NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **September 24, 2014**

LOCATION: **Orinda Masonic Center, 9 Altarinda Rd., Orinda**

TIME: **6:30 p.m. social; 7:00 p.m. talk (no dinner) Cost: $5 per regular member; $1 per student or K – 12 teachers**

SPEAKER: **Thomas L. Holzer, U.S. Geological Survey**

Catastrophic Earthquakes in a Crowded World

The 21st century began with 5 catastrophic earthquakes (>50,000 fatalities) in the first decade compared to only 7 in the entire 20th century. This sudden increase prompted concern that the growing human population of the planet was leading to significantly more earthquake fatalities. We analyzed multiple earthquake fatality catalogs going back centuries and concluded that catastrophic earthquakes are indeed increasing in frequency, and the frequency can be correlated with world population. Based on U.N. population projections and our correlation, we estimate that number of catastrophic earthquakes will triple or quadruple in number in the 21st century compared to the 20th century. We also estimate that total global earthquake fatalities during the 21st century will double or triple compared to the 20th century, when only 1.5 million people died. This will greatly increase the need for post-earthquake humanitarian aid. An interesting question that arises is how many people might die in a worst-case earthquake scenario. We speculate that an earthquake with a death toll of one million people is conceivable because of the increasing urbanization of the planet. Since the first modern city to exceed a population of one million people developed in the early 19th century, more than 525 cities with populations of more than one million now exist. Twelve cities exceed 20 million. Many of these cities sit in seismically active areas and do not practice seismic resistant construction. Thus, a direct hit could easily kill one million people.

…Continued on Back…

NCGS 2012 – 2013 Calendar

September 24, 2014; 7:00 pm
Dr. Thomas Holzer, USGS
Catastrophic Earthquakes In a Crowded World

October 29, 2014; 7:00 pm
B. Lynn Ingram, UC Berkeley
The West without Water

November 19, 2014; 7:00 pm
Christopher Lewis
Tales of the Oil and Gas Fields and Thereabouts

January 28, 2015; 7:00 pm
TBA

Peninsula Geologic Society

For an updated list of meetings, abstracts, and field trips go to http://www.diggles.com/pgs/. The PGS has also posted guidebooks for downloading, as well as photographs from recent field trips at this web address. Please check the website for current details.

Bay Area Science

This website provides a free weekly emailed newsletter consisting of an extensive listing of local science based activities (evening lectures, classes, field trips, hikes, and etc). Go to: http://www.bayareascience.org/

Association of Engineering Geologists San Francisco Section

Upcoming Events

Meeting locations rotate between San Francisco, the East Bay, and the South Bay. Please check the website for current details. To download meeting details and registration form go to: http://www.aegsf.org/.

USGS Evening Public Lectures

Ground Shaking in the 1989 Loma Prieta Earthquake: A view from 25 years later

Brad Aagaard, USGS Research Geophysicist
Thursday, September 25, 2014, 7:00 p.m. PDT
USGS, Conference Room A, Bldg. 3, Menlo Park, California; September Flyer (Acrobat PDF)
Watch Live Online

- What factors controlled the variability in ground shaking in the earthquake?
- Will the ground shaking in future earthquakes display similar patterns?
- Hear about the advances made in recording ground shaking over the past 25 years.
- Learn how USGS uses this information to quickly assess the impact of earthquakes.

Hey Buddy Can Ya Lend a Hand?

(or… Extra Curricular Activities)

Submitted by NCGS Member Mark Petrofsky

1) Randall Museum Needs Assistance - I have taken on the responsibility for Mary Jane Holmes rock and fossil collection. I have combined it with mine. We also have offers from other sources for contributions. I am in the process of contacting a number of educational institutions regarding the future use of these materials. This collection is not a 'display' collection but one that would be primarily useful for teaching about California rocks, minerals and fossils. The best contact I've made so far is with the Randall Museum in San Francisco. The person in charge of educational outreach, Marcus W., has a BA in geology. Almost his first words were that, "Rocks tell stories", when we spoke. It is the story of the geology of San Francisco and the Greater Bay Area that he would most like to tell. The Randall Museum is about to undergo a major remodel which means he will have a new space to work with and time to develop pedagogy. Unfortunately the downside means that they have to pack up their existing collection, which, while extensive is more appropriate to the exhibit model, not the story model. This is where Mary Jane's and my collection could be valuable. There is enough material that other uses may also be feasible. I will be bringing some rocks to the next NCGS meeting for help with identification unless there are members who would like to come to my home to help with the last of this effort. **The more immediate need is for people to help pack and catalog the Randall Museum's collection**. Hopefully there are also people in the S.F. Mineral and Gem Society to help out. Marcus is very flexible in terms of time. None of this is an NCGS activity. **If you wish to help out or contribute in any way, ideas, rocks, time, money, etc, please contact me** at the email address on the front cover of the newsletter.

2) National Ass'n. of Geoscience Teachers - The NCGS has been offered table space at the National Ass'n. of Geoscience Teachers, Western Region, annual meeting. This takes place from **Friday evening Oct. 10th through Sunday Oct. 12th at Sacramento State Univ**. I would like us to at least have a presence on Saturday the 11th. **If you are interested in helping out in any way, especially by attending, please let me know**, hopefully we can carpool. There are some great field trips and speakers.

Sierra exfoliation in action

Thanks to John Christian!

See this interesting video of a Sierra Nevada granite slab exfoliating right before your eyes: http://geotripper.blogspot.com/2014/08/exfoliation-in-action-in-twain-harte.html

Napa quake jumpstarts stream flows, though probably only temporarily

BY GUY KOVNER, THE PRESS DEMOCRAT
September 4, 2014
Thanks to John Christian for forwarding the article.

Three creeks in Sonoma Valley and two more in Napa and Solano counties have dramatically increased water flows since the Aug. 24 earthquake in Napa County, a phenomenon familiar to scientists for more than a century and well established in Santa Rosa history.

