Seismological Society of America
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Media Advisory – Tip Sheet
Seismological Society of America 2009 Annual Meeting
April 8 - 10, 2009 at
Portola Hotel & Spa in Monterey, California

Information is embargoed until start time of session.

All times Pacific Daylight Time (Pacific Time).

The Seismological Society of America (SSA) is an international scientific society devoted to the advancement of seismology and its applications in understanding and mitigating earthquake hazards and in imaging the structure of the earth.

Wednesday, April 8

►LiDAR technology uncovers new information about active faults in California
Session: Applications of LiDAR Data to the Study of Active Faults
Location: De Anza Ballroom I, Wednesday, April 8, 2:15 p.m.

A laser imaging technology, known as LiDAR, is yielding new information about active faults. The aerial mapping technology emits laser pulses from an instrument mounted on an airplane and returns precise topographical details of the surface, allowing for an unobstructed view despite the cover of foliage or forests. LiDAR is especially useful for analyzing rugged, poorly accessible forested terrain.
Highlights:

- George E. Hilley, et al., examined the topographical changes at two sites: the San Andreas Fault in the Carrizo Plain, California, and the Santa Cruz Mountains, which was the epicenter of the 1989 Loma Prieta earthquake. Using LiDar they studied features on the landscape for what they might suggest about the rates of motion along the faults that push the rock upward. They found that where diverse rock types exist, such as in the Santa Cruz Mountains, differences in the ability of these rocks to resist erosion may leave an imprint on the landscape at least as important as the accrued effects of many earthquakes.

  Hilley explains that mountain ranges represent a balance between the uplift of rock, caused by tectonic processes that include faulting/earthquake rupture, and the rate at which erosion tears down the mountains. The sum of many, many earthquakes causes rocks in mountain ranges like the Santa Cruz Mountains to deform Earth's surface, and as this happens, the effects of erosion takes this rock, turns it into soil or debris that rivers can transport, and moves it out of the mountain range. The rate at which erosion removes the rock is often related to steepness of the landscape. If faulting moves rocks upward very rapidly, then the landscape necessarily must get steeper to move all of that rock out of the mountain range compared to a more gentle landscape in which faults uplift rock much more slowly.

Hilley, et al., used LiDAR data in the Carrizo Plain, and have found that the uplift of rock, driven by motion along the San Andreas Fault, is recorded faithfully by the landscape. When looking at a mountain range the size of the Santa Cruz Mountains, they can no longer assume that the mountain range is made of just dirt - it contains many different rock types, and some rocks may be easier to erode than others. Even if the rate at which faults move rock upward is constant, changes in the strength of rock to resist erosion creates enormous changes in the steepness of the mountain range.

- The use of LiDAR has facilitated new geologic insights about the complex Kern Canyon Fault, which transects the southern Sierra Nevada from Walker Basin northward to the headwaters of the Kern River. Based in part on the new LiDAR data, this active fault is known to be a major contributor to seismic hazard for the two dams at Lake Isabella. Because the fault extends beneath one of the dams, assessments of fault activity, earthquake recurrence, sense of slip, and expected amounts of coseismic rupture are critical for dam safety considerations. Preliminary interpretation of data supports fault-section boundaries suggesting possible fault sections ranging from 13 to 49 km long and rupture segments perhaps as long as about 70 or 80 km. The project is being conducted by the US Army Corps of Engineers, as part of the analysis of dam safety for the Isabella Dams on the Kern River. This analysis involves a systematic, focused investigation program for characterizing seismic hazards and for considering possible alternatives for dam remediation

- Northern San Andreas Fault: Using LiDAR, scientists have produced more precise maps of active fault traces, in particular along the northern San Andreas Fault. This work has also helped scientists to identify new sites where more detailed field work aimed at understanding earthquake recurrence and fault behavior can be done.

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Thursday, April 9

► Understanding risk to Seattle's high-rise buildings from a giant Cascadian earthquake

Session: Deterministic Simulated Ground Motion Records Under ASCE/SEI (7-05: Guidance for the Geotechnical Industry
Location: DeAnza Ballroom 3, Thursday 9 April, 2009, 8:30 a.m.

