NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **May 25, 2011; Special Annual Dinner Meeting!**

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

TIME: **6:00 p.m. social (Early); 7:00 p.m. talk Cost: $20 per regular member**

Reservations are required by May 21, 2011
We are sorry but we will not be able to accommodate "walk-ins"

SPEAKER: **Dr. Eldridge Moores**

Assembling California: An Update

Also:

The initiative on recognition of Earth Science for entrance into the University: 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…. *…continued on the back…*

NCGS 2010 – 2011 Calendar

Wednesday May 25, 2011
DINNER MEETING! EARLY TIME!
Dr. Eldridge Moores
Assembling California: An Update
Also: ***The initiative on recognition of Earth Science for entrance into the University: an Update***
6:00 pm at Orinda Masonic Lodge

Wednesday June 29, 2011
Dr. John Wakabayahsi
Franciscan Mélanges: Evidence for Sedimentary Origins, Multiple Subduction-Exhumation Cycles, Subduction Accretion, Subduction Erosion and Non Accretion
7:00 pm at Orinda Masonic Lodge

Our Usual Summer Break!

September 28, 2011
TBA
7:00 pm at Orinda Masonic Lodge

October 9 – 15, 2011
Earth Science Week
TBA

October 26, 2011
TBA
7:00 pm at Orinda Masonic Lodge

Upcoming NCGS Events

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.

- May 10: Erik Olsborg, CEG; Discovering the Geology of the California Northern Coastline
- 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.

- May 10, 2011; **Erik Olsborg, CEG;** ***Discovering the Geology of the California Northern Coastline***
- June 14, 2011; **David W. Bieber, PG, PGP, CEG, CHG; Geological Services Manager Geocon Consultants, Inc.:** ***Case studies on the application of engineering geology and rock mechanics to hardrock aggregate mining in the operations and closure process***

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/

- May 26, 2011; The Future of 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).

NCGS Notes The Passing of Member Thelma Dana

Former NCG Treasurer passed recently. What follows was published in the Contra Costa Times on May 1, 2011.

Thelma Dana Mar. 28, 1925 ~ Mar. 1, 2011 Resident of Concord, CA Thelma Dana, a fifty year resident of Concord, and fifth generation Californian, passed away quietly at home with family and pets at her side. Thelma was born and raised on the San Francisco peninsula and as a child lived abroad in Manila, Philippines and Honolulu, Hawaii. While living in Manila she had the opportunity to travel to Shanghai and many other places in Asia including, Guam and Tokyo. The Dwyer family returned to the United States during Thelma's teen years. Thelma attended Burlingame High School, the College of San Mateo, Munson's Business College (San Francisco) and, later in life, Diablo Valley College, where she studied geology and other sciences. During the sixties and seventies Thelma was very active in the California Republican party, including the Contra Costa County Republican Central Committee. Her involvement included service as vice-chairman for women's affairs, chairman of the communications committee, and membership on the editorial review board. She was also a member of the Contra Costa County Headquarters Committee, the California State Republican Central Committee, the California Federation of Republican Women, the California Republican Assembly, and the Young Republicans. Thelma's time living abroad helped inspire in her a zest for life and an interest in the world and everything in it, especially traveling and nature. A woman of varied interests, Thelma also had a passion for entertaining, photography, geography, geology and gardening. She was an ardent nature lover, enthusiastic hiker and rockhound. Thelma loved animals, especially her many pets, which over the years included many cats and dogs and two desert tortoises. As part of her love of animals Thelma volunteered at the Alexander Lindsay Jr. Wildlife Museum in Walnut Creek, where she served as a docent for many years and was active in museum fundraising. Contributions may be made to the [Thelma Dana Memorial Fund] at the Lindsay Wildlife Museum in Walnut Creek, 1931 First Ave. Walnut Creek, CA 94597 (925-935-1978).

Just so we know who we're talking about

Category: Humor • Philosophy of Science, by John S. Wilkins

Below is a humorous and possibly true account of reality TV trying to include geologists. With appropriate substitutions, the same thing could be said of any academic...

While the media rarely represents geologists to the general population, (excluding sound bytes on Discovery Channel volcano specials), there was one recent attempt to integrate geologists into a television program.

