramento, CA, 74 p.
- Fisk, L. H., and Butler, T. M., 2005, Brookwood Subdivision Project paleontological resource impact assessment: Report prepared for ECORP Consulting and Placer County Planning Department, by PaleoResource Consultants, Sacramento, CA, 23 p.
- Fisk, L. H., 2005, Bridgeview Energy Facility application for certification paleontological resource section: Report prepared for URS Corporation and TransCanada Pipeline Company, by PaleoResource Consultants, Sacramento, CA, 41 p.
- Fisk, L. H., 2005, Paleontological resource impact assessment of APN 386-030-13 lying westerly of Morning Drive in northeast Bakersfield, California: Report prepared for the City of Bakersfield, California, by PaleoResource Consultants, Sacramento, CA, 52 p.
- Fisk, L. H., 2005, Havre-Rainbow rebuild project paleontological resource impact assessment: Report prepared for the Western Area Power Administration and Golder Associates, Inc., by PaleoResource Consultants, Sacramento, CA, 95 p.
- Fisk, L. H., 2006, Paleontological resource impact assessment of the Niland Gas Turbine Plant Project: Report prepared for Imperial Irrigation District, Imperial, CA, and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 22 p.
- Fisk, L. H., 2006, Paleontological evaluation report for the U. S. Highway 50 High Occupancy Vehicle Lanes and Community Enhancements Project from kilopost 1.4 to 20.6 (post mile 0.9 to 12.8) in Sacramento County, California: Report prepared for California Department of Transportation, District 3, Sacramento, CA, and URS Corporation, Oakland, CA, by PaleoResource Consultants, Sacramento, CA, 30 p.
- Fisk, L. H., 2006, Paleontological resource impact assessment of the El Centro Gas Turbine Plant Project: Report prepared for Imperial Irrigation District, Imperial, CA, and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 22 p.
- Fisk, L. H., 2006, Paleontological resource impact assessment, Ellis Street Overcrossing Project in the City and County of Madera, California: Report prepared for the City of Madera, CA, and Valley Planning Consultants, Madera, CA, by PaleoResource Consultants, Sacramento, CA, 44 p.
- Fisk, L. H., 2006, A Middle Miocene fossil flora from the Los Trancos Member of the Topanga Formation salvaged from the American Campus Communities Project on the campus of University of California, Irvine, California: Report prepared for Discovery Works, Long Beach, CA, by PaleoResource Consultants, Sacramento, CA, 16 p.

## Reports – Selected (cont'd.)

---

- Fisk, L. H., 2006, Paleontological evaluation report for the West Merced-Bear Creek Structures Replacement Project, State Route 99 from post mile 15.8 to 17.3, Merced County, California: Report prepared for California Department of Transportation, District 10, Fresno, CA, and Parsons Transportation Group, Inc., San Francisco, CA, by PaleoResource Consultants, Sacramento, CA, 44 p.
- Fisk, L. H., 2006, Panoche Energy Center application for certification paleontological resource section: Report prepared for URS Corporation, Santa Barbara, CA, and Duke Energy Generation Services, Cincinnati, OH, by PaleoResource Consultants, Sacramento, CA, 37 p.
- Fisk, L. H., 2006, A Middle Miocene fossil flora from the Los Trancos Member of the Topanga Formation salvaged from the Anteater Recreation Center Project on the campus of University of California, Irvine, California: Report prepared for Discovery Works, Long Beach, CA, by PaleoResource Consultants, Sacramento, CA, 11 p.
- Fisk, L. H., 2006, Paleontological evaluation report for the Herndon Auxiliary Lane Project, State Route 41 from post mile 47.5 to 49.1, Fresno County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Francisco, CA, by PaleoResource Consultants, Sacramento, CA, 42 p.
- Fisk, L. H., 2006, Bullard Energy Center application for certification paleontological resource section: Report prepared for URS Corporation, Santa Barbara, CA, and Duke Energy Generation Services, Cincinnati, OH, by PaleoResource Consultants, Sacramento, CA, 42 p.
- Fisk, L. H., 2006, Starwood Power-Midway, LLC Peaking Project application for certification paleontological resource section: Report prepared for URS Corporation, San Diego, CA, and Starwood Power Corporation, Greenwich, CO, by PaleoResource Consultants, Sacramento, CA, 45 p.
- Fisk, L. H., 2006, St. Joseph Marelo Parish and Life Center Project paleontological resource impact assessment: Report prepared for Williams + Paddon Architects + Planners Inc., Roseville, CA, 1 p.
- Fisk, L. H., 2006, Paleontological resource impact assessment for General Holding, Inc.'s "The Canyons" Subdivision in northeast Bakersfield, California: Report prepared for the Planning Division, City of Bakersfield, CA, by PaleoResource Consultants, Sacramento, CA, 50 p.
- Fisk, L. H., 2006, Fossil woods from the Los Trancos Member of the Topanga Formation salvaged from the Biological Sciences Unit 3 Project on the Campus of University of California, Irvine, California: Report prepared for Discovery Works, Los Alamitos, CA, by PaleoResource Consultants, Sacramento, CA, 16 p.
- Fisk, L. H., 2006, Palynology report on samples from the Moorpark Mammoth site in the City of Moorpark, Ventura County, California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 2 p.
- Fisk, L. H., 2006, Paleontological evaluation report for the Jackson Valley Roadway Project on State Route 88 from post mile 0.0 to 5.5 in Amador County, California: Report prepared for California Department of Transportation, District 10, Fresno, CA, and Parsons Transportation Group, Inc., San Francisco, CA, by PaleoResource Consultants, Sacramento, CA, 46 p.
- Fisk, L. H., 2006, Paleontological mitigation plan, I-580/I-205 Truck Bypass in Alameda and San Joaquin counties, California: Report prepared for California Department of Transportation, District 10, Fresno, CA, and Parsons Transportation Group, Inc., San Francisco, CA, by PaleoResource Consultants, Sacramento, CA, 44 p.
- Fisk, L. H., 2007, Paleontological resource impact assessment of the Ocotillo Power Plant Project: Report prepared for URS Corporation, Santa Barbara, CA, and Competitive Power Ventures, Palm Springs, CA, by PaleoResource Consultants, Sacramento, CA, 42 p.
- Fisk, L. H., 2007, Paleontological resource survey of the northern Smoke Creek Desert, Washoe County, Nevada: Report prepared for Bureau of Land Management, Winnemucca, NV, by PaleoResource Consultants, Sacramento, CA, 173 p.
- Fisk, L. H., 2007, Fossil plant remains from the Pliocene Puente Formation, Pine Valley Estates Project, San Bernardino County, California: Report prepared for SWCA Environmental Consultants, South Pasadena, CA, by PaleoResource Consultants, Sacramento, CA, 5 p.
- Fisk, L. H., 2007, A Middle Miocene fossil flora from the Los Trancos Member of the Topanga Formation salvaged from the Engineering Parking Structure Project on the Campus of University of California, Irvine, California: Report prepared for Discovery Works, Los Alamitos, CA, by PaleoResource Consultants, Sacramento, CA, 17 p.
- Fisk, L. H., 2007, Paleontological resource impact assessment for the Atwater-Merced Expressway Project, Merced County, California: Report prepared for CirclePoint, Merced County Association of Governments, and California Department of Transportation, by PaleoResource Consultants, Sacramento, CA, 49 p.
- Fisk, L. H., 2007, Paleontological evaluation report for the Highway 1 High Occupancy Vehicle Lane Widening Project in Santa Cruz County, California: Report prepared for Parsons Transportation Group, Santa Cruz Regional Transportation Commission, and California Department of Transportation, by PaleoResource Consultants, Sacramento, CA, 45 p.
- Fisk, L. H., and Blakely, S. J., 2007, Anaheim Municipal Power Station application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Goleta, CA, by PaleoResource Consultants, Sacramento, CA, 36 p.
- Fisk, L. H., and Blakely, S. J., 2007, Ausra-Carrizo Solar Farm application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 38 p.
-

