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WEDNESDAY, July 20TH, 2011

Tsunami Hazards in the San Diego Region

Presented by

Dr. Mark Legg – Legg Geophysical

Where: **Bali Hai Restaurant**, 2230 Shelter Island Drive, San Diego

When: 5:30 pm – Social Hour
6:30 pm – Dinner
7:15 pm – Program

Dinner: Polynesian Buffet

Cost: $35 per person, Checks made Payable to "SDAG" $5 discount for members, STUDENTS: $20. Walk-Ins and 11th Hour Reservations, please add $5.

Reservations: Make your reservation **online** at www.sandiegogeologists.org, **No later than noon, *Monday*, June 18th.**

SPEAKER ABSTRACT

Tsunami Hazards in the San Diego Region

Dr. Mark Legg, Legg Geophysical, 6541 Gothard St Ste 107, Huntington Beach, CA 92647

Tsunami hazards in the San Diego Region are assessed using newly defined offshore tsunami sources and recently available high-resolution bathymetric/topographic data. Using the Method of Splitting Tsunami (MOST) numerical code (Titov and Synolakis, 1998), we simulate locally, regionally, and distant-generated tsunamis. Local tsunami source models use more realistic fault and landslide data than previous investigations. Most active faults offshore southern California, south of the Transverse Ranges, are strike-slip accommodating the northwest displacement of the Pacific Plate past North America. Because major strike-slip faults have complex geometries with numerous bends and stepovers, there are significant regions of oblique-slip where seafloor uplift or subsidence may occur during large earthquakes. The local tectonic sources for tsunami offshore San Diego include uplift at major restraining bends along the San Clemente, Palos Verdes, and Catalina fault zones, and subsidence along the trantensional Coronado Bank fault zone. Oblique-reverse movement along east-dipping "blind thrusts" is also considered near the coast along the San Mateo and Carlsbad "thrusts". Non-tectonic local sources include major submarine landslides at Thirtymile Bank and Coronado Canyon. Distant sources include major subduction zones around the Pacific Rim. Cascadia Subduction Zone events represent the significant regional tectonic sources.

Except for the Alaska-Aleutian Trench, modeling results suggest that local sources are responsible for the largest waves within San Diego Bay and Mission Bay. Wave heights predicted inside the harbor are consistently smaller than outside because of sheltering by Point Loma, North Island, and the Silver Strand. However, historical accounts, recent tsunami observations, and our predictions show that San Diego Bay is vulnerable to strong tsunami-induced currents. In particular, large currents are expected inside the harbor for various distant and local tsunami sources with estimated flow velocities exceeding 100 cm/s. Such currents have been damaging to harbor facilities, such as wharves and piers, and may cause boats to break from moorings and ram into adjacent harbor structures, as observed in recent historic tsunamis. More recently, following the Mw=9.1 March 11, 2011, Japan earthquake and the M_W=8.8 February 27, 2010, Chile earthquake, tsunami-induced currents damaged docks and piers around Shelter Island confirming our findings. We note that the first generation of inundation maps in use by San Diego County emergency managers was based on much larger "worst case but realistic scenarios" (Synolakis et al. 2002), which reflected the understanding of offshore hazards ten years ago. Large inundation and overland flow depths were observed exclusively in local tsunami source simulations. In particular, locally induced tsunamis appear capable to overtop the Silver Strand. The results suggest that further investigation of local tsunami sources is needed to better understand the risk posed by these low-probability but high-consequence events. We also predict that a coastal community can be devastated by simultaneous large waves at the shoreline and large currents in locations with small flow depths. Coastal areas with narrow lagoons bordered by steep sea cliffs may be particularly vulnerable due to wave amplification at the lagoon entrance. Convulsive sedimentary deposits identified in coastal areas may record large prehistoric tsunamis.

References:

Synolakis, C.E., Borrero, J.C. and Eisner, R. 2002, Developing inundation maps for southern California, in Proceedings of the 2002 Coastal Disasters Conference ASCE Conf, Proc, 258, 848862.

Titov, V.V. and Synolakis, C.E. 1998, Numerical modeling of tidal wave runup, Journal of Waterways, Port, Coastal and Ocean Engineering, ASCE, 124(4), 157-171.

