

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



Website: [www.ncgeolsoc.org](http://www.ncgeolsoc.org)

## NCGS OFFICERS

### *President:*

Mark Sorrensen,  
[msorensen@itsi.com](mailto:msorensen@itsi.com)  
Innovative Technical Solutions, Inc.

### *President-Elect:*

Open  
*Field Trip Coordinator:*  
John Christian,  
[jmc62@sbcglobal.net](mailto:jmc62@sbcglobal.net)  
Patent Legal Assistant

### *Treasurer:*

Phil Reed, [philecreed@yahoo.com](mailto:philecreed@yahoo.com)  
Consultant

### *Program Chair:*

Tom Barry,  
[Tom.Barry@shawgrp.com](mailto:Tom.Barry@shawgrp.com)  
Shaw Group, Inc.

### *Scholarship:*

Phil Garbutt,  
[plgarbutt@comcast.net](mailto:plgarbutt@comcast.net)  
Retired, Cal State East Bay

### *K-12 Programs:*

Paul Henshaw,  
[candphenshaw@comcast.net](mailto:candphenshaw@comcast.net)  
Retired, K-12 education

### *Membership:*

Rob Nelson,  
[rlngeology@sbcglobal.net](mailto:rlngeology@sbcglobal.net)  
Clearwater Group, Inc.

### *NCGS Newsletter & Website Editor:*

Mark Detterman  
[mddetter1@gmail.com](mailto:mddetter1@gmail.com)  
Alameda County Environ. Health

### *Secretary:*

Dan Day: [dandav94@pacbell.net](mailto:dandav94@pacbell.net)  
NCGS Voice Mail: 925-424-3669  
VA Engineering, Inc.

## COUNSELORS

Mel Erskine,  
[mcerskine@comcast.net](mailto:mcerskine@comcast.net)  
Consultant

Tridib Guha,  
[Tridibguha@sbcglobal.net](mailto:Tridibguha@sbcglobal.net)  
Advanced Assessment Services, Inc.

Don Lewis, [donlewis@comcast.net](mailto:donlewis@comcast.net)  
Consultant

Ray Sullivan,  
[sullivan@lucasvalley.net](mailto:sullivan@lucasvalley.net)  
Emeritus, San Francisco State University

## MEETING ANNOUNCEMENT

**DATE:** April 28, 2010

**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:** Dr. Adrian Brown, SETI Institute

### *Mars Dust and Ice: A Voyage to the Poles with the Mars Reconnaissance Orbiter*

The Martian polar regions are the most dynamic regions of the Red Planet. Dr. Adrian Brown from the SETI Institute is a researcher on the Mars Reconnaissance Orbiter (MRO) mission that has been in orbit since 2007. Onboard MRO are a high resolution camera (HiRISE), context camera (CTX), and daily mapping camera (MARCI) in addition to a near infrared mapping spectrometer, the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM). Dr. Brown has used data from these cameras and spectrometer to examine the properties and behavior of surface ices, clouds and atmospheric dust over the past 3 Earth years. These new datasets are addressing some of our old questions about how dust storms form on Mars, and how much water is available for future explorers of the Red Planet. Dr. Brown is the coordinator for the SETI Seminar Series, which can be found at <http://youtube.com/setiinstitute>. Dr. Brown will describe how we know what we know about the polar regions of Mars and how MRO has uncovered new complexities and fascinating details at a spatial resolution previously only available to spy satellites.

**Biography:** Dr. Adrian Brown is currently working as a planetary science researcher at the [NASA Ames Research Center](http://www.nasa.gov) and [SETI Institute](http://www.seti.org) in Mountain View, Calif., United States of America. Adrian has a background in computer science and electrical engineering - his first degree was in Electrical Engineering from the Australian Defense Force Academy in Canberra, Australia. After receiving his Electrical Engineering degree, Adrian served with the Royal Australian Navy as a Weapons Engineer and Fire Control Officer on Her Majesty's Australian Ships CANBERRA and ARUNTA, in addition to numerous shore postings around Australia.

...Continued on the back...

## NCGS 2009 – 2010 Calendar

Wednesday April 28, 2010

*Mars Dust and Ice: A voyage to the poles with Mars Reconnaissance Orbiter*

Dr. Adrian Brown, SETI Institute  
7:00 pm at Orinda Masonic Lodge

Wednesday May 26, 2010

**SPECIAL DINNER MEETING!!**

*The Haitian Earthquake*

(Tentative; Carol is still in Haiti)

Dr. Carol Prentice, USGS, Menlo Park  
6:00 pm at Orinda Masonic Lodge (EARLY)

Wednesday June 30, 2010

TBA

7:00 pm at Orinda Masonic Lodge

**Our Usual Summer Break: July – August 2010**

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### Upcoming NCGS Field Trips

April 25, 2010  
Sunday

*Mammoth Rocks and the Geology of the Sonoma Coast;* E. Breck Parkman, Senior State Archaeologist, California State Parks, and Rolfe Erickson, Emeritus, Sonoma State University

**There's still room until Wednesday April 21<sup>st</sup>!**

Do you have a place you've wanted to visit for the geology? Let us know. We're definitely interested in ideas. For those suggestions, or for questions regarding, field trips, please contact John Christian at: [jmc62@sbcglobal.net](mailto:jmc62@sbcglobal.net).