Carriger Creek, a steelhead spawning stream on the city of Sonoma's west flank, was bone dry — save for shallow, isolated pools of water — before the magnitude-6.0 temblor went off 12 days ago from an epicenter about 9 miles to the east.

Richard Grahman enjoyed the music of crystal-clear water splashing over smooth gray rocks this week in the creek behind his home on Grove Street.

"This is amazing," said Grahman, a retiree who has lived next to the creek for 14 years. "The sound is delightful."

Heavy winter rains transform the narrow waterway into a 6-foot-deep torrent that sometimes overruns its banks, with a roar that can be heard a mile away, he said. The melodic flow that now matches a typical April on Carriger Creek is likely caused by seismic shock waves that opened fractures in bedrock, allowing groundwater to flow rapidly into surface streams.

As far back as 1865, a local newspaper described rising streams in the Santa Cruz Mountains following a magnitude-6.5 quake on the San Andreas fault, and a federal government study found the magnitude-6.9 Loma Prieta quake in 1989 squeezed about 23 billion gallons of groundwater from the same mountains.

Flow changes in springs were anecdotally reported in Sonoma County, 124 miles north of the Loma Prieta epicenter, the study said.

"I couldn't believe my eyes," Grahman said, when he first spotted the flowing water about three days after the Napa quake. Experts say it won't last long, and Grahman said it's already dropped by more than half.

Calabasas and Felder creeks, which also run through Sonoma Valley, have seen similar post-quake flows, said Marcus Trotta, a Sonoma County Water Agency hydrogeologist.

A U.S. Geological Survey gauge on Sonoma Creek downstream from the confluence with Calabasas Creek — and above the other two creeks — measured a 20-fold surge in stream flow from a 0.10 cubic-feet-per-second trickle Aug. 24 to nearly 2.0 cfs Wednesday.

"Holy mackerel," Grahman said when he heard that statistic. "Over time, that's a lot of water."

About 15 miles due east, Eileen Susa marveled over the post-quake invigoration of Tulocay Creek, which flows under Fourth Avenue east of Napa, where the quake struck hard from an epicenter 5 miles to the south.

Dry since April, the creek surprised Susa and her neighbors with flowing water two days after the temblor that wreaked more than $360 million in damage to government property, homes and businesses in Napa County.

"For us it could be a blessing," said Susa, who lives in a water-poor area outside the city. "We might have struck gold," she said, if the earthquake "busted open a few springs." But if it drains away groundwater, the creek would prove to be a thief, Susa said.

When it rains hard, Tulocay Creek is a flood zone, she said, reflecting California's boom-to-bust relationship with water.

Napa County Flood Control and Water Conservation District crews checked the area, where there are natural springs but no water mains, and found no obvious source for the water in Tulocay Creek, said Rick Thomasser, the district's operations manager.

"They said it was an impressive flow for this time of year," he said. "It's a little bit of a mystery. It's sort of Mother Nature doing her thing."

About 5 miles further east, residents of Green Valley, an unincorporated area in Solano County, were surprised by flowing water in previously dry Green Valley Creek four days after the Napa quake. They were also initially a bit concerned because the creek is downstream from two dams that hold water for the city of Vallejo, said Bill Mayben, president of the Green Valley Landowners Association.

"It kind of looks like April," he said.

The dams were checked and cleared by city, county and state inspectors, said Franz Nestlerode, Vallejo's assistant public works director for water. But seepage from rock fissures in a small canyon on Wild Horse Creek had increased tenfold, from about 100 gallons to about 1,000 gallons of water per minute, he said.

Wild Horse Creek flows from the city reservoirs and joins Green Valley Creek about 2 miles downhill.

"We think pockets of groundwater opened in rocky material," Nestlerode said, acknowledging that he is not a geologist. Tests showed the alkalinity of the seeping water was "consistent with groundwater" and not comparable to water in the reservoirs, he said.

Mayben said he has heard that explanation, but said it does not account for flows in Green Valley Creek above the confluence with Wild Horse Creek. "The jury is still out," he said.

Neither scientists nor Sonoma County historians were surprised by the watery aftermath to the Napa temblor.

"Seismic events have long been known to cause changes in the level of oceans, streams, lakes and the water table," said a 66-page USGS study of hydrological disturbances from the Loma Prieta quake, including a tsunami in Monterey Bay and increased stream flows in the Santa Cruz Mountains and as far as 55 miles from the epicenter.

Studies in the mountains indicated that "strong shaking increased the permeability of the shallow groundwater system by opening fractures" that sent groundwater into surface streams, said Tom Holzer, a USGS research engineering geologist who coordinated the study published in 1994.

Holzer said in an email that he suspects a "similar phenomenon" boosted stream flows after the Napa quake.

The underground water level in three deep wells in Sonoma Valley monitored by the Sonoma County Water Agency rose as much as 5 feet at 3:20 a.m. Aug. 24, exactly the time of the Napa quake, said Trotta, the agency's hydrogeologist.

Seismic waves are known to deform the aquifer, pushing water up wells like toothpaste squeezed from a tube, Holzer said.

The two worst earthquakes ever to hit Santa Rosa — in 1906 and 1969 — had an impact on the city's first tourist attraction, White Sulphur Springs, established on Taylor Mountain in 1862. The popular destination's run came to an abrupt end in 1906, when the temblor best known for devastating San Francisco also crushed downtown Santa Rosa and shut off the spa's main mineral spring.

Six decades later, downtown Santa Rosa was again ravaged by ground shaking and the hot spring was temporarily restored. It disappeared again within a year.

Streams in the Santa Cruz Mountains returned to normal six to eight weeks after the Loma Prieta quake, and Holzer said the current flows will probably cease in about the same period.

Scientists: Quake directed its main force at Napa

BY ELLEN KNICKMEYER, ASSOCIATED PRESS
September 4, 2014

SAN FRANCISCO — Emerging data on last month's 6.0 magnitude earthquake shows it directed most of its force north toward Napa and the Napa Valley, hitting hard enough to move one side of the West Napa Fault north by 18 inches, the head of the U.S. Geological Survey's Earthquake Science Center said Thursday.