Aggeliki Barberopoulou, Burak Uslu, and Costas Synolakis, USC Tsunami Research Center, Los Angeles, NOAA PMEL, Seattle.

SPEAKER BIO

SPEAKER: **DR. MARK LEGG -** Dr. Legg received a B.S. in Space Sciences & Mechanical Engineering from the Florida Institute of Technology in 1973. At F.I.T, he also studied Physical Oceanography for the M.S. program. Dr. Legg continued his graduate studies in Oceanography at the Scripps Institution of Oceanography, with a National Science Foundation Graduate Fellowship, where he received his M.S. in 1980. In 1985, Dr. Legg completed his Ph.D., Geological Sciences, at the University of California, Santa Barbara. His post-graduate research focused upon the geology and seismotectonics of the California Continental Borderland, with detailed studies of the inner borderland west of San Diego and northern Baja California. While a graduate student, Dr. Legg conducted earthquake hazard and risk analysis research for the J.H. Wiggins Company, and helped the California Division of Mines & Geology (California Geological Survey) map faults and earthquakes in the borderland. After the Ph.D., Dr. Legg expanded his marine seismic exploration skills at the Amoco Tulsa Research Center. Since 1988, Dr. Legg returned to Southern California to continue his offshore faulting and earthquake hazards studies. Recent offshore faulting and earthquake research efforts have included submersible dives (Alvin, Turtle, and Delta) to study borderland faults directly, multibeam swath bathymetry mapping of seafloor structure, and acquisition, processing, and interpretation of MCS and single-channel seismic profiles throughout the borderland. He continues to educate the larger community regarding the seismic hazards of the borderland including the potential for locally-generated tsunamis through seminars and publication. Dr. Legg was awarded the 2002 EERI/FEMA Professional Fellowship to study southern California tsunami hazards with Professor Costas Synolakis at the USC Tsunami Research Center where Dr. Legg continues as a Research Associate. As President of Legg Geophysical, a small consulting firm that specializes in Earth Sciences and Risk Analysis, Dr. Legg is involved in many diverse projects relating to both natural and man-made hazards funded by both government and commercial agencies. He is also a participating scientist with the Southern California Earthquake Center and was awarded the SCEC Outstanding Education Award in 1998 and 2000. Dr. Legg has been an adjunct professor at San Diego State University, and a Visiting Assistant Research Geophysicist at UC Santa Barbara. Ongoing collaboration with scientists at Cal State Long Beach, University of Southern California, Oregon State University and UC Santa Barbara is providing more accurate maps of the Borderland geology for fault and tectonic studies used to evaluate earthquake and tsunami hazards to coastal areas. Most recently, Dr. Legg's work focuses on obtaining high-resolution multichannel seismic reflection images of active tectonic structures in the California Continental Borderland, so that more accurate and precise understanding of the regional tectonic evolution and submarine earthquake potential may be achieved. Dr. Legg has become one of the leading experts on the 3D geometry of active strike-slip fault zones with a focus on areas of oblique-slip as found in restraining bends and releasing stepovers where vertical seafloor displacement during large earthquakes may produce destructive local tsunamis.

2011 SDAG MEETING SCHEDULE – Mark your Calendars!

Meetings are usually on the 3rd Wednesday of the month but may change to accommodate speaker and meeting place schedules. Check here for updates!

August 17, 2011	**Tom Rockwell – EQ recurrence in So Cal versus other parts of the world**
September 14, 2011	**Dave Schug – San Vicente Dam Raise**
October 19, 2011	**SDAG Field Trip Preview with Dr. Gary Girty**

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PRESIDENTS CORNER, JULY 2011

Hi all,

Half-way through summer and the annual field trip is getting close. Keep in mind papers if you have something to submit but haven't yet (like me)! Also keep the date, November 4th through 6th. This will be a quality trip to an area we don't often have opportunity to visit, not to mention the area's closure one year from now!

Our speaker schedule is also shaping up well. In addition to Mark Legg discussing tsunamis at Bali Hai this month and Tom Rockwell discussing earthquakes at Tom Hams Lighthouse next month, we are finalizing plans for Dave Schug to bring us the latest on the San Vicente dam raise in September. Note the September meeting is a week earlier than usual, the second Wednesday rather than third Wednesday.

