# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



## MEETING ANNOUNCEMENT

**DATE:** **March 30, 2011**

**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. James G. Moore, U.S.G.S., Menlo Park, CA**

## *Native American Granite Cisterns in the Sierra Nevada*

A belt of circular meter-size granite basins extends for 240 km at mid-elevations on the west flank of the southern Sierra Nevada. More than a thousand of these basins are distributed over 220 sites with a median elevation of 6400 feet. In addition a cluster of 350 similar basins occurs on glaciated bedrock in the northern Sierra. They were clearly made by Native Americans for evaporating saline water from a salt spring for producing salt as a commodity. New data on the age and climatic setting of the southern basins indicate that they too were man-made cisterns but used for storing fresh water. Some of these basins contain AD 1350 volcanic ash indicating they were in use before the end of the Medieval Climate Anomaly (AD 800-1350) characterized by extended drought in the West. The cistern water was apparently used to enable food gatherers to extend their seasonal residence in summer camps during drought periods.

**Biography: Dr. James G. Moore**, now retired from the US Geological survey, received his BS in geology from Stanford; MS from University of Washington; and PhD from Johns Hopkins. He made geologic studies of 10 15-minute quadrangles in the central Sierra Nevada, which led to a book: "Exploring the Highest Sierra", which weaves together the history of exploration and mapping of the range with the development of pioneering geologic concepts. Another book recently published: "King of the 40th Parallel- Discovery in the American West" recounts the adventures of Clarence King who became the first Director of the US Geological Survey. *…continued on the back…*

# *NCGS 2010 – 2011 Calendar*

**Wednesday April 27, 2011**
Dr. Greg Croft
***Coal and the Peak of World Carbon Emissions***
7:00 pm at Orinda Masonic Lodge

**Wednesday May 25, 2011**
**DINNER MEETING! EARLY TIME!**
Dr. Eldridge Moores
TBA
6:00 pm at Orinda Masonic Lodge

**Wednesday June 29, 2011**
Dr. John Wakabayahsi (Tentative)
Franciscan TBA
7:00 pm at Orinda Masonic Lodge

***Our Usual Summer Break!***

**October 9 – 15, 2011**
Earth Science Week
TBA

## Upcoming NCGS Events

| | |
|---|---|
| April 30, 2011 (Tentative) | Cantua Creek II; Dr. Mel Erskine |
| June 25 & 26, 2011 | Geology of Lake Tahoe Region, Dr. Richard Schweickert, Emeritus, University of Nevada, Reno |

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@sbcglobal.net**

## 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.

- March 8, 2011, Mike Sawlan, USGS; ***Unraveling the Stratigraphy and Genesis of the Grande Ronde Basalt, Columbia River Basalt Group, Using New, High-Quality Geochemical and Paleomagnetic Data from Selected Sections Across the Columbia Plateau and into the Columbia River Gorge***
- April 12, 2011, open
- May 10, 2011, Jorge Vazquez, USGS
- June 7, 2011, Jon Hagstrum, USGS, Presidential Address

## 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 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/

- March 31, 2011; ***Geomagnetic field influence on avian homing instincts***; Jon Hagstrom
- April 28, 2011; Earthquake Prediction; Susan Hough
- May 26, 2011; Rare Earth Elements; Keith Long
- June 30, 2011; California Seafloor Mapping Program; Sam Johnson
- July 2011; Climate Variability/Change & SF Bay-Delta; Jim Cloern Ecosystem

## Bay Area Science
### (http://www.bayareascience.org/)

This website came to our attention recently and we wanted to pass the information along to members. The 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).

**(This was carried in last month's newsletter, but we couldn't help but repeat it in light of recent events)**

## CGS Tsunami Web Site
## National Tsunami Awareness and Preparedness Week
## March 20 – 26, 2010

CGS has also announced the National Tsunami Awareness and Preparedness Week and has created an extensive webpage with downloadable education materials, new tsunami inundation maps, and a new CGS Tsunamis Note at:

http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/Pages/Index.aspx.