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**The Pinnacles Partnership  
presents**

**Geology Field Day  
2010 San Juan Bautista  
Trekking the Faultline  
(Local field trips)**

**Dinner & Not Just Rock & Roll  
Scoping the Night Sky**

WHERE: Windhaven Ranch, San Bautista  
WHEN: Saturday, May 8th 9 am-midnight  
ADMISSION: \$10 adults; \$5 under 18

(Vendors and exhibitors free)

**Day activities include:**

- Join in on a "rock exchange," (Bring a bucket of rocks to share & trade)
- Sign-up to lead or join in on group talks, presentations & demonstrations
- Sign up now for a local geology field trip to see the San Andreas Fault and mining operations in Granite Rock's Quarry in Aromas (space is limited)
- Learn more about Pinnacles National Monument
- Tour the Mission and the San Andreas Fault in San Juan Bautista
- Learn about earthquake faults and local geology
- Learn about landslides, fire, and rock hazards
- Personal and community disaster preparedness
- Learn to identify rocks, minerals, and fossils
- Learn about lapidary and jewelry metal craft (with vendors and club activities)
- Study geologic maps and geologic educational resources
- Talk with scientists about ongoing research and Investigations in the region
- Teacher and student study and relaxation space – all day
- Join in a raffle, a silent auction, and more! (Got samples to donate?)
- Enjoy nearby San Juan Bautista, Fremont Peak SP, or wineries along the fault
- Just come and enjoy a day, dinner, wine patio, and evening star party on Windhaven Ranch!

**Bring a demo!**

**See and do geology as art**

**Got ideas and stuff to help get kids interested in geology and nature?**

**Bring an instrument!**

**Help make songs and music about rocks and geology**

**To register (and for more details) go to**

**<http://www.pinnaclespartnership.org>**

(The Pinnacles partnership is a non-profit organization that supports programs at the Pinnacles national Monument.)

**Proceeds will support the Pinnacles National Monument**

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**AEG Sacramento Section  
Spring 2010 Field Trip  
GLACIAL AND POST-  
GLACIAL  
GEOMORPHOLOGY  
Of YOSEMITE VALLEY AND  
VICINITY**

**April 30 - May 2, 2010**

Greg Stock – National Park Service

Valerie Zimmer – U.C. Berkeley

Anna Brody – CSU Fresno

Jerry DeGraff – U.S. Forest Service

Alan Gallegos - U.S. Forest Service

Jim Borchers – U.S. Geological Survey (retired)

Jim Roche – National Park Service

**With contributions from:**

Brian Collins – U.S. Geological Survey

Ed Harp – U.S. Geological Survey

Mark Reid – U.S. Geological Survey

Gerald Wiczorek – U.S. Geological Survey  
(retired)

**Field Trip Summary and Details**

Yosemite National Park was founded primarily because of its outstanding geology, and the park continues to be one of the world's best natural laboratories for geologic research. Join AEG members presently working in Yosemite for a two-day field trip highlighting recent advancements in our understanding of the glacial and post-glacial geomorphology of the area. New, never seen before research will be presented. Topics will include new evidence for the timing and magnitude of Pleistocene glaciations; rates of river incision and canyon deepening; the 1997 flood and implications for future climate change; recent Yosemite Valley rock falls including the 2008 Glacier Point and 2009 Ahwiyah Point events; applications of terrestrial laser scanning, DEM analyses, cosmogenic dating, and shallow geophysics for rock-fall hazard assessment; seismic and acoustic monitoring of Yosemite Valley rock falls; and GPS monitoring of the Ferguson rock slide. We have campsites reserved at the Hodgdon Meadow Campground in Yosemite National Park for the nights of Friday, April 30 and Saturday, May 1. Saturday evening will be the main social event with a shared meal provided; participants will need to provide all other meals. Alternate accommodations are available outside the park for those who do not wish to camp, but motel and park entrance fees are the responsibility of the individual. Please note that

carpooling will be crucial for this event, as we are only allowed 10 vehicles at the campground, and parking at the field trip stops is limited. We have reserved two 15-person vans for the field trip. The vans will depart Sacramento on Friday afternoon, and will return on Sunday evening. The use of personal vehicles is strongly discouraged. For those travelling from outlying areas and/or are staying outside the park, arrangements can be made to leave your vehicles at the campground or at a nearby day-use parking area during the field trip.

**Tentative Schedule**

Friday, April 30th Vans depart from Sacramento (afternoon). Location TBD.

Saturday, May 1st 8:00am – Depart campground for Yosemite Valley stops

5:00 pm – Return to campground/group dinner

Sunday, May 2nd 8:30 am – Depart campground for additional stops in Yosemite Valley + Ferguson rock slide (Highway 140)

2:00 pm – Field trip completed

5:30 pm – Arrive in Sacramento

Contact Drew Kennedy at:

[dkennedy@SAGEengineers.com](mailto:dkennedy@SAGEengineers.com) or (916) 521-1105

for more information and to reserve your space.