**Reports – Selected (cont'd.)**

Fisk, L. H., and Blakely, S. J., 2007, Paleontological evaluation report for the I-215/Van Buren Boulevard Interchange Project on Interstate 215 from post mile 32.3 to 35.9 in Riverside County, California: Report prepared for California Department of Transportation, District 08, San Bernardino, CA, and Kimley-Horn and Associates, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 33 p.

Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan Caldecott Improvement Project: Report prepared for California Department of Transportation, District 04, Oakland, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 65 p.

Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan, Devil's Den Rehab Project: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 61 p.

Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan State Route 180 Sequoia Freeway Segment 3 Project: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 63 p.

Fisk, L. H., and Cornelius, A. E., 2007, Sierra Vista Specific Plan: 2005-147 paleontological resource impact assessment: unpublished report prepared for ECORP Consulting, Inc., and City of Roseville, by PaleoResource Consultants, Sacramento, CA, 32 p.

Fisk, L. H., and Cornelius, A. E., 2007, Paleontological resource impact assessment for San Francisco Public Utilities Commission's Bay Division Pipelines 3 and 4 Crossover Facilities Project: unpublished report prepared for Tetra Tech, Inc., by PaleoResource Consultants, Sacramento, CA, 40 p.

Fisk, L. H., and Cornelius, A. E., 2007, Paleontological resource impact assessment of the Chan property, Placer County, California; unpublished report prepared for ECORP Consulting, Inc. and Placer County Planning Department, by PaleoResource Consultants, Sacramento, CA, 40 p.

Fisk, L. H., and Cornelius, A. E., 2007, Technical Memorandum; paleontological survey South Heart Project: unpublished report prepared for South Heart Coal LLC and Golder Associates, Inc., by PaleoResource Consultants, Sacramento, CA, 35 p.

---

Fisk, L. H., and Cornelius, A. E., 2007, Paleontological survey of a 40 acre parcel of Bureau of Land Management land in northeast Bakersfield, CA: unpublished report prepared for Canyons LLC, Bakersfield, CA and City of Bakersfield, CA, by PaleoResource Consultants, Sacramento, CA, 30 p.

Fisk, L. H., Maloney, D. F., and Peck, P. R., 2007, Fossil plant remains from the Mio-Pliocene Capistrano Formation, Prima Deshecha Landfill, Orange County, California: Report prepared for Chambers Group, Inc., by PaleoResource Consultants, Sacramento, CA, 14 p.

Fisk, L. H., 2008, Fossil Plant Remains from the Pacific City Project, Huntington Beach, California: unpublished report prepared for Professional Archaeological Services, San Diego, CA, 10 p.

Fisk, L. H., and Cornelius, A. E., 2008, Baseline study report; paleontological survey Nelson Creek Project: unpublished report prepared for Nelson Creek Coal LLC and Golder Associates, Inc., by PaleoResource Consultants, Sacramento, CA, 38 p.

Fisk, L. H., and Blakely, S. J., 2008, Hydrogen Energy California application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 46 p.

Fisk, L. H., and Myers, J. A., 2008, Fossil plant remains from the Antelope Valley Landfill near Palmdale, California: Unpublished report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 30 p.

Fisk, L. H., and Cornelius, A. E., 2008, Paleontological resource impact assessment for the I-580 westbound high-occupancy vehicle lane widening project, Alameda County, California: Report prepared for Alameda County Congestion Management Agency, Oakland, CA, California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 46 p.

Fisk, L. H., Jensen, K. G., Maloney, D. F., and Riseley, P. W., 2008, Cretaceous grass-like fossils from the Panoche Formation (Great Valley Sequence) salvaged from the State Route 41 Sunflower II (Cottonwood Canyon) Project in northwestern Kern County, California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 17 p.

Fisk, L. H., Jensen, K. G., Maloney, D. F., and Riseley, P. W., 2008, Palynology report on Quaternary samples from the Avenal Bridge Site, State Route 41 Sunflower II (Cottonwood Pass) Project in northwestern Kern County, California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 8 p.

Fisk, L. H., and Haasl, D. M., 2008, Paleontological evaluation report for the Bradley OH Replacement Project, State Route 140, Merced County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 42 p.

Fisk, L. H., and Blakely, S. J., 2008, Paleontological evaluation report for the Island Park Six Lane Project in Fresno and Madera Counties, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 43 p.

Fisk, L. H., and Blakely, S. J., 2008, Paleontological resource impact assessment, Highway 1 Soquel-Morrissey Project: Report prepared for California Department of Transportation, District 05, Santa Cruz, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 44 p.

Fisk, L. H., and Blakely, S. J., 2008, Paleontological resource impact assessment, SR198 Hanford: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 63 p.

Fisk, L. H., and Cornelius, A. E., 2008, Preliminary paleontological resource impact assessment, Seismic Upgrade of Bay Division Pipelines 3 and 4 at the Hayward Fault Crossing Phase 2: Report prepared for San Francisco Planning Department and San Francisco Public Utilities Commission, San Francisco, CA, 43 p.