According to various blog sources, CBS was looking to produce a new reality TV show for 2008, after correctly predicting that the writers' strike would cut down on their ability to create blue-toned dramatic shows centering around corpses. One of their production managers happened to see a documentary on a volcanologist researching lava in Hawaii, and seeing the danger and excitement inherent in people smashing molten hot 'magma' with rock hammers, pitched the idea of a 'geologist survivor-type' show.

In December of 2007, CBS hired a production crew to pull the show together; the scenario was that nine geologists would be placed in the field, where they would vote each other off based on their willingness to do dangerous geologist type feats common to the field; like researching active volcanoes, earthquakes, landslides, and landing in bush planes on glaciers. Geologists that weren't up to the task would be voted off, and the last remaining "Hard-core geologist" would win a prize.

The production was plagued from the beginning. They were successful in finding nine geologists, 6 males and three females, between 25 and 50 years of age, and they quickly set up the first challenge; researching an active volcano in the Phillipines. The geologists and camera crew set up camp near the bottom of the volcano. The camera crew filmed the nine geologists bonding. The geologists were supplied with alchohol (a common strategy to loosen up the cast in reality TV), but the camera crew was surprised to notice that even after drinking gallons of the liquid, the geologists did not change their behavior, and continued talking in an obscure jargonized language about 'bombs', 'breccia,' and 'lahars,' none of which made for good reality TV.

This trend continued through the entire first challenge; the geologists were seemingly oblivious to the camera, and the only interpersonal drama occurred when the seismologist and structural geologist got into a yelling match over the best recipe for chili. When the camera-crew and geologists went up to do research on the volcano, instead of sticking together, the geologists scattered into the landscape, and the camera-crew found themselves unable to find more than two at a time.

Also, after listening to the volcanologist eagerly predict just how soon the volcano would blow, the camera-crew became extremely nervous and returned to the camp. The final result was almost no footage, and the editors were unable to make sense of what footage there was because they had no idea what the hell the geologists were talking about. Finally, few of the scientists seemed to understand

the concept of 'voting off' another member. After consulting a nearby university, the crew finally explained that the geologists were 'competing for a GSA research grant.'

This didn't go well either, as the geologists pointed out that they didn't have the time to write a research paper. Finally, they were simply told to get rid of someone on some sort of criteria. After a council, the geologists decided that whoever had the worst ám with a rock hammer would be told to leave.

The second event, landing in a bush plane in upper Alaska, was a complete failure. None of the geologists were nervous at the idea, which destroyed the drama the crew was hoping for, and worse yet, no-one in the production crew was willing to accompany the geologists to the site, out of sheer terror. The result was that small cameras were given to two of the geologists to film themselves. When the footage and geologists returned, the editors found tapes filled with footage and commentary about mountains and 'glacial erratics'. Only ten percent of the footage featured humans, and most of that footage was simply the petrologist standing by outcrops for scale.

By the time the production reached Hawaii, most of the camera-crew had quit (because of the steady diet of chili and the dangerous situations), and only five of the geologists were left; not because they had been voted off, but because they had been over-excited by rock formations at various locations and had refused to leave. Moreover, paying for an almost-constant supply of beer and transportation of the geologists' luggage (which mainly consisted of rock samples and unmentionably dilapidated field clothing), had almost exhausted the budget. CBS finally pulled the plug on the project in January of 2008, despite their fear that they might be sued for withdrawing the promise of a prize; however, none of the geologists sued, as they were still under the impression that they needed to publish a research paper to receive the money.

Profile

John Wilkins is an eternal student, who thinks philosophy of biology is **at least** as interesting as politics or sport and twice as important. He has a PhD from the University of Melbourne and worked at the University of Queensland, in Australia, before taking up a research fellowship at the University of Sydney. After a varied career, involving factories, gardening, civil service, publishing, graphics, public relations but not, unfortunately for the CV, driving a truck, John finally completed his thesis on species concepts in 2004, which he has worked into two books.

This blog ~~is designed~~ evolved to host any random thoughts that happen to be passing through my forebrain at a given moment. So there will be errors...