## MINES AND WINES OF SAN DIEGO COUNTY WORKSHOP AND FIELD TRIP

April 8-10, 2011

Open to first 30 registrants; $150

Lectures, Mining History, Gem Pegmatites, Gold Deposits, and Tectonics of the Elsinore Fault Zone


(see http://www.menghiniwinery.com

or call 760.765.2072)

This workshop and two-day field trip program explores the tectonics and mining history of eastern San Diego County. Our base of operations is the Menghini Winery, on Wynola Road in Julian. There will be geology lectures and wine tasting Friday and Saturday evening at the Menghini winery. The Saturday field trip will be to the Cryo-Gene gem pegmatite mine, and to the Eagle and Washington gold mines at Julian. The Sunday field trip will be to the Ranchito Gold Mine near Banner. Optional field trip stops include Montezuma pegmatites, Pack Rat Feldspar/Rare Earth pegmatite and the paleontological sculptures at Anza Borrego. Registration includes 1) wine tasting 2) Saturday and Sunday breakfasts, box lunches and Saturday dinner 3) admission fees to the field trip mine sites and 4) camping privileges at the Menghini Winery Friday and Saturday nights.

For more information including a brochure, contact Gregg Wilkerson, 7005 Hooper Ave., Bakersfield, CA 93308; 661-391-6081 or 661-246-9485, gwilkers@blm.gov.

(Thanks to Sandy Figuers for bringing this to our attention)

## Rockies formed by suction? Theory may stick

The formation of these mountains has long presented a puzzle to geologists

*George Rose / Getty Images*

By Jessica Marshall
Discovery News

The Rocky Mountains may have been formed when a giant suction created a counter force that thrust the mountains upward. The proposal also could potentially explain the surprising bands of gold, silver other minerals that streak at a near right angle across the Rockies in Colorado.

The craggy Rocky Mountains may have been formed when a giant suction created a counter force that thrust the mountains upward, according to a new theory.

The Rocky Mountains, rising from the center of the North American continent, have long presented a puzzle to geologists.

Mountains generally form where continental plates crash into each other: the Himalayas rise where India smashes into Asia, for example. But the nearest plate boundary to the Rockies runs along the west coast of North America, forming the coastal mountain ranges.

"The Rocky Mountains have always been a problem because they look like a collisional mountain range. They look like the Himalayas but we can't find the India," said Basil Tikoff of the University of Wisconsin, Madison.

"It's just a weird situation in the Rocky Mountains that despite the fact that they have extraordinarily good geology and geophysics that we don't get the basic geology of how they formed."

Since the 1980s, the dominant theory has been that the Farrallon plate to the west skidded underneath the North American plate above it at a shallow angle, creating ripples far out in front, like trying to pry a sticky pancake off a griddle. The further you stick the spatula underneath, the more it sticks to the spatula and rumples the pancake ahead of the spatula edge.

Yet a number of geologists note that several types of evidence are inconsistent with this idea. Types of rocks found in California indicate that this shallow scraping isn't possible because it should have sheared away the bottom layer of the plates, and ancient rocks representative of the bottom have been found where they shouldn't be.

"There's a fundamental assumption of what's going on that does not stand up to further scrutiny," said Tikoff.

Now researchers provide evidence in support of a new idea that they say may explain not only the Rockies' rising but also the gold, silver and other mineral deposits that thread through the mountains in Colorado.

The new hypothesis revolves around the idea that underneath Wyoming is an area where the North American plate is extra thick, protruding like a hull into the more fluid part of the upper mantle below. As the Farrallon plate slid underneath, the fluid layer beneath flowed around the hull shape and into the cavity where the plates meet and as it tried to flow out again, it created a downward suction force.

Seemingly paradoxically, the suction, combined with the plate pressing in from the side, created the forces that pushed up the Rockies, Jones said.

Evidence supports the new idea, he noted, including the presence of a two-mile-thick layer of marine shale in Wyoming where the downward suction would have created an undersea basin starting about 75 million years ago.

Another aspect of the proposal is that it could potentially explain the surprising bands of gold, silver other minerals that streak at a near right angle across the Rockies in Colorado. The unusual fluid flow created by the keel formation could have drawn magma up from below, creating the metal deposits that drove prospectors to the Colorado Rockies in the late 1800s.

"I suspect for people who are thinking hard about this problem, this is likely to become a leading candidate if not the leading candidate" said Tikoff of the proposed mechanism. "It makes predictions you can test."

