

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



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

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## MEETING ANNOUNCEMENT

**DATE:** **October 24, 2012 (ONE WEEK EARLY!!)**

**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. Ray Wells, US Geological Survey

### ***“Revolutionary” Tectonics in the Pacific Northwest: The Role of Rotating Microplates and Mega-Blocks Along the Cascadia Convergent Margin***

Dr. Ray Wells of the U.S. Geological Survey will present a lecture on the tectonics in the Pacific Northwest. Dr. Wells has been a research geologist for almost 30 years, concentrating on the use of geologic mapping, magnetic rock properties (paleomagnetism) and GPS to solve large-scale problems in the Earth’s on-going structural evolution. Ray has produced a simple, hands-on block model of the Pacific Northwest, which he will demonstrate at the talk. Today, over 200 of the models are used in classrooms around the Pacific Northwest.

Deformation and paleomagnetic rotations over the past 50 million years indicate that the Cascadia fore arc is moving northward along the west coast and breaking up into large rotating blocks. Deformation occurs mostly around the margins of a large, relatively non-seismic Oregon coastal block composed of thick oceanic crust. This 400 km-long block is moving slowly clockwise with respect to North America about a rotation pole in eastern Oregon, thus increasing convergence along its leading edge near Cape Blanco and creating an extensional volcanic arc on its trailing edge. Northward movement of the block breaks western Washington into smaller, seismically active blocks and compresses them against the Canadian Coast Mountains. Movement of these blocks may be up to 9 mm/yr, sufficient to produce damaging earthquakes in a broad deformation zone along block margins.

Recent GPS data show that clockwise rotation of Oregon continues today, but the rotations extend throughout the Pacific Northwest. Rotation rates from GPS studies are similar to older paleomagnetic rates. Northward moving Oregon is currently squeezing Washington against slower moving Canada: this constriction has produced the Yakima fold and thrust belt and its analogs, like the Seattle fault, in the forearc. Locally, right lateral shear in the forearc is apparent in the GPS data, consistent with recently discovered right lateral faults in the Portland area that may be seismically active. In a broad sense, the smaller, clockwise rotating blocks of the Pacific Northwest appear to be caught like a giant ball bearing between the much larger Pacific and North American plates. ... *Continued on back....*

# NCGS 2010 – 2011 Calendar

## Tuesday, October 16, 2012

Dr. Ron Blakey; AAPG Distinguished Lecturer  
*Using Paleogeographic Maps to Portray Phanerozoic Geologic and Paleotectonic History of Western North America*

Time TBA – Likely Chevron late morning or luncheon presentation and a UC Berkeley presentation at 4 or 5 pm

## October 24, 2012 (ONE WEEK EARLY!)

Dr. Ray Wells, US Geological Survey  
*Revolutionary tectonics in the Pacific Northwest: Role of rotating microplates and mega-blocks in Cascadia*  
7:00 pm at Orinda Masonic Lodge

## November 28, 2012

Dr. Patrick Muffler, US Geological Survey, Geologist Emeritus  
*Lassen Volcanic National Park -- a wonderland of volcanoes and thermal features*

## Our Usual December Break

January 30, 2013

TBA

February 27, 2013

TBA

March 27, 2013

TBA

April 24, 2013

**NO MEETING**

Meet us at:

Pacific Section AAPG Meeting; Monterey CA

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## Upcoming NCGS Events

Saturday, October 20<sup>th</sup>, 2012 **Teachers' Workshop – Geological Field Trip on Mount Diablo** (See Attached Flyer; *Sorry Teachers Only!*)  
8:30am – 4:30pm

Friday, November 2, 2012 **The Caldecott Fourth Bore Project; Tunneling Through a Miocene Plate Boundary** (See form)

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 Tridib Guha at: [TridibGuha@yahoo.com](mailto:TridibGuha@yahoo.com).

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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.

- November 13, 2012, Paul A Hsieh will give a talk about the Deepwater Horizon oil spill; meeting in Hartley

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## Bay Area Science

(<http://www.bayareascience.org/>)

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).

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## 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/>.

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## USGS Evening Public Lecture Series

The USGS Evening Public Lecture Series events are free and are intended for a general public audience that may not be familiar with the science being discussed. Monthly lectures are usually scheduled for the last Thursday evening of each month during most of the year but are occasionally presented on the preceding Thursday evening to accommodate the speakers. For more information on the lectures, including a map of the lecture location (Building 3, 2nd floor; Conference Room A) go to: <http://online.wr.usgs.gov/calendar/>

Thursday, October 25, 2012 [Watch Live at 7pm PDT](#); USGS, Conference Room A, Bldg 3, Menlo Park, California

- *Exploring Mars With Curiosity --searching the Martian surface for evidence of habitable conditions*; by USGS Astrogeology Science Center's **Ken Herkenhoff**
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## Followup For Last Month's Tsunami Talk by Cindy Pridmore

For those of you who missed the talk last month and are not familiar with the great tsunami website the California Geological Survey has put together, please use the following link. Its kid friendly, it's got cool videos, you can check out interactive (Google) maps to see if your vacation home, your child's school, or any number of other spots are safe, and it even has references! Go to:

[http://www.consrv.ca.gov/cgs/geologic\\_hazards/Tsunami/Inundation\\_Maps/Pages/Index.aspx](http://www.consrv.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/Pages/Index.aspx)

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## 2012-2013 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 2012-2013 academic year. More than one scholarship may be awarded at each academic level.