Scientists' ongoing study of the quake is helping explain why the city of Napa suffered so much of the damage in the Aug. 24 quake even though the epicenter was about 5 miles to the south, said Tom Brocher, head of Earthquake Science Center. Older buildings in downtown Napa that had been only partially reinforced against earthquakes, or not reinforced at all, incurred much of the damage, including some old chimneys and building facades that tumbled to the ground.

"The energy really pointed right on Napa," Brocher said. Additionally, vineyard-rich Napa Valley lies on soil and other, softer geological deposits, that shake harder and longer than bedrock, Brocher said.

Napa Earthquake Cleanup

Dowtown Napa was closed off to traffic, but an almost festive type atmosphere evolved as locals, and tourists gawped at the damage from the Sunday Aug. 24, 6.0 temblor. (Kent Porter / Press Democrat) 2014
Sanitation workers with Napa Recycling and Waste Services clean up a large pile of trash from the damage caused by Sunday's earthquake in front of Browns Valley Elementary School in Napa on Tuesday, August 26, 2014. (Conner Jay/The Press Democrat)
A man dumps a mattress in with a large pile of trash created from Sunday's earthquake in front of Browns Valley Elementary School in Napa on Tuesday, August 26, 2014. (Conner Jay/The Press Democrat)
Garrett Hammell takes a break from trying to cleanup the mess in his apartment caused by Sunday's earthquake in Napa on Tuesday, August 26, 2014. Hammell's apartment was deemed unsafe for occupants and all residents were forced to leave. (Conner Jay/The Press Democrat)
Residents and tourists take pictures in front of the damage caused by Sunday's earthquake in downtown Napa on Tuesday, Aug. 26, 2014. (Conner Jay/The Press Democrat)

He spoke by phone after a USGS seminar Tuesday for seismic experts to share data on the quake, the hardest to hit Northern California in 25 years.

Official damage estimates still are being tallied. Counts so far range from the hundreds of millions of dollars to more than $1 billion. More than 100 people suffered injuries serious enough to seek medical treatment, although no one died.

Beyond the immediate shock that moved the west side of the West Napa Fault 18 inches, afterslips — slips on a fault after an earthquake— have shifted it another few inches, Brocher said. Scientists found cracks in the ground over a 10-mile distance.

Earthquake experts have called the quake a successful test of an early-quake warning system, ShakeAlert, which the USGS is testing in conjunction with universities. ShakeAlert monitors in San Francisco picked up the first waves of the Napa quake eight

seconds before the main force of the shock reached San Francisco, scientists at Thursday's briefing said.

In the case of a longer, bigger quake along the San Andreas fault, for example, seismic experts believe the warning system could provide up to a minute of warning before the main shock hit San Francisco, Brocher said.

Textbook theory behind volcanoes may be wrong

In the typical textbook picture, volcanoes, such as those that are forming the Hawaiian islands, erupt when magma gushes out as narrow jets from deep inside Earth. But that picture is wrong, according to a new study from researchers at Caltech and the University of Miami in Florida.

New seismology data are now confirming that such narrow jets don't actually exist, says Don Anderson, the Eleanor and John R. McMillian Professor of Geophysics, Emeritus, at Caltech. In fact, he adds, basic physics doesn't support the presence of these jets, called mantle plumes, and the new results corroborate those fundamental ideas.

"Mantle plumes have never had a sound physical or logical basis," Anderson says. "They are akin to Rudyard Kipling's 'Just So Stories' about how giraffes got their long necks."

Anderson and James Natland, a professor emeritus of marine geology and geophysics at the University of Miami, describe their analysis online in the September 8 issue of the *Proceedings of the National Academy of Sciences*.

According to current mantle-plume theory, Anderson explains, heat from Earth's core somehow generates narrow jets of hot magma that gush through the mantle and to the surface. The jets act as pipes that transfer heat from the core, and how exactly they're created isn't clear, he says. But they have been assumed to exist, originating near where Earth's core meets the mantle, almost 3,000 kilometers underground -- nearly halfway to the planet's center. The jets are theorized to be no more than about 300 kilometers wide, and when they reach the surface, they produce hot spots.

While the top of the mantle is a sort of fluid sludge, the uppermost layer is rigid rock, broken up into plates that float on the magma-bearing layers. Magma from the mantle beneath the plates bursts through the plate to create volcanoes. As the plates drift across the hot spots, a chain of volcanoes forms -- such as the island chains of Hawaii and Samoa.

"Much of solid-Earth science for the past 20 years -- and large amounts of money -- have been spent looking for elusive narrow mantle plumes that wind their way upward through the mantle," Anderson says.

To look for the hypothetical plumes, researchers analyze global seismic activity. Everything from big quakes to tiny tremors sends seismic waves echoing through Earth's interior. The type of material that the waves pass through influences the properties of those waves, such as their speeds. By measuring those waves using hundreds of seismic stations installed on the surface, near places such as Hawaii, Iceland, and Yellowstone National Park, researchers can deduce whether there are narrow mantle plumes or whether volcanoes are simply created from magma that's absorbed in the sponge-like shallower mantle.

No one has been able to detect the predicted narrow plumes, although the evidence has not been conclusive. The jets could have simply been too thin to be seen, Anderson says. Very broad features beneath the surface have been interpreted as plumes or super-plumes, but, still, they're far too wide to be considered narrow jets.

But now, thanks in part to more seismic stations spaced closer together and improved theory, analysis of the planet's seismology is good enough to confirm that there are no narrow mantle plumes, Anderson and Natland say. Instead, data reveal that there are large, slow, upward-moving chunks of mantle a thousand kilometers wide.

In the mantle-plume theory, Anderson explains, the heat that is transferred upward via jets is balanced by the slower downward motion of cooled, broad, uniform chunks of mantle. The behavior is similar to that of a lava lamp, in which blobs of wax are heated from below and then rise before cooling and falling. But a fundamental problem with this picture is that lava lamps require electricity, he says, and that is an outside energy source that an isolated planet like Earth does not have.