Testing the predictions made by the hypothesis will be the next step, Jones agreed.

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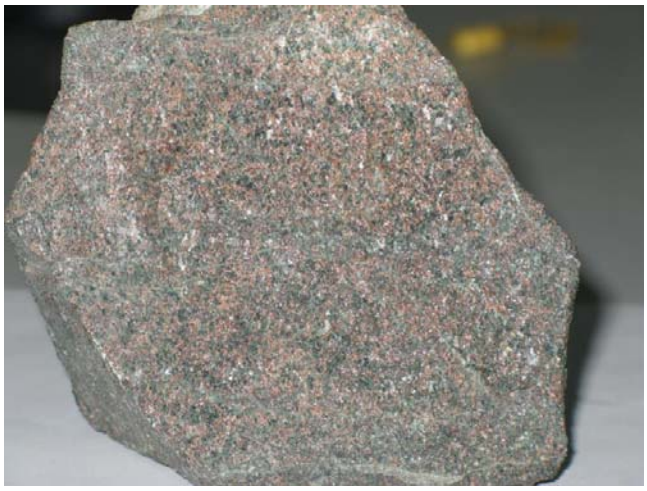
## New 'Thermometer' Helps Scientists Accurately Measure Rock Formation

ScienceDaily — A University of Arkansas researcher and his colleagues have used magnesium isotopes to determine the temperature at which rocks form, which will allow scientists to better study the formation of Earth's crust and mantle as well as the formation of meteorites.

Fang-Zhen Teng, professor of geosciences, and Wang-Ye Li, Yilin Xiao and Jian Huang of the University of Science and Technology of China report their findings in *Earth and Planetary Science Letters*.

"Knowing the temperature of rock formations is important to understanding the Earth's evolution," Teng said. "We also can study extraterrestrial samples to know more about how meteorites formed and evolved."

Of course, most rocks on earth have been rocks for millions and millions of years, making it difficult to determine their thermal history.



*Magnesium isotopes found in this eclogite from the Davie Mountains of China provide information as to the temperature at which the rock formed millions of years ago. The grains are garnets and the green ones are omphacites. (Credit: Fang-Zhen Teng)*

"We have to study the formation temperature of rocks indirectly," Teng said. Several methods for doing so exist, but most do not give accurate readings at the high temperatures where rocks form. "How the temperature varies at depth within the Earth's crust and mantle is still uncertain," Teng said.

The researchers studied magnesium isotope fractionation in eclogite, a metamorphic rock that contains the minerals omphacite and garnet, found in a mountain range in China. Eclogites form at high temperatures and pressures and often form from subducted ocean floor basalts that are drawn below Earth's crust, and are brought to the surface during mountain-building processes.

Isotopes have the same chemical properties, but different weights, so some processes cause what looks like the same material to behave differently. In this case, the researchers looked at isotope fractionation, or the separation of isotopes into different areas within the rock. The magnesium isotope fractionation within a rock depends upon the temperature at which the atoms stopped moving within it, which is the time that the rock has formed.

The scientists found that the fractionation of magnesium isotopes is big at high temperatures, which allows researchers to then study it accurately. The researchers looked at other isotopes, but found the fractionation to be too small to measure precisely. The light magnesium isotopes move quickly to a low energy state (i.e., garnet), whereas the heavy isotopes prefer a high-energy state (i.e., omphacite). The proportion of light and heavy isotopes in each state in a given rock determines the temperature at which the rock formed. Using this magnesium isotope fractionation, the researchers can determine the temperature of rock formation to a higher precision. For example, if previous isotope "thermometers" only determined the temperature to a precision of within 50 degrees Celsius, then the magnesium thermometer can reach a precision of within 20 degrees Celsius.

By knowing the temperature of the rock formation, scientists will be able to determine the cooling rate of rocks at different depths within Earth's crust and mantle. This will help them learn more about how the rocks cool down. "This will help us determine how mountains were built. If we know the 'cooking' history, we can determine how fast the mountains were built and how the plates collide and evolve," Teng said.

The researchers plan to collect samples from mountain building areas to further use this new tool.

**Story Source:**

The above story is reprinted from materials provided by University of Arkansas, Fayetteville.