The Cascadia subduction zone is likely to produce the strongest shaking experienced in the lower 48 states. Although seismic activity in the Pacific Northwest has been relatively low in the past two centuries, there is a growing consensus that this fault zone ruptures in giant earthquakes (magnitude exceeding 9); the last rupture is inferred to have occurred in 1700. What is the risk to high-rise buildings from such a giant earthquake? Although four giant subduction earthquakes occurred elsewhere in the past century, there were no cities with high-rise buildings in the heavily shaken areas for any of these events. Furthermore, ground motions have never been recorded in areas strongly shaken by a giant earthquake.

T. Heaton and J. Yang of Caltech simulated ground shaking from an earthquake similar to the giant Sumatran earthquake (M 9.2) that occurred in 2004, and which is hypothesized to be similar to the giant earthquakes in the Pacific Northwest. The simulated shaking lasts for more than four minutes and it is dominated by low frequency motions. While smaller buildings (e.g., wooden houses) are not particularly susceptible to these low frequency motions, tall buildings resonate at the low frequencies contained in these simulations. The Seattle basin exacerbates the situation by significantly amplifying these long-period motions in the Seattle metropolitan area. Heaton and Yang simulated the response of modern steel 6- and 20-story buildings to the hypothetical ground motions. Although there are many unanswered questions about such a future earthquake, they report that severe damage and possible collapse is indicated in many of their simulations. Buildings that were constructed prior to important building code changes that were made as a result of the 1994 Northridge earthquake are especially vulnerable to this long period shaking. Heaton and Yang report that, given the current state of understanding, there is insufficient knowledge of ground shaking and of building response to ensure the integrity of tall buildings in such an earthquake.

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► California's Central Coast Earthquake Hazards: New information about recently identified faults
Session: California's Central Coast Hazards
Location: DeAnza Ballroom I, Thursday, April 9, 8:30 a.m.

Seismologists are re-evaluating the earthquake potential of the Central Coast, a very complex tectonic region located west of the San Andreas Fault, between Monterey Bay and the Western Transverse Ranges. This area of increasing population growth ranks as one of the top 40 U.S. metropolitan areas with significant earthquake risk.

Speakers from the US Geological Survey, PG&E and academia will compare fresh data to illuminate the complexity of faulting in the central California coastal region.

Three talks will use separate datasets to focus on the California Central Ranges, Hosgri Fault Zone and nearby faults:

- Fault structure of the California Central Coast: Jeanne Hardebeck, US Geological Survey, will present and interpret new earthquake relocations and focal mechanisms for earthquakes occurring along the central California coast, including the offshore region near San Luis Obispo. A prominent newly-observed feature is a 25 km long linear trend of seismicity running just offshore and parallel to the coast-line in the region of Point Buchon. This seismicity trend is accompanied by a linear magnetic anomaly, and both the seismicity and the magnetic anomaly are truncated where they obliquely meet the Hosgri Fault. Focal mechanisms indicate that this feature is a vertical strike-slip fault.

- Geophysical characterization of the Hosgri Fault zone: High-resolution marine magnetic and seismic-reflection data collected offshore Point Buchon show that the Hosgri Fault represents a complex zone of steeply dipping faults that varies significantly in character along strike. The boundary of a northwest-trending linear magnetic anomaly off Point Buchon corresponds to a linear trend of small earthquakes, suggesting an active fault. Continued interpretation and geophysical modeling of magnetic, seismic reflection, and seismicity data will help determine whether or not the magnetic boundaries are fault boundaries, and if so, how these structures relate to the Hosgri Fault Zone.

- Constraints on 3-dimensional structure from gravity and magnetic data: V. E. Langenheim, US Geological Survey, will present analysis based on a new physical dataset that is sensitive to magnetic properties of rock, mapping fault boundaries. Her research suggests complex, non-linear features with intersecting faults. Fault and basin geometry will be important for estimating shaking potential of scenario earthquakes.

►**"Seismic Hazard Risk Mitigation-Intersection of Policy and Politics" by Assemblyman Sam Blakeslee:** Luncheon Address
Thursday, April 9, 2009, 12 noon

Assemblyman Sam Blakeslee will discuss major challenges facing the California Legislature as it seeks to prepare a populous for the next Big One.