Trip size is limited to 30. **The trip will sell out quickly so reserve your spot now!**

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**Peninsula Geologic Society**

**Upcoming meetings**

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.

- May 11, 2010, Julie C. Fosdick, Stanford, Andes research.
- June 1, 2010, Victoria Langenheim, Presidential address

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**Association of Engineering Geologists**

**San Francisco Section**

**Upcoming meetings**

Meeting locations rotate between San Francisco, the East Bay, and the South Bay. Please check the website for current details:

- May 11, 2010, Dr. Paul Marinos, 2010 Jahns Distinguished Lecturer
- June 8, 2010, John Wakabayashi, New Insights into the Processes of Franciscan Melange Development

To download meeting details and registration form go to: <http://www.aegsf.org/>.

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## **An Update on the BGG**

In regards with the relocation of the California Board of Geology & Geophysics to the Board of Professional Engineers and Land Surveyors, activities continue. The following is an out take of a larger posting (fifteen pages) on the Southern California Section of the Association of Environmental and Engineering Geologists (AEG), one of the more active sources of information on the topic. More is available at:

<http://www.aegsc.org/bggnews/>

## **Status Update on AB 1431**

By Charles Nestle March 26, 2010

As discussed previously by Peter Thams (AEG southern California Section Chair) in the AEG southern California Section newsletter and in the March AEG News, Assembly Bill 1431 (Hill) proposes to change the name of the Board for Professional Engineers and Land Surveyors to include one geologist and to add one geologist position on the board. How this is to be accomplished was the subject of a decidedly mono-directional "negotiation" between the sponsor of this bill, Professional Engineers in California Government (PECG) and their supporters, and AEG representatives during a meeting in PECG's offices on February 16, 2010. Peter's discussion of that meeting was emailed to AEG members March 1, and follows here:

## **Union Representing Engineers in State Government Opposes Adding Geophysicist to Board for Professional Engineers and Land Surveyors**

Peter Thams

The three section chairs of California AEG, Peter Thams, John Pfeiffer and Jared Pratt, along with Charles Nestle of the Legislative Committee met with the union Professional Engineers in California Government (PECG) on February 16, 2010, and were told PECG would not support an effort to place more than one geologist on the Board for Professional Engineers and Land Surveyors (BPELS). At a meeting in Assembly Member Hill's office back in December, AEG representatives (Peter Thams and John Pfeiffer) were told that if AEG did not oppose PECG sponsored Assembly Bill AB 1431, which increases the size of BPELS by one to allow for a geologist and changes the name of the board to include geologists and geophysicists,

Assembly Member Hill's office and PECG's lobbyist, Steve Baker, would do everything they could to amend the bill to add a geologist and a geophysicist, once the bill cleared the assembly. AB1431 has cleared the Assembly and is moving on to the Senate, where it appears to be doomed to failure because it will likely need to be amended to include an additional public member, increasing the size of the board by two, and the Governor is unlikely to sign it.

PECG, representatives of various professional associations representing engineers, and G.V. Ayers from the Senate Business and Professions Committee also present at the meeting, didn't come right out and say they wouldn't support the addition of a geophysicist or more than one geologist to the BPELS, they simply opposed the only practical option of accomplishing this, which is to maintain the size of the board at thirteen and replace two engineering title acts with the two geology practice acts. Other options that stand no chance of success would be cautiously considered, but engineers were not going to give up their stranglehold on the board. It should be noted that BPELS does not have the majority seven public members stipulated in law, only recently acquired a fifth public member to equal the engineers on the board, and are still outnumbered by technical members that, including a land surveyor, total six. Representatives from Assembly Member Hill's office (author of the bill) and the Governor's office, who was also invited to the meeting, did not attend.

The message was really very simple and was even alluded to if not outright stated: None of this matters to us and we're not going to waste any more time on it. It was left up to us (AEG) to garner support from the absent Governor's office to increase the size of the board. So it seems even the PECG proposal as written was doomed to failure from the outset and PECG was just going through the motions to mollify the relatively few geologists they represent in state government. The good news is that all those opposed to adding a geologist and a geophysicist to the board said they would support re-establishing the Board for Geologists and Geophysicists (BGG). The California Sections of AEG are discussing whether to oppose the PECG-sponsored AB1431 unless it is amended or support if amended. Whichever direction is chosen, we will work to amend the bill to include a both a geologist and a geophysicist through legislature with or without the support of PECG or the engineering organizations. Since the February 16th meeting, we have been told that PECG will amend the bill to eliminate geophysicists from the proposed name change in response to protest from BPELS staff.

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Immediately following this meeting (beginning on the sidewalk outside the door), Jared, Peter, John, Judy Wolen, and I discussed our options regarding support or opposition to the bill: support if amended, oppose unless amended, or remain neutral. This discussion continued for several days and generally settled on support unless amended. Later we heard that Senator Mark Wyland's office recommended remaining neutral (taking no position). Senator Wyland's opinion is important because we've approached him to carry legislation to reinstate the Board for Geologists and Geophysicists, and we want to maintain a good working relationship with him and his staff.

