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PROFESSIONAL SUMMARY

Dr. Thomas Rockwell is an internationally renowned paleoseismologist and geomorphologist. He is an expert on the tectonics of California, Baja California, and Turkey. He has conducted extensive trenching programs to date earthquakes on faults in the western U.S., Middle East, Asia, and Argentina. He routinely uses soil stratigraphy and geomorphology to assess rates and recency of fault activity. Providing input on the age of the soils or geomorphic surfaces of interest, and assisting with fault evaluations to resolve recency and magnitude of movement, he often acts as a consultant for local geotechnical and archaeological consulting firms. In addition to his duties as a professor of neotectonics and Quaternary geology at San Diego State University, Dr. Rockwell has been the principal investigator for numerous research studies funded by the National Science Foundation, the United States Geological Survey, and the Southern California Earthquake Center. He is a Founder of and Senior Partner in Earth Consultants International.

EDUCATION

Ph.D.	Geology, University of California, Santa Barbara	1983
B.S.	Geology, University of Nevada, Reno	1976

PROFESSIONAL HISTORY

Senior Consultant, Earth Consultants International, Inc.	2/1997-present
Professor, San Diego State University	7/1989-present
Associate Professor, San Diego State University	7/1985-7/1989
Assistant Professor, San Diego State University	1/1983-7/1985
Lecturer, California Institute of Technology, Pasadena	9/1982-12/1982
Geologist, Dames and Moore, Los Angeles, California	3/1980-8/1980
Research and teaching assistant at the University of California, Santa Barbara	9/1977-6/1982
Research and teaching assistant at the University of Illinois	9/1980-12/1980
Research and teaching assistant at the University of Nevada	9/1976-12/1976

PROFESSIONAL AFFILIATIONS AND SOCIETIES

- Geological Society of America - Fellow
- Society of Economic Paleontologists and Mineralogists, Pacific Section
- San Diego Association of Geologists
- Association of Engineering Geologists
- Sigma Xi

SELECT PROJECT EXPERIENCE

Project Manager for the seismic hazard assessment of the San Vicente Dam, Phase IV, San Diego California. This project involved detailed field mapping, petrographic analysis and trenching of a fault that is known to be present beneath the San Vicente Dam, and possibly affects the proposed raising of the dam. The fault was first identified in the 1940s during the original construction of the dam, but no records indicated its activity. In our work, we demonstrated that the fault resulted from emplacement of the Mt. Woodson granodiorite and

has experienced only very minor post-Cretaceous slip. Given these findings, the fault's surface fault rupture potential during the lifetime of the dam is considered very low.

Senior Project Geologist for the Seismic Hazard Characterization of the Panama Canal Zone.

This is an ongoing project to characterize all of the known faults within and near the Panama Canal that may pose a seismic risk to the Canal system. Specifically, this is a follow up project to earlier investigations of the Gatún and Limón faults with the intent of quantifying the level of activity within the system. Due to the terrain, this project involves primarily imagery analysis, field mapping and limited subsurface work.

Principal Investigator for a Southern California Earthquake Center- (SCEC) and US Geological Survey- (USGS) funded study on the paleoseismology of the San Jacinto fault zone.

This is an ongoing, multi-year study to characterize the earthquake history and hazards of the central and southern San Jacinto fault located in southern California. Specifically, this project has involved two and three dimensional trenching to resolve the slip and earthquake history of past events, and the reduction of LiDAR data and field mapping to resolve slip distribution for the past several (M7.4) major earthquakes. The Working Group on the Southern California Earthquake Probabilities has used these studies to construct hazard estimates for the region.

Principal Investigator for a National Science Foundation- (NSF) and SCEC-funded group of projects on the study of fault zone damage, rock pulverization and damage asymmetry.

The goal of these projects is to characterize the style and extent of damage formation that results from dynamic ruptures along major faults, and to test whether some faults have a preferred direction of rupture. This will have major implications on estimates of damage intensity resulting from directivity in future earthquakes and can be used as a predictive tool in assessing damage in future large earthquakes.

Project Manager for the Seismic Hazard Assessment of Sabor Dam, Vilarica Basin, Portugal.