**Reports – Selected (cont'd.)**

- Fisk, L. H., 2008, Paleontological evaluation report for the SR198/12th Avenue Interchange Project in Kings County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 39 p.
- Fisk, L. H., and Blakely, S. J., 2008, SES Solar Two application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 58 p.
- Fisk, L. H., and Blakely, S. J., 2008, Watson Cogeneration Steam and Electric Reliability Project application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 43 p.
- Fisk, L. H., Jensen, K. G., and Maloney, D. F., 2008, Fossil plant remains salvaged from excavations for construction of the Rampart Police Station in the City of Los Angeles, Southern California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Sacramento, CA, 16 p.
- Fisk, L. H., and Haasl, D. M., 2008, Final report on the results of the paleontological resources mitigation program for the I-580/I-205 Truck Bypass Project in Alameda and San Joaquin Counties, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 141 p.
- Fisk, L. H., Jensen, K. G., and Maloney, D. F., 2008, Fossil plant remains salvaged from excavations for the Symantec Fox Hills Campus Project in Culver City, California: Report prepared for Archaeo-Paleo Resource Management, Inc., Marina Del Rey, CA, by PaleoResource Consultants, Sacramento, CA, 12 p.
- Fisk, L. H., and Haasl, D. M., 2008, Panoche Energy Center additional substation expansion petition to amend final Commission decision paleontological resource impact assessment: Report prepared for California Energy Commission and URS Corporation, Santa Ana, CA, by PaleoResource Consultants, Sacramento, CA, 12 p.
- Fisk, L. H., and Haasl, D. M., 2008, Final report on the results of the paleontological resources mitigation program for the SR33 Devil's Den Rehabilitation Project 06-KIN-33 PM 0.0/7.8 (KP 0.0/11.7) in Kings County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 138 p.
- Fisk, L. H., and Blakely, S. J., 2008, Hydrogen Energy California Project application for certification paleontological resources technical report: Report prepared for California Energy Commission and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 42 p.
- Fisk, L. H., and Pratt, L. R., 2009, Otay Mesa Final report on the results of the paleontological resources mitigation program for the Upper Northwest Interceptor Section 9 and Northeast Area 1 and 2 Projects, Sacramento County, California: Report prepared for Sacramento Regional County Sanitation District and MWH Americas, Inc., Sacramento, CA, by PaleoResource Consultants, Sacramento, CA, 92 p.
- Jensen, K. G., and Fisk, L. H., 2009, Palynology of two samples of Quaternary sediments collected by Dr. Joyce Lucas-Clark, PhD in the San Francisco Bay area, California: Report prepared for Clark Geological Services Inc., Fremont, CA, by PaleoResource Consultants, Sacramento, CA, 2 p.
- Fisk, L. H., and Mahan, T. S., 2009, Final report on the results of the paleontological resources mitigation program for the SR180, Sequoia Freeway-Segment 3 Project PM R63.3/R66.5 (KP R101.2/R107.0) in Fresno County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 114 p.
- Fisk, L. H., and Haasl, D. M., 2009, West Valley Energy Center application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Oakland, CA, by PaleoResource Consultants, Sacramento, CA, 39 p.
- Fisk, L. H., and Pratt, T. R., 2009, Preliminary paleontological mitigation plan, State Route 46 Expressway Segment 2 06-SLO/KERN-PM 0.0/2.5 (KP 0.0/4.0): Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 62 p.
- Fisk, L. H., and Haasl, D. M., 2009, Paleontological evaluation report Avenue 12 Interchange Project in Madera County, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and URS Corporation, Oakland, CA, by PaleoResource Consultants, Sacramento, CA, 46 p.
- Fisk, L. H., and Pratt, L. R., 2009, Otay Mesa Energy Center final report on the results of the paleontological resources monitoring and mitigation program: Report prepared for California Energy Commission and URS Corporation, San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 75 p.
- Fisk, L. H., and Haasl, D. M., 2009, Panoche Energy Center final report on the results of the paleontological resources monitoring and mitigation program: Report prepared for California Energy Commission and URS Corporation, Santa Ana, CA, by PaleoResource Consultants, Auburn, CA, 61 p.
- Fisk, L. H., and Blakely, S. J., 2009, Soda Mountain Solar Project application for certification paleontological resources section: Report prepared for California Energy Commission and Far Western Anthropological Research Group, Inc., Las Vegas, NV, by PaleoResource Consultants, Auburn, CA, 44 p.
- Fisk, L. H., and Haasl, D. M., 2009, Panoche Energy Center evaporation ponds petition to amend final Commission decision paleontological resource impact assessment: Report prepared for California Energy Commission and URS Corporation, Santa Ana, CA, by PaleoResource Consultants, Auburn, CA, 6 p.
- Fisk, L. H., and Blakely, S. J., 2009, Paleontological resource survey of portions of the Soda Mountains, San Bernardino County, California: Report prepared for Bureau of Land Management, Barstow, CA, by PaleoResource Consultants, Auburn, CA, 51 p.

## Reports – Selected (cont'd.)

---

- Fisk, L. H., Haasl, D. M., and Maloney, D. F., 2009, Fossil plant remains from the Metropolitan Water District of Southern California Inland Feeder Project, Riverside County, California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Auburn, CA, 22 p.
- Haasl, D. M., Fisk, L. H., and Blakely, S. J., 2010, Preliminary report on the biochronology of the Squire Member of the Pismo Formation: Report prepared for Fugro GeoConsulting Services William Lettis and Associates, Inc., Walnut Creek, CA, by PaleoResource Consultants, Auburn, CA, 16 p.
- Haasl, D. M., and Fisk, L. H., 2010, Preliminary paleontological resource impact assessment of the proposed Collinsville Wind Farm: Report prepared for Far Western Anthropological Research Group, Inc., Davis, CA, by PaleoResource Consultants, Auburn, CA, 3 p.
- Fisk, L. H., Haasl, D. M., and Blakely, S. J., 2010, California High-Speed Train Fresno to Bakersfield paleontological resources evaluation: Report prepared for California High-Speed Rail Authority, U. S. Department of Transportation Federal Railroad Administration, and URS Corporation, Oakland, CA, by PaleoResource Consultants, Auburn, CA, 83 p.
- Fisk, L. H., and Maloney, D. F., 2011, Sub-fossil remains salvaged from excavations for construction of the SCLA Water Treatment Plant in the City of Victorville, San Bernardino County, California: unpublished report prepared for ArchaeoPaleo Resource Management, Inc., Marina del Rey, CA, by PaleoResource Consultants, Auburn, CA, 6 p.
- Fisk, L. H., Haasl, D. M., and Kottachchi, N. J., 2011, Paleontological mitigation report for the SR41 North Bound Ramp Meters Project, PM R27.6/R29.8 (KP R44.4/R47.9) in Fresno County, California: unpublished report prepared for URS Corporation and California Department of Transportation, District 06, Fresno, CA, by PaleoResource Consultants, Auburn, CA, 57 p.
- Fisk, L. H., Haasl, D. M., and Kottachchi, N. J., 2011, Paleontological mitigation report for the SR41 Herndon Auxiliary Lane Project, PM R29.5/R30.5 (KP R47.2/R48.8) in Fresno County, California: unpublished report prepared for URS Corporation and California Department of Transportation, District 06, Fresno, CA, by PaleoResource Consultants, Auburn, CA, 55 p.
- Fisk, L. H., and Blakely, S. J., 2011, Paleontological Mitigation Plan [for the] Interstate 215 and Van Buren Boulevard Interchange Project: unpublished report prepared for Kimley-Horn & Associates Inc. and California Department of Transportation, District 08, San Bernardino, CA, by PaleoResource Consultants, Auburn, CA, 36 p.
- Haasl, D. M., and Fisk, L. H., 2011, Paleontological mitigation plan for the State Route 99/Pelandale Avenue Interchange Project: unpublished report prepared for the City of Modesto and California Department of Transportation, District 10, Fresno, CA, by PaleoResource Consultants, Auburn, CA, 40 p. Fisk, L. H., Haasl, D. M., and Pratt, L. R., 2011, Paleontological baseline technical report for the LOSSAN North Rail Corridor Project in San Luis Obispo and Santa Barbara Counties: unpublished report prepared for Parsons Transportation Group Inc. and California Department of Transportation, District 05, San Francisco, CA, by PaleoResource Consultants, Auburn, CA, 115 p.
- Fisk, L. H., and Blakely, S. J., 2011, CPV Sentinel Energy Project paleontological resource monitoring and mitigation plan: unpublished report prepared for CPV Sentinel Energy, LLC and URS Corporation, San Francisco, CA, by PaleoResource Consultants, Auburn, CA, 44 p.
- Fisk, L. H., and Pratt, L. R., 2011, Final report on the results of the paleontological resources mitigation program for the State Route 46 Expressway Segment 2, 06-Slo/Kern-PM 0.0/2.5 (KP 0.0/4.0): unpublished report prepared for URS Corporation and California Department of Transportation, District 06, Fresno, CA, by PaleoResource Consultants, Auburn, CA, 57 p.
- Haasl, D. M., and Fisk, L. H., 2011, Final report on the results of the paleontological resources monitoring and mitigation program for the East Cliff Drive Bluff Stabilization Project: unpublished report prepared for County of Santa Cruz, Santa Cruz, CA, by PaleoResource Consultants, Auburn, CA, 61 p.
- Pratt, L. R., Haasl, D. M., and Fisk, L. H., 2011, Paleontological evaluation report for the Redwood Parkway-Fairgrounds Drive Improvement Project in Solano County, California: unpublished report prepared for CirclePoint and Solano Transportation Authority, Suisun City, CA, by PaleoResource Consultants, Auburn, CA, 42 p.
- Fisk, L. H., Blakely, S. J., and Pratt, L. R., 2011, Paleontological monitoring and treatment plan for the California Valley Solar Ranch Project: unpublished report prepared for San Luis Obispo County, High Plains Ranch II, LLC, and ASM Affiliates, Inc., by PaleoResource Consultants, Auburn, CA, 19 p.
- Fisk, L. H., and Blakely, S. J., 2011, California High-Speed Train Fresno to Bakersfield Section paleontological resources technical report: unpublished report prepared for California High-Speed Rail Authority and U. S. Department of Transportation Federal Railroad Administration, by PaleoResource Consultants, Auburn, CA, 83 p.
- Pratt, L. R., Haasl, D. M., and Fisk, L. H., 2011, Paleontological resources inventory report for the Fulton-Fitch Mountain 60kv Reconductoring Project in Sonoma County, California: unpublished report prepared for Pacific Gas & Electric Company and North Coast Resource Management, by PaleoResource Consultants, Auburn, CA, 38 p.
- Fisk, L. H., and Blakely, S. J., 2011, Paleontological resource impact assessment for the proposed Loomis Basin Equine Medical Center, Penryn, California: unpublished report prepared for Crossroads Ventures Group, by PaleoResource Consultants, Auburn, CA, 2 p.
- Fisk, L. H., and Blakely, S. J., 2011, Paleontological resources report – addendum, Highway 1 High Occupancy Vehicle Lane Project: unpublished report prepared for California Department of Transportation, District 05, by PaleoResource Consultants, Auburn, CA, 7 p.