The new measurements suggest that what is really happening is just the opposite: Instead of narrow jets, there are broad upwellings, which are balanced by narrow channels of sinking material called slabs. What is driving this motion is not heat from the core, but cooling at Earth's surface. In fact, Anderson says, the behavior is the regular mantle convection first proposed more than a century ago by Lord Kelvin. When material in the planet's crust cools, it sinks, displacing material deeper in the mantle and forcing it upward.

"What's new is incredibly simple: upwellings in the mantle are thousands of kilometers across," Anderson says. The formation of volcanoes then follows from plate tectonics -- the theory of how Earth's plates move and behave. Magma, which is less dense than the surrounding mantle, rises until it reaches the bottom of the plates or fissures that run through them. Stresses in the plates, cracks, and other tectonic forces can squeeze the magma out, like how water is squeezed out of a sponge. That magma then erupts out of the surface as volcanoes. The magma comes from within the upper 200

kilometers of the mantle and not thousands of kilometers deep, as the mantle-plume theory suggests.

"This is a simple demonstration that volcanoes are the result of normal broad-scale convection and plate tectonics," Anderson says. He calls this theory "top-down tectonics," based on Kelvin's initial principles of mantle convection. In this picture, the engine behind Earth's interior processes is not heat from the core but cooling at the planet's surface. This cooling and plate tectonics drives mantle convection, the cooling of the core, and Earth's magnetic field. Volcanoes and cracks in the plate are simply side effects.

The results also have an important consequence for rock compositions -- notably the ratios of certain isotopes, Natland says. According to the mantle-plume idea, the measured compositions derive from the mixing of material from reservoirs separated by thousands of kilometers in the upper and lower mantle. But if there are no mantle plumes, then all of that mixing must have happened within the upwellings and nearby mantle in Earth's top 1,000 kilometers.

The paper is titled "Mantle updrafts and mechanisms of oceanic volcanism."

Story Source: The above story is based on materials provided by California Institute of Technology. The original article was written by Marcus Woo.

Journal Reference: Don L. Anderson and James H. Natland. **Mantle updrafts and mechanisms of oceanic volcanism**. *PNAS*, September 8, 2014.

Synchronization of North Atlantic, North Pacific preceded abrupt warming, end of ice age

Scientists have long been concerned that global warming may push Earth's climate system across a "tipping point," where rapid melting of ice and further warming may become irreversible -- a hotly debated scenario with an unclear picture of what this point of no return may look like.

This image depicts the Hubbard Glacier ice front, with floating ice 'growlers' in August 2004.
Credit: Photo courtesy of Oregon State University

A newly published study by researchers at Oregon State University probed the geologic past to understand mechanisms of abrupt climate change. The study pinpoints the emergence of synchronized climate variability in the North Pacific Ocean and the North Atlantic Ocean a few hundred years before the rapid warming that took place at the end of the last ice age about 15,000 years ago.

The study suggests that the combined warming of the two oceans may have provided the tipping point for abrupt warming and rapid melting of the northern ice sheets.

Results of the study, which was funded by the National Science Foundation, appear this week in *Science*.

This new discovery by OSU researchers resulted from an exhaustive 10-year examination of marine sediment cores recovered off southeast Alaska where geologic records of climate change provide an unusually detailed history of changing temperatures on a scale of decades to centuries over many thousands of years.

"Synchronization of two major ocean systems can amplify the transport of heat toward the polar regions and cause larger fluctuations in northern hemisphere climate," said Summer Praetorius, a doctoral student in marine geology at Oregon State and lead author on the *Science* paper. "This is consistent with theoretical predictions of what happens when Earth's climate reaches a tipping point."

"That doesn't necessarily mean that the same thing will happen in the future," she pointed out, "but we cannot rule out that possibility."

The study found that synchronization of the two regional systems began as climate was gradually warming. After synchronization, the researchers detected wild variability that amplified the changes and accelerated into an abrupt warming event of several degrees within a few decades.

"As the systems become synchronized, they organized and reinforced each other, eventually running away like screeching feedback from a microphone," said Alan Mix, a professor in OSU's College of Earth, Ocean, and Atmospheric Sciences and co-author on the paper. "Suddenly you had the combined effects of two major oceans forcing the climate instead of one at a time."

"The example that we uncovered is a cause for concern because many people assume that climate change will be gradual and predictable," Mix added. "But the study shows that there can be vast climate swings over a period of decades to centuries. If such a thing happened in the future, it could challenges society's ability to cope."

What made this study unusual is that the researchers had such a detailed look at the geologic record. While modern climate observations can be made every day, the length of instrumental records is relatively short -- typically less than a century. In contrast, paleoclimatic records extend far into the past and give good context for

modern changes, the researchers say. However, the resolution of most paleo records is low, limited to looking at changes that occur over thousands of years.

In this study, the researchers examined sediment cores taken from the Gulf of Alaska in 2004 during an expedition led by Mix. The mountains in the region are eroding so fast that sedimentation rates are "phenomenal," he said. "Essentially, this rapid sedimentation provides a 'climate tape recorder' at extremely high fidelity."

Praetorius then led an effort to look at past temperatures by slicing the sediment into decade-long chunks spanning more than 8,000 years -- a laborious process that took years to complete. She measured ratios of oxygen isotopes trapped in fossil shells of marine plankton called foraminifera. The isotopes record the temperature and salinity of the water where the plankton lived.

When the foraminifera died, their shells sank to the sea floor and were preserved in the sediments that eventually were recovered by Mix's coring team.

The researchers then compared their findings with data from the North Greenland Ice Core Project to see if the two distinct high-latitude climate systems were in any way related.

Most of the time, the two regions vary independently, but about 15,500 years ago, temperature changes started to line up and then both regions warmed abruptly by about five degrees (C) within just a few decades. Praetorius noted that much warmer ocean waters likely would have a profound effect on northern-hemisphere climates by melting sea ice, warming the atmosphere and destabilizing ice sheets over Canada and Europe.

A tipping point for climate change "may be crossed in an instant," Mix noted, "but the actual response of the Earth's system may play out over centuries or even thousands of years during a period of dynamic adjustment."