When the latest amended version of the bill was released (March 9, 2010) and scheduled for hearing on March 22, we re-evaluated our position and settled on Oppose As Written and Amended (see attached letter dated March 12, 2010). We felt that our position had been misunderstood in the past (as when Sam Blakeslee's staff thought we would prefer the BGG be incorporated into BPELS rather than the SMGB), and wanted to be certain that there would be no misunderstanding. We also felt that acquiescing to continually being told what to do had gotten us nowhere, and that it was time to begin doing what we know to be right.

"Compromise in the rough-and-tumble legislative process is not achieved by doilies and tea."

Jerry Brown — CA State Attorney General and former CA Governor

A few days prior to the March 22 hearing date, Judy Wolen called to say that a few legislators' staff wanted to meet with me prior to the hearing to discuss AEG's position letter. Apparently our position was unexpected, and people had taken notice. Judy Wolen and I met with the staff of Senator Wyland, Assembly Member Hill (the bill's author), and G.V. Ayers, the consultant to the Senate Committee on Business, Professions and Economic Development. I said that this was an important bill, that it was absolutely necessary to have a geologist on the board, that passage of this bill was better than the it's not passing (no geologist on the board), but that it didn't go far enough. I also told what I was going to say during the hearing. Staff were pleased that ours was a "soft oppose" rather than a "hard oppose."

We picked up a hearing agenda from a rack in the corridor, and earlier I had been handed a copy of a letter of support for AB 1431 prepared by Joanne Arnold, Assistant Executive Officer of BPELS (both

documents are attached. I had time only to scan them cursorily, but I should have taken the time to thoroughly read these prior to the hearing. We were constantly moving around and talking to people and there just wasn't time available to pause.

During the hearing, which was attended by myself, John Pfeiffer (AEG Sacramento Section Chair), and Judy Wolen (AEG Legislative analyst), the expected discussions were heard: Assembly Member Hill's introduction was nearly word for word what I had relayed as my introduction (coincidence?), support was provided by Steve Baker (representing PECG), Joanne Arnold (BPELS), and then I spoke when asked if there was any opposition. The committee's staff then recommended adding one additional public member to BPELS, raising the total members as proposed in AB 1431 from 13 to 15 members. Given the Governor's long-stated position on boards and commissions, and the fact that he has only appointed enough members to each board to maintain a quorum (assuming they all show up), proposing to increase the size of the board guarantees the Governor's veto. Nevertheless, all voted yes (as expected). Then, as he did at the June 15, 2009 hearing, Senator Wyland made a very telling brief discussion about how the abolition of the BGG was unnecessary as it was a special funded board and no impact to the general fund resulted from consolidating it with BPELS.

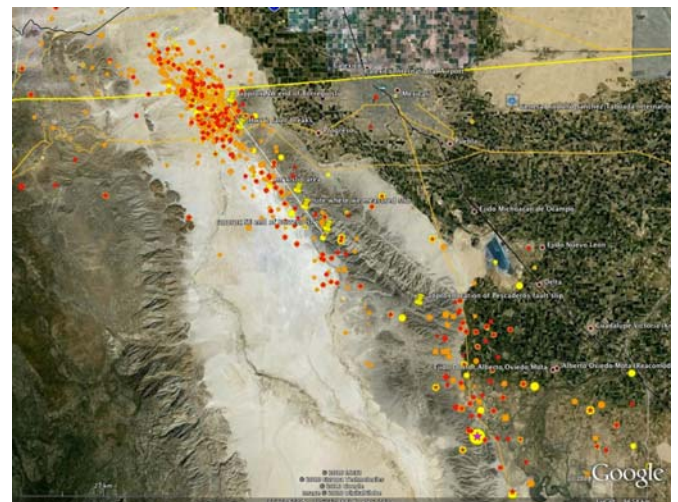
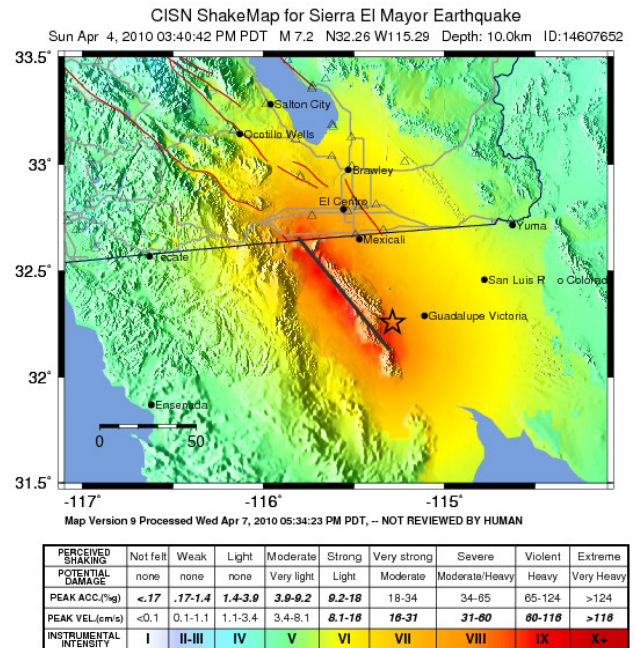
On the flight back to Los Angeles, I thoroughly read the agenda discussion and Joanne Arnold's letter — *twice* — and recognized that the arguments in support of AB 1431 prepared by Ms. Arnold and reiterated in the agenda, had no basis in fact. Had I recognized this earlier, I would have pointed this out during the hearing (though the outcome probably would not have changed). Instead, that evening I wrote a second letter (attached) discussing the fatal flaws in Ms. Arnold's logic. What we will never know is if this letter represents a gross misunderstanding or lack of knowledge of the most fundamental aspects of the Professional Engineers Act by the board's Assistant Executive Officer, or if that letter intentionally misrepresented the facts. Ultimately neither matters; what does is that the statements in that letter clearly illustrate that we must all diligently scrutinize facts as presented by representatives of BPELS. Because at least some of the information presented by that board is demonstrably false.

