



LOS ANGELES BASIN GEOLOGICAL SOCIETY

October 2024 Newsletter & 100th Anniversary
of the Pacific Section round up edition!

Borehole Seismic and Fiber Optic Seismic Vector Sensors Applied to Enhanced Oil and Gas Recovery and Geothermal Projects as well as Monitoring California Faults and Pipelines

*Bjorn Paulsson, Michael Wylie, and Ruiqing He
Paulsson Inc., Van Nuys, California*

**Thursday, October 24th, 11:30AM
Signal Hill Petroleum, 2633 Cherry Ave., Signal Hill
2nd floor Conference Room,**

Abstract

The borehole utilization of 3C fiber optic seismic vector sensor technologies (FOSVS) has enabled the detection, recording, and processing of $< M5$ seismic events at frequencies $> 2,000$ Hz, at a depth of 5,500' by monitoring and tracking the injection and flow of CO_2 in a fractured carbonate reef. In one application within an enhanced oil and gas recovery project, the sound of CO_2 injection was correlated to micro seismic events and injection pressure to aid in the dynamic processes underway during injection.

Earthquake monitoring is another application for 3C sensors. The San Andreas Fault (SAF) at Parkfield, California, was mapped as a single-trace, right-lateral, strike-slip fault. The 2004 $M6$ earthquake occurred 11 years later than predicted and ruptured in the opposite direction than anticipated. The disconnect between prediction and outcome illustrates that earthquake prediction science retains large uncertainties. Seven months after the 2004 earthquake, the deployment of an 80-level, 3C, 240-channel, 4,000'-long clamped seismic array at a depth of 9,000' in the San Andreas Fault Observatory at Depth main hole next to the SAF, allowed the monitoring and mapping of small

and large earthquakes for 13 days. Over 400 M3-M5 events were recorded in the borehole array equipped with 15Hz geophones. The USGS in the same period recorded 47 events using surface and near surface seismic sensors. The borehole-hosted seismic data enabled the construction of a detailed velocity model around the SAF which allowed spatial accuracy of the many large and small seismic events from the SAF in greater detail. By analyzing the location of the hypocenters of the largest 100 earthquakes recorded on the borehole array, a clear picture of the SAF's complex structures and dynamics was achieved.

Successful borehole seismic monitoring of the SAF provides strong evidence that large arrays of borehole 3C vector sensors, e.g. geophones or accelerometers, are needed to monitor and understand subsurface dynamic processes such as active earthquake faults as well as fluid injections and extractions, in addition to real-time monitoring of critical infrastructure such as pipelines installed over seismically-active faults.

Biographies

Bjorn N.P. Paulsson, Ph.D., is the CEO and President of Paulsson, Inc., of Van Nuys, California, specializing in borehole seismic methods for 47 years extending to a previous company he formed, Paulsson Geophysical Services, Inc., and as a senior research geophysicist with Chevron. Bjorn has authored more than 50 papers, holds 9 patents with another one in the application process.

Michel T.V. Wylie, Ph.D., is a Senior Principal Engineer with Paulsson, Inc., and serves as their senior optical systems engineer, developing time division multiplexing fiber optic interrogators, Fabry-Perot and Michelson-based interferometric sensors, and conducting borehole seismic surveys.

Ruiqing He, Ph.D., is a Principal Geophysicist with Paulsson, Inc., and has served as their senior seismologist since 2010 and prior worked at PGSI with Bjorn. Ruiqing focuses on analyzing test data from newly-developed fiber optic sensors, field data acquisition and processing of vertical seismic profiles (VSP), in addition to modeling and design for VSPs.

Luncheon prices, cash or check

Lunch and Talk (pre-registered)	\$25.00	Retired:	\$20.00
Student:	\$10.00		
Walk-ins:	\$35.00		

Reservations are required by noon, October 23rd, at labgs.org/meeting_info.html or directly contact LABGS Secretary Joseph Landeros at (626) 497-1710 or landerosjd@gmail.com.

The Pacific Section AAPG Turned 100! It rocked!