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# Fossil Bird Study Describes Ripple Effect of Extinction in Animal Kingdom

ScienceDaily — A University of Florida study demonstrates extinction's ripple effect through the animal kingdom, including how the demise of large mammals 20,000 years ago led to the disappearance of one species of cowbird.

The study shows the trickle-down effect the loss of large mammals has on other species, and researchers say it is a lesson from the past that should be remembered when making conservation, game and land-use decisions today.

"There's nothing worse for a terrestrial ecosystem than the loss of large mammals -- and the loss of apex predators like sharks, tuna and other large fish will have the same negative impact on the oceans," said study co-author David Steadman, ornithology curator at the Florida Museum of Natural History on the UF campus. "We're seeing it with the loss of lions and elephants in parts of Africa, as well as in Florida with the decline of panthers. There's no question these losses will have a negative domino effect on our ecosystems."

The fossil study of eight songbird species from northern Mexico by Florida Museum ornithologists

is currently available online and will appear in the March 8th print edition of the journal *Palaeogeography, Palaeoclimatology, Palaeocology*.

An extinct cowbird, *Pandanaris convexa*, is the most common bird found at the fossil site called Térapa, in Sonora, Mexico, about 150 miles south of Arizona. This is the first time fossils of the large bird, a member of the blackbird family, have been found in Mexico.

Finding the extinct cowbird at the fossil site was unpredictable and unexpected, according to Jim Mead, chair of the department of geosciences at East Tennessee State University, who has collected a variety of fossils at the site, including the birds used in the study. Mead described the findings at Térapa as "bizarre and exciting."

"The tropical environment is unusual because the site is so far from the coast," Mead said. "The fossil record also provides evidence animals migrated from north to south and, unexpectedly, from south to north."

The cowbird has previously only been found at the Rancho La Brea fossil site in California and a site in Reddick, between Gainesville and Ocala in North Central Florida. The study expands the bird's known range and creates new questions about whether it may have lived across the southern U.S.

"The extinct cowbird needed grasslands and these big mammals to survive," said lead author Jessica Oswald, a National Science Foundation predoctoral fellow at the Florida Museum. "Those two things play into each other because mega mammals maintain grasslands. They keep big trees from coming in and colonizing the areas because they graze, stomp and trample little saplings."

Like modern cowbirds, this species probably fed on seeds and insects large mammals exposed, Oswald said. The mammals included extinct species of ground sloth, mammoth, horse, tapir, camel and bison.

About 20,000 years ago, most of these large mammals went extinct, which lead to the extinction of scavengers like condors and vultures, as well as cowbirds, Steadman said. Extinctions, especially mass extinctions, can cause radical species loss and changes in species distribution.

"Big species can't exist in a vacuum, nor can smaller species," Steadman said. "When one piece of the puzzle goes extinct, there is no good way of predicting what sort of trickle-down effect, what kind of cascade effect that will have."

The study also confirms the area was once marshy grassland, possibly surrounded by a savanna near a river. Fossils of plants, reptiles and mammals of all sizes, and 31 species of birds other than songbirds have been recovered from the Térapa site over the past 10 years. Most of these species are found today in grasslands or wetlands, Steadman said.

Steadman and Oswald used the Florida Museum's more than 24,000 skeletal specimens of birds to identify the Mexican fossils.

Songbirds make up more than 50 percent of the world's living bird species, but the fossil record is poorly developed, especially in Central and South America. Oswald said this study helps build the fossil record of songbirds in Mexico.

Finding bird fossils, as well as bones of other small animals, is a time-consuming and labor-intensive process. Sediment is placed in a fine mesh sieve and water is used to remove dirt and debris from the bones.

**Journal Reference**: Jessica A. Oswald, David W. Steadman. **Late pleistocene passerine birds from Sonora, Mexico**. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 2011; 301 (1-4): 56.