**\$ 1,000 Masters Degree Scholarship**  
**\$ 2,000 Ph.D. Degree Scholarship**

Please submit your letter and proposal by U.S. Mail postmarked **no later than DECEMBER 15, 2012** to:

Phillip Garbutt, Chair  
Voice: (510) 581-9098  
NCGS Scholarship Committee  
e-mail: [plgarbutt@comcast.net](mailto:plgarbutt@comcast.net)  
6372 Boone Drive, Castro Valley, CA 94552-5077  
NCGS website: <http://www.ncgeolsoc.org>

**Scholarship Awards will be made on or about  
January 31, 2013**

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## NCGS and AAPG 2011 – 2012 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 2012 - 2013 NCGS  
Competition**

The deadline for application submittal by candidates for the \$750 NCGS award is Monday, January 11, 2013.

The Northern California Geological Society (NCGS) is seeking applications from candidates in Northern California for the 2011 - 2012 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 award will be announced February 2013.

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 Monterey, CA, April 2013, plus up to \$250 toward meeting expenses. The regional winner's project will be submitted to AAPG headquarters for the national contest. The national award winner will receive an expense-paid trip to attend the AAPG meeting in Denver, CO, June, 2014.

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.

Interested candidates or nominators can request application information and an entrant application form, or submit an application, by contacting:

NCGS website: <http://www.ncgeolsoc.org>  
Paul Henshaw; [candphenshaw@comcast.net](mailto:candphenshaw@comcast.net)  
Chair, NCGS K – 12 Geosciences Education Committee;  
6 Rachel Ranch Court Clayton, CA 94517 (925) 673-8745

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## NCGS 2013 K-12 \$500 GEOSCIENCE TEACHING AWARD

**Two Categories:  
Grades K-8 and Grades 9-12**

## Call for Applications for 2012 - 2013

NCGS invites applications from candidates in the Northern California for 2012-2013 K-12 Geoscience Teaching Award. Applications may be submitted by any teacher regardless of experience.

Applications should address teaching of units covering any of the earth or environmental sciences, including but not limited to mineralogy, petrology, economic geology, geomorphology, paleontology, hydrology, and planetary geology are invited from physical science, earth science, and geology teachers.

The deadline for application submittal by candidates for the \$500 NCGS award is Monday, January 11, 2013. The application process is simple (see Application Information and Application Form).

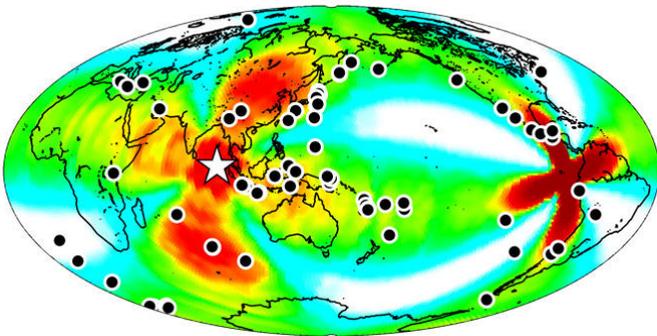
The winner will receive a \$500 award at a Northern California Geological Society meeting in Orinda in late February 2013. Interested candidates can request an Application Information and an Entrant Application Form or submit an application by contacting:

NCGS website: <http://www.ncgeolsoc.org>  
Paul Henshaw; [candphenshaw@comcast.net](mailto:candphenshaw@comcast.net)  
Chair, NCGS K – 12 Geosciences Education Committee;  
6 Rachel Ranch Court Clayton, CA 94517 (925) 673-8745

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## Large 2012 Earthquake Triggered Temblors Worldwide for Nearly a Week

This year's largest earthquake, a magnitude 8.6 temblor on April 11 centered in the East Indian Ocean off Sumatra, did little damage, but it triggered quakes around the world for at least a week, according to a new analysis by seismologists from the University of California, Berkeley, and the U.S. Geological Survey (USGS).



*A map of the earthquakes triggered around the globe within a week of the April 2012 earthquake off the coast of Sumatra (white star). (Credit: Fred Pollitz, USGS)*

The April 11 quake was unusually large -- the tenth largest in the last 100 years and, similar to a few other recent large quakes, triggered small quakes during the three hours it took for seismic waves to travel through Earth's crust.

The new study shows, however, that some faults weren't rattled enough by the seismic waves to fail immediately, but were primed to break up to six days later.

The findings are a warning to those living in seismically active regions worldwide that the risk from a large earthquake could persist -- even on the opposite side of the globe -- for more than a few hours, the experts said.

"Until now, we seismologists have always said, 'Don't worry about distant earthquakes triggering local quakes,'" said Roland Burgmann, professor of earth and planetary science at UC Berkeley and coauthor of the study. "This study now says that, while it is very rare -- it may only happen every few decades -- it is a real possibility if the right kind of earthquake happens."

"We found a lot of big events around the world, including a 7.0 quake in Baja California and quakes in Indonesia and Japan, that created significant local shaking," Burgmann added. "If those quakes had been in an urban area, it could potentially have been disastrous."

Burgmann and Fred F. Pollitz, Ross S. Stein and Volkan Sevilgen of the USGS will report their results online on Sept. 26 in advance of publication in the journal *Nature*.

Burgmann, Pollitz, a research seismologist, and their colleagues also analyzed earthquake occurrences after five other recent temblors larger than 8.5 -- including the deadly 9.2 Sumatra-Andaman quake in 2004 and the 9.0 Tohoku quake that killed thousands in Japan in 2011 -- but saw only a very modest increase in global earthquake activity after these quakes. They said this could be because the East Indian Ocean quake was a "strike-slip" quake that more effectively generates waves, called Love waves, that travel just under the surface and are energetic enough to affect distant fault zones.

