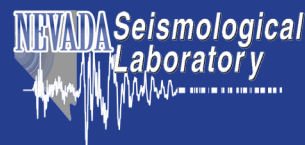
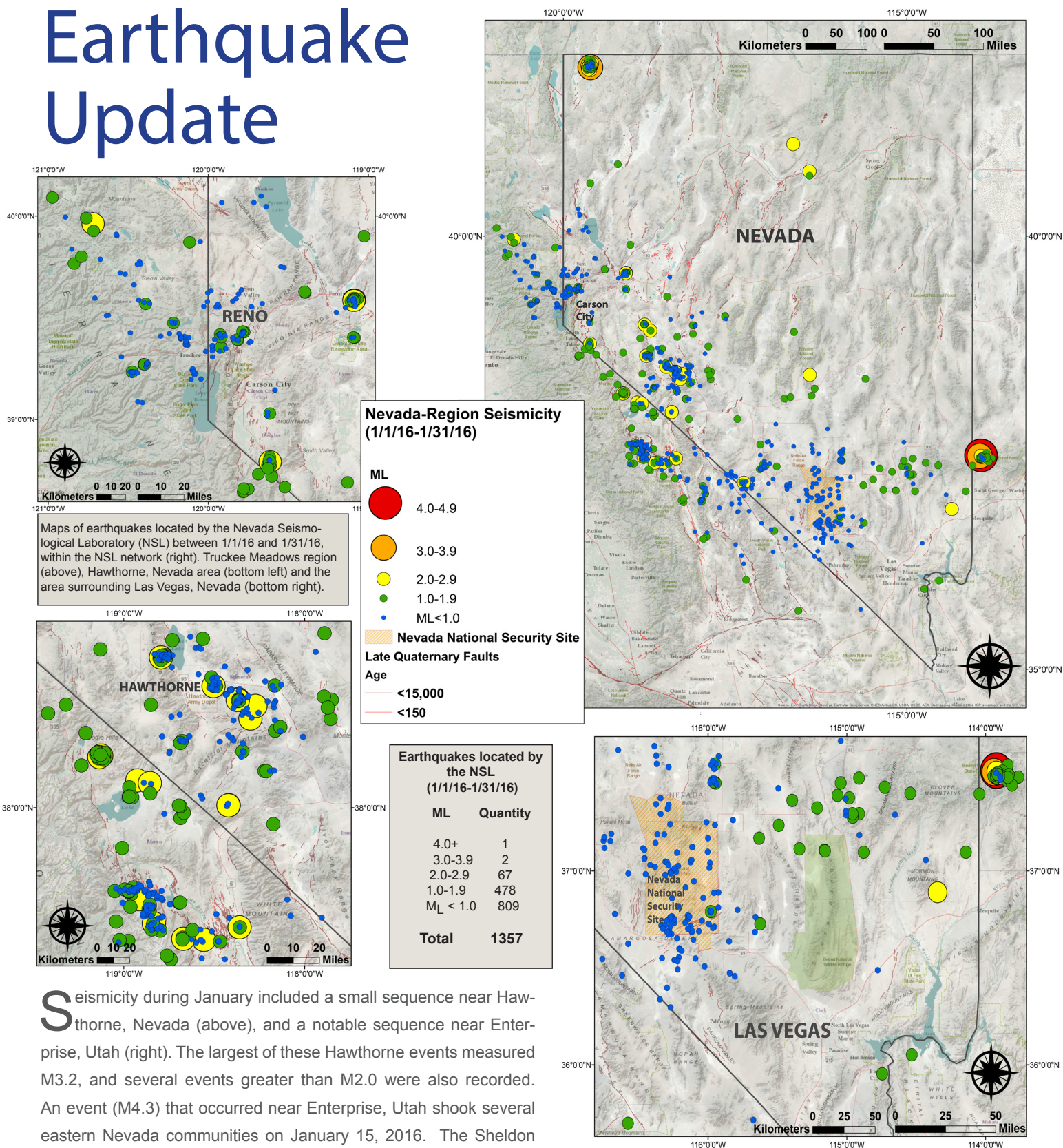


WHAT'S SHAKING



newsletter of the
THE NEVADA SEISMOLOGICAL LABORATORY

Earthquake Update



Seismicity during January included a small sequence near Hawthorne, Nevada (above), and a notable sequence near Enterprise, Utah (right). The largest of these Hawthorne events measured M3.2, and several events greater than M2.0 were also recorded. An event (M4.3) that occurred near Enterprise, Utah shook several eastern Nevada communities on January 15, 2016. The Sheldon Sequence also continues to be active in northwestern Nevada.