## Reports – Selected (cont'd.)

- Kramer, D., Winter, J., Herson, L. W., Fisk, L. H., and Haasl, D. M., 2011, Paleontological mitigation plan, State Route 99 Manteca Widening Project, San Joaquin County, California: unpublished report prepared for California Department of Transportation District 06, by HDR, Inc. and PaleoResource Consultants, Auburn, CA, 11 p.
- Haasl, D. M., and Fisk, L. H., 2011, Paleontological mitigation plan for the State Route 99/Pelandale Avenue Interchange Project: unpublished report prepared for California Department of Transportation District 06, PaleoResource Consultants, Auburn, CA, 39 p.
- Fisk, L. H., and Maloney, D. F., 2011, Fossil plant remains salvaged from excavations for the City of Industry Water Recycling Project (Phase IIB) Package 1A in the City of Industry, California: unpublished report prepared for Paleo Environmental Associates Inc. by PaleoResource Consultants, Auburn, CA, 9 p.
- Haasl, D. M., and Fisk, L. H., 2010, Final report on the results of paleontological resource impact mitigation for the Fort Funston Pipe Repair and Replacement Project: Report prepared for City of Daly City, Redwood Engineering, and National Park Service, Redwood City, CA, by PaleoResource Consultants, Auburn, CA, 4 p.
- Fisk, L. H., and Haasl, D. M., 2010, Report on significance of fossils salvaged from the Caldecott 4<sup>th</sup> Bore Project: Report prepared for Contra Costa Transportation Authority and California Department of Transportation Federal Railroad, by PaleoResource Consultants, Auburn, CA, 5 p.
- Haasl, D. M., and Fisk, L. H., 2011, Technical memorandum on potential impacts on paleontological resources during excavations for Dixon Transit Center, West B Street Pedestrian/Bicycle Undercrossing Project in Solano County, California: unpublished report prepared for CirclePoint and City of Dixon by PaleoResource Consultants, Auburn, CA, 3 p.
- Fisk, L. H., and Maloney, D. F., 2012, Site-specific health and safety plan for the Mountain Pass Lateral Project: unpublished report prepared for ASM Affiliates, Inc., Ecology and Environment, Inc., and Kern River Gas Transmission Company by PaleoResource Consultants, Auburn, CA, 44 p.
- Butler, T. M., and Fisk, L. H., 2012, Amoruso Ranch Specific Plan paleontological resource impact assessment: unpublished report prepared for Brookfield Sunset, LLC and VCS Consulting, LLC by PaleoResource Consultants, Auburn, CA, 38 p.
- Blakely, S. J., and Fisk, L. H., 2012, Hydrogen Energy California Project Application for Certification paleontological resources technical report: unpublished report prepared for URS Corporation by PaleoResource Consultants, Auburn, CA, 47 p.
- Blakely, S. J., and Fisk, L. H., 2012, Occidental of Elk Hills, Inc. Block Survey I paleontological resources impact assessment of Sections 5, 6, and 8, T32S R24E and Sections 25-26, T31S R23E in the Buena Vista Hills, Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 40 p.
- Haasl, D. M., and Fisk, L. H., 2012, Paleontological baseline technical report for the Goldfield Mining Project in Esmeralda County, Nevada: unpublished report prepared for International Minerals – Metallic Goldfield, Inc. and Bureau of Land Management by PaleoResource Consultants, Auburn, CA, 19 p.
- Blakely, S. J., and Fisk, L. H., 2012, Paleontological resources impact assessment of Sections 20 and 28 within T31S R23E, Section 32 within T31S R24E, and Section 14 within T32S R24E, Buena Vista Hills, Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 40 p.
- Fisk, L. H., and Maloney, D. F., 2012, Fossil plant remains salvaged from excavations for the City of Industry Water Recycling Project (Phase IIB) Package 1B in the City of Industry, Los Angeles County, California: unpublished report prepared for Paleo Environmental Associates Inc. by PaleoResource Consultants, Auburn, CA, 12 p.
- Blakely, S. J., and Fisk, L. H., 2012, Paleontological resources impact assessment of Sections 11 and 12 within T30S R22E, Elk Hills, Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 45 p.
- Haasl, D. M., Blakely, S. J., and Fisk, L. H., 2012, Final report on the results of the paleontological resources mitigation program for the Non-Unit Gunslinger Project in the Elk Hills, western Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 106 p.
- Fisk, L. H., and Maloney, D. F., 2012, Fossil plant remains salvaged from excavations for the Triunfo Sanitation District Conifer Tank Replacement Project in the unincorporated community of Oak Park in southeastern Ventura County, California: unpublished report prepared for Paleo Environmental Associates Inc. by PaleoResource Consultants, Auburn, CA, 14 p.
- Haasl, D. M., and Fisk, L. H., 2012, Final report on the results of paleontological resource mitigation for the Crest Apartments Seawall Project: unpublished report prepared for Dennis Norton Designs, Capitola, CA, by PaleoResource Consultants, Auburn, CA, 7 p.
- Haasl, D. M., and Fisk, L. H., 2012, CPV Sentinel Energy Project Final Report on the Results of the Paleontological Resources Monitoring and Mitigation Program: unpublished report prepared for California Energy Commission, CPV Sentinel, LLC, and URS Corporation, San Francisco, CA by PaleoResource Consultants, Auburn, CA, 86 p.
- Haasl, D. M., and Fisk, L. H., 2013, Paleontological evaluation report for the SR4-SR160 Connectors Project: unpublished report prepared for California Department of Transportation and Contra Costa Transportation Authority, by PaleoResource Consultants, Auburn, CA, 50 p.
- Haasl, D. M., and Fisk, L. H., 2013, Code of safe practices (site-specific health and safety plan) for the Plainsburg at State Route 99 Project: unpublished report prepared for California Department of Transportation, Fresno, CA, by PaleoResource Consultants, Auburn, CA, 44 p.