"Understanding those dynamics requires that we look at examples from the past," Mix said. "If we really do cross such a boundary in the future, we should probably take a long-term perspective and realize that change will become the new normal. It may be a wild ride."

Added Praetorius: "Our study does suggest that the synchronization of the two major ocean systems is a potential early warning system to begin looking for the tipping point."

Story Source: The above story is based on materials provided by **Oregon State University**. *Note: Materials may be edited for content and length.*

Journal Reference: S. K. Praetorius, A. C. Mix. **Synchronization of North Pacific and Greenland climates preceded abrupt deglacial warming**. *Science*, 2014; 345 (6195): 444 DOI: 10.1126/science.1252000

Study links Greenland ice sheet collapse, sea level rise 400,000 years ago

A new study suggests that a warming period more than 400,000 years ago pushed the Greenland ice sheet past its stability threshold, resulting in a nearly complete deglaciation of southern Greenland and raising global sea levels some 4-6 meters.

The study is one of the first to zero in on how the vast Greenland ice sheet responded to warmer temperatures during that period, which were caused by changes in the Earth's orbit around the sun.

Results of the study, which was funded by the National Science Foundation, are being published this week in the journal *Nature*.

"The climate 400,000 years ago was not that much different than what we see today, or at least what is predicted for the end of the century," said Anders Carlson, an associate professor at Oregon State University and co-author on the study. "The forcing was different, but what is important is that the region crossed the threshold allowing the southern portion of the ice sheet to all but disappear.

Few reliable models and little proxy data exist to document the extent of the Greenland ice sheet loss during a period known as the Marine Isotope Stage 11. This was an exceptionally long warm period between ice ages that resulted in a global sea level rise of about 6-13 meters above present. However, scientists have been unsure of how much sea level rise could be attributed to Greenland, and how much may have resulted from the melting of Antarctic ice sheets or other causes.

"This may give us a better sense of what may happen in the future as temperatures continue rising," Carlson added.

Co-author Robert Hatfield (Oregon State University) prepares to sample sediment carried by icebergs that fill a fjord in west-central Greenland. Credit: Image courtesy of Oregon State University

To find the answer, the researchers examined sediment cores collected off the coast of Greenland from what is called the Eirik Drift. During several years of research, they sampled the chemistry of the glacial stream sediment on the island and discovered that different parts

of Greenland have unique chemical features. During the presence of ice sheets, the sediments are scraped off and carried into the water where they are deposited in the Eirik Drift.

"Each terrain has a distinct fingerprint," Carlson noted. "They also have different tectonic histories and so changes between the terrains allow us to predict how old the sediments are, as well as where they came from. The sediments are only deposited when there is significant ice to erode the terrain. The absence of terrestrial deposits in the sediment suggests the absence of ice.

"Not only can we estimate how much ice there was," he added, "but the isotopic signature can tell us where ice was present, or from where it was missing."

This first "ice sheet tracer" utilizes strontium, lead and neodymium isotopes to track the terrestrial chemistry.

The researchers' analysis of the scope of the ice loss suggests that deglaciation in southern Greenland 400,000 years ago would have accounted for at least four meters -- and possibly up to six meters -- of global sea level rise. Other studies have shown, however, that sea levels during that period were at least six meters above present, and may have been as much as 13 meters higher.

Carlson said the ice sheet loss likely went beyond the southern edges of Greenland, though not all the way to the center, which has not been ice-free for at least one million years.

In their Nature article, the researchers contrasted the events of Marine Isotope Stage 11 with another warming period that occurred about 125,000 years ago and resulted in a sea level rise of 5-10 meters. Their analysis of the sediment record suggests that not as much of the Greenland ice sheet was lost -- in fact, only enough to contribute to a sea level rise of less than 2.5 meters.

"However, other studies have shown that Antarctica may have been unstable at the time and melting there may have made up the difference," Carlson pointed out.

The researchers say the discovery of an ice sheet tracer that can be documented through sediment core analysis is a major step to understanding the history of ice sheets in Greenland -- and their impact on global climate and sea level changes. They acknowledge the need for more widespread coring data and temperature reconstructions.

"This is the first step toward more complete knowledge of the ice history," Carlson said, "but it is an important one."

Lead author on the *Nature* study is Alberto Reyes, who worked as a postdoctoral researcher for Carlson when both were at the University of Wisconsin-Madison. Carlson is now on the faculty in Oregon State's College of Earth, Ocean, and Atmospheric Sciences.

Story Source: The above story is based on materials provided by Oregon State University and ScienceDaily, June 25, 2014.

Journal Reference: Alberto V. Reyes, Anders E. Carlson, Brian L. Beard, Robert G. Hatfield, Joseph S. Stoner, Kelsey Winsor, Bethany Welke, David J. Ullman. **South Greenland ice-sheet collapse during Marine Isotope Stage 11**. *Nature*, 2014; 510 (7506): 525.

Carbon dioxide 'sponge' could ease transition to cleaner energy

A sponge-like plastic that sops up the greenhouse gas carbon dioxide (CO_2) might ease our transition away from polluting fossil fuels and toward new energy sources, such as hydrogen. The material -- a relative of the plastics used in food containers -- could play a role in President Obama's plan to cut CO_2 emissions 30 percent by 2030, and could also be integrated into power plant smokestacks in the future.

The report on the material is one of nearly 12,000 presentations at the 248th National Meeting & Exposition of the American Chemical Society (ACS), the world's largest scientific society, taking place here through Thursday.

"The key point is that this polymer is stable, it's cheap, and it adsorbs CO_2 extremely well. It's geared toward function in a real-world environment," says Andrew Cooper, Ph.D. "In a future landscape where fuel-cell technology is used, this adsorbent could work toward zero-emission technology."

CO_2 adsorbents are most commonly used to remove the greenhouse gas pollutant from smokestacks at power plants where fossil fuels like coal or gas are burned. However, Cooper and his team intend the adsorbent, a microporous organic polymer, for a different application -- one that could lead to reduced pollution.