Due to an out of town commitment I have in July, Todd will be getting some advanced practice on presidents duties like announcements, telling you all that the food is ready, and handing out the speaker gift. Be nice to him and leave the tomatoes at home that evening, ok?

Chuck Houser, President

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2011 SDAG Field Trip: Picacho State Recreation Area and the Cargo Muchachos: Cool Facts, Part I

Gold mining within the Chocolate and Cargo Muchacho Mountains has a long and stored history, yet remains relatively unknown when compared to the other California gold camps of the Sierra Nevadas or the Mojave Desert.

- Gold was first discovered in California by Spanish settlers around 1780, very likely at the Potholes Mining District, where the Laguna Dam now resides. Placer deposits were probably worked by Spanish soldiers.
- Mexican miners were among the first to learn of the 1849 gold rush in Northern California. They were adept at locating gold deposits in places where Anglos were not. American miners were antagonistic toward the Mexicans, and drove them out. By the mid-1850's many resettled in southeastern California and western Arizona and discovered most of the major placer deposits of the area.
- Mexican miners traveled and worked in family groups. Among the methods used in placer deposits was the blanket method. Simply throw sand up in a blanket and let the wind blow the lighter materials away. Gold nuggets remain, while finer gold is captured in the hairs of the blanket.
- While Anglos preferred to develop and mechanize deposits, Mexican miners and their families lived in what could be called subsistence mining, just recovering enough to make a living. When gold petered out, they moved on. This is one of the reasons so little is known of the early mining days of the area.

These tidbits are essentially from one fascinating paper that will be published the guidebook. However, I need support (sponsor donations) to acquire the rights to publish archival mine photos that will further enhance the paper. Please contact your VP Todd Wirths at 858-337-0098 or todd@wirths.com for any suggestions, comments, etc. More to come, thanks!

2011 SDSU

2011 SDSU Geology Department/Alumni Picnic Announcement

When: Saturday, Sept. 10, 2011, 11am-4pm

Where: Santee Lakes, Picnic Spot "O"

What: The Geology Department & AGS will provide burgers and hot dogs, our Alumni Group will provide beverages; please bring a dish to share

Parking: is $5/car or there is ample free parking a short walk away at the intersection of Fanita Parkway and Lake Canyon Rd.

We are looking for someone to bring a volleyball net & ball or any other fun group games! Family & guests are most welcome! Please **RSVP at the Dept. website after Aug. 1.** (www.geology.sdsu.edu)

Association of Earth Science Editors 45th Annual Meeting

"Expanding our Boundaries: Geoscience Editing in the Digital World"

Governors Inn Hotel, Tallahassee, Florida
November 14–17, 2011
Technical sessions November 15–16
Field trip on karst features November 17

For more information about the annual meeting, visit www.aese.org or contact Jane Eggleston, host chair, jegg@usgs.gov, or Carole Ziegler, AESE vice president, technical program chair, sdageditor@gmail.com. AESE is an organization of editors, journal managers, and others involved with publication in the earth sciences. Its purpose is to facilitate cooperation among editors and to promote effective dissemination of earth-science information. AESE maintains liaisons with AGI, AAAS, CSE, EASE, and GSA. The registration fee for the annual meeting includes a one-year membership in AESE. Membership benefits include a subscription to AESE's quarterly digital newsletter, the *Blueline*, and access to a members-only listserv and jobs board. Follow us on our Web site at www.aese.org, on our blog at geoeditors.wordpress.com, on Facebook at tinyurl.com/3n2vrxw, on Twitter at twitter.com/#!/AESErocks, and LinkedIn at tinyurl.com/3scpt7e

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Qualifications Summary and Objective: I have 14 years experience directing surface water quality monitoring programs with a proven record of excelling in monitoring plan implementation, quality control, public notification and continuous improvement in operational effectiveness and efficiency. I have built and maintained relationships with key staff in academia, industry, and all levels of government in San Diego and California. I have a widely applicable skill set which includes: analytical thinking, communication and writing skills, data analysis and management, inter and intra- agency project coordination, and staff supervision and training. My objective is to obtain a career position with an industry leader where I can contribute my skills to build the success of my employer as well grow professionally. Detailed work experience, education and more at www.linkedin.com/in/cbclifton2010. Email cbc2006@cox.net or 619-964-1776. Contact: **Clay Clifton**

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