Source:
http://scienceblogs.com/evolvingthoughts/2008/03/just_so_we_know_who_were_talki.php

GPS Data Used to Model Effects of Tidal Loads on Earth's Surface

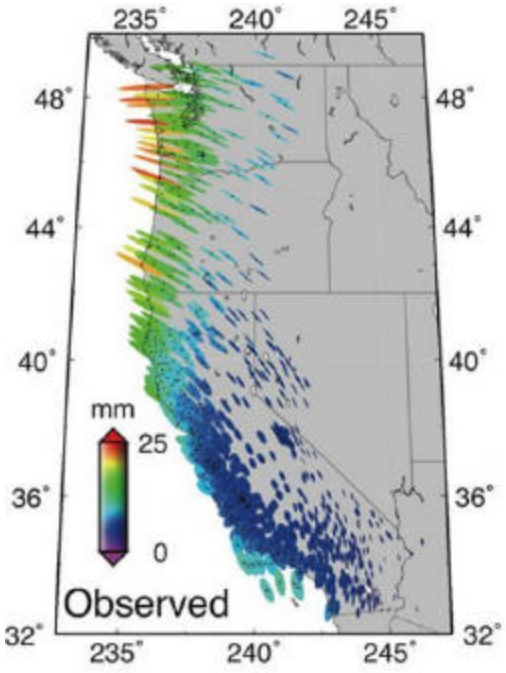
ScienceDaily - For many people, Global Positioning System (GPS) satellite technology is little more than a high-tech version of a traditional paper map. Used in automobile navigation systems and smart phones, GPS helps folks find their way around a new neighborhood or locate a nearby restaurant. But GPS is doing much, much more for researchers at the California Institute of Technology (Caltech): it's helping them find their way to a more complete understanding of Earth's interior structure.

Up until now, the best way to explore Earth's internal structures -- to measure geological properties such as density and elasticity -- has been through seismology and laboratory experiments. "At its most fundamental level, seismology is sensitive to specific combinations of these properties, which control the speed of seismic waves," says Mark Simons, professor of geophysics at Caltech's Seismological Laboratory, part of the Division of Geological and Planetary Sciences. "However, it is difficult using seismology alone to separate the effects that variations in density have from those associated with variations in elastic properties."

Now Simons and Takeo Ito, visiting associate at the Seismological Laboratory and assistant professor of earth and planetary dynamics at Nagoya University in Japan, are using data from GPS satellite systems in an entirely new way: to measure the solid earth's response to the movements of ocean tides -- which place a large stress on Earth's surface -- and to estimate separately the effects of Earth's density and the properties controlling response when a force is applied to it (known as elastic moduli).

Their work was published in *Science* Express.

By using measurements of Earth's movement taken from high-precision, continuously recording permanent GPS receivers installed across the western United States by the Plate Boundary Observatory (PBO), the researchers were able to observe tide-induced displacements -- or movements of Earth's surface -- of as little as one millimeter. PBO is a component of EarthScope, a program that seeks to understand the processes controlling earthquakes and volcanoes by exploring the structure and evolution of the North American continent.



The outline of each ellipse represents the motion the ground makes as the earth flexes in response to the time and space dependent tides. There is an ellipse for each of the GPS sites used in the study, and the color indicates the amplitude of the tidal response movement. (Credit: California Institute of Technology)

The team focused on understanding the properties of the asthenosphere, a layer of weak and viscous upper mantle that lies below Earth's crust, and used those measurements to build one-dimensional models of Earth's response to the diurnal tides in the western United States.

"The asthenosphere plays an important role in plate tectonics, as it lies directly under the plates," explains Ito. "The results of our study give us a better understanding of the asthenosphere, which in turn can help us understand how the plates move."

The models provided a look at the variations in density from Earth's surface down to a depth of about 400 kilometers. The researchers found that the density of the asthenosphere under the western United States and the eastern Pacific Ocean is abnormally low relative to the global average.

"Variations in density can either be caused by variations in the chemical makeup of the material, the presence of melt, or due to the effects of thermal expansion, whereby a given material will decrease in density as its temperature increases," explains Simons. "In this study, we interpret the observed density anomaly to be due to the effects of elevated temperatures in the asthenosphere below the western United States and neighboring offshore areas. The required peak temperature anomaly would be about 300 degrees Celsius higher than the global average at those depths."