Burgmann explained that most large quakes take place at subduction zones, where the ocean bottom sinks below another tectonic plate. This was the origin of the Sumatra-Andaman quake, which produced a record tsunami that took more than 200,000 lives. The 2012 East Indian Ocean quake involved lateral movement -- referred to as strike-slip, the same type of movement that occurs along California's San Andreas Fault -- and was the largest strike-slip quake ever recorded.

"This was one of the weirdest earthquakes we have ever seen," Burgmann said. "It was like the 1906 San Francisco earthquake, a strike-slip event, but it was huge -- 15 times more energetic. This earthquake and an 8.3 that followed were in a very diffuse zone in an oceanic plate close to the Sumatra subduction zone, but it wasn't a single fault that produced the quake, it was a crisscrossing of three or four faults that all ruptured in sequence to make such a big earthquake, and they ruptured deep."

The seismologists analysis found five times the expected number of quakes during the six days following the April 11 quake and aftershock. An unusually low occurrence of quakes during the 6-12 days before that

8.6 quake may have accentuated the impact, possibly because there were many very-close-to-failure faults sensitive to a triggering shock wave, Pollitz said.

One possible mechanism for the delayed action, Burgmann said, is that the East Indian Ocean quake triggered a cascade of smaller, undetectable quakes on these faults that led to larger ruptures later on.

Alternatively, large quakes could trigger nearly undetectable tremors or microquakes that are a sign of slow slip underground.

"One possibility is that the earthquake immediately triggers slow slip in some places, maybe accompanied by detectable tremor, and then that runs away into a bigger earthquake," Burgmann speculated. "Some slow slip events take days to a week or more to evolve."

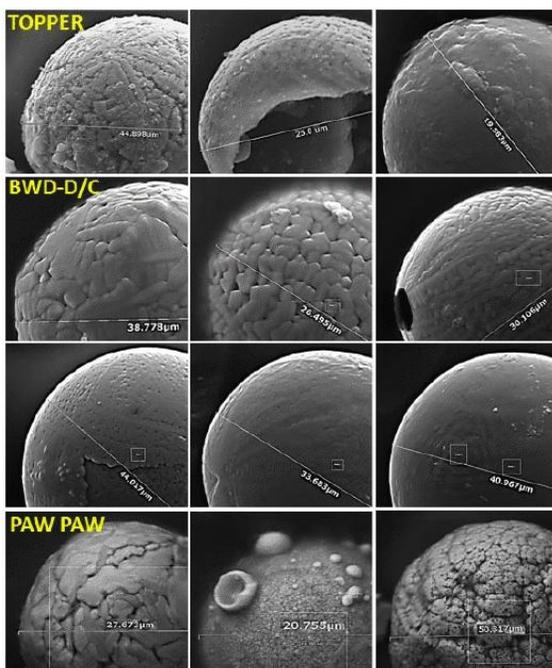
The work was supported by the USGS.

**Story Source:** The above story is reprinted from materials provided by **University of California - Berkeley**. The original article was written by Robert Sanders.

**Journal Reference:** Fred F. Pollitz, Ross S. Stein, Volkan Sevilgen, Roland Bürgmann. **The 11 April 2012 east Indian Ocean earthquake triggered large aftershocks worldwide.** *Nature*, 2012; DOI: [10.1038/nature11504](https://doi.org/10.1038/nature11504)

## Comet May Have Exploded Over Canada 12,900 Years Ago After All

Did a massive comet explode over Canada 12,900 years ago, wiping out both beast and man in North America and propelling Earth back into an ice age?



*Micro-spherules from Clovis sites, including UofSC's Topper. (Credit: Image courtesy of University of South Carolina)*

That's a question that has been hotly debated by scientists since 2007, with the University of South Carolina's Topper archaeological site right in the middle of the comet impact controversy. However, a new study published Sept.17 in the *Proceedings of the National Academy of Sciences (PNAS)* provides further evidence that it may not be such a far-fetched notion.

USC archaeologist Albert Goodyear is a co-author on the study that upholds a 2007 PNAS study by Richard Firestone, a staff scientist at the Department of Energy's Lawrence Berkeley National Laboratory.

Firestone found concentrations of spherules (micro-sized balls) of metals and nano-sized diamonds in a layer of sediment dating 12,900 years ago at 10 of 12 archaeological sites that his team examined. The mix of particles is thought to be the result of an extraterrestrial object, such as a comet or meteorite, exploding in Earth's atmosphere. Among the sites examined was USC's Topper, one of the most pristine U.S. sites for research on Clovis, one of the earliest ancient peoples.

"This independent study is yet another example of how the Topper site with its various interdisciplinary studies has connected ancient human archaeology with significant studies of the Pleistocene," said Goodyear, who began excavating Clovis artifacts in 1984 at the Topper site in Allendale, S.C. "It's both exciting and gratifying."

Younger-Dryas is what scientists refer to as the period of extreme cooling that began around 12,900 years ago and lasted 1,300 years. While that brief ice age has been well-documented -- occurring during a period of progressive solar warming after the last ice age -- the reasons for it have long remained unclear. The extreme rapid cooling that took place can be likened to the 2004 sci-fi blockbuster movie "The Day After Tomorrow."