Plastic that soaks up carbon dioxide could someday be used in plant smokestacks. Credit: American Chemical Society

The new material would be a part of an emerging technology called an integrated gasification combined cycle (IGCC), which can convert fossil fuels into hydrogen gas. Hydrogen holds great promise for use in fuel-cell cars and electricity generation because it produces almost no pollution. IGCC is a bridging technology that is intended to jump-start the hydrogen economy, or the transition to hydrogen fuel, while still using the existing fossil-fuel infrastructure. But the

IGCC process yields a mixture of hydrogen and CO_2 gas, which must be separated.

Cooper, who is at the University of Liverpool, says that the sponge works best under the high pressures intrinsic to the IGCC process. Just like a kitchen sponge swells when it takes on water, the adsorbent swells slightly when it soaks up CO_2 in the tiny spaces between its molecules. When the pressure drops, he explains, the adsorbent deflates and releases the CO_2, which they can then collect for storage or convert into useful carbon compounds.

The material, which is a brown, sand-like powder, is made by linking together many small carbon-based molecules into a network. Cooper explains that the idea to use this structure was inspired by polystyrene, a plastic used in styrofoam and other packaging material. Polystyrene can adsorb small amounts of CO_2 by the same swelling action.

One advantage of using polymers is that they tend to be very stable. The material can even withstand being boiled in acid, proving it should tolerate the harsh conditions in power plants where CO_2 adsorbents are needed. Other CO_2 scrubbers -- whether made from plastics or metals or in liquid form -- do not always hold up so well, he says. Another advantage of the new adsorbent is its ability to adsorb CO_2 without also taking on water vapor, which can clog up other materials and make them less effective. Its low cost also makes the sponge polymer attractive. "Compared to many other adsorbents, they're cheap," Cooper says, mostly because the carbon molecules used to make them are inexpensive. "And in principle, they're highly reusable and have long lifetimes because they're very robust."

Cooper also will describe ways to adapt his microporous polymer for use in smokestacks and other exhaust streams. He explains that it is relatively simple to embed the spongy polymers in the kinds of membranes already being evaluated to remove CO_2 from power plant exhaust, for instance. Combining two types of scrubbers could make much better adsorbents by harnessing the strengths of each, he explains.

The research was funded by the Engineering and Physical Sciences Research Council and E.ON Energy.

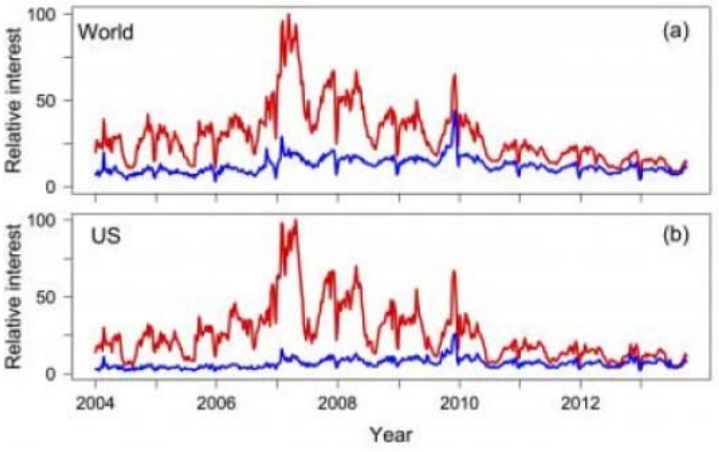
Story Source: The above story is based on materials provided by American Chemical Society (ACS). *Note: Materials may be edited for content and length.*
Cite This Page: American Chemical Society (ACS). "Carbon dioxide 'sponge' could ease transition to cleaner energy." ScienceDaily, August 10, 2014.

Public interest in climate change unshaken by scandal, but unstirred by science

The good news for any passionate supporter of climate-change science is that negative media reports seem to have only a passing effect on public opinion, according to Princeton University and University of Oxford researchers. The bad news is that positive stories don't appear to possess much staying power, either. This dynamic suggests that climate scientists should reexamine how to effectively and more regularly engage the public, the researchers write.

Measured by how often people worldwide scour the Internet for information related to climate change, overall public interest in the topic has steadily waned since 2007, according to a report in the journal *Environmental Research Letters*. Yet, the downturn in public interest does not seem tied to any particular negative publicity regarding climate-change science, which is what the researchers primarily wanted to gauge.

First author William Anderegg, a postdoctoral research associate in the Princeton Environmental Institute who studies communication and climate change, and Gregory Goldsmith, a postdoctoral researcher at Oxford's Environmental Change Institute, specifically looked into the effect on public interest and opinion of two widely reported, almost simultaneous events.



Princeton University and University of Oxford researchers found that negative media reports seem to have only a passing effect on public opinion, but that positive stories don't appear to possess much staying power, either. Measured by how often people worldwide scour the Internet for information related to climate change, overall public interest in the topic has steadily waned since 2007. To gauge public interest, the researchers used Google Trends to document the Internet search-engine activity for "global warming" (blue line) and "climate change" (red line) from 2004 to 2013. They examined activity both globally (top) and in the United States (bottom). The numbers on the left indicate how often people looked up each term based on its percentage of the maximum search volume at any given point in time. Credit: Image courtesy of William Anderegg

The first involved the November 2009 hacking of emails from the Climate Research Unit at the University of East Anglia in the United Kingdom, which has been a preeminent source of data confirming human-driven climate change. Known as "climategate," this event was

initially trumpeted as proving that dissenting scientific views related to climate change have been maliciously quashed. Thorough investigations later declared that no misconduct took place.

The second event was the revelation in late 2009 that an error in the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) -- an organization under the auspices of the United Nations that periodically evaluates the science and impacts of climate change -- overestimated how quickly glaciers in the Himalayas would melt.

To first get a general sense of public interest in climate change, Anderegg and Goldsmith combed the freely available database Google Trends for "global warming," "climate change" and all related terms that people around the world searched for between 2004 and 2013. The researchers documented search trends in English, Chinese and Spanish, which are the top three languages on the Internet. Google Trends receives more than 80 percent of the world's Internet search-engine activity, and it is increasingly called upon for research in economics, political science and public health.