This project assessed the activity and hazard associated with the Vilarica fault in northeastern Portugal, as it related to the proposed Sabor Dam. ECI conducted a complete assessment of this fault. This assessment included aerial photography and Landsat imagery analysis, field mapping, paleoseismic investigations at three sites to date the past several events, and 3D trenching at one site to resolve displacement in the past several surface ruptures. This work led to the proper seismic parameters used to design the new dams.

Project Manager for the Seismic Hazard Assessment of the Costa Azul LNG Facility, Baja California, Mexico.

This project involved several phases, including a regional assessment of the site's viability, the seismic source characterization for the site, detailed geologic mapping of the site and surrounding area, determination of the slip rate for the nearby Salsipuedes fault, and site specific trenching to clear each proposed tank pad for the potential of active faults.

Project Manager for the Seismic Hazard Assessment, San Vicente Dam, San Diego California, Phase II.

In this phase, ECI assessed the origin and activity of the inferred "Right Abutment Fault" that potential could have affected the enlargement of San Vicente Dam. Using mapping, trenching and petrographic analysis of rock samples across the fault, we demonstrated that the fault is a minor structure that predated uplift of the Peninsular Ranges in the late Cretaceous and is therefore not a constraint to the dam.

Project Manager and Project Geologist for the Characterization of the Coronado Fault, State Route 75 and 282 Transportation Corridor Project. On this project, ECI assisted Kleinfelder Associates in assessing the activity of the Coronado fault, and determining the design parameters for a proposed transportation tunnel project that crosses the fault. Specific tasks included interpretation of CPT and boring data, and assistance in logging and interpretation of a trench exposure that was emplaced across the fault.

Principal Investigator for a NSF-funded project entitled “Stratigraphic, geomorphic, and paleoseismic record of coseismic fold growth in western Argentina” (collaborative project with Oregon State University). On this project, we wanted to test whether or not the growth stratigraphy and geomorphology provided accurate indications for the timing of past blind thrust earthquakes. To determine this, we used secondary bedding plane faults as proxies for the actual rupture history to compare with the fold history inferred from the other methods. Overall, this project involved trenching, mapping, and a variety of advanced dating techniques.

Senior Consultant for the Seismic Hazard characterization of the Gatún and Limón Faults, central Panama, for the Panama Canal Authority. The Panama Canal Authority is undergoing an extensive planning program to expand the capacity of the existing Canal. As part of this program, considerable concern was raised by Canal geologists about the validity of the existing seismic hazard models being used for seismic risk assessments and design. Earth Consultants International was retained by the Autoridad del Canal de Panamá (ACP) to undertake a paleoseismic investigation of the Gatún and Limón faults. Using 2-D and 3-D trenching techniques, ECI geologists were able to determine that both faults had generated several Holocene earthquakes. The United States Geological Survey is incorporating the determined recurrence intervals and slip rates into a new seismic hazard model.

Senior Consultant for the Geologic Constraints Investigation, Planning, and Environmental Impact Report for a new 35,000-acre resort community in Kern County. As part of the master planning team, Earth Consultants International undertook and completed a phased assessment of the geological and geotechnical constraints to the planning of this large resort and residential project. In Phase I, ECI used existing materials, aerial photographs, and on-site field mapping to delineate the major geological issues: active faulting, liquefaction susceptibility, slope and landslide instability, and flooding. In Phase II, ECI used a series of trenches to locate and delimit the active fault avoidance zones in bedrock, cone penetrometer tests (CPTs), and continuously cored borings to locate and constrain the fault through deep saturated sediments. ECI also participated in the planning process and in the preparation of the environmental documentation for the project Environmental Impact Report (EIR).

Principal Investigator for a USGS-funded study on the “Late Holocene earthquake history of the Brawley fault: Did the 1690 San Andreas earthquake rupture the Brawley fault?” This study involved excavating the first trenches across the Brawley fault in the Imperial Valley to investigate whether large San Andreas fault ruptures propagate as far south as Brawley, and whether a San Andreas rupture could involve the Imperial fault. We excavated a number of trenches to resolve the late Holocene rupture history of this fault, which ruptured in both the 1940 and 1979 earthquakes. We found that most of its activity in the past 300 years began with the 1940 earthquake, suggesting that recent observations of creep and triggered slip may

represent recent acceleration of slip, possibly leading up to failure of the southern San Andreas fault.