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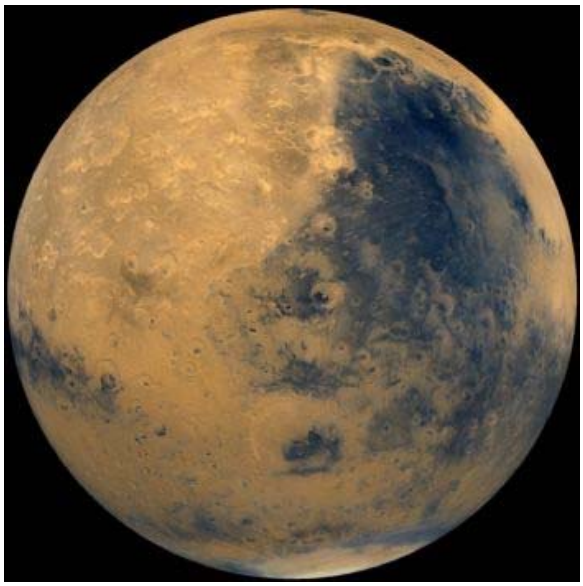
## A Nuclear Explosion on Mars

by Jonathan DuHamel

It has long been a mystery of why there is a super-abundance of uranium, thorium, and potassium on the Martian surface concentrated near Mare Acidalium in the region of the large, shallow depression. Also, the Martian atmosphere has an unusual amount of radiogenic isotopes.

An explanation for this Martian mystery was presented by Space Physicist John Brandenburg at the 42nd Lunar and Planetary Science Conference in Houston, TX this month. According to the press release, Brandenburg suggests, “evidence shows that approximately 180 million years ago the planet Mars was devastated by a massive natural nuclear explosion. This natural event filled its atmosphere with radio-isotopes, irradiated its soil and atmosphere with neutrons, and spread a layer of radioactive material on the surface of Mars. His analysis estimates the force of the explosion to have been in excess of 1 million one megaton hydrogen bombs. This explosion created a region of enhanced

radioactivity centered in the northern Mare Acidalium region at approximately 55N and 15 W." You can read Brandenburg's paper here.



If you think Brandenburg's proposal is far-fetched, consider that something similar almost happened in Africa about two billion years ago.

In 1956, uranium was discovered in Oklo, Gabon, then a French colony. The uranium was mined and used in French nuclear reactors. Most uranium is the stable heavy isotope U-238 and has to be refined to recover the fissionable U-235. It was found that the uranium from Gabon was unusually depleted in U-235. Geologists investigated and in 1972 proposed that the U-235 was depleted because the Gabon deposits were the remains of a natural spontaneous nuclear reactor.

As explained by Andrew Alden, writing in about.com, geology:

What made such a thing possible was that in the distant past uranium was naturally enriched in U-235, that is, less of it had decayed away by nuclear fission. About 1.7 billion years ago, to be more precise, a natural deposit of uranium ore was radioactive enough to generate about 100 kilowatts of heat, off and on, for more than a million years.

Geologic forces gathered the uranium together. First a layer of sandstone was infiltrated by uranium-bearing groundwater, leaving a relatively thin sheet of uranium-oxide ore. Then the rocks were tilted, and as they eroded downward the groundwater concentrated the uranium minerals, sweeping them downward within the sandstone until a thick stripe of ore was built up. That's when things heated up.

To understand what happened next, you need to know a little about nuclear reactors. The nuclei of uranium atoms normally decay with the release of energetic neutrons—so energetic that they fly away without interacting with other uranium nuclei. The neutrons need to be slowed down before they can start splitting other uranium nuclei, which release more neutrons and start a feedback cycle. Something needs to moderate the neutrons. The first artificial reactor, built in 1942, used balls of enriched uranium spread out inside a large pile of graphite blocks, which served as a moderator.

But water acts as a moderator, too. At Oklo there was a lot of water, probably a river flowing above the buried orebody. The water allowed the nuclear interactions to reach the critical point, and the reactor began to work. But as it heated up, the water turned to steam and flowed away. With the moderator gone, the chain reaction stopped and did not start again until the orebody cooled and the water returned. This simple feedback cycle kept the Oklo reactors (there were at least a dozen of them) active until the U-235 was depleted. That took about a million years. When the Oklo mine was producing ore in the 1970s it was that telltale depletion of U-235, unheard-of in nature, that tipped scientists off.

A remarkable thing about the Oklo reactors is that the highly radioactive waste products stayed put without the elaborate containment we use today on nuclear power plant waste. More than a billion years later, everything is contained within a few meters of its source.