Internet searches related to climate change began to climb following the 2006 release of the documentary "An Inconvenient Truth" starring former vice president Al Gore, and continued its ascent with the release of the IPCC's fourth report, the researchers found.

Anderegg and Goldsmith specifically viewed searches for "climategate" between Nov. 1 and Dec. 31, 2009. They found that the search trend had a six-day "half-life," meaning that search frequency dropped by 50 percent every six days. After 22 days, the number of searches for climategate was a mere 10 percent of its peak. Information about climategate was most sought in the United States, Canada and Australia, while the cities with the most searchers were Toronto, London and Washington, D.C.

The researchers tracked the popularity of the term "global warming hoax" to gauge the overall negative effect of climategate and the IPCC error on how the public perceives climate change. They found that searches for the term were actually higher the year before the events than during the year afterward.

"The search volume quickly returns to the same level as before the incident," Goldsmith said. "This suggests no long-term change in the level of climate-change skepticism.

We found that intense media coverage of an event such as 'climategate' was followed by bursts of public interest, but these bursts were short-lived."

All of this is to say that moments of great consternation for climate scientists seem to barely register in the public consciousness, Anderegg said. The study notes that independent polling data also indicate that these events had very little effect on American public opinion. "There's a lot of handwringing among scientists, and a belief that these events permanently damaged public trust. What these results suggest is that that's just not true," Anderegg said.

While that's good in a sense, Anderegg said, his and Goldsmith's results also suggest that climate change as a whole does not top the list of gripping public topics. For instance, he said, climategate had the same Internet half-life as the public fallout from pro-golfer Tiger Woods' extramarital affair, which happened around the same (but received far more searches).

A public with little interest in climate change is unlikely to push for policies that actually address the problem, Anderegg said. He and Goldsmith suggest communicating in terms familiar to the public rather than to scientists. For example, their findings suggest that most people still identify with the term "global warming" instead of "climate change," though the shift toward embracing the more scientific term is clear.

"If public interest in climate change is falling, it may be more difficult to muster public concern to address climate change," Anderegg said. "This long-term trend of declining interest is worrying and something I hope we can address soon."

One outcome of the research might be to shift scientists' focus away from battling short-lived, so-called scandals, said Michael Oppenheimer, Princeton's Albert G. Milbank Professor of Geosciences and International Affairs. The study should remind climate scientists that every little misstep or controversy does not make or break the public's confidence in their work, he said. Oppenheimer, who was not involved in the study, is a long-time participant in the IPCC and an author of the Fifth Assessment Report being released this year in sections.

"This is an important study because it puts scientists' concerns about climate skepticism in perspective," Oppenheimer said. "While scientists should maintain the aspirational goal of their work being error-free, they should be less distracted by concerns that a few missteps will seriously influence attitudes in the general public, which by-and-large has never heard of these episodes."

Story Source: The above story is based on materials provided by Princeton University.

Journal Reference: Anderegg, William R. L., Gregory R. Goldsmith. **Public interest in climate change over the past decade and the effects of the 'climategate' media event**. *Environmental Research Letters*, May 20, 2014

Princeton University. "Public interest in climate change unshaken by scandal, but unstirred by science." ScienceDaily, May 20, 2014.

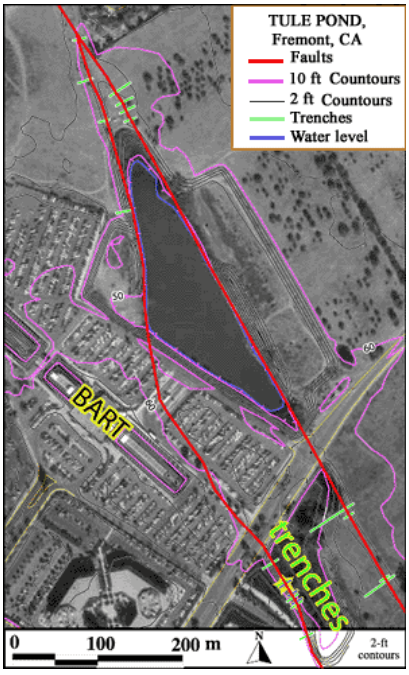
NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

A TEACHER' WORKSHOP
NCGS FIELD TRIP FOR THE NATIONAL EARTH SCIENCE WEEK
Saturday October 25, 2014, 9am - 3:30 pm

The Hayward Fault – Identifying Urban and Natural Features in the East Bay

Leader:
Dr. Joyce R. Blueford, Math Science Nucleus
with Dr. Ray Sullivan, emeritus San Francisco State University

Over the last million years, the natural beauty of Fremont has been shaped by the Hayward Fault. This teacher workshop will start at Tule Ponds at Tyson Lagoon Wetland Center and end up at the Fremont Earthquake Exhibit in Central Park. Discover the "fault creep" and off sets as we walk along the Hayward fault and explore the dramatic faulting effects in both a natural and urban environment. Learn how we use the measurable movements to incorporate into lesson plans.



Both these facilities are part Fremont Learning Corridor that trace the Hayward Fault from Fremont to Union City. The Math Science Nucleus offers a host of field trips in this area. Lesson plans on the geology and natural history along the Hayward Fault (and correlated to the Next Generation Science Standard) will be illustrated.

To learn more about both areas please consult the Math Science Nucleus website (http://msnucleus.org)
.NCGS is hosting a BBQ lunch at Tule Ponds.
For registration and/or additional information please email - blueford@msnucleus.org

Co-sponsored by Math Science Nucleus

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

2014-2015 RICHARD CHAMBERS MEMORIAL SCHOLARSHIPS

The Northern California Geological Society is pleased to announce the availability of their **Richard Chambers Memorial Scholarships** to help support graduate–level student research in geology during the 2014-2015 academic year. More than one scholarship may be awarded at each academic level.

$ 1,000 Scholarships will be awarded to students working towards the Masters Degree.