Firestone's team presented a provocative theory: that a major impact event -- perhaps a comet -- was the catalyst. His copious sampling and detailed analysis of sediments at a layer in the Earth dated to 12,900 years ago, also called the Younger-Dryas Boundary (YDB), provided evidence of micro-particles, such as iron, silica, iridium and nano-diamonds. The particles are believed to be consistent with a massive impact that could have killed off the Clovis people and the large North American animals of the day. Thirty-six species, including the mastodon, mammoth and saber-toothed tiger, went extinct.

The scientific community is rarely quick to accept new theories. Firestone's theory and support for it dominated the annual meeting of the American Geophysical Union and other gatherings of Paleoindian archaeologists in 2007 and 2008.

However, a 2009 study led by University of Wyoming researcher Todd Surovell failed to replicate Firestone's findings at seven Clovis sites, slowing interest and research progress to a glacial pace.

This new PNAS study refutes Surovell's findings with its lack of reported evidence.

"Surovell's work was in vain because he didn't replicate the protocol. We missed it too at first. It seems easy, but unless you follow the protocol rigorously, you will fail to detect these spherules. There are so many factors that can disrupt the process. Where Surovell found no spherules, we found hundreds to thousands," said Malcolm LeCompte, a research associate professor at Elizabeth City State University and lead author of the newly released PNAS article.

LeCompte began his independent study in 2008 using and further refining Firestone's sampling and sorting methods at two sites common to the three studies: Blackwater Draw in New Mexico and Topper. He also took samples at Paw Paw Cove in Maryland, a site common to Surovell's study.

At each site he found the same microscopic spherules, which are the diameter of a human hair and distinct in appearance. He describes their look as tiny black ball bearings with a marred surface pattern that resulted from being crystalized in a molten state and then rapidly cooled. His investigation also confirmed that the spherules were not of cosmic origin but were formed from earth materials due to an extreme impact.

LeCompte said it was Topper and Goodyear's collaboration, however, that yielded the most exciting results.

"What we had at Topper and nowhere else were pieces of manufacturing debris from stone tool making by the Clovis people. Topper was an active and ancient quarry at the time," LeCompte said. "Al Goodyear was instrumental in our approach to getting samples at Topper."

Goodyear showed LeCompte where the Clovis level was in order to accurately guide his sampling of sediments for the Younger Dryas Boundary layer. He advised him to sample around Clovis artifacts and then to carefully lift them to test the sediment directly underneath.

"If debris was raining down from the atmosphere, the artifacts should have acted as a shield preventing spherules from accumulating in the layer underneath. It turns out it really worked!" Goodyear said. "There were up to 30 times more spherules at and just above the Clovis surface than beneath the artifacts."

LeCompte said the finding is "critical and what makes the paper and study so exciting. The other sites didn't have artifacts because they weren't tool-making quarries like Topper."

While the comet hypothesis and its possible impact on Clovis people isn't resolved, Goodyear said this independent study clarifies why the Surovell team couldn't replicate the Firestone findings and lends greater credibility to the claim that a major impact event happened at the Younger Dryas Boundary 12,900 years ago.

"The so-called extra-terrestrial impact hypothesis adds to the mystery of what happened at the YDB with its sudden and unexplained reversion to an ice age climate, the rapid and seemingly simultaneous loss of many Pleistocene animals, such as mammoths and mastodons, as well as the demise of what archaeologists call the Clovis culture," Goodyear said. "There's always more to learn about the past, and Topper continues to function as a portal to these fascinating mysteries."

Goodyear joined USC's College of Arts and Sciences and its South Carolina Institute for Archaeology and Anthropology in 1974 to pursue prehistoric archaeology.

### **The Topper story**

Al Goodyear, who conducts research through the University of South Carolina's S.C. Institute of Anthropology and Archaeology, began excavating Clovis artifacts along the Savannah River in Allendale County in 1984. It quickly became one of the most documented and well-known Clovis sites in the United States. In 1998, with the hope of finding evidence of a pre-Clovis culture earlier than the accepted 13,100 years, Goodyear began focused excavations on a site called Topper, located on the property of the Clariant Corp.

His efforts paid off. Goodyear unearthed small tools such as scrapers and blades made of the local chert that he believed to be tools of an ice age culture back some 16,000 years or more. His findings, as well as similar ones yielded at other pre-Clovis sites in North America, sparked great change and debate in the scientific community.

Goodyear reasoned that if Clovis and later peoples used the chert quarry along the Savannah River, the quarry could have been used by even earlier cultures.

Acting on a hunch in 2004, Goodyear dug even deeper into the Pleistocene terrace and found more artifacts of a pre-Clovis type buried in a layer of sediment stained with charcoal deposits. Radiocarbon dates of the burnt plant remains yielded ages of 50,000 years, which suggested man was in South Carolina long before the last ice age.

Goodyear's findings not only captured international media attention, but it has put the archaeology field in flux, opening scientific minds to the possibility of an even earlier pre-Clovis occupation of the Americas.

Since 2004, Goodyear has continued his Clovis and pre-Clovis excavations at Topper. With support of Clariant

Corp. and SCANA, plus numerous individual donors, an expansive shelter and viewing deck now sit above the dig site to allow Goodyear and his team of graduate students and public volunteers to dig free from the heat and rain and to protect what may be the most significant early-man dig in America.