### Reports – Selected (cont'd.)

- Fisk, L. H., and Haasl, D. M., 2013, Paleontological mitigation plan for the Highway 129 Curve Realignment Project, Santa Cruz County, California: unpublished report prepared for California Department of Transportation and ICF Jones & Stokes, Inc., Los Angeles, CA, by PaleoResource Consultants, Auburn, CA, 89 p.
- Fisk, L. H., and Haasl, D. M., 2013, Paleontological mitigation plan for the Gaviota Curve Realignment Project, Santa Barbara County, California: unpublished report prepared California Department of Transportation and ICF Jones & Stokes, Inc., Los Angeles, CA, by PaleoResource Consultants, Auburn, CA, 102 p.
- Haasl, D. M., and Fisk, L. H., 2013, Paleontological evaluation report for the Interstate 680 Northbound HOV/Express Lane Project: unpublished report prepared for California Department of Transportation and Alameda County Transportation Commission, Oakland, CA, by PaleoResource Consultants, Auburn, CA, 57 p.
- Fisk, L. H., and Maloney, D. F., 2013, Palynology of sediment samples collected from the Plio-Pleistocene Palm Spring Formation in the Indio Hills, Riverside County, California: unpublished report prepared for Paleo Solutions, Inc., Monrovia, CA, by PaleoResource Consultants, Auburn, CA, 10 p.
- Fisk, L. H., and Maloney, D. F., 2013, Fossil plant remains salvaged from excavations for the Hall of Justice parking structure in the City of Los Angeles, Los Angeles County, California: unpublished report prepared for ArchaeoPaleo Resource Management, Inc., Marina del Rey, CA, by PaleoResource Consultants, Auburn, CA, 14 p.
- Fisk, L. H., and Haasl, D. M., 2014, Granite Bay Island Estates paleontological resource impact mitigation assessment: unpublished report prepared for TRC Solutions, Inc. and Maverick Partners West, Roseville, CA, by PaleoResource Consultants, Auburn, CA, 45 p.
- Butler, T. M., Haasl, D. M., and Fisk, L. H., 2014, Amoruso Ranch Specific Plan paleontological resource impact assessment: unpublished report prepared for Brookfield Sunset, LLC and VCS Consulting, LLC by PaleoResource Consultants, Auburn, CA, 38 p.
- Fisk, L. H., and Haasl, D. M., 2014, The Park at Granite Bay paleontological resource impact assessment: unpublished report prepared for TRC Solutions, Inc. and Maverick Partners West, Roseville, CA, by PaleoResource Consultants, Auburn, CA, 45 p.
- Haasl, D. M., and Fisk, L. H., 2014, Paleontological mitigation report for the Candlestick Point Redevelopment Project, Sub-phase CP-01, San Francisco County, California: unpublished report prepared for Office of Community Investment and Infrastructure and Lennar Urban, San Francisco, CA, by PaleoResource Consultants, Auburn, CA, 22 p.
- Haasl, D. M., and Fisk, L. H., 2014, Paleontological mitigation report for the State Route 26 Sandstone Creek Curve Correction Project, San Joaquin County, California: unpublished report prepared for ICF Jones & Stokes, Inc. and California Department of Transportation, District 10, by PaleoResource Consultants, Auburn, CA, 26 p.
- Fisk, L. H., 2015, Paleontological resource impact assessment for the proposed Douglas Boulevard Senior Living Facility, Placer County, California: unpublished report prepared for Westech Company, Newcastle, CA, by PaleoResource Consultants, Auburn, CA, 2 p.
- Fisk, L. H., 2015, Paleontological resource impact assessment for the proposed Granite Bay Senior Center, Placer County, California: unpublished report prepared for TRC Solutions, Inc. and Maverick Partners West, Roseville, CA, by PaleoResource Consultants, Auburn, CA, 2 p.
- Fisk, L. H., and Haasl, D. M., 2015, Paleontological resource impact mitigation plan for the Candlestick Point Redevelopment Project, Sub-phases CP-02 through CP-05, San Francisco County, California: unpublished report prepared for Office of Community Investment and Infrastructure and Lennar Urban, San Francisco, CA, by PaleoResource Consultants, Auburn, CA, 40 p. .
- Fisk, L. H., Maloney, D. F., and Peck, P. R., 2015, Fossil plant remains salvaged from excavations for the Rancho Mission Viejo Project, Phase 2, Orange County, California: unpublished report prepared for Archaeological Resource Management Corporation, Rancho Palos Verdes, CA, by PaleoResource Consultants, Auburn, CA, 36 p.
- Fisk, L.H., and Haasl, D.M., 2015, Paleontological evaluation report for the Fulton-Fitch Mountain 60 Kv Reconductoring Project in Sonoma County, California: unpublished report prepared for Pacific Gas & Electric and TRC Companies by PaleoResource Consultants, Auburn, CA, 48 p.
- Haasl, D. M., Fisk, L. H., and Wagner, H.M., 2015, Paleontological mitigation report for the State Route 99 Arboleda Drive Freeway Project, Merced County, California: unpublished report prepared for ICF Jones & Stokes, Inc. and California Department of Transportation, District 10, by PaleoResource Consultants, Auburn, CA, 88 p.

**PaleoResource Consultants**  
**F & F GeoResource Associates, Inc.**  
550 High Street, Suite 108, Auburn, CA 95603  
Phone: (530) 885-9696 ~ Fax: (530) 887-2274  
info@paleoresource.com



**Dr. David M. Haasl, PhD**  
Senior Paleontologist

### Experience Summary

Dr. David M. Haasl joined the PRC team with a PhD from the University of California at Davis with a specialization in paleobiology and an M.S. from Western Washington University with an emphasis in invertebrate paleontology. Previously, he was a Museum Scientist and Collections Manager at the University of California, Museum of Paleontology, in Berkeley, California, where he also served as Editor of the journal *PaleoBios*. He has published several scientific papers in paleontology, and has others in preparation.

