



Danielle Verdugo

Staff Consultant

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Ms. Verdugo has 6 years experience identifying and characterizing the earthquake potential of active faults using tectonic geomorphology and paleoseismic analyses. She employs state-of-the-art techniques, including remote sensing, digital field mapping, surveying, and 2-D and 3-D fault trenching to help clients understand and mitigate the impact of active faulting to their projects. Her project experience ranges from characterizing alluvial fan activity for flood hazard assessments to assessing recency in displacements along active fault systems.

EDUCATION

B.S. Geological Sciences, San Diego State University, San Diego, CA

2004

M.S. Geological Sciences, San Diego State University, San Diego, CA

expected 2008

PROFESSIONAL HISTORY

Staff Geologist, Earth Consultants International, Inc., California

Jan 2007 – present

Adjunct Faculty, Grossmont College, El Cajon, CA

Aug – Dec 2007

Research Assistant, San Diego State University, San Diego, CA

Aug 2002 – Jan 2007

PROFESSIONAL AFFILIATIONS

Southern California Earthquake Center

Seismological Society of America

American Geophysical Union

PROJECT EXPERIENCE

Staff Geologist, Fault Hazard Investigation to determine recency of activity of the Agua Dulce fault, for design considerations of the Panama Canal Expansion project, Panamá, 2008. Several expert panel reviews of the hazard data generated by ECI for the Panama Canal Expansion Project revealed the necessity for an additional study of the Agua Dulce fault to generate quantitative data of the fault's seismic history. The Agua Dulce fault potentially impacts the proposed placement of the new expansion locks, which will occupy an area formerly planned for expansion in 1939. ECI excavated five trenches across the fault zone, located, mapped and analyzed terrace deposits in order to constrain the timing of the most recent earthquakes on the fault zone.

Staff Geologist for the investigation of recent displacement of the Las Cruces Trail in the 1621 earthquake on the Pedro Miguel Fault, Central Panamá, 2007. Following the successful characterization of the Pedro Miguel and Miraflores fault hazards, a team of ECI and other geologists recognized that a historical trans-isthmian trail was crossed and displaced by the northern section of the Pedro Miguel fault. This study established the existence of the Pedro Miguel fault at the circa 1500s trail site north of the canal and documented the first historical evidence for the 1621 earthquake, with displacement of the Las Cruces Trail measuring over 3 meters.

Staff Geologist for the quantitative characterization of the Pedro Miguel and Miraflores faults, central Panamá, 2007. Earth Consultants International was retained under contract to the Autoridad del Canal de Panamá (ACP) to conduct detailed studies of the Pedro Miguel and Miraflores faults in the Canal Area of central Panama. As part of the study, we used DEM and stereo aerial photos to

map lineaments and tectonic geomorphic features indicative of active faulting. Following the imagery review, we conducted a field paleoseismic study using both two- and three-dimensional trenching techniques to understand the location and timing of paleoearthquakes and displacement per event for each fault. In total, over 40 trenches were excavated to provide ACP with a detailed and quantitative characterization of fault hazard from the Pedro Miguel and Miraflores faults in and around the Panama Canal region.

Staff Geologist for a geomorphic flood hazard investigation for a proposed housing development in the Coachella Valley, California; 2007. ECI was retained to assist in the development of a realistic flood hazard model to aid in flood mitigation planning for a large residential development. We used a dated soil-chronosequence developed just south of the project site, aerial photo analysis and geomorphic field mapping to evaluate the recency of flooding on the fan. Once the active channels for 100- and 500-year flood events were identified, we surveyed several channel cross-sections across the fan to accurately calculate the depth of past flooding. These data were then incorporated into realistic flood hazard models for use in the design and layout of the new development.

Staff Geologist for a seismic hazard investigation of the San Bernardino Valley College to locate the active traces of the San Jacinto fault for campus redevelopment planning, 2007. The San Bernardino Valley College campus in San Bernardino was constructed upon an elevated pressure ridge (the Bunker Hill Dike) formed along the San Jacinto fault. As part of an overall campus redevelopment planning, this study was undertaken to quantify the fault rupture hazard through the SBVC. In addition to the threat posed by surface rupture, other secondary seismic impacts were addressed, including liquefaction, shaking amplification, and ground deformation due to folding. This project involved the excavation of five trenches within the campus area to eliminate the potential of unknown active traces and areas of deformation along the San Jacinto fault in areas where new buildings are to be erected.

Consulting Geologist for a seismic hazard assessment of the San Vicente Dam Raising Project, Phase IV, San Diego California; 2006. This project involved detailed field mapping, trenching and petrographic analysis of a fault known to underlie San Vicente Dam that, if found to be active, could severely impact the plans to raise the level of the dam, thereby increasing the capacity of the reservoir that provides most of San Diego's drinking water. The fault was first identified in the 1940s during construction of the dam, but its recency of activity appears to have not been assessed at that time. Based on our work we demonstrated that the fault resulted from emplacement of the Mt. Woodson granodiorite, has experienced only very minor post-Cretaceous slip, and is therefore not likely to pose a future surface fault rupture hazard to the dam.

RESEARCH EXPERIENCE

Graduate Thesis Project, 2006-2008. Conducted two investigations into the past earthquake history and slip on two faults in the southern San Jacinto fault system. The first investigation characterized slip per event on the Superstition Mountain fault. I uncovered two channels, each displaced by multiple events over the last 1200 years. The documentation and survey of these channels lead to a calculated slip rate of 5 mm/yr with an average of 1.7 m of displacement in individual events. The second investigation consisted of trenching the North Break of the 1968 Coyote Creek fault rupture. This study found event evidence and displacements totaling less than 1 m of slip in the last 3000 years. This suggests that the southern section of the North Break involved in the 1968 event is the not long-term active strand of the Coyote Creek Fault. I also mapped a previously unrecognized structure less than 1 km from the 1968 break that is a more likely candidate for carrying the 5 mm/yr of slip for this fault.

Research Assistant for a tectonic geomorphological research project of the Clark strand of the San Jacinto fault zone, 2005. Conducted field reconnaissance and identification of tectonic geomorphologic evidence along a section of the Clark strand for a magnitude 7, or greater, historical rupture of the southern San Jacinto fault zone. Slip distribution results show that slip increases towards the aseismic “Anza Gap” in the last event, suggesting Anza to be a possible area

Research Assistant for the Paleoseismic Study of the La Laja Fault, San Juan, Argentina, 2004. Participated in the excavation, cleaning and logging of multiple trenches along the La Laja Fault in eastern Argentina. Conducted a topographic survey of the offset terrace surfaces to quantify vertical deformation across the fault zone proper, as well as off-fault warping and deformation.

Research Assistant for the Paleoseismic Study of the Imperial Fault, 2003. Provided field assistance in the paleoseismic study at Harris Road on the Imperial fault. This included cleaning, gridding and photologging of the trench walls as well as recording unit descriptions and helping with event interpretations.

Research Assistant for a study of the paleoseismology of the Clark strand of the southern San Jacinto fault at Hog Lake, Anza, California, 2002. Provided field assistance in initial round of trenching studies at the Hog Lake site. This included cleaning, gridding and photologging of the trench walls as well as recording unit descriptions and helping with event interpretations.