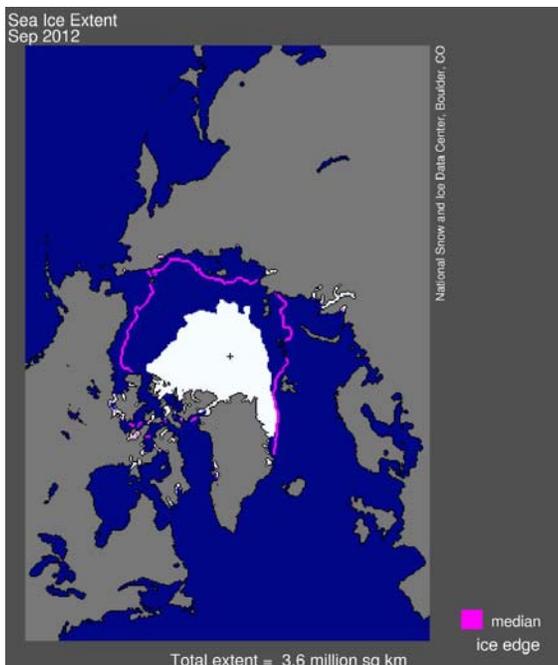
**Story Source:** The above story is reprinted from materials provided by [University of South Carolina](#), via Newswise.

**Journal Reference:** M. A. LeCompte, A. C. Goodyear, M. N. Demitroff, D. Batchelor, E. K. Vogel, C. Mooney, B. N. Rock, A. W. Seidel. **PNAS Plus: Independent evaluation of conflicting microspherule results from different investigations of the Younger Dryas impact hypothesis.** *Proceedings of the National Academy of Sciences*, 2012; DOI: [10.1073/pnas.1208603109](https://doi.org/10.1073/pnas.1208603109)

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## Arctic Sea Ice Shatters Previous Low Records; Antarctic Sea Ice Edges to Record High

This September, sea ice covering the Arctic Ocean fell to the lowest extent in the satellite record, which began in 1979. Satellite data analyzed by NSIDC scientists showed that the sea ice cover reached its lowest extent on September 16. Sea ice extent averaged for the month of September was also the lowest in the satellite record.



Arctic sea ice extent for September 2012 was 3.61 million square kilometers (1.39 million square miles). The magenta line shows the 1979 to 2000 median extent for that month. The black cross indicates the geographic North Pole. (Credit: NSIDC)

The near-record ice melt occurred without the unusual weather conditions that contributed to the extreme melt

of 2007. In 2007, winds and weather patterns helped melt large expanses of ice. "Atmospheric and oceanic conditions were not as conducive to ice loss this year, but the melt still reached a new record low," said NSIDC scientist Walt Meier. "This probably reflects loss of multi-year ice in the Arctic, as well as other factors that are making the ice more vulnerable." Multi-year ice is ice that has survived more than one melt season and is thicker than first-year ice.

NSIDC Director Mark Serreze said, "It looks like the spring ice cover is so thin now that large areas melt out in summer, even without persistent extreme weather patterns." A storm that tracked through the Arctic in August helped break up the weakened ice pack.

Arctic sea ice extent reached its lowest point this year on September 16, 2012 when sea ice extent dropped to 3.41 million square kilometers (1.32 million square miles). Averaged over the month of September, ice extent was 3.61 million square kilometers (1.39 million square miles). This places 2012 as the lowest ice extent both for the daily minimum extent and the monthly average. Ice extent was 3.29 million square kilometers (1.27 million square miles) below the 1979 to 2000 average.

The Arctic ice cap grows each winter as the sun sets for several months and shrinks each summer as the sun rises higher in the northern sky. Each year the Arctic sea ice reaches its annual minimum extent in September. It hit its previous record low in 2007. This summer's low ice extent continued the downward trend seen over the last 33 years. Scientists attribute this trend in large part to warming temperatures caused by climate change. Since 1979, September Arctic sea ice extent has declined by 13 percent per decade. Summer sea ice extent is important because, among other things, it reflects sunlight, keeping the Arctic region cool and moderating global climate.

In addition to the decline in sea ice extent, a two-dimensional measure of the ice cover, the ice cover has grown thinner and less resistant to summer melt. Recent data on the age of sea ice, which scientists use to estimate the thickness of the ice cover, shows that the youngest, thinnest ice, which has survived only one or two melt seasons, now makes up the large majority of the ice cover.

Climate models have suggested that the Arctic could lose almost all of its summer ice cover by 2100, but in recent years, ice extent has declined faster than the models predicted. Serreze said, "The big summer ice loss in 2011 set us up for another big melt year in 2012. We may be looking at an Arctic Ocean essentially free of summer ice only a few decades from now." NSIDC scientist Julienne Stroeve recently spent three weeks in the Arctic Ocean on an icebreaker ship, and was surprised by how thin the ice was and how much open water existed between the individual ice floes. "According to the satellite data, I expected to be in

nearly 90% ice cover, but instead the ice concentrations were typically below 50%," she said.

As the Arctic was experiencing a record low minimum extent, the Antarctic sea ice was reaching record high levels, culminating in a Southern Hemisphere winter maximum extent of 19.44 million square kilometers (7.51 million square miles) on September 26. The September 2012 monthly average was also a record high, at 19.39 million square kilometers (7.49 million square miles) slightly higher than the previous record in 2006. Temperatures over Antarctica were near average this austral winter. Scientists largely attribute the increase in Antarctic sea ice extent to stronger circumpolar winds, which blow the sea ice outward, increasing extent.

NSIDC scientist Ted Scambos said, "Antarctica's changes -- in winter, in the sea ice -- are due more to wind than to warmth, because the warming does not take much of the sea ice area above the freezing point during winter. Instead, the winds that blow around the continent, the "westerlies," have gotten stronger in response to a stubbornly cold continent, and the warming ocean and land to the north."