### Experience Record

2007 – Present	<u>Senior Paleontologist</u> , PaleoResource Consultants, Auburn, CA. Duties: supervises paleontological impact assessments and resource impact mitigation programs requiring monitoring of major earth-moving projects, recovery and collection of fossil remains and fossiliferous rock samples, supervision of field personnel, and preparation of progress and final reports. Also performs fossil identifications and coordinates all museum curations.
2002-2007	<u>Museum Scientist</u> , University of California Museum of Paleontology, Berkeley, CA. Duties: curation and maintenance of fossil and Recent invertebrate collections, loaning specimens to other institutions, providing support for museum outreach programs, and providing record and repository assistance for paleontological consultants.
2004 - 2005	<u>Editor</u> , <i>PaleoBios</i> , the peer-reviewed paleontology journal of UCMP.
2000 - 2002	<u>Adjunct Instructor</u> , California State University, Chico.
2000	<u>Assistant Museum Scientist</u> , University of California Museum of Paleontology, Berkeley, CA. Duties: curation of USGS fossil invertebrate collection.
1998 - 1999	<u>Adjunct Instructor</u> , Woodland Community College, Woodland, CA.
1998 - 1999	<u>Adjunct Instructor</u> , Western Oregon State University, Monmouth, OR
1993 - 1998	<u>Teaching Assistant</u> , Dept. of Geology, University of Calif., Davis.
1992 - 1993	<u>Critical Areas Administrator</u> , Whatcom County, Bellingham, WA. Duties: reviewed building/land disturbance applications for compliance with the geological hazards portion of a growth management regulation.

### Education

PhD, Geology, 2000, University of California Davis, Davis, California  
Dissertation title: Phylogenetic Relationships Among Nassarine Gastropods: Combining Morphologic and Stratigraphic Data

MS, Geology, 1993, Western Washington University, Bellingham, WA  
Master's Thesis Title: Extinction Patterns of Gulf Coast Late Eocene Molluscs: Central Mississippi

BS with High Honors, Geology, 1990, Oregon State University, Corvallis, OR

### **Professional Organizations**

Geological Society of America  
Paleontological Society

### **Publications (Selected)**

- Haasl, D. M., and Hansen, T. A., 1996, Timing of latest Eocene molluscan extinction patterns in Mississippi: *Palaios*, vol 11, p. 487-494.
- Haasl, D. M., 2000, Phylogenetic relationships among nassariine gastropods: *Journal of Paleontology*, vol. 74, p. 839-852.
- Hansen, T. A., Kelley, P. H., and Haasl, D. M., 2004, Paleocological patterns in molluscan extinctions and recoveries; comparison of the Cretaceous-Paleogene and Eocene-Oligocene extinctions in North America: *Palaeogeography, Palaeoclimatology, Palaeoecology*, vol. 214, p. 233-242.
- Pyenson, N. D., and Haasl, D. M., 2007, A whale skeleton-bivalve community from the late Miocene of California: *Biology Letters*, vol. 3, p. 709-711.
- Haasl, D. M., Fisk, L. H., Maloney, D. F., Perry, F. A., Boessenecker, R., Blakely, S. J., and Pratt, L. R., 2009, Paleontological resource mitigation at Santa Cruz, California: Geological Society of America Annual Meeting, Abstracts with Programs, vol. 41, no. 7, p. 454-455.
- Powell, C. L., II, Fisk, L. H., Maloney, D. F., and Haasl, D. M., 2010, Biostratigraphy of the San Joaquin Formation in Borrow-Source Area B-17, Kettleman Hills Landfill, North Dome, Kettleman Hills, Kings County, California: U. S. Geological Survey Open-File Report 2010-1140, 29 p.

### **Reports (Selected)**

- Fisk, L. H. and D. M. Haasl, 2008. Final report on the results of the paleontological resources mitigation program for the SR33 Devil's Den Rehabilitation Project in Kings County, California: unpublished report prepared by PaleoResource Consultants for California Department of Transportation District 6, Fresno, California, 138 p.
- Fisk, L. H. and D. M. Haasl, 2008 Paleontological evaluation report for the Bradley OH Project, State Route 140, Merced County, California: unpublished report prepared by PaleoResource Consultants for California Department of Transportation District 6, Fresno, California, 42 p.
- Fisk, L. H., and Haasl, D. M., 2008, West Valley Energy Center application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Oakland, CA, by PaleoResource Consultants, Sacramento, CA, 39 p.
- Fisk, L. H., and Haasl, D. M., 2009, Panoche Energy Center final report on the results of the paleontological resources monitoring and mitigation program: Report prepared for California Energy Commission and URS Corporation, Santa Ana, CA, by PaleoResource Consultants, Auburn, CA, 61 p.
- Fisk, L. H., and Haasl, D. M., 2009, Panoche Energy Center evaporation ponds petition to amend final Commission decision paleontological resource impact assessment: Report prepared for California Energy Commission and URS Corporation, Santa Ana, CA, by PaleoResource Consultants, Auburn, CA, 6 p.
- Fisk, L. H., Haasl, D. M., and Maloney, D. F., 2009, Fossil plant remains from the Metropolitan Water District of Southern California Inland Feeder Project, Riverside County, California: Report prepared for Paleo Environmental Associates, Inc., Altadena, CA, by PaleoResource Consultants, Auburn, CA, 22 p.
- Haasl, D. M., and Fisk, L. H., 2010, Fossil remains from Las Positas College, Livermore, California: Report prepared for Las Positas Community College, Livermore, CA, by PaleoResource Consultants, Auburn, CA, 45 p.
- Haasl, D. M., Fisk, L. H., and Blakely, S. J., 2010, Preliminary report on the biochronology of the Squire Member of the Pismo Formation: Report prepared for Fugro GeoConsulting Services William Lettis and Associates, Inc., Walnut Grove, CA, by PaleoResource Consultants, Auburn, CA, 16 p.

- Fisk, L. H., Haasl, D. M., and Blakely, S. J., 2010, California High-Speed Train Fresno to Bakersfield paleontological resources evaluation: Report prepared for California High Speed Rail Authority, U. S. Department of Transportation Federal Rail Administration, and URS Corporation, Oakland, CA, by PaleoResource Consultants, Auburn, CA, 83 p.
- Haasl, D. M., and Fisk, L. H., 2010, Preliminary paleontological resource impact assessment of the proposed Collinsville Wind Farm: Report prepared for Far Western Anthropological Research Group, Inc., Davis, CA, by PaleoResource Consultants, Auburn, CA, 3 p.
- Haasl, D. M., and Fisk, L. H., 2010, Final report on the results of paleontological resource impact mitigation for the Fort Funston Pipe Repair and Replacement Project: Report prepared for City of Daly City, Redwood Engineering, and National Park Service, Redwood City, CA, by PaleoResource Consultants, Auburn, CA, 4 p.
- Pratt, L. R., Haasl, D. M., and Fisk, L. H., 2011. Paleontological evaluation report for the Redwood Parkway – Fairgrounds Drive Improvement Project in Solano County, California: report prepared for Solano Transportation Authority and CirclePoint by PaleoResource Consultants, Auburn, CA, 45 p.
- Pratt, L. R., Haasl, D. M., and Fisk, L. H., 2011, Paleontological resources inventory report for the Fulton-Fitch Mountain 60kV Reconductoring Project in Sonoma County, California: report prepared for Pacific Gas and Electric Company and North Coast Resource Management by PaleoResource Consultants, Auburn, CA, 38 p.

