

May 2021



LOS ANGELES BASIN GEOLOGICAL SOCIETY

May 27th (Thursday) – 12:00 Noon

This will be a virtual (on-line) meeting using ZOOM. See below for instructions.

Turning Hills into Mountains: How the collision of the Santa Ana Mountains and the Puente Hills dominate OC's seismic hazard

Eldon Gath

Earth Consultants International

Abstract

About one million years ago, not long by geologic standards, what will become central Orange County was under the waters of the Pacific Ocean, and the beach was to the east, perhaps as far as San Bernardino. Obviously things have changed for the better if you happen to own property in Orange County, but this change has not come without hazard to those properties. Although Orange County has never really experienced its own large earthquake, the earthquake hazard is very real, and it has been the regular occurrence of such large earthquakes that has crafted the landscape of the Orange County that we see today. The Santa Ana Mountains are being driven north episodically about 3-6 feet by M~7 earthquakes on the Elsinore fault where it trends northwest along their eastern flank. This relentless northerly push that started 2-3 million years ago has shoved thousands of feet and 70 million years of OC's sedimentary rocks onto the nose of the granitic-cored mountain range much as a snow plow shoves the snow onto its blade and if angled, out to the side. Meanwhile, about 1 million years ago, the Puente

Hills began to rise above sea level by the push of the Puente Hills thrust fault. As they began to rise, the southern part was scraped off and pushed to the west along an old fault that became the Whittier fault. As the Santa Ana Mountains and the Puente Hills continued to converge, space became a problem, and the younger sediments of the Santa Ana River began to buckle upwards forming the Anaheim, Peralta, and Coyote Hills, and Loma Ridge. The Santa Ana River remains trapped within this zone of collision between the Puente Hills and the Santa Ana Mountains, but the uplift of the Puente Hills in the Santa Ana Canyon has accelerated in the last 100,000 years due to the collision, resulting in highly elevated river gravel terraces on the south flank of the Puente Hills. This collision is pretty complicated but discernable in the landscape and the geology. How it relates to earthquake hazard is also complicated because we only have limited observational data on the Elsinore and Whittier faults, and even more limited and inferential data on the Puente Hills fault. What these data tell us though is that these faults fail in very large (M7+) earthquakes, and all of them are nearing the ends of their

recurrence cycles. However, there are also a myriad of smaller faults (Coyote Hills east and west, Peralta Hills, El Modena, and Chino faults) plus landforms that are suggestive of underlying fault causation (Loma Ridge, Santiago Canyon, Anaheim Hills, and many more). We have no data on the earthquake cycles on these faults. Do they rupture separately in M6.5+ events or do they rupture in conjunction with the Elsinore, Puente or Whittier faults in M7.5+ events? We simply do not know, but we can tell from the microseismicity that they are stressed, and will someday release that stress onto the population of Orange County.

Speaker's Biography

Eldon Gath, President of Earth Consultants International and a 41-year resident of Orange County, has worked on engineering geology projects all over the world but surprisingly few consulting projects actually in Orange County. However he has spent decades looking at, and thinking about, the tectonic geomorphology of Orange County, and this talk is the synthesis of an MS at CSLA (two actually), a PhD at UCR, and a PhD at UCI - all incomplete. Eldon is a Fellow of the GSA; a Life Member and Past President of AEG; the past US National Group Leader and North American VP of IAEG; and an Honorary Member, Board Member, and Past President of SCGS. He served as the GSA/AEG Richard Jahns Distinguished Lecturer in Applied Geology in 2015 and this is one of the talks he presented, though updated with new thoughts (and maybe a little data). Eldon has also been active in the Orange County Historical Society, giving a version of this talk to several historical society groups, though unfortunately the last three scheduled talks had to be postponed, and using the opportunity to bring a bit of geologic history and earthquake hazard awareness to an entirely different OC population.

**This will be a virtual meeting
using Zoom.**

When:

Thursday, May 27, 2021

12:00-1:00 pm

Virtual Meeting Reservations:

Reservations should be made by:

12:00 Noon Wednesday April 21st.

**To register please email our LABGS
secretary, Joseph Landeros at
landerosjd@gmail.com**

This is just to get a head count.

**To join the talk, please use the
following Zoom link (paste it into
your web browser):**

<https://us02web.zoom.us/j/81700685403?pwd=UHF5Sm5zdEpVNDZ5UCs1czgzcjQ3QT09>

ID: 817 0068 5403

Passcode: 340382

**Please download the ZOOM app before
the start of the talk, if you have not
already done so.**

LABGS Student Scholarships

Karla Tucker

LABGS has awarded three scholarships this year with the support of the PSAAPG Foundation. All three are graduate students at CSULB. We are hoping to recognize them in person at our June meeting. Please read a little bit about their research below.



Nader Tavassoli

The near east region is an excellent locality to study the Indian Ocean Summer Monsoon (IOSM) spatial and temporal impact in the Quaternary. Lake Maharlou is situated in the southwest part of Iran and could be considered the most southern end of Zagros ranges to shed light on the IOSM migration extent during the Last Glacial Maximum (LGM) transition. My emphasis is to gather a comprehensive study on Lake Maharlou climatic transition from the LGM to early Holocene, inferred from sedimentological and geochemical data. Lake Maharlou has existed since the early Pleistocene and should have recorded the LGM transition in this region. I will be working on a lake sediment core to reconstruct the past

20,000 years of climatic patterns in the Iranian region and further examine the influence of (IOSM) migration toward higher latitudes in this period.



Ellen Justis

I am a first-year master's student studying island groundwater geochemistry with Dr. Benjamin Hagedorn at California State University Long Beach. My thesis focuses on the evolution of the hydrogeochemistry and alkalinity of tropical island groundwater on Moorea and Tetiaroa (French Polynesia) and the subsequent impacts on surrounding coral reefs. This summer, I will be preparing preliminary datasets and am excited to go to French Polynesia in August.



Kenton Crabtree

Thesis Title: INVESTIGATION OF IN-SITU TEMPERATURE AND PROCESSES OF DIAGENETIC TRANSITION FROM OPAL-A TO OPAL-CT AND THEIR PHYSICAL/CHEMICAL CONTROLS IN THE SUBSURFACE SAN JOAQUIN BASIN, CALIFORNIA

"This project is focused on the Monterey Formation in the San Joaquin Valley investigating temperature windows in which opal-A and opal-CT silica phases undergo diagenesis (dissolution and reprecipitation). The study will address the great spread in the temperatures of the silica phase transitions that have been reported by previous studies, utilizing a variety of different methods. If the depth and temperature of diagenetic transition windows can be better predicted, it may result in changes to current oil well completions and help reduce risk and uncertainty. I am utilizing softwares such as Petrel and PetroMod along with digital well and temperature logs to reconstruct burial histories and temperature ranges at which these rocks were buried and underwent diagenesis."

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ANNOUNCEMENTS:

***Do you know if your PSAAPG/LABGS membership is current?
If you don't know, please check via the PSAAPG website:***

<http://www.psaapg.info/cloud/miscellaneous/dues.php>

Please inform a LABGS Board member if you have a pertinent announcement or chime in at the end of the Zoom meeting.