Maps compiled by D. Molisee (2016)

DEVELOPMENTS

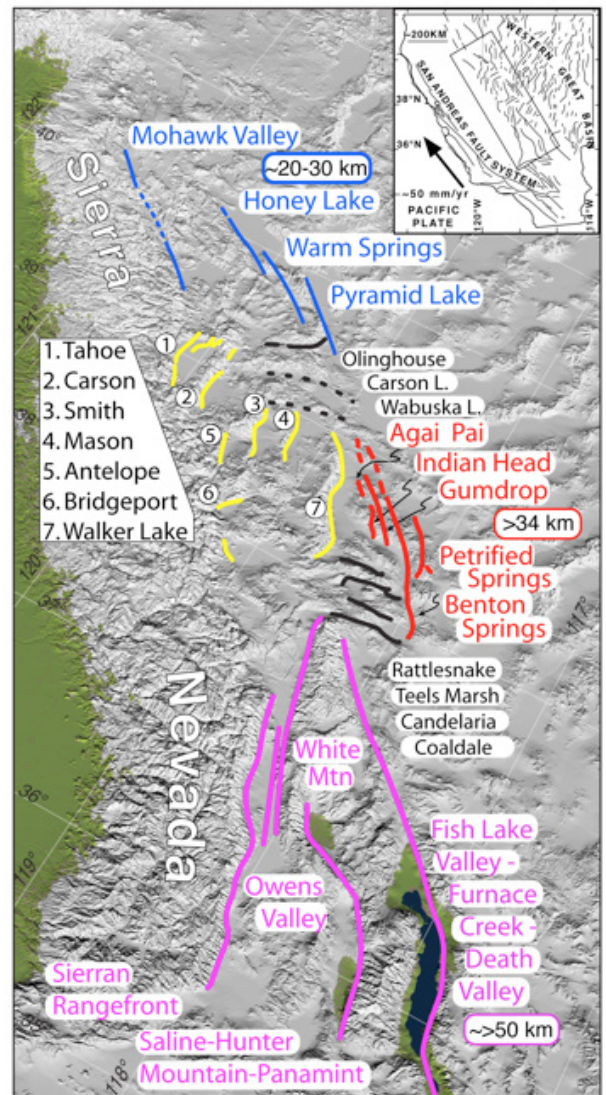
NSL Graduate Students Leverage Funding from the National Science Foundation

Funding for Steve Angster and Ian Pierce has come from a National Science Foundation grant (Steve Wesnousky, lead PI) focused on the deformation pattern and kinematics of the Walker Lane. The ultimate goal of this funded project is to develop a better understanding for how geodetically observed northwest directed right lateral transtensional shear is accommodated within the earth's crust in the central Walker Lane.

The Walker Lane is a region in western Nevada that has a high strain rate, resulting in large (M7) earthquakes. Using geodesy, the amount of motion can be understood in great detail. The role of Steve and Ian in this project is to constrain the amount of right-lateral slip that has accrued during the Quaternary Period (the last 2.5 million years) on a set of right lateral fault systems. Right lateral faults result in side-to-side motion rather than vertical motion. Steve

will focus on the Agai-Pai, Indian Head, Gumdrop, Benton Springs, and Petrified fault systems, while Ian will study the Tahoe, Carson, Antelope Valley, Smith Valley, Mason Valley, and Walker Lake fault systems. All faults shown in the map to the right.

Currently, Steve has measured and collected data used for dating samples on the most prominent faults, the Petrified Spring and Benton Springs fault, used to determine Quaternary slip rates. Ian is using high-resolution elevation datasets (which come from airborne laser scanning data) to measure fault offsets, and cosmogenic isotope dating to constrain the timing of these offsets. The combination of research by these two researchers in the Nevada Seismological Laboratory/Center for Neotectonics will categorize many of the dominant fault systems in the Walker Lane.



ABOVE: The Walker Lane is a tectonic region of eastern California and Western Nevada. Faults in this system pose risks to all major urban populations in Nevada (both Las Vegas and Reno areas!). By studying these faults, researchers are able to better understand the risks these faults impose.