►**The impact of 1989 Loma Prieta Earthquake—20 years later**
Session: Advances in science, engineering, public policy and hazard mitigation as a result of the 1989 Loma Prieta earthquake.
Location: DeAnza Ballroom 1, Thursday, April 9, 2009, 1:30 p.m.

The Loma Prieta earthquake transformed the earthquake sciences and engineering and remains a major focus of study, some twenty years later. The 17 October 1989 magnitude 6.9 Loma Prieta earthquake severely shook the San Francisco and Monterey Bay regions and initiated major changes in earthquake science and engineering, disaster response and public policy well beyond California.

The 1989 earthquake epicenter was located near Loma Prieta peak in the Santa Cruz Mountains, approximately 14 km (9 mi) northeast of Santa Cruz and 96 km (60 mi) south-southeast of San Francisco, and it has had perhaps the most profound societal impact of any U.S. earthquake.

Direct observations and instrumental recordings of the earthquake and its damaging effects on the region's infrastructure have led to improved understanding in earthquake processes, including earthquake forecasting, fault interaction and how one large earthquake may trigger another, ground motions, site response, liquefaction and building response as well as significant improvements to building codes and design standards for lifelines. Major programs such as the Caltrans bridge seismic retrofit program, San Francisco's Building Occupancy Resumption Program (BORP), and the California Seismic Hazards Mapping Program came about because of the 1989 earthquake.

In this session, speakers from the public and private sectors will address the advances in science, engineering, public policy and hazard mitigation that resulted directly from the Loma Prieta earthquake.

Two talks provide broad overviews of the earthquake's legacies:

- Thomas L. Holzer and Robert L. Wesson, U.S. Geological Survey, describe how Loma Prieta alerted the nation to its earthquake hazard and prompted new earthquake hazard assessments in the central U.S. and southern California, and the continuance of the program in the Pacific Northwest where the potential for major earthquakes was just starting to be recognized. They also describe how the "successful" forecasting of the earthquake prompted intensive efforts to improve long-term earthquake forecasting, and how changes in the rate of earthquakes and creep on the Hayward Fault confirmed that the release of earthquake strain can affect the earthquake potential of nearby faults. Loma Prieta was one of the best recorded earthquakes in U.S. history and these records led to significant changes in the building code, particularly in how local soil conditions are taken into account. Despite the $4 million investment in studying the earthquake, important questions remain unanswered. For example, the Lake Elsman foreshocks that preceded Loma Prieta remain a mystery and illustrate the challenge of recognizing foreshocks before a large earthquake.

- Chris Poland, Degenkolb Engineers, describes the legacy of the earthquake on state and local public policy. The California Seismic Safety Commission prepared an action plan that led to numerous programs and projects including the Hospital Facilities Seismic Safety Act. The California Geologic Survey initiated mapping of areas with potentially serious seismic hazards from landslides and liquefaction. Images of the earthquake prompted many local cities to recognize and to start mitigating the risks that they faced. Communities also committed to post-earthquake inspection of buildings when the need for quick post-earthquake re-occupancy became apparent.

Two talks address current initiatives:

- FIRE! Are fire and water agencies adequately prepared for a major earthquake today? Fire following the 1989 earthquake caused the greatest U.S. earthquake-related loss since 1906. The recent ShakeOut Scenario in Southern California involved over 5 million people and concluded that approximately 1,600 ignitions following a M7.8 earthquake on the San Andreas Fault would destroy about 200 million sq. ft. of building floor area accompanied by hundreds to perhaps a thousand deaths, a loss of $40 to $100 billion dollars and hundreds of thousands homeless. This Invited Speaker will discuss reducing this "fire-following" problem via improvements to protect densely built neighborhoods. He will depart the meeting immediately following his talk (DeAnza Ballroom 1, Thursday April 9, 2pm) in order to address the San Francisco Fire Commission

- The San Francisco Department of Building Inspection is assessing anew the City's seismic risk – the likely impact of future earthquakes on buildings citywide. Debra Walker, member of the San Francisco Building Inspection Commission, will address pending policy recommendations regarding seismic risk to soft story, wood-frame buildings, which typically have large openings on the ground floor, making the first story weak or "soft" and the building vulnerable to falling over during an earthquake. The recommendations were recently submitted to Mayor Newsom for consideration.