This type of data provides keys to understanding the chemical and mechanical dynamics of the planet, such as how heat flows through the mantle and how tectonic plates on Earth's surface are evolving.

"It is amazing that by measuring the twice-a-day centimeter-scale cyclic movement of Earth's surface with a GPS receiver, we can infer the variation of density 220 kilometers below the surface," says Simons.

Now that the researchers know it is possible to use GPS to derive measurements of internal Earth structures, they anticipate several new directions for this research.

"We hope to extend the observations to be global in scope, which may require temporary deployments of GPS in important areas that are typically tectonically bland -- in other words, devoid of significant earthquakes and volcanoes -- and thus do not have existing dense continuous GPS arrays already in place," says Simons. Next steps may also include going beyond the current one-dimensional depth-dependent models to build 3-D models, and combining the GPS approach with more conventional seismic approaches.

"The method we developed for gathering data from GPS devices has significant potential for improving 3-D images of Earth's internal structure," says Ito.

This research was supported by the National Science Foundation; Grants-in-Aid for Scientific Research, part of Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT); JSPS Postdoctoral Fellowships for Research Abroad; and the Gordon and Betty Moore Foundation.

Journal Reference:

T. Ito, M. Simons. **Probing Asthenospheric Density, Temperature, and Elastic Moduli Below the Western United States**. *Science*, 2011

Evolution of Human 'Super-Brain' Tied to Development of Bipedalism, Tool-Making

ScienceDaily - Scientists seeking to understand the origin of the human mind may want to look to honeybees -- not ancestral apes -- for at least some of the answers, according to a University of Colorado Boulder archaeologist.

CU-Boulder Research Associate John Hoffecker said there is abundant fossil and archaeological evidence for the evolution of the human mind, including its unique power to create a potentially infinite variety of thoughts expressed in the form of sentences, art and technologies. He attributes the evolving power of the mind to the formation of what he calls the "super-brain," or collective mind, an event that took place in Africa no later than 75,000 years ago.

CU-Boulder researcher John Hoffecker, shown here working at a site in Russia dating back 45,000 years, believes there is mounting archaeological evidence for the evolution of a human "super-brain" no later than 75,000 years ago that spurred a modern capacity for novelty and invention. (Credit: Vance T. Holliday, University of Arizona)

An internationally known archaeologist who has worked at sites in Europe and the Arctic, Hoffecker said the formation of the super-brain was a consequence of a rare ability to share complex thoughts among individual brains. Among other creatures on Earth, the honeybee may be the best example of an organism that has mastered the trick of communicating complex information -- including maps of food locations and information on potential nest sites from one brain to another -- using their intricate "waggle dance."

"Humans obviously evolved a much wider range of communication tools to express their thoughts, the most important being language," said Hoffecker, a fellow at CU's Institute of Arctic and Alpine Research. "Individual human brains within social groups became integrated into a neurologic Internet of sorts, giving birth to the mind."

While anatomical fossil evidence for the capability of speech is controversial, the archaeological discoveries of symbols coincides with a creative explosion in the making of many kinds of artifacts. Abstract designs scratched on mineral pigment show up in Africa about 75,000 years ago and are widely accepted by archaeologists as evidence for symbolism and language. "From this point onward there is a growing variety of new types of artifacts that indicates a thoroughly modern capacity for novelty and invention."

The roots of the mind and the super-brain lie deep in our past and are likely tied to fundamental aspects of our evolution like bipedalism and making stone tools, he said. It was from the making of tools that early humans first developed their ability to project complex thoughts or mental representations outside the individual brain -- our own version of the honeybee waggle dance, Hoffecker said.

While crude stone tools crafted by human ancestors beginning about 2.5 million years ago likely were an indirect consequence of bipedalism -- which freed up the hands for new functions -- the first inklings of a developing super-brain likely began about 1.6 million years ago when early humans began crafting stone hand axes, thought by Hoffecker and others to be one of the first external representations of internal thought.

Ancient hand axes achieved "exalted status" as mental representations since they bear little resemblance to the natural objects they were made from -- generally cobbles or rock fragments. "They reflect a design or mental template stored in the nerve cells of the brain and imposed on the rock, and they seemed to have emerged from a strong feedback relationship among the hands, eyes, brains and the tools themselves," he said.