LEFT: Ian Pierce (left) and Steve Angster (right) have worked together on projects in the US and abroad in the Himalayan range after last year's M7.8 earthquake. This new funding from NSF allows them to use their skills to understand fault systems in western Nevada.





RESEARCH & RESEARCHERS

NSL Graduate Students and Post-doctoral Researcher conduct sediment core sampling offshore Southern California

NSL graduate students Rachel Hatch and Courtney Brailo along with Post-doctoral researcher Dr. Jayne Bormann recently collaborated with Scripps Institution of Oceanography and the University of California, San Diego to collect oceanic sediment cores offshore Southern California. The data collected using the Research Vessel R/V Thomas Thompson (pictured above) will be used to constrain the timing of motion along strike-slip faults offshore Southern California.

These cores sample sediments collected from the seafloor in cylindrical sections. The cores collected

during this campaign, sample from sediment depths ranging from 10-40 feet. These cores can be used to date offset sediment layers imaged in high resolution seismic data, analogous to paleoseismic trenches seen on land. In addition, these cores also sample turbidite/debris layers that show the telltale signs of violent shaking due to past earthquakes, providing a time history for shaking in this region.

For Rachel Hatch (*below left*), being aboard the R/V Thompson offered the opportunity to learn about marine methods and ship operations in a research environment. Shifts for the “science crew” last 12-hours (from

noon to midnight and then midnight to noon). During watch, scientists collect the cores and also track pertinent data such as core sampling locations, lengths, and any collection issues. The cores are prepped for transport and onboard analysis.

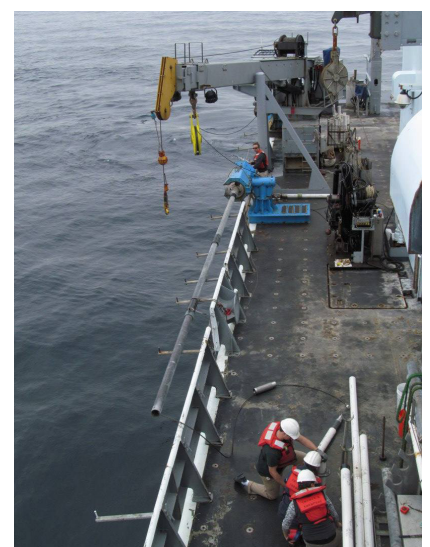
Dr. Jayne Bormann (*below middle*) is more familiar with life on a research vessel, having participated in many previous seismic projects in 2013. Some of the cores collected will be used directly for Dr. Bormann’s research on the San Diego Trough fault and its history of large earthquakes along this heretofore poorly studied, major faultline offshore SoCal.



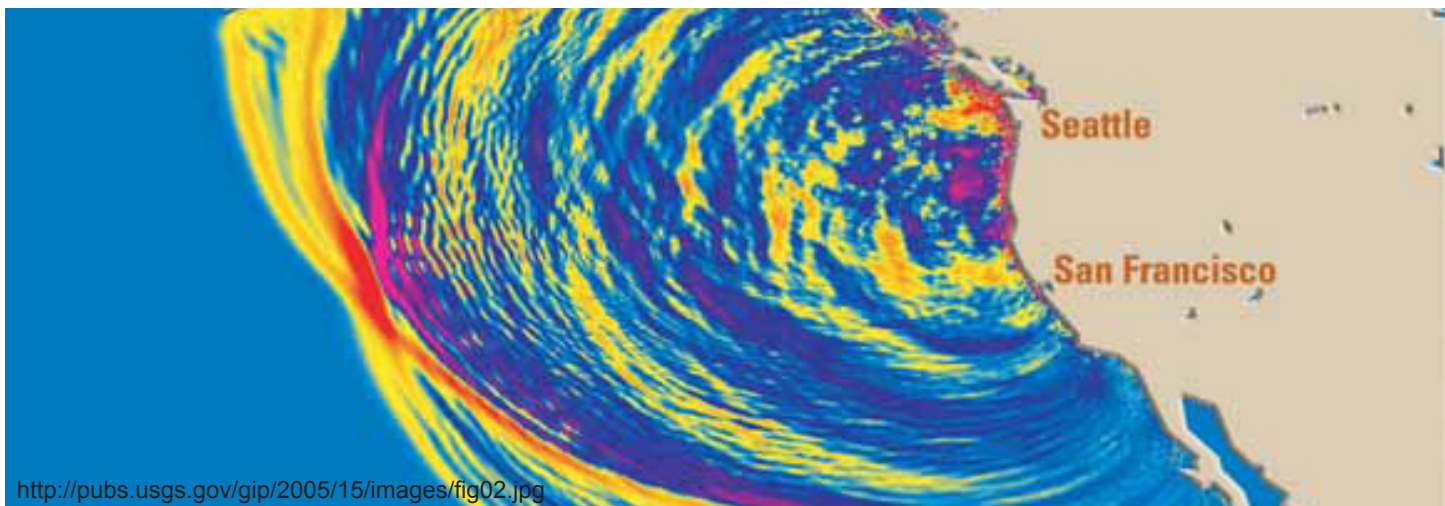
NSL PhD Student Rachel Hatch works on deck of the R/V Thompson to document core details.