# M<sub>w</sub> 7.2 Sierra El Mayor Earthquake (Northern Baja California Earthquake)

A major earthquake has been felt throughout Southern California, Arizona, Nevada, and Baja California Norte, Mexico. The M<sub>w</sub>7.2 event occurred at 3:40PM PDT, 22:40 UTC, on Sunday, April 4th, 2010. The epicenter was located 30 miles (48 km) SSE of Calexico, CA. The closest town is 11 miles (17.7 km) WSW from the epicenter, located at Guadalupe Victoria, Baja California Norte, Mexico. The fault rupture appears to extend 75 km northwest, from the epicenter in Baja California through the US-Mexico border.

The magnitude 7.2 Sierra El Mayor earthquake of Sunday April 4th 2010, occurred in northern Baja California, approximately 30 miles south of the Mexico-USA border at shallow depth along the principal plate boundary between the North American and Pacific plates. This is an area with a high level of historical seismicity, and also it has recently been seismically active, though this is the largest event to strike in this area since 1892. The 4 April earthquake appears to have been larger than the M 6.9 earthquake in 1940 or any of the early 20th century events (e.g., 1915 and 1934) in this region of northern Baja California. At the latitude of the earthquake, the Pacific plate moves northwest with respect to the North America plate at about 1.8 inches per year.

The principal plate boundary in northern Baja California consists of a series of northwest-trending strike-slip (transform) faults that are separated by pull-apart basins. The faults are distinct from, but parallel to, strands of the San Andreas fault system. The April 4 main-shock occurred along a strike-slip segment of the plate boundary that coincides with the southeastern part of the Laguna Salada fault system. It is a complex event that may have begun with east-down motion along faults on the eastern edge of the Sierra El Mayor, then progressed to the northwest with oblique slip, that is, a combination of lateral shift to the right and also east-down motion. Overall, the location and



focal-mechanism of the earthquake are consistent with the shock having occurred on this fault system. We have received initial measurements from field geologists from the Centro de Investigación Científica y de Educación Superior de Ensenada, BC. (CICESE) who have observed surface rupture associated with the 2010 event at 32.578621° ; -115.725814°. Highway 2 was offset at this location by a total of about 1.2 meters across a zone of fractures that offset the road towards the right, and with the east side also dropping downwards. Aftershocks appear to extend in both directions along this fault system from the epicenter of the 4 April 2010 event.



Field photo displaying vertical displacement exceeding 2 meters. More photos are available by clicking on the photo above. Photo by Borrego Rupture Mapping Team (John Fletcher, Prof. CICESE, Orlando Teran, Ph.D. Student, CICESE, Ronald Spelz, Ph.D. Post-doc, UABC, Tom Rockwell, Prof. SDSU, Eulalia Marsana, Prof. Univ. of Barcelona, Geoff Sarneros, SDSU).

The aftershock zone extends from near the northern tip of the Gulf of California to 6 miles northwest of the Mexico-USA border. Earthquakes having magnitudes as high as 7 have been historically recorded from the section of the Pacific/North American plate boundary on which the 4 April 2010 earthquake occurred. The 1892 earthquake occurred along the Laguna Salada fault system, but surface offsets associated with the 1892 event lie farther northwest than the 4 April 2010 mainshock's epicenter. The 2010 event's aftershock zone extends to the northwest, overlapping with the portion of the fault system that is thought to have ruptured in 1892. The 1940 Imperial Valley earthquake approached magnitude 7, though it occurred farther to the north and on the Imperial fault. Both the 1892 and 1940 earthquakes were associated with extensive surface faulting.

An event of M 7.0 or 7.1 occurred in this region in 1915, and then a M 7.0 to 7.2 in 1934 broke the Cerro Prieto fault with up to several meters of surface slip. In the vicinity of the 4 April 2010 earthquake, there are several active faults and it has not yet been determined specifically which fault the earthquake occurred on. Within the transition from the ridge-transform boundary in the Gulf of California to the continental transform boundary in the Salton Trough, faulting is complex. Most of the major active

faults are northwest-southeast oriented right-lateral strike-slip faults that are common in mechanism to the San Andreas fault and parallel Elsinore and San Jacinto faults, that run north of the Mexico-USA border.