Senior Consultant for the Active Fault Constraints Investigation phase of the Planning and Environmental Impact Report for the 17,000-acre “Centennial” project, a new master planned residential community proposed in northern Los Angeles County. As a consultant to the project’s principal geotechnical consultant, Earth Consultants International was tasked with identifying, characterizing, and constraining the active fault hazards within this master planned community immediately adjacent to the San Andreas fault, and near to the Garlock fault. In Phase 1, all previously mapped and newly interpreted faults were compiled into a GIS database. All of these faults were evaluated for mapping accuracy, sense and magnitude of offsets, and their impact on overlying sediments so as to constrain their age. In Phase 2, those faults that could not be demonstrated to be inactive or to not exist, and which were in potential development areas, were trenched and quantitatively evaluated as to age of activity, width of the fault zone, and their impact to the development planning. Fault hazard management zones were recommended, and structural setbacks were established. During subsequent, more detailed geotechnical studies, ECI has been called to provide on-call field review and interpretation of fault features as they are revealed in the field investigation exposures.

Senior Consultant for a coseismic deformation analysis of the Coyote Pass Blind Thrust Fault for design of the Northeast Interceptor Sewer tunnel. Earth Consultants International was retained by the City of Los Angeles to assist in the design of the NEIS tunnel through the area of the Coyote Pass Escarpment, an area of active surface folding associated with a blind thrust fault. Using core data obtained by City geologists for the geotechnical investigation, supplemented with two additional borings, we were able to geographically constrain the passive and active hinges of the fold where the NEIS tunnel would experience deformation strains and tilts in the next earthquake. Using paleoseismic and geomorphic data collected on another study (LA MTA Red Line tunnels), we were able to quantify these coseismically generated strains, extrapolated to the next earthquake. Based on this analysis, the City’s tunnel design engineers were able to design strengthening measures appropriate to resisting the earthquake-generated deformations.

Senior Consultant for the Seismic Hazard Assessment of a proposed LNG Facility in northern Honduras. In this study, we collected and interpreted CPT data to locate faults that potentially could affect placement of tanks. Several faults were first identified in seismic profile lines, and ECI confirmed their presence with CPT data. Using field-based data processing, ECI was able to construct reliable cross-sections of the local deltaic stratigraphy in the field to guide subsequent CPT soundings.

Principal Investigator for a SCEC-funded, multi-year investigation of faults in the Eastern California Shear Zone. With research funding, we developed over thirty trench sites on faults of the Eastern California Shear Zone to investigate its Holocene rupture history. These data lead to the understanding that large earthquakes occur as temporal clusters, with the 1992 and 1999 earthquakes simply being part of the current temporal cluster. In contrast, individual faults have return periods measured in many thousands of years. These data are now incorporated into seismic hazard models for southern California.

Principal Investigator for a USGS-funded investigation into the Paleoearthquake history of the North Anatolia Fault, Western Turkey. In this study, we excavated nearly 50 trenches along several segments of the North Anatolian fault to resolve the rupture history for the past thousand years near Istanbul, one of the largest cities in the Middle East. Based on these studies, and working with historical records of large earthquakes, we generated estimates of likelihood for a near-future earthquake in the Marmara Sea near Istanbul. Planners and politicians in Turkey are using these studies to guide public policy, and retrofit strategies.

Principal Investigator, Fault Rupture Hazard Study for a Cement Plant in Haifa, Israel (2000). The study included a review and compilation of all historical events reported in the area, analysis of these records using the Bakun and Wentworth method to estimate their size and location, and evaluation of the seismic risk posed by the Carmel fault.

Project Manager and Principal Consultant, Fault Investigation of the Sunset Marquis Hotel site in West Hollywood, to look for traces of the Hollywood fault (1999-2000). The study used continuously sampled, hollow-stem borings on transects perpendicular to the fault zone to locate and characterize six fault traces. It was determined that five of these did not offset sediments at least 100ka, and are therefore inactive.

Consultant, Seismic Hazard Assessment for Moorpark Tract 5054, Moorpark, Ventura County, California. The goal of this project was to assess the potential for ground deformation associated with secondary, shallowly, buried thrust faults in the area of the proposed development. A probability analysis of the potential for these faults to rupture or cause ground deformation during the lifetime of the project was provided. Engineering solutions that could be implemented during construction to reduce the hazard posed by these structures were discussed with the client and project engineer.

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