Recently a team of scientists took advantage of this excellent preservation and studied the isotopes of xenon gas—a product of uranium decay—trapped in phosphate minerals at Oklo. Led by Alex Meshik of Washington University of St. Louis, they reported in 2004 that the reactor went through eight cycles a day, running for 30 minutes then shutting down for two and a half hours. The whole thing is reminiscent of geysers.

Why was uranium so much more radioactive then? With a half-life of 700 million years, U-235 started out making up nearly half of all uranium when the solar system began some 4560 million years ago. Many shorter-lived radioisotopes that existed in the beginning, like aluminum-26, have become extinct. We know of their former existence by the presence of their decay products in ancient meteorites—nuclear fossils.

The abundance of water in Gabon prevented a nuclear explosion. On Mars, however, it is hypothesized that the uranium deposit was much larger than that at Oklo, large enough to contain the errant neutrons after being triggered by a deep intrusion of groundwater.

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

# "GEOLOGY OF THE LAKE TAHOE REGION, NEVADA and CALIFORNIA"


# NCGS LAKE TAHOE FIELD TRIP

**Saturday, June 25 and Sunday, June 26, 2011**

## Field Trip Leader:

**Dr. Richard Schweickert, Professor Emeritus of Geology**
**University of Nevada, Reno**

**Field Trip Coordinator:**
**Tridib Guha**

### *Field Trip Leader's Biography:*

**Dr. Richard Schweickert** received his Ph.D. in Geology at Stanford University, and was an Associate Professor at Columbia University and then Professor of Geology at the University of Nevada, Reno until his retirement in January 2010. He was a Foundation Professor at the University since 1993. He specializes in research on structural geology and tectonics, with special emphasis on the Sierra Nevada and the western U.S. With NSF funding, he has carried out research in Alaska, California, Nevada, Chile, Argentina, Newfoundland, Italy, and Corsica. His ongoing research includes: active faults, landslides, and tsunamis in the Lake Tahoe basin involving detailed structural mapping, trenching, drilling, submarine geology, soil gas profiling, and stratigraphic studies; volcanic stratigraphy of the Lake Tahoe basin; stratigraphy, structure, and geologic history of the Tahoe City area; and structure and stratigraphy of the Saddlebag Lake pendant and adjacent areas in the High Sierra.

Major discoveries by Schweickert and his students since the early 1980's include:

- regional thrust faults in the eastern Sierra Nevada
- a Triassic caldera near Tioga Pass, Yosemite National Park
- a major syn-batholithic dextral strike-slip fault system with over 400 km displacement
- Paleozoic and Mesozoic subduction complexes and island arcs in the Sierra Nevada region
- active faults, mega-landslides, and past tsunamis in the Lake Tahoe basin

### *Lake Tahoe Field Trip Synopsis:*

The Lake Tahoe basin is an active half-graben at the Sierra Nevada-Great Basin boundary. The basin was dammed near its present outlet by basaltic shield volcanoes about 2 Ma and ~900 Ka. Three main active fault zones lie within the basin and are capable of M7 earthquakes. Such earthquakes would likely generate significant tsunamis. A mega-landslide along the western edge of the lake removed latest Pleistocene glacial moraines, produced a ~10 $km^3$ debris avalanche, and generated a tsunami at least 30m high. Giant boulder mega-ripples were produced on shallow shelves north and south of the mega-landslide. The age of the mega-landslide is uncertain, but likely is between 15 Ka and 7 Ka. This fieldtrip will feature stops at South Lake Tahoe, Emerald Bay, Meeks Bay, Sugar Pine Point, Eagle Rock, Tahoe City, and Kings Beach. Evidence of active faults, landslides, glaciation, basaltic volcanism, and tsunamis will be emphasized.

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

This 2-day field trip will start from Pleasant Hill, go to Sacramento (pick up), and continue to South Lake Tahoe via Hwy 50, where we will meet the Field Trip Leader. Camping will be provided at Sugar Pine State Park

**Time & Departure**: 7:00 am Saturday June 25, 2011 at the Sun Valley Mall Sears Co. parking lot, Pleasant Hill (corner of Contra Costa Blvd and Willow Pass Road) – The Sacramento pick up place will be announced later.