Here are photos provided by Danny Ashcraft and forwarded by Tucson geologist Peter Megaw, showing dust clouds stirred up in the mountains by Sunday's magnitude 7.2 Sierra El Mayor Earthquake:



For a source of good information go to <http://www.scsn.org/>

# How Dinosaurs Came to Rule the Earth

Jeanna Bryner

More than 200 million years ago, as North Africa was ripping away from North America, opening up the Atlantic Ocean, hot lava poured out from Earth's surface. The lava, enough to more than cover the United States, created inhospitable conditions for most life ... except the dinosaurs.

And new geologic discoveries suggest this climate catastrophe was the ticket for the dinosaur's rise to rule.



*Reuters – A Tarbosaurus dinosaur skeleton is displayed during an exhibition "Dinosaurs, treasures of Gobi"*

At that time, about half of all species on Earth died out in what is called the end-Triassic extinction. Scientists have suggested massive volcanic eruptions could be to blame, spewing out lava and greenhouse gases such as carbon dioxide that would have totally changed the climate.

The new research, detailed this week in the journal *Proceedings of the National Academy of Sciences*, makes a firm case for volcanoes as the culprit but also pieces together other evidence for how the volcanic scenario led to dinosaurs dominating the landscape.

"The big thing is many people have heard why dinosaurs went extinct," said study researcher Jessica Whiteside, paleontologist and assistant professor of geological sciences at Brown University in Rhode Island. But the question 'Why they came to be' is much more exciting."

In addition to looking at an uptick in life rather than its demise, the researchers also took a unique approach to fossil hunting. Their finding is based partly on chemical fossils rather than the beasts' bony remains.

## *Chemical fossils*

Whiteside and her colleagues specifically looked at the ratio of two carbon isotopes, or atoms of the same element that have a different number of neutrons, in the wax of ancient leaves and wood found in lake sediments mixed with volcanic material called basalts. The samples came from eastern North America and England. They found the lighter isotope called carbon-12 was higher relative to the heavier carbon-13, a signature of a volcanic eruption.

Here's how it works: At the time, the continents were stuck together into a supercontinent called Pangea. The giant block began to break up as the North American and the African plates began to drift apart. As the two plates parted ways, fissures formed, releasing massive outflows of lava.

The carbon dioxide gas that spewed out with lava is known to have a high carbon-12 amount relative to the heavier isotope. Plants then take up that gas when photosynthesizing and forming new plant material. And so the presence of plants with lots of the lighter carbon suggests they sprouted in the wake of the eruptions.

Results also showed about half of plant species perished, along with a spike in fern spores around the time of the first lava flows, which makes sense since ferns are among the first plant species to pop up in an environment scarred by volcanism.

## *Dinosaurs take over*

Next, the team matched up the timing of the eruptions with the disappearance of a group of reptiles called crurotarsans from past research using footprints of the animals found in the same rocks. Crurotarsans were dinosaurs' main competitors during the Triassic period

After the lava flows, the "fossil record for crurotarsans is nearly completely gone," Whiteside said.

As for how the reptiles, plants and other species died out, Whiteside said the volcanoes may have caused various lethal changes to the environment. "Changes to the pH of the oceans, which killed most of the animals that make shells, and this greenhouse warming would likely have decimated many of the reptiles, including dinosaurs' main competitors," she told LiveScience. (The pH measures the acidity or alkalinity of a substance.)

Without competition for food, early meat-eating dinosaurs like *Tyrannosaurus rex* and *Velociraptor* took over, the researchers speculate. Study researcher In a past study, Paul Olsen from the Lamont-Doherty Earth Observatory of Columbia University, who was part of the research study team, showed that theropod (meat-eating dinosaurs) footprints after the Triassic mass extinction had become much larger, corresponding to larger body sizes.

It's still a mystery as to why these early dinosaurs even survived the volcanism, let alone thrived, Whiteside said, "It's really that it was just a fortuitous combination of traits that they unwittingly possessed that let them get through the catastrophic climate change that their competitors didn't have."

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## **Scientists say fresh water from lake was dumped into Arctic Ocean**

By David Fogarty

SINGAPORE - Scientists say they have found the trigger of a sharp cooling 13,000 years ago that plunged Europe into a mini ice age. Mark Bateman from the University of Sheffield in England said a catastrophic flood unleashed from a giant North American lake dumped large amounts of fresh water into the Arctic Ocean. This led to the shutting down of the Gulf Stream ocean circulation pattern that brings warmth to Europe.

"We're talking about a lake the size of the (United Kingdom) emptying very quickly," Bateman told Reuters by telephone. "We don't know the exact period of time but we're talking about a catastrophic flood." The finding has confirmed past theories about the likely cause of a sudden cooling period called the Younger Dryas when temperatures in Europe, similar to

today's, quickly returned to ice age conditions. The cooling lasted for about 1,400 years.

"Our research shows that if you put a large volume of fresh water into the North Atlantic in a very short space of time, this is what happens," Bateman said. His team's work is published in the latest issue of the journal *Nature*. The Gulf Stream acts like a conveyor belt by bringing warm water from the tropics to Europe while cold salty water sinks to the depths in the far north. This "overturning" circulation draws in yet more warm water from the south.