The “PS100” celebration hosted by your Society and sponsored by the Pacific Section kicked off on Friday, September 13th at the Whittier Brewery. Many of our usual LABGS suspects were present along with all of the Pacific Section Executive Committee and some notables including Stan and Ginnie Eschner and Mike Clark (all the way from Fairfield). The next day brought a host of very interesting talks at Villalobos Hall, on the beautiful campus of Whittier College, along with a wonderful awards ceremony: our ever steadfast Scholarship Chairperson, Karla Tucker, received the well-deserved Pacific Section Distinguished Service Award and our VP & Program Director Rick Behl received the penultimate Pacific Section Honorary Life Membership Award! Congratulations to Karla and Rick for these achievements!

On Sunday a large portion of our attendees took in a great “petroleum system” mix of Puente Formation source rock and reservoir rock captured in outcrop in the in Hills of the same name: two stops in Turnbull Canyon to see the Sycamore Canyon sandstone and La Vida shale, respectively; one overview stop in the Brea Olinda oil field to observe regional features of the greater eastern Los Angeles Basin; an extremely interesting lunch time poster at the Olinda Oil Museum presented by Tania Gonzales regarding neotectonic activity of the Santa Anas and the Whittier Fault Zone and various implications; add to this the fascinating exhibits of the Olinda Oil Museum exhibits inside and outside; following lunch was the last official stop – a short walk north on the Olinda Oil Trail to see a spectacular drag fold with overturned limbs within the Puente hanging wall along the Whittier Fault Zone. Three bonus stops included additional mind-boggling exposures of the Puente, Fernando, and La Habra formations that can only be described as tectonically active.

Many folks came together to make this event a success - in particular, Rick and Karla - and a special thanks to our Secretary Joe Landeros for some amazing field trip pictures! Thank you to all of those who attended and made the icebreaker, talks, dinner, award ceremony, and field trip so memorable!

Additional photos from the event will be shared in subsequent newsletters.

Pictures from the 100th Anniversary of the Pacific Section



(L), Karla with Dan and (R) Rick with Tony Reid and Becca Schempp at their awards ceremony.



Whittier Brewery, Friday night, September 13th Ice Breaker, left-right: Tony Reid, Dan Steward, Kenton Crabtree, Lisa Alpert, Simmie Chehal, Amy Spaziani, and Kristy Whitaker. To the right, a spectacular regional oil field and wildcat sectioned, canvas map plucked from the old Chevron data collection by Karla, pointing to a talk in progress on Saturday, September 14th at Villalobos Hall, Whittier College.

The Pacific Section AAPG Awards

Honorary Life Membership

Richard J. Behl, Ph.D., Michael P. Nelson

Distinguished Service Award

Karla E. Tucker, Simarjit “Simmie” Chehal, Renee F. Richards, Paul C. Henshaw, Ph.D.

Distinguished Educator Award

Allegra Hosford Scheirer, Ph.D.

Young Professional Distinguished Service Award

Kenton J. Crabtree

Congratulations to all and we thank them for their service to the Pacific Section and their local Geological Societies: Los Angeles, Coast, and San Joaquin.

Thank You Signal Hill Petroleum!

The Executive Committee and the Society at-large would like to sincerely thank Signal Hill Petroleum for their gracious and steadfast support of our monthly meetings by providing a very nice and roomy venue.

Announcement!

Daniel Rice, a 2024 CSU Long Beach geology graduate, has volunteered to join the Society as your new Treasurer! When you have an opportunity, introduce yourself to Daniel and thank him for filling this important position. Daniel lives in Carson, his favorite hobby is scouting new places to go and new food to try, and in support of these endeavors Daniel is currently job hunting in the environmental geology industry. Welcome aboard Daniel and thank you again for your willingness to serve.

LABGS Board Members

President: Dan Steward, (424) 634-6740, daniel@ironhorseenergy.com

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Scholarship Chairperson: Karla Tucker, (714) 658-0474, ktkr2@aol.com

Secretary & Webmaster: Joseph Landeros, (626) 497-1710, landerosjd@gmail.com

“This time, like all times, is a very good one, if we but know what to do with it.”

- *Ralph Waldo Emerson (1802 – 1882)*