## **References**

---

**Client Name and Title:** Mr. Joel LaCagnin  
**Agency/Organization:** Public Works, County of Santa Cruz  
**Address:** 710 Ocean Street, Room 410, Santa Cruz, CA 95060  
**Telephone:** 831-454-2799  
**E-mail:** dpw117@co.santa-cruz.ca.us

**Client Name and Title:** Mr. Richard C. Stewart, PG, Engineering Geologist  
**Agency/Organization:** California Department of Transportation  
**Central Region Environmental Planning Division**  
**Address:** 2015 East Shields Avenue, Suite 100, Fresno, CA 93726  
**Telephone:** 559-243-8229  
**E-mail:** richard\_c\_stewart@dot.ca.gov

**PaleoResource Consultants**  
**F & F GeoResource Associates, Inc.**  
550 High Street, Suite 108, Auburn, CA 95603  
Phone: (530) 885-9696 ~ Fax: (530) 887-2274  
info@paleoresource.com



**Brendan J. Pfeiffer**  
Staff Paleontologist

---

### Experience Summary

Brendan Pfeiffer is a Staff Paleontologist at PaleoResource Consultants. His responsibilities include paleontological field assessments and monitoring on mitigation projects. In addition to field work, Mr. Pfeiffer works in the preparation laboratory cataloging and tracking fossil samples collected from the field and preparing a variety of micro- and macrofossil samples for identification.

Mr. Pfeiffer was initially hired as a summer intern for PaleoResource Consultants and spent three summers during his undergraduate study gaining a wide variety of experience in paleontology. Upon the completion of his B.S. in Geology, Mr. Pfeiffer was hired as a Staff Paleontologist with the company. His experience includes field surveying, fossil recovery and cataloging, daily report generation, and the laboratory preparation and identification of micro- and macrofossils.

---

### Experience Record

2015 - Present	<u>Staff Paleontologist</u> . PaleoResource Consultants, Auburn, CA. Duties include field assessments and monitoring on mitigation projects, specimen salvage, identification, and preparation, and daily report writing.
2014 - 2015	<u>Wellsite Geologist</u> . Columbine Logging Inc., Denver, CO. Duties included rock sampling and identification, the generation of a visual log of the drilling process, and daily report generation. Worked primarily on drill rigs in the Denver-Julesburg Basin.
2010, 2011, 2014	<u>Summer Intern</u> . PaleoResource Consultants, Auburn, CA. Duties included field assessments, screen washing, and the salvage, identification, and preparation of specimens.

---

### Affiliations and Certifications

Rocky Mountain Association of Geologists, Member  
The Paleontological Society, Member  
The Geological Society of America, Member

---

### Education

B.S., Geology, 2014, University of Northern Colorado, Greeley, Colorado.



**Skills**

<b>Computer</b>	Proficient in the Microsoft Office Suite of programs. Proficient with Corel Draw and Photo-Paint. Minor experience with ArcGIS.
<b>Fieldwork</b>	Proficient in geologic field methods including geologic mapping, structural analysis, and stratigraphic data collection. Knowledge of paleontological resource monitoring techniques during construction activities. Proficient in identifying fossils and fossiliferous sediments in the field
<b>Laboratory</b>	Proficient with the Petrographic microscope. Proficient in paleontological preparation laboratory techniques such as fossil specimen preparation, searching screenwashed sediments for microvertebrate remains, photographing, and cataloging fossil specimens. Familiar with basic chemistry procedures and possesses ability to keep accurate laboratory records.

---

**PaleoResource Consultants**  
**F & F GeoResource Associates, Inc.**  
550 High Street, Suite 108, Auburn, CA 95603  
Phone: (530) 885 - 9696 ~ Fax: (530) 887 - 2274  
info@paleoresource.com



**Stephen J. Blakely**  
Project Manager / Staff Paleontologist

### **Experience Summary**

Stephen J. Blakely is a Project Manager and Staff Paleontologist at PaleoResource Consultants, working out of the Auburn office. He is primarily responsible for the management of paleontological resource assessment and monitoring projects, as well as for the preparation of proposals and technical reports. In addition to project management duties, Mr. Blakely performs field surveys for assessments and as a field paleontologist on monitoring projects.

Mr. Blakely also has several years experience working in the construction industry and geological experience working at the University of California at Davis' sedimentology laboratory. He has a background in geology from study at the University of California at Davis. He has contributed on the preparation of numerous paleontological resource impact assessments and surveys, as well as on the preparation of paleontological mitigation and monitoring plans.

### **Experience Record**

2007 – Present     Project Manager/Staff Paleontologist, PaleoResource Consultants, Auburn, California. Manages paleontological resource assessment and mitigation projects. Prepares assessment reports, mitigation plans, and other related documents. Coordinates and performs field assessments and field monitoring activities.

2006                 Research Assistant, Sedimentology Laboratory, University of California at Davis. Processed peat cores from the Sacramento / San Joaquin Delta. Extracted U-Channels for Paleomag analysis; sampled for pollen analysis; archived samples.

### **Affiliations and Certifications**

Geological Society of America - Member  
PASSPORT Contractor Oilfield Safety Training  
BNSF Contractor Railway Safety Training  
e-RAILSAFE Contractor Railway Safety Training

### **Education**

University of California at Davis, Davis, California 2002-2007. Geology.

Sierra College of Rocklin, 2000 – 2002, Geology Student of the Year, 2002.

**Related Course Work**

---

Sedimentology and Stratigraphy, Paleobiology  
Optical Mineralogy and Petrology, Structural Geology  
Spring and Summer Field Geology, Writing in Science

**Skills**

---

- Computer** Comfortable in PC or Mac environments. Proficient in applications in Microsoft Office. Proficient with Corel Draw and Photo-Paint. Knowledge of Adobe Illustrator and Photoshop. Minor experience with ArcGIS.
- Fieldwork** Proficient in geologic field methods including geologic mapping and stratigraphic data collection. Knowledge of paleontological resource monitoring techniques during construction activities. Proficient in identifying fossils and fossiliferous sediments in the field. Knowledge of Total Station operation, GPS, and various geophysical techniques. Has performed numerous paleontological resource assessment surveys and has performed paleontological monitoring in support of paleontological mitigation plans.
- Laboratory** Proficient with the Petrographic microscope. Proficient in searching screen-washed sediments for microvertebrate remains. Familiar with other paleontological preparation laboratory techniques such as photographing and cataloging laboratory specimens. Familiar with basic chemistry procedures and possesses ability to keep accurate laboratory records.
- Communication** Ability to write clearly and concisely. Effective public speaker. Report writing ability.