► Yellowstone earthquake swarms
Session: Volcano Monitoring Using Seismology and Complementary Methods
Location: Bonsai Ballroom, Thursday, 9 April, 2009, 1:30 p.m.

The second largest earthquake swarm ever recorded in Yellowstone National Park occurred during the two weeks from 27 December 2008 and 7 January 2009 and included more than 1000 earthquakes. Analysis of the swarm suggests epicenters migrated north over the 12 day period and maximum hypocenter depths abruptly shallowed from 12 km to 3 km depth at the time of rapid cessation of activity on Jan. 7. Source properties of the swarm earthquakes suggest that the swarm may be due to the movement of hydrothermal fluids through pre-existing cracks, as suggested by recent analysis by University of Utah scientists.

The Yellowstone Volcano Observatory (YVO) was created as a partnership among the U.S. Geological Survey (USGS), Yellowstone National Park, and University of Utah to strengthen the long-term monitoring of volcanic and earthquake unrest in the Yellowstone National Park region. Yellowstone is the site of the largest and most diverse collection of natural thermal features in the world and the first National Park

Friday, April 10

► Silver Creek Fault in downtown San Jose, Calif.
Session: Active-Source Seismic Imaging—Characterizing the Subsurface
Posters: Location: Serra I, Friday, April 10, 2009, 8:30 a.m.

Active-source seismology is the chief investigative tool for imaging the Earth's crust. This paper focuses on the use of active-source seismic studies to image faults, basin geometry, groundwater, geologic hazards and the local and regional tectonic setting.

Silver Creek Fault in downtown San Jose, California: The Silver Creek fault has been mapped in the hills south of San Jose, from east of Morgan Hill to the alluvial-covered parts of the Santa Clara Valley, where it is presumed to extend farther northwestward beneath downtown San Jose. To more precisely locate the Silver Creek fault within the city of San Jose, Rufus Catchings, et al., acquired seismic profiles across the fault zone in 1999 and in 2007. Because the fault zone extends beneath downtown San Jose, the fault may pose a significant seismic hazard to the region.

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► Imaging and Discovery from USArray and EarthScope
Location: DeAnza Ballroom II, Friday, April 10, 2009, 1:30 p.m.

Unprecedented dense deployment of EarthScope USArray Transportable Array, Flexible Array and Magnetotelluric instruments is providing data that are being used to develop a new generation of high-resolution Earth models and understanding of structure and processes. Fresh observations:

- Earthscope Gradiometry: Charles A. Langston, et al., will discuss a new tool for understanding seismic waves by taking a snapshot of how seismic waves propagate across the United States. Rather than evaluate how the ground shakes as seismic waves pass through, this tool looks directly at the seismic wave and how it behaves. Using a newly developed theory, this research offers an entirely new way to consider seismic waves, opening new fields of study.

- Evolution and Effects on the Western U.S. of the Yellowstone Hotspot and Mantle Plume: The Yellowstone hotspot resulted from interaction of a mantle plume with the overriding N. America plate producing a ~800-km wide, ~300-m high topographic swell centered on Yellowstone and produced the 800 km-long, 17 Ma Yellowstone-Snake River Plain volcanic field. Scientists have observed an unprecedented episode of caldera uplift, up to 7 cm/yr from 2004-2008 -- an accelerated rate of 2-3 times the rate recorded in historic time that is consistent with magma intrusion rate of 0.1 km^^3/year, or tens of times larger than the average annual rate of mapped uplift of the caldera. Extrapolating the location of the Yellowstone mantle-source southwestward to an initial position at 17 million years ago beneath eastern Oregon and the southern LIP Columbia Plateau basalt field, suggests a common mantle source for these features. Robert Smith, et al., suggest that the original plume ascended vertically behind the subducting Juan de Fuca plate, but at ~12 Ma became entrained in faster mantle flow beneath continental lithosphere and became tilted into its present configuration

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