Further information: <http://nsidc.org/arcticseaicenews/>

**Story Source:** The above story is reprinted from materials provided by **National Snow and Ice Data Center**.

**Reference:** *Arctic sea ice shatters previous low records; Antarctic sea ice edges to record high*; National Snow and Ice Data Center (2012, October 3)

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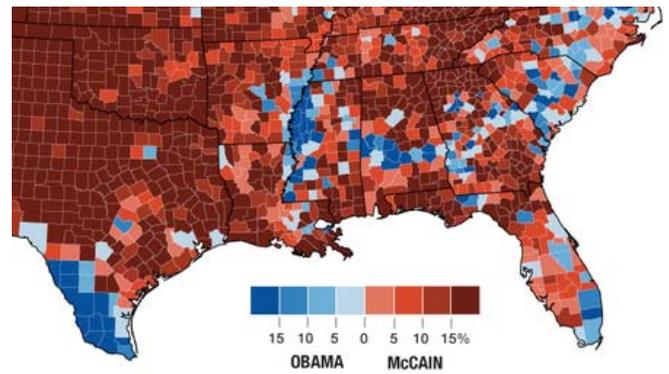
**It's Time -  
Renew Your NCGS  
Membership!  
Use the Attached Form!  
Or  
Go To The Website!**

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## Obama's Secret Weapon In The South: Small, Dead, But Still Kickin'

October 10, 2012; by Robert Krulwich; NPR

Look at this map, and notice that deep, deep in the Republican South, there's a thin blue band stretching from the Carolinas through Georgia, Alabama and Mississippi. These are the counties that went for Obama in the last election. A blue crescent in a sea of red.



*Matt Stiles/NPR*

These same counties went mostly blue in 2004 and 2000. Why? Well, the best answer, says marine biologist Craig McClain, may be an old one, going back before the Civil War, before 1776, before Columbus, back more than 100 million years to the days when the Deep South was under water. Those counties, as he writes [here](#), went for Obama because trillions and trillions and trillions of teeny sun-loving creatures died there. He's talking about plankton. That's why the Republicans can't carry those counties. Blame plankton.

[Don't leave. I know some of you bounced here because my headline was political, and the word "plankton" will send you scuttling back to HuffPo, Politico and Drudge, where politics is plankton-free. But before you go, check out this next map.]

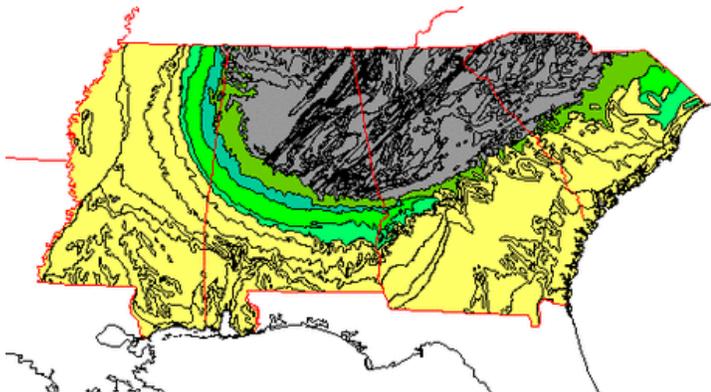


Ron Blakey/[Northern Arizona University](#)

It's an image of North America as it looked during the Cretaceous era, 129 million to 65 million years ago. As you can see, much of the continent was still covered by water. The Deep South had a shoreline that curled through the Carolinas, Georgia, Alabama and Mississippi, and there, in the shallow waters just offshore, were immense populations of floating, single-celled creatures who drifted about, trapped sunshine, captured carbon, then died and sank to the sea bottom.

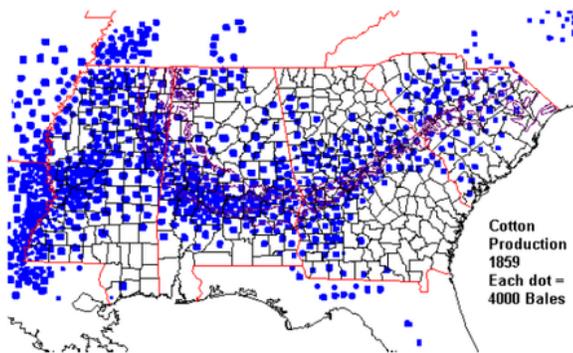
Those creatures became long stretches of nutritious chalk. ([I love chalk.](#))

When sea levels dropped and North America took on its modern shape, those ancient beaches — so alkaline, porous and rich with organic material — became a "black belt" of rich soil, running right through the South. You can see the Cretaceous beaches in this map, colored green. McClain got these [maps from geologist Steve Dutch's website](#), at the University of Wisconsin, Green Bay.



Steven Dutch/[Geology and Election 2000](#)

And because this stretch was so rich and fertile, when cotton farmers moved here in the 19th century, this stretch produced the most cotton per acre. Harvests of 4,000-plus bales were common here. Notice that the most productive plantations mirror the ancient coastline.