$ 2,000 Scholarships will be awarded to students working towards the Ph.D. Degree.

These scholarships will be awarded competitively, based upon our review of submitted summaries of proposed research. Funds are intended to support field and laboratory components of research programs. The research should be scheduled for completion during the 2014-2015 calendar years. Winners' may/will be invited to speak or otherwise present their research at a regular NCGS evening meeting in Orinda, California.

Funding priority for these scholarships will be directed to research focused on topics in general geology, geologic mapping, structural, economic, engineering and/or environmental geology, geophysics, stratigraphy, paleontology and/or paleoecology implemented in northern California and/or states immediately adjacent to northern California.

Application Procedure

Candidates may apply by forwarding a signed cover letter on University Department letterhead requesting the award, accompanied by a brief (no more than 2 pages) summary of their proposed research topic. This letter must include candidates contact information (both departmental and home mailing and email addresses, & telephone numbers).

The bottom of the candidate letter must bear this note (filled out):

Degree Program: _____, Approved by: _____, (print): _____,
Title: _____, Telephone: _____, e-mail address: _____, and date: _____.

with the signature and printed name, title, telephone & e-mail of the department chair person or thesis advisor. Please indicate which scholarship (Masters or Ph.D.) you are applying for. No other application form is required.
Please submit your letter and proposal by U.S. Mail postmarked **no later than DECEMBER 14, 2014** to:

Phillip Garbutt, Chair
NCGS Scholarship Committee
6372 Boone Drive
Castro Valley, CA 94552-5077

Voice: (510) 581-9098
e-mail: plgarbutt@comcast.net
NCGS website: http://www.ncgeolsoc.org
issued: September 5, 2014

Scholarship Awards will be made on or about January 31, 2015

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY and
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

K-12 EARTH SCIENCE TEACHER OF THE YEAR AWARD

$750 Northern California Geological Society
$500 Pacific Section AAPG
$5,000 National AAPG

Call for Nominations for the Year 2014-15 NCGS Competition

The Northern California Geological Society (NCGS) is pleased to announce that it will accept applications from candidates in the Northern California region for the Year 2014-15 competition for the Earth Science Teacher of the Year Award. The $750 NCGS award is intended to recognize pre-college earth science programs already in place, and to encourage their organization in districts where they have not been fully developed. Nominations of qualified K-12 teacher candidates are solicited from teachers, school administrators, teacher outreach programs, and other interested parties.

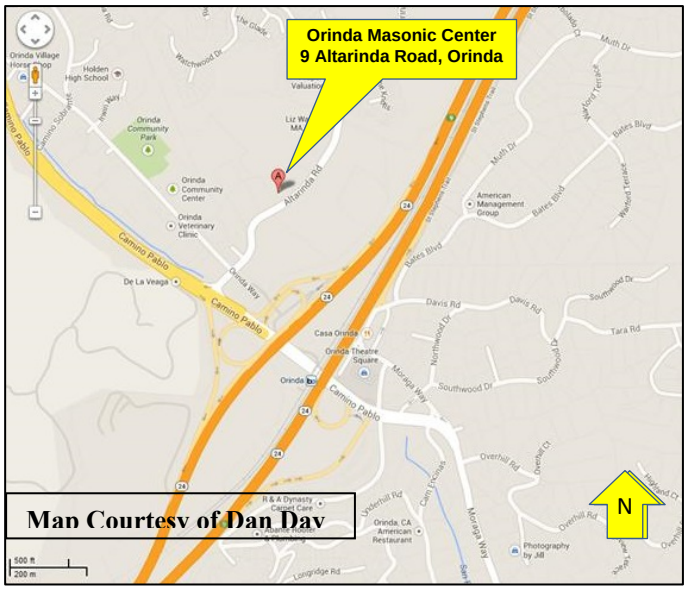
The NCGS awardee's application will be submitted to a regional competition sponsored by the American Association of Petroleum Geologists (AAPG) Pacific Section. The Pacific Section winner will receive a $500 award at the Pacific Section regional meeting in Ventura / Oxnard, CA, May 2015, plus up to $250 toward meeting expenses. The regional winner's project will be submitted to AAPG headquarters for the national contest. The national winner will receive an expense-paid trip to attend the national AAPG meeting in Alberta, Canada, June 2016, to receive the national award.

At the national level, the AAPG Foundation presents an annual $5,000 award to a K-12 teacher for *Excellence in the Teaching of Natural Resources in the Earth Science.* The award recognizes balanced incorporation of natural resource extraction and environmental sustainability concepts in pre-college Earth science curricula. It includes $2,500 to the teacher's school for the winning teacher's use, and $2,500 for the teacher's personal use.

The deadline for application submittal by candidates for the $750 NCGS award is Tuesday, January 16, 2015.

Interested candidates or nominators can request Application Information and an Entrant Application Form, or submit an application, by contacting:

Mark Petrofsky
Chair, K – 12 Geosciences Education Committee
Northern California Geological Society
1385 Rose Street, Berkeley, CA
510-526-4944
mpetrof@hotmail.com



Biography: Dr. Thomas L. Holzer is a research engineering geologist with the U.S. Geological Survey in Menlo Park, California, and a consulting professor with joint appointments in the Departments of Civil and Environmental Engineering and Geological and Environmental Sciences at Stanford University. He is also a California certified engineering geologist. He received his B.S.E. in geological engineering from Princeton University and his M.S. in hydrology and Ph.D. in geology from Stanford University. His current research interests are probabilistic liquefaction hazard mapping and the statistics of earthquake fatalities. He is the author of more than 120 professional publications.

What! *It's Renewal Time;* Already!? Yes!
We Operate From September to September.
Please Use the Attached Renewal Form or Grab it from the Website!

Northern California Geological Society
c/o Mark Detterman
3197 Cromwell Place
Hayward, CA 94542-1209

Would you like to receive the NCGS newsletter by e-mail? If you are not already doing so, and would like to, please contact **Rob Nelson** at **rlngeology@sbcglobal.net** to sign up for this free service.