**Cost**: $120/person. Includes transportation by chartered bus, guidebook, morning coffee & pastries, lunches, and refreshments, BBQ dinner with vino & beer on Saturday night. Camping is included.

**A list of participants will be circulated so that you can arrange carpools to the departure location**.

**********REGISTRATION FORM - Lake Tahoe Field Trip) **********

Name:_____ E-mail:_____

Phone :_____ Phone (cell):_____ Meals: Regular : ( ) or Veg: ( )

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

Questions: e-mail: tridibguha@sbcglobal.net Phone: (925) 370-0685 (evening), (925) 451-1999 (day)

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

# NCGS DINNER MEETING

## *"Assembling California: an Update"*

***Also***

***"The initiative on recognition of Earth Science for entrance into the University: an Update"***

**Wednesday May 25, 2011**

**Speaker: Dr. Elridge M. Moores,** Distinguished Professor Emeritus
University of California, Davis
6:00 PM at Orinda Masonic Center
(Reservations are required by May 21, 2011, Limit 100 persons)
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. Elridge Moores**. For this unique 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 a deluxe veggie burger will be served in place of BBQ. Desert will include assorted cookies and brownies. We may be again serving wines from California specials (90 pts +).** Please also note that a vegetarian option is available if notified ahead (please see the registration form below).

### *Abstract: Assembling California: an Update*

During the plate tectonic revolution in the 1960's, at first California geology played a small role. That changed with the December, 1969 Asilomar Penrose Conference, in which the Franciscan complex became the type example of a subduction complex, and the Sierra Nevada became a prime example of an Andean-style continental margin. Ophiolite emplacement and collisions between oceanic island arcs and the continent also were invoked in 1970 to explain western U.S. tectonic development, but acceptance of these ideas proceeded more slowly.

In the past two decades, however, many new data and concepts have enriched the picture of northern California's tectonic development, especially since publication of John McPhee's *Assembling California (1993)*. North America probably rifted away some 650-750 million years ago from its former continuation currently present in eastern Australia-East Antarctica. The oldest rocks in northern California--Shoo Fly-Antelope sediments, and the Trinity ophiolite--may have originated from the Appalachians/west Africa and Iapetus Ocean, respectively. Plate tectonic activity in the past 200 million years included collision of Pacific-derived island archipelagoes with North America, as well as subduction of several plates beneath the continental margin. An ophiolitic slab beneath the Great Valley tectonically overlies the continental edge of North America, resulting in a "double Moho" beneath the Valley. This feature has probably kept the Valley low as the Sierra and Coast Ranges rose around it.

Folds and thrusts in the northern Sierra Nevada may be as young as Cretaceous in age (Christe, 2010). At least one archipelago collision (Wrangellia) may be as young as 100 million years. The "Sevier-Laramide" orogeny may have resulted from mid-Cretaceous collision of a "ribbon continent" with North America (Johnston, 2008, Hildebrand, 2009) About 50 million years ago a Tibet-like highland (also called the "Nevadoplano": DeCelles, 2004) had developed in central-eastern Nevada, with a drainage divide in eastern Nevada (Henry et al, 2008). Major streams drained westward from this highland over deformed and eroded older Sierra rocks to the ocean in the present-day Sierra foothills. Deposits

include the Auriferous Gravels of the northern Sierra and younger silicic tuffs (Valley Spring formation) derived from large calderas in central Nevada. The San Andreas Fault system began some 29 million years ago. At present, the Sierra Nevada and Great Valley constitute the ***Sierra Microplate***, located between the Pacific and North American plates.

The long-term evolution of the North American Pacific margin encompasses complex processes of rifting, subduction, collision, igneous and metamorphic activity, and large-scale faulting of all types over some 650 million years. The western Pacific and Alpine orogens provide many insights into the nature of the tectonic development of the complex North American Pacific margin.