The emerging modern mind in Africa was marked by a three-fold increase in brain size over 3-million-year-old human ancestors like Lucy, thought by some to be the matriarch of modern humans. Humans were producing perforated shell ornaments, polished bone awls and simple geometric designs incised into lumps of red ochre by 75,000 years ago. "With the appearance of symbols and language -- and the consequent integration of brains into a super-brain -- the human mind seems to have taken off as a potentially unlimited creative force," he said.

The dispersal of modern humans from Africa to Europe some 50,000 to 60,000 years ago provides a "minimum date" for the development of language, Hoffecker speculated. "Since all languages have basically the same structure, it is inconceivable to me that they could have evolved independently at different times and places."

A 2007 study led by Hoffecker and colleagues at the Russian Academy of Sciences pinpointed the earliest evidence of modern humans in Europe dating back 45,000 years ago. Located on the Don River 250 miles south of Moscow, the multiple sites, collectively known as Kostenki, also yielded ancient bone and ivory needles complete with eyelets, showing the inhabitants tailored furs to survive the harsh winters.

The team also discovered a carved piece of mammoth ivory that appears to be the head of a small figurine dating to more than 40,000 years ago. "If that turns out to be the case, it would be the oldest piece of figurative art ever discovered," said Hoffecker, whose research at Kostenki is funded in part by the National Science Foundation.

The finds from Kostenki illustrate the impact of the creative mind of modern humans as they spread out of Africa into places that were sometimes cold and lean in resources, Hoffecker said. "Fresh from the tropics, they adapted to ice age environments in the central plain of Russia through creative innovations in technology."

Ancient musical instruments and figurative art discovered in caves in France and Germany date to before 30,000 years ago, he said. "Humans have the ability to imagine something in the brain that doesn't exist and then create it," he said. "Whether it's a hand axe, a flute or a Chevrolet, humans are continually

recombining bits of information into novel forms, and the variations are potentially infinite."

While the concept of a human super-brain is analogous to social insects like bees and ants that collectively behave as a super-organism by gathering, processing and sharing information about their environment, there is one important difference, Hoffecker said. "Human societies are not super-organisms -- they are composed of people who are for the most part unrelated, and societies filled with competing individuals and families."

Since the emergence of the modern industrial world beginning roughly 500 years ago, creativity driven by the human super-brain has grown by leaps and bounds, from the invention of mechanical clocks to space shuttles. Powerful artificial intelligence could blur the differences between humans and computers in the coming centuries, he said.

Hoffecker is the author of an upcoming book, titled "Landscape of the Mind: Human Evolution and the Archaeology of Thought," to be published by Columbia University Press in May. For more information on Hoffecker's book visit http://cup.columbia.edu/book/978-0-231-14704-0/landscape-of-the-mind.

Story Source:

The above story is reprinted (with editorial adaptations by Science*Daily* staff) from materials provided by University of Colorado at Boulder.

Electric Yellowstone: Conductivity Image Hints Supervolcano Plume Is Bigger Than Thought

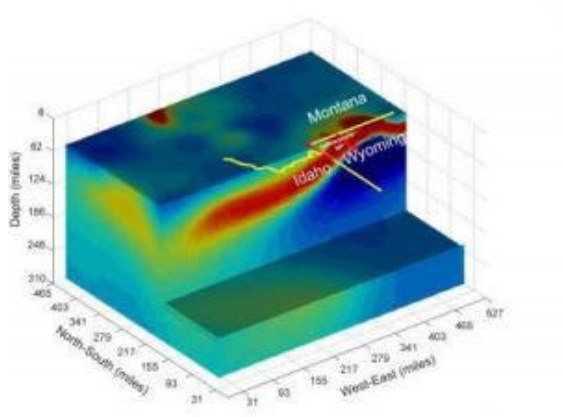
ScienceDaily - University of Utah geophysicists made the first large-scale picture of the electrical conductivity of the gigantic underground plume of hot and partly molten rock that feeds the Yellowstone supervolcano. The image suggests the plume is even bigger than it appears in earlier images made with earthquake waves.

"It's like comparing ultrasound and MRI in the human body; they are different imaging technologies," says geophysics Professor Michael Zhdanov, principal author of the new study and an expert on measuring magnetic and electrical fields on Earth's surface to find oil, gas, minerals and geologic structures underground.