**SELECTED REPORTS:**

---

- Fisk, L. H., and Blakely, S. J., 2007, Anaheim Municipal Power Station application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Goleta, CA, by PaleoResource Consultants, Sacramento, CA, 36 p.
- Fisk, L. H., and Blakely, S. J., 2007, Ausra-Carrizo Solar Farm application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 38 p.
- Fisk, L. H., and Blakely, S. J., 2007, Paleontological evaluation report for the I-215/Van Buren Boulevard Interchange Project on Interstate 215 from post mile 32.3 to 35.9 in Riverside County, California: Report prepared for California Department of Transportation, District 08, San Bernardino, CA, and Kimley-Horn and Associates, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 33 p.
- Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan Caldecott Improvement Project: Report prepared for California Department of Transportation, District 04, Oakland,

- CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 65 p.
- Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan, Devil's Den Rehab Project: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 61 p.
- Fisk, L. H., and Blakely, S. J., 2007, Paleontological mitigation plan State Route 180 Sequoia Freeway Segment 3 Project: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 63 p.
- Fisk, L. H., and Blakely, S. J., 2008, Hydrogen Energy California application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Denver, CO, by PaleoResource Consultants, Sacramento, CA, 46 p.
- Fisk, L. H., and Blakely, S. J., 2008, Paleontological evaluation report for the Island Park Six Lane Project in Fresno and Madera Counties, California: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Auburn, CA, 43 p.
- Fisk, L. H., and Blakely, S. J., 2008, Paleontological resource impact assessment, Highway 1 Soquel-Morrissey Project: Report prepared for California Department of Transportation, District 05, Santa Cruz, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Sacramento, CA, 44 p.
- Fisk, L. H., and Blakely, S. J., 2008, Paleontological resource impact assessment, SR198 Hanford: Report prepared for California Department of Transportation, District 06, Fresno, CA, and Parsons Transportation Group, Inc., San Diego, CA, by PaleoResource Consultants, Auburn, CA, 39 p.
- Fisk, L. H., and Blakely, S. J., 2008, SES Solar Two application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, San Diego, CA, by PaleoResource Consultants, Auburn, CA, 58 p.
- Fisk, L. H., and Blakely, S. J., 2008, Watson Cogeneration Steam and Electric Reliability Project application for certification paleontological resources section: Report prepared for California Energy Commission and URS Corporation, Denver, CO, by PaleoResource Consultants, Auburn, CA, 43 p.
- Fisk, L. H., and Blakely, S. J., 2009, Soda Mountain Solar Project application for certification paleontological resources section: Report prepared for California Energy Commission and Far Western Anthropological Research Group, Inc., Las Vegas, NV, by PaleoResource Consultants, Auburn, CA, 44 p.
- Fisk, L. H., and Blakely, S. J., 2009, Paleontological resource survey of portions of the Soda Mountains, San Bernardino County, California: Report prepared for Bureau of Land Management, Barstow, CA, by PaleoResource Consultants, Auburn, CA, 51 p.

Blakely, S.B, and Fisk, L.H, 2009, Paleontological resource survey near Chambless, San Bernardino County, California: unpublished report prepared Bureau of Land Management, by PaleoResource Consultants, Auburn, CA, 64 p.

Blakely, S.B, and Fisk, L.H, 2011, Paleontological resource survey of Sections 5, 6, and 8, T32S R24E and Sections 25-26, T31S R23E, Buena Vista Hills, Kern County, California: unpublished report prepared for the United States Department of the Interior Bureau of Land Management, by PaleoResource Consultants, Auburn, CA, 44 p.

Blakely, S. J., Fisk, L. H., and Haasl, D. M., 2011, Fresno to Bakersfield paleontological resources technical evaluation, California High-Speed Train Project EIR/EIS: Report prepared for URS Corporation, California High-Speed Rail Authority, and U.S. Department of Transportation Federal Railroad Administration by PaleoResource Consultants, Auburn, CA, 66 p.

Fisk, L. H., and Blakely, S. J., 2011, CPV Sentinel Energy Project paleontological resource monitoring and mitigation plan: Report prepared for CPV Sentinel, LLC., and URS Corporation, by PaleoResource Consultants, Auburn, CA, 44 p.

Fisk, L. H., and Blakely, S. J., 2011, Paleontological mitigation plan, Occidental of Elk Hills, Inc., Non-Unit Gunslinger Project: Report prepared for Occidental of Elk Hills, Inc., and ASM Affiliates, Inc., by PaleoResource Consultants, Auburn, CA, 49 p.

Fisk, L.H., Blakely, S.J., and Pratt, L., 2011, California Valley Solar Ranch Paleontological Monitoring and Treatment Plan, Report prepared for ASM Affiliates, Inc., High Plains Ranch II, LLC, and San Luis Obispo County Department of Planning and Building, by PaleoResource Consultants, Auburn, CA, 40 p.

Fisk, L. H., and Blakely, S. J., 2011, California High-Speed Train Fresno to Bakersfield Section paleontological resources technical report: unpublished report prepared for California High-Speed Rail Authority and U. S. Department of Transportation Federal Railroad Administration, by PaleoResource Consultants, Auburn, CA, 83 p.

Fisk, L. H., and Blakely, S. J., 2011, Paleontological resource impact assessment for the proposed Loomis Basin Equine Medical Center, Penryn, California: unpublished report prepared for Crossroads Ventures Group, by PaleoResource Consultants, Auburn, CA, 2 p.

Fisk, L. H., and Blakely, S. J., 2011, Paleontological resources report – addendum, Highway 1 High Occupancy Vehicle Lane Project: unpublished report prepared for California Department of Transportation, District 05, by PaleoResource Consultants, Auburn, CA, 7 p.

Blakely, S. J., and Fisk, L. H., 2012, Hydrogen Energy California Project Application for Certification paleontological resources technical report: unpublished report prepared for URS Corporation by PaleoResource Consultants, Auburn, CA, 47 p.

Blakely, S. J., and Fisk, L. H., 2012, Occidental of Elk Hills, Inc. Block Survey I paleontological resources impact assessment of Sections 5, 6, and 8, T32S R24E and Sections 25-26, T31S R23E in the Buena Vista Hills, Kern County, California: unpublished

report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 40 p.

Blakely, S. J., and Fisk, L. H., 2012, Paleontological resources impact assessment of Sections 20 and 28 within T31S R23E, Section 32 within T31S R24E, and Section 14 within T32S R24E, Buena Vista Hills, Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 40 p.

Blakely, S. J., and Fisk, L. H., 2012, Paleontological resources impact assessment of Sections 11 and 12 within T30S R22E, Elk Hills, Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 45 p.

Haasl, D. M., Blakely, S. J., and Fisk, L. H., 2012, Final report on the results of the paleontological resources mitigation program for the Non-Unit Gunslinger Project in the Elk Hills, western Kern County, California: unpublished report prepared for ASM Affiliates, Inc. and Occidental of Elk Hills, Inc. by PaleoResource Consultants, Auburn, CA, 106 p.