## *Speaker Biography:*

Eldridge M. Moores is Distinguished Professor of Geology at the University of California, Davis. He was born and raised in the remote Arizona mining town of Crown King, where his father and grandfather operated small lead-zinc-gold mines. The Moores family was musically inclined, and Eldridge began to play the cello when he was thirteen, a passion he has enthusiastically pursued his entire life. He attended high school in Phoenix where he excelled in music and history. He majored in Geology at the California Institute of Technology and received his Bachelor's Degree in 1959. In 1963 he received a Ph.D. in Geology from Princeton University as a student of Professor Harry Hess. His post doctoral work at Princeton recognized the Troodos ophiolite complex on the Mediterranean island of Cyprus as ancient oceanic crust.

Eldridge came to U.C. Davis in 1966, and was Department Chair during the early 1970's. He continued his plate tectonic research, focusing on the tectonic evolution of Northern California and the Western U.S., and on the tectonics of the Alps, the Himalayas, Pakistan, Greece, and Cyprus. Eldridge has also made significant contributions to the plate tectonic evolution of Precambrian continental terranes and the associated bio-evolutionary effects. Dr. Moores has published extensively on Northern California tectonics, orogenies in the western United States, the evolution of the California Coast Range, processes of ophiolite emplacement, and on spreading center tectonics and ocean ridge ore deposition. He was President of the Geological Society of America in 1996, and editor of Geology magazine from 1981 to 1987. Eldridge received the GSA Distinguished Services Award in 1988 and the GSA Distinguished Career Award in 2006. He is a Fellow of the Geological Society of America, the California Academy of Sciences, and the American Association for the Advancement of Science, and an Honorary Fellow of the Geological Society of London. He received the Geological Association of Canada Medal in 1994 and was presented an Honorary D.Sc. from the College of Wooster in 1997. In 2003 the U.C. Davis Academic Senate awarded him its Distinguished Scholarly Public Service Award.

Dr. Moores is also actively involved in promoting Earth Science education at the K-12, undergraduate, and graduate levels locally, in Yolo County, and in Sacramento. He is a member of the National Science Foundation and has served on several other academic advisory committees in the Federal government. Eldridge collaborated closely with author John McPhee on the book "Assembling California," one of five books on geology in the 1998 Pulitzer Prize winning series "Annals of the Former World." He has also co-authored two geology textbooks with U.C. Davis colleague Dr. Robert J. Twiss, ***Tectonics*** and ***Structural Geology***.

**********  **Dinner Logistics**  **********

**Meeting Details**: Social Hour: 6:00 – 7:00 pm; Dinner: 7:00 – 8:00 pm **Presentation**: 8:00 – open
**Time**: May 25, 2011, 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA. **Cost**: **$20/person**

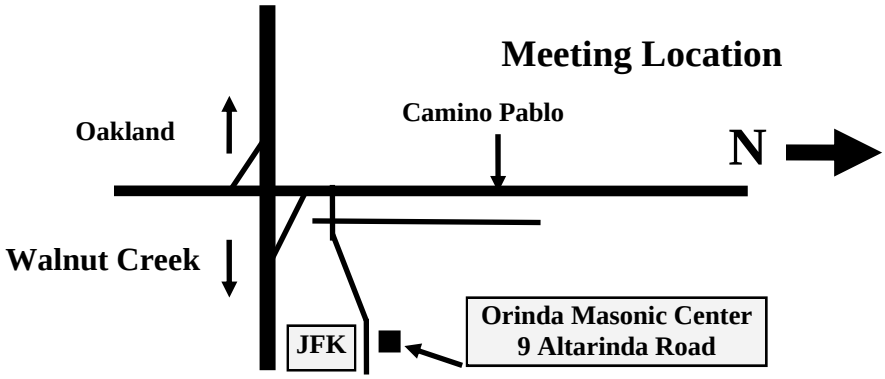
**********REGISTRATION FORM (Dr. Elridge Moores Dinner) **********

Name:_____ E-mail:_____

Phone (day):_____ Phone (cell) _____

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 Phone: (925) 370-0685 (evening) (925) 451-1999 (day)




***Biography, continued:***

Jim also served as Scientist-in-Charge of the Hawaiian Volcano Observatory and investigated about 20 world-wide, on-going volcanic eruptions. He has participated in 25 oceanographic cruises and made numerous dives in research submarines to investigate volcanic rocks on the submerged flanks of young volcanoes. Current research is on young volcanic rocks of the Tahoe Basin, and on quench features of Columbia River lava.

Northern California Geological Society
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