Climate scientists fear rapid global warming could trigger a sharp increase in the amount of meltwater from Greenland. This surge in fresh water could trigger a tipping point that overwhelms the Gulf Stream, shutting it down and likely plunging Europe into another deep freeze.

Bateman and his team confirmed the path of the floodwaters from Lake Agassiz that covered part of what is now Canada and the northern United States. The lake had formed in front of the ice-sheet that once covered a large part of North America.

Scientists had previously guessed that a giant flood unleashed from the lake probably caused the Younger Dryas cooling but couldn't confirm the route of the floodwaters. Bateman found that the waters flowed down the Mackenzie River, Canada's longest, rather than the Saint Lawrence Seaway that had previously seemed the most likely route.

Studying sediments from cliff sections along the river delta, he said the evidence spanned a large area at many altitudes. This could only be explained by a mega-flood from Lake Agassiz.

Dating of the sediments helped the team pin down the date of the flooding, showing that it occurred right at the start of the Younger Dryas.

Satellite observations and computer models by scientists have shown that the Greenland icesheet is melting at an accelerating rate, dumping large amounts of ice and meltwater into the North Atlantic.

A study published in the journal *Science* last November said recent summers further

accelerated Greenland's mass loss to the equivalent of 273 cubic kilometers of water per year in the period 2006-2008. The also represented 0.75 millimeters of global sea level rise per year.

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## **Arctic Ocean awakening as ice melts**

**Sleepiest ocean is mixing more and supporting more summer life**

**By Larry O'Hanlon**

Earth's sleepiest ocean is waking, say researchers. The Arctic Ocean's ice-capped depths have been quiet for millennia, thanks to winds being largely unable to ruffle the surface and stir things up. The rapid loss of summer ice cover is changing all that, however, creating internal waves in the Arctic waters that could dramatically change life there — and perhaps even accelerate the sea ice loss. "It's a very, very quiet ocean," said Luc Rainville of the University of Washington's Applied Physics Laboratory, in Seattle.

He and his colleague Rebecca A. Woodgate have just published a study in the latest issue of *Geophysical Research Letters* reporting how Arctic waters along the continental shelves are getting more turbulent as the summer ice disappears and waves start churning the water like in other oceans.

"If you put instruments down in the Pacific or Atlantic oceans you'll see density changes every few hours" indicating the passage of internal waves within the ocean, Rainville explained to *Discovery News*. These underwater waves move water up, down, sideways and have been measured at heights of up to 200 meters near Hawaii. The internal waves keep the oceans forever turbulent, fertile and unable to settle into quiet pools with warm waters on top and colder, nutrient-rich waters below.

The ice-topped Arctic Ocean, on the other hand, is just such a stratified, calm place because sea ice muffles all waves "like a big damper," Rainville explained. But that is becoming less the case as summer sea ice melt is opening up ever wider expanses of water around the northern continental shelves of North America and Asia.

All that wave action is expected to bring deep water nutrients closer to the surface, where with sunlight they'll feed summer phytoplankton blooms — forming a vast new foundation for the Arctic marine food web.

Among the more worrisome questions raised by a more turbulent Arctic Ocean is whether or not it could speed up the melting of Arctic sea ice. "That's a big open question," Rainville said. "It's possible because the Arctic is a very peculiar ocean." Unlike any other ocean basin, the Arctic has a lot of very fresh, very cold water on top from melted ice, what's called the cold halocline layer. But about 100 meters below is very salty, slightly warmer water. If internal waves become powerful enough to mix these waters, then yes, the warmer surface could accelerate the melting of sea ice.

"Storms in the central Arctic with reduced ice cover can easily lead to vertical mixing levels that can erode or even remove the cold halocline layer," said Ilker Fer of the University of Bergen, Norway's Geophysical Institute. "The ice is then easily exposed to the relatively warm Atlantic water, possibly leading to a positive feedback." For now, says Rainville, about all that can be said with reasonable certainty is that the Arctic is bound to become a place of greater seasonal extremes: Rowdy with waves, more mixing and therefore more marine life in the summers, but with the age-old funereal quiet returning for the ice-capped winter months.

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**As usual of late, the editor sincerely thanks John Christian for suggesting more than several of these articles for the newsletter! Please thank him for spotting some of these suggestions!**

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



## NCGS DINNER - MEETING

*The Haiti Earthquake of 12 January 2010: A Geologic Perspective*  
Wednesday May 26, 2010

**Speaker: Dr. Carol Prentice**, U.S. Geological Survey, Menlo Park  
6:00 pm at Orinda Masonic Center

**(Reservations are required by May 21, 2010)**

**We are sorry but we will not be able to accommodate “walk-ins”**

Stepping out of our normal routine, the **Northern California Geological Society** is pleased to announce this *special dinner and evening* with **Dr. Carol Prentice**. She just returned from four weeks of fieldwork in Haiti in late March. For this special event, planned for our normal monthly meeting date, but starting one-half hour early, we are planning in typical NCGS style, a Back Forty Texas BBQ dinner consisting of **Pork Ribs and BBQ Chicken, Tossed Green Salad, BBQ Beans, Fresh Corn Cobettes**. For vegetarian dinners deluxe veggie burger will be served in place of BBQ. Desert will include assorted cookies and brownies. We may be again serving wines from BevMo specials (90 pts +). Please also note that a vegetarian option is available if notified ahead (see registration form below).