Dr. Jayne Bormann prepares a core for transport and storage onshore for analysis.



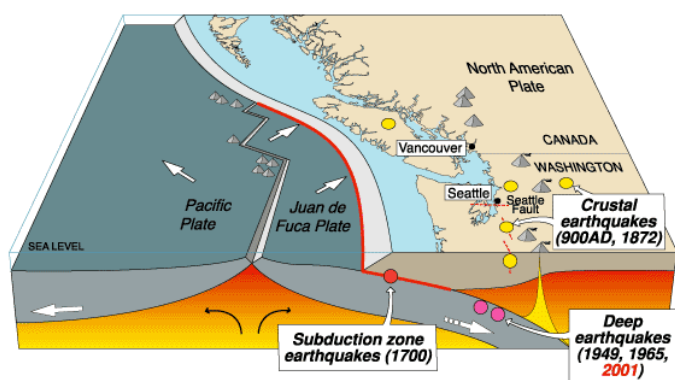
Science crew works on deck to set up and retrieve cores.



HISTORICAL EVENT HIGHLIGHT

1700 Cascadia Earthquake

Cascadia earthquake sources



Source	Affected area	Max. Size	Recurrence
● Subduction Zone	W.WA, OR, CA	M 9	500-600 yr
● Deep Juan de Fuca plate	W.WA, OR,	M 7+	30-50 yr
● Crustal faults	WA, OR, CA	M 7+	Hundreds of yr?

https://upload.wikimedia.org/wikipedia/commons/7/72/Cascadia_earthquake_sources.png

<http://4.bp.blogspot.com/-oLRQfS-oVxI/Tv5oBMj-BtI/AAAAAAAAABs8/Rf4nqFneh1I/s1600/gf.gif>

The **Cascadia earthquake of 1700** occurred along the Cascadia subduction zone on January 26th. The size of this event is estimated to have been between M8.7- M9.2. This event is often associated with the "Orphan Tsunami" in Japan because a destructive wave was well documented, but associated with a lack of accompanying shaking. There was no earthquake in Japan that could have triggered such a tsunami! This suggests that the tsunami originated elsewhere. Indicators for the earthquake offshore of Washington & Oregon come from native oral traditions originating from the Cascadia region. Anecdotal references to large shaking and flooding events have been noted; however no dates or times are definitive. In the 1990's, scientists found evidence of extreme ground shaking through debris layers found offshore of Washington and Oregon. Additionally, the strongest evidence discovered in the 1980's is from forests killed by the exposure to salty ocean water as the coastline sank because of strain-release due to the megquake.

A recent article in the New Yorker brought attention to potential repeat events of comparable size. Read the article at: <http://www.newyorker.com/magazine/2015/07/20/the-really-big-one>

Recent fault studies at our lab focused near Tahoe and Truckee suggest portions of both the Mohawk Valley and Lake Tahoe faults may rupture in tandem with the Cascadia Subduction Zone -- highlighting that large Cascadia events may cause triggering of other fault systems. Triggering of the our local faults represents an indirect but substantial seismic concern to the Reno/Tahoe region.

Did you know?

Did you know that this event is classified as a **Megathrust** caused by the Juan de Fuca plate subducting beneath the North American Plate.

Other examples of Megathrust events in recent times include the 2004 "Boxing Day" Indian Ocean earthquake & tsunami - responsible for killing 230,000 people. The 2011 Tōhoku earthquake and tsunami was also a megathrust event. This event was responsible for killing nearly 16,000 individuals in Japan.