"It's a totally new and different way of imaging and looking at the volcanic roots of Yellowstone," says study co-author Robert B. Smith, professor emeritus and research professor of geophysics and a coordinating scientist of the Yellowstone Volcano Observatory.

The new University of Utah study has been accepted for publication in *Geophysical Research Letters*, which plans to publish it within the next few weeks.

In a December 2009 study, Smith used seismic waves from earthquakes to make the most detailed seismic images yet of the "hotspot" plumbing that feeds the Yellowstone volcano. Seismic waves move faster through cold rock and slower through hot rock. Measurements of seismic-wave speeds were used to make a three-dimensional picture, quite like X-rays are combined to make a medical CT scan.



This image, based on variations in electrical conductivity of underground rock, shows the volcanic plume of partly molten rock that feeds the Yellowstone supervolcano. Yellow and red indicate higher conductivity, green and blue indicate lower conductivity. Made by University of Utah geophysicists and computer scientists, this is the first large-scale "geoelectric" image of the Yellowstone hotspot. (Credit: University of Utah.)

The 2009 images showed the plume of hot and molten rock dips downward from Yellowstone at an angle of 60 degrees and extends 150 miles west-northwest to a point at least 410 miles under the Montana-Idaho border -- as far as seismic imaging could "see."

In the new study, images of the Yellowstone plume's electrical conductivity -- generated by molten silicate rocks and hot briny water mixed in partly molten rock -- shows the conductive part of the plume dipping more gently, at an angle of perhaps 40 degrees to the west, and extending perhaps 400 miles from east to west. The geoelectric image can "see" only 200 miles deep.

Two Views of the Yellowstone Volcanic Plume

Smith says the geoelectric and seismic images of the Yellowstone plume look somewhat different because "we are imaging slightly different things." Seismic images highlight materials such as molten or partly molten rock that slow seismic waves, while the geoelectric image is sensitive to briny fluids that conduct electricity.

"It [the plume] is very conductive compared with the rock around it," Zhdanov says. "It's close to seawater in conductivity."

The lesser tilt of the geoelectric plume image raises the possibility that the seismically imaged plume, shaped somewhat like a tilted tornado, may be enveloped by a broader, underground sheath of partly molten rock and liquids, Zhdanov and Smith say.

"It's a bigger size" in the geoelectric picture, says Smith. "We can infer there are more fluids" than shown by seismic images.

Despite differences, he says, "this body that conducts electricity is in about the same location with similar geometry as the seismically imaged Yellowstone plume."

Zhdanov says that last year, other researchers presented preliminary findings at a meeting comparing electrical and seismic features under the Yellowstone area, but only to shallow depths and over a smaller area.

The study was conducted by Zhdanov, Smith, two members of Zhdanov's lab -- research geophysicist Alexander Gribenko and geophysics Ph.D. student Marie Green -- and computer scientist Martin Cuma of the University of Utah's Center for High Performance Computing. Funding came from the National Science Foundation (NSF) and the Consortium for Electromagnetic Modeling and Inversion, which Zhdanov heads.

The Yellowstone Hotspot at a Glance

The new study says nothing about the chances of another cataclysmic caldera (giant crater) eruption at Yellowstone, which has produced three such catastrophes in the past 2 million years.

Almost 17 million years ago, the plume of hot and partly molten rock known as the Yellowstone hotspot first erupted near what is now the Oregon-Idaho-Nevada border. As North America drifted slowly southwest over the hotspot, there were more than 140 gargantuan caldera eruptions -- the largest kind of eruption known on Earth -- along a northeast-trending path that is now Idaho's Snake River Plain.

The hotspot finally reached Yellowstone about 2 million years ago, yielding three huge caldera eruptions about 2 million, 1.3 million and 642,000 years ago. Two of the eruptions blanketed half of North America with volcanic ash, producing 2,500 times and 1,000 times more ash, respectively, than the 1980 eruption of Mount St. Helens in Washington state. Smaller eruptions occurred at Yellowstone in between the big blasts and as recently as 70,000 years ago.