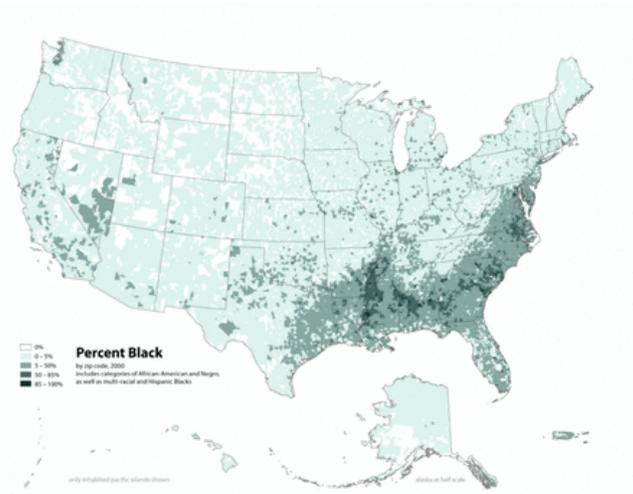


Steven Dutch/[Geology and Election 2000](#)

Then came slavery.

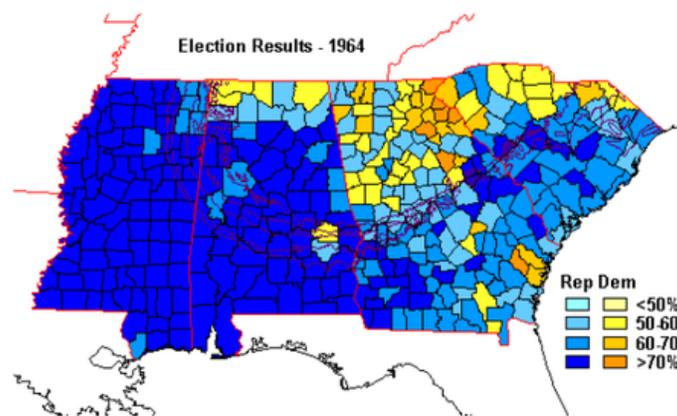
McClain, quoting from Booker T. Washington's autobiography, *Up From Slavery*, points out: "The part of the country possessing this thick, dark and naturally rich soil was, of course, the part of the South where the slaves were most profitable, and consequently they were taken there in the largest numbers." After the Civil War, a lot of former slaves stayed on this land, and while many migrated North, their families are still there.

In this 2000 census, you can see that the counties with the biggest populations of African-Americans still trace that Cretaceous shoreline.



[Enlarge U.S. Census via Wikimedia Commons](#)

This, says marine biologist McClain, explains that odd stretch of Obama blue; it's African-Americans sitting on old soil from ancient organisms that turned sunshine into fertilizer. So plankton remain a force in Southern elections — though not always, not continuously. After the Civil War, when the South voted solidly Democratic and Jim Crow laws ruled, many blacks couldn't vote, so the pattern disappears. Voting rights laws hadn't been passed during the Goldwater-Johnson election of 1964, so in this map, the African-American difference is invisible.



[Enlarge Steven Dutch/Geology and Election 2000](#)

But some African-Americans were still there. So was the soil (though it's not as rich as it once was), and so were the rocks that geologist Steve Dutch "found immediately familiar" because they mapped those ancient shores. All of which is to say, when you cover politics, sometimes, without realizing it, you are also telling rock tales. Geology, every so often, peeks through.

*Geologist Steve Dutch's detailed maps, and careful analysis, come from a study he did of the Bush-Gore election in 2000. He called it "Geology and Election 2000." You can find that [here](#). "Dr. M" (that's Craig McClain's Nom de Blog at "Deep Sea News") wrote his geology analysis [here](#).*

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



**NCGS FIELD TRIP**  
**Saturday November 2, 2012**

## **The Caldecott Fourth Bore Project: Tunneling Through a Miocene Plate Boundary**

**Leaders: Chris Ridsen, Engineering Geologist, California Department of Transportation**  
**Ivy Morrison, Public Information Officer, Caldecott Fourth Bore Project**

The new Fourth Bore of the Caldecott Tunnel will add two westbound lanes to the north of the existing six that connect Alameda and Contra Costa Counties along State Route 24. The tunnel has been designed and constructed using the New Austrian Tunneling Method (also known as the Sequential Excavation Method). This system is appropriate for addressing the abruptly changing ground conditions of the East Bay Hills: one small section of tunnel is excavated and supported using shotcrete and rock bolts, and a fully reinforced concrete lining completes the tunnel. The length of excavation and the type and amount of initial support is tailored to the immediate ground conditions.

The Fourth Bore traverses Miocene sedimentary rocks that span the transition of the North American/Pacific Plate margin from one of subduction to that of transform. Three main formations of the Miocene age are found between the portals of the tunnel, from west to east: the Sobrante, the Claremont, and the Orinda Formations. Each presents unique challenges to the designers and constructors of the tunnel. The Fourth Bore represents a culmination of more than 100 years of tunneling through this hillside.

On this field trip, we'll discuss the design and construction of the new Fourth Bore, the history of the Caldecott Tunnels, the tectonic significance of the formations within the tunnel, some of the challenges posed by these formations, and some of the extensive paleontological findings made during excavation of the tunnels. The trip will begin in the project construction office in Lafayette, where a brief presentation will describe the purpose and scope of the project, the funding sources that have made it possible, and the New Austrian (Sequential Excavation) Tunneling Method. An overview of the field trip will also be provided. From there, we'll drive through the third bore and make a stop at the west portal of the original Kennedy Tunnel at the western side of the tunnel. Here we'll talk about the history of the tunnels and some of the early work performed on Bores 1 and 2, which were constructed in 1937. Our next stop will be on the west side of the tunnels to see an exposure of the Sobrante Formation. (We will pause for a brief photo opportunity at or near the western portal.)