### ***Abstract: The Haiti Earthquake of 12 January 2010: A Geologic Perspective***

The M7.0 earthquake that occurred in Haiti last January produced unprecedented destruction given the size of the earthquake. It caused more than twice as many casualties as any previous M7 earthquake of any size since 1900. The tectonic setting of Hispaniola, the island shared by the nations of Haiti and the Dominican Republic, within the plate-boundary zone between the Caribbean and North American plates guarantees that future large earthquakes are inevitable. There are three major structures that take up plate-boundary slip in the vicinity of Hispaniola, and likely many other poorly known secondary faults that are capable of producing large, potentially damaging earthquakes. Geologic investigations indicate that the 12 January earthquake was a complex event, causing coastal uplift and only minor surface rupture along a short section of the major fault in southern Haiti. The details of the 12 January event held many surprises from a scientific perspective, but the inevitability of earthquakes this size in this region is no surprise, and the tragic loss of life due to poor construction practices is also no surprise.

**Biography:** **Carol Prentice** received both MS and Ph. D. degrees in Geoscience from the California Institute of Technology, and her B. A. degree in Geology from Humboldt State University. Dr. Prentice taught earth science for three years at the high-school level after college and before entering graduate school. She is currently a research geologist at the U.S. Geological Survey, and is the project chief for the San Francisco Bay Area Earthquake Hazards Project. Carol’s research involves the geologic study of active faults in northern California, the Caribbean, and Asia.

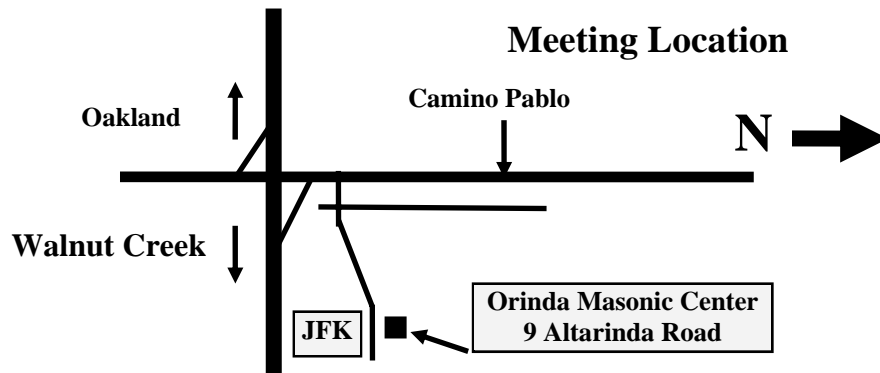
\*\*\*\*\* Dinner Logistics \*\*\*\*\*

Meeting Details: Social Hour: 6:00 – 7:00 pm; Dinner: 7:00 – 8:00 pm Presentation: 8:00 – open  
**Time:** May 26, 2010, 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA. **Cost: \$20/person**

\*\*\*\*\*REGISTRATION FORM (Dr. Carol Prentice Dinner)\*\*\*\*\*

Name: \_\_\_\_\_ E-mail: \_\_\_\_\_  
Phone (day): \_\_\_\_\_ Phone (cell) \_\_\_\_\_ Phone (evening): \_\_\_\_\_  
Dinner: Regular: \_\_\_\_\_ Vegetarian: \_\_\_\_\_ (Please check one) Check Amount: \_\_\_\_\_

Please mail a check made out to NCGS to: **Tridib Guha, 5016 Gloucester Lane, Martinez, CA 94553**  
Questions: e-mail: [tridibguha@sbcglobal.net](mailto:tridibguha@sbcglobal.net) Phone: (925) 370-0685 (evening) (925) 691-9002 (day)



Adrian is a certified Java programmer, and has worked as a Software Engineer for a variety of commercial projects for IBM, Zurich and other businesses. He has a Masters in Computer Science from the University of New England in Armidale, New South Wales. Adrian completed his PhD in Earth and Planetary Science at Macquarie University, in Sydney, Australia. The topic of his defense was "Hyperspectral Mapping of Ancient Hydrothermal Systems". His advisors were Prof. Malcolm Walter of the Australian Centre for Astrobiology and Dr. Thomas Cudahy of CSIRO Exploration and Mining in Perth, Western Australia. Adrian is a fully qualified Private pilot, and has used this skill to enhance his knowledge of remote sensing by flying over study regions in Western Australia. He holds current endorsements on C172 and Piper Warrior single engine aircraft. Adrian is qualified in remote first aid and as an outback four wheel drive exponent. Adrian is an Australian citizen, and grew up in Melbourne, Victoria. He is keen on personal fitness. He is a fan of the Australian Rules football club Essendon, and an avid listener to JJJ and TAL.

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 **Dan Day** at [danday94@pacbell.net](mailto:danday94@pacbell.net) to sign up for this free service.