Seismic and ground-deformation studies previously showed the top of the rising volcanic plume flattens out like a 300-mile-wide pancake 50 miles beneath Yellowstone. There, giant blobs of hot and partly molten rock break off the top of the plume and slowly rise to feed the magma chamber -- a spongy, banana-shaped body of molten and partly molten rock located about 4 miles to 10 miles beneath the ground at Yellowstone.

Computing a Geoelectrical Image of Yellowstone's Hotspot Plume

Zhdanov and colleagues used data collected by EarthScope, an NSF-funded effort to collect seismic, magnetotelluric and geodetic (ground deformation) data to study the structure and evolution of North America. Using the data to image the Yellowstone plume was a computing challenge because so much data was involved.

Inversion is a formal mathematical method used to "extract information about the deep geological structures of Earth from the magnetic and electrical fields recorded on the ground surface," Zhdanov says. Inversion also is used to convert measurements of seismic waves at the surface into underground images.

Magnetotelluric measurements record very low frequencies of electromagnetic radiation -- about 0.0001 to 0.0664 Hertz -- far below the frequencies of radio or TV signals or even electric power lines. This low-frequency, long-wavelength electromagnetic field penetrates a couple hundred miles into Earth. By comparison, TV and radio waves penetrate only a fraction of an inch.

The EarthScope data were collected by 115 stations in Wyoming, Montana and Idaho -- the three states straddled by Yellowstone National Park. The stations, which include electric and magnetic field sensors, are operated by Oregon State University for the Incorporated Research Institutions for Seismology, a consortium of universities.

In a supercomputer, a simulation predicts expected electric and magnetic measurements at the surface based on known underground structures. That allows the real surface measurements to be "inverted" to make an image of underground structure.

Zhdanov says it took about 18 hours of supercomputer time to do all the calculations needed to produce the geoelectric plume picture. The supercomputer was the Ember cluster at the University of Utah's Center for High Performance Computing, says Cuma, the computer scientist.

Ember has 260 nodes, each with 12 CPU (central processing unit) cores, compared with two to four cores commonly found on personal computer, Cuma says. Of the 260 nodes, 64 were used for the Yellowstone study, which he adds is "roughly equivalent to 200 common PCs."

To create the geoelectric image of Yellowstone's plume required 2 million pixels, or picture elements.

Journal Reference:

Zhdanov, M. S., R. B. Smith, A. Gribenko, M. Cuma, and M. Green. **Three-Dimensional Inversion of Large-Scale EarthScope Magnetotelluric Data Based On The Integral Equation Method: Geoelectrical Imaging Of The Yellowstone Conductive Mantle Plume**. *Geophys. Res. Lett.*, 2011

"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

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.

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** **********

For details and a registration form please go to the NCGS website:
http://www.ncgeolsoc.org/FieldTripInfo/Lake%20Tahoe%20FT%20Flyer.pdf.

After reading the form, if you have further questions, please contact **Tridib Guha** with unanswered questions at:
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**

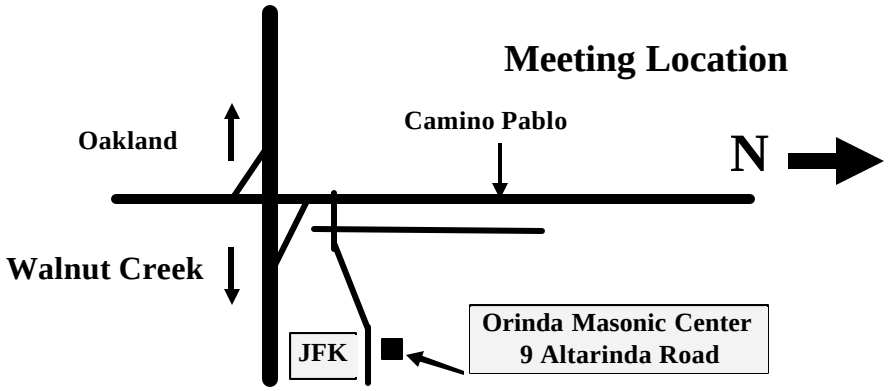
**********REGISTRATION FORM (Dr. Elridge Moores Dinner) **********

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)



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Biography: Please see attached Diner Announcement Flyer for Dr. Moores biography!

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

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