The discussion will then focus on the challenges of tunneling through the weakest rocks found in the tunnel. It was, in fact, in these ground conditions, that the Project marked a significant milestone in late November 2011, with the breakthrough of the tunnel's top portion approximately 200 meters east of the Oakland portal. From there, we move east through our imaginary tunnel to the type-locality of the Claremont Formation. Here we can see the Claremont very much as it is exposed in the tunnel – nearly vertical and locally overturned. Just east of this location is a small erosional feature that delineates the contact between Claremont and Orinda Formations. This transition from deep marine porcelainites of the Claremont to more terrestrial gravels, sands, and muds of the Orinda represents the transition of the plate boundary from subduction to predominantly strike-slip. The trip will culminate on the east side of the tunnel where we can see the well-known exposures of Orinda Formation conglomerate, sandstone, and mudstone. We'll discuss the paleontology of the Caldecott Tunnels, focusing on the vertebrate-rich Orinda Formation.

**Important Information for Your Visit to the Caldecott Fourth Bore:**

- We will meet at the Lafayette Construction Office (3390 Mount Diablo Blvd, Suite 200) for a short presentation, and to distribute safety gear, including reflective vests, hardhats, and goggles
- Please park behind the office in the back rows of the parking lot, if possible, and enter the building from the back. (This is the easiest way to find us.) We are upstairs on the second floor.
- **Carpooling is essential, especially to the job site.** There is very limited parking on the western side of the tunnel. We will circulate attendees list.

**Attire:**

- Please wear long pants and shirts with sleeves (we suggest dressing in layers)
- **Appropriate footwear is required: hiking shoes or boots are best.** Absolutely no tennis shoes, flipflops, cowboy boots, high heels, or other footwear that has a heel, does not cover the foot, or does not provide adequate traction.

**For safety reasons, individuals not wearing the appropriate attire will not be permitted on the construction site.**

**Liability Waiver Forms:**

- Our contractor, Tutor Saliba (TSC) requires that each site visit participant signs a liability waiver form, and signs in at the TSC office in Orinda.

**THIS FIELD TRIP WILL BE LIMITED TO 40 PEOPLE IN TWO GROUPS.  
(Morning Session - 9:00 am to 12:30 pm.: Afternoon Session 1:30 pm to 5:00 pm)**

\*\*\*\*\* **Field Trip Logistics** \*\*\*\*\*

**Time & Meeting Place:** November 2, 2012, 8:30 am Morning Session; 12:30 pm Afternoon Session  
3300 Mount Diablo Blvd., Suite 200, Lafayette.

**Cost:** \$20/person (guidebook, lunch, refreshments, soft drinks)

\*\*\*\*\* **REGISTRATION FORM (Caldecott Tunnel Field Trip)** \*\*\*\*\*

Name: \_\_\_\_\_ E-mail: \_\_\_\_\_

Carpool origin: \_\_\_\_\_ Phone: \_\_\_\_\_ Phone (alternate): \_\_\_\_\_

Lunch: Regular: \_\_\_\_\_ Vegetarian: \_\_\_\_\_ (Please check one) Check Amount: \_\_\_\_\_

**Preferred Session -----**

Please mail a check made out to "NCGS" to: **Tridib Guha  
5016 Gloucester Lane,  
Martinez, CA 94553**

Questions: e-mail: [tridibguha@yahoo.com](mailto:tridibguha@yahoo.com) Phone: (925) 370-0685 (evening) (925) 451-1999 (day)

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



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Please fill out this form and attach your check made out to NCGS.

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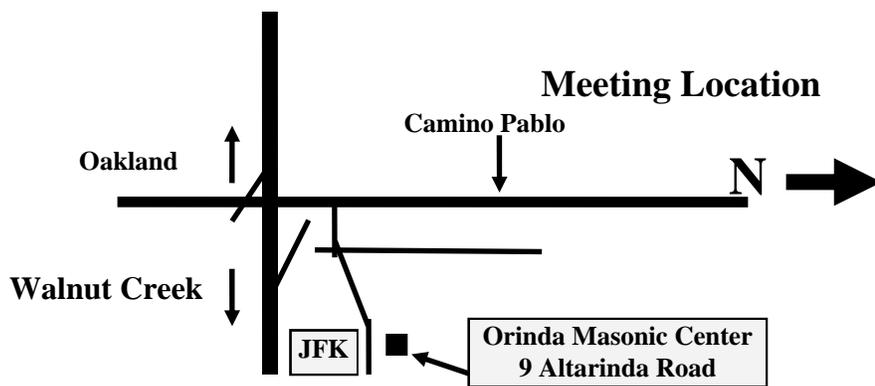
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**Speaker Biography:** **Dr. Ray Wells** received a dual B.S. in geology and art from Pennsylvania State University in 1972, an M.S. in geology from the University of Oregon in 1975, and a Ph.D. in geology from the University of California, Santa Cruz in 1982. Between 1983 and 1995 he was a Project Chief at the USGS for the *Northwest Urban Corridor Geologic Maps and Synthesis*, the *Plio-Pleistocene Rotations*, *San Andreas Fault System*, the *Roseburg, Oregon Geologic Map and Synthesis*, and the *Tectonic Framework of the Tillamook Volcanics, Oregon* programs. Between 1991 and 1996 he was the USGS Regional Coordinator for the *CASCADIA Continental Survey Program*, and since 1995 he has been a Project Chief for the *Pacific Northwest Urban Corridor Geologic Mapping* program at the US Geological Survey. He has been an author or co-author on at least 72 publications (a complete list is available on the NCGS website).

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

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