NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **May 30, 2012** **ANNUAL DINNER MEETING!!**

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

TIME: **6:00 p.m social; 7:00 p.m. Dinner; 8:00 p.m. Talk.**
Watch The Early Time!
Please Note: Walk-ins Cannot Be Accommodated!
Cost: See Attached Reservation Form

SPEAKER: **Dr. Geoffrey W. Marcy**
Professor of Astronomy
University of California, Berkeley

The Hunt for Another Earth"

The new Kepler spaceborn telescope is hunting for Earth-size planets, with hundreds in its sights. Kepler has already found definitively rocky planets, like earth, and is now hunting for habitable ones. This talk will present up-to-the-minute results from the Kepler Team. Biologists are working with astronomers to assess the environmental conditions necessary for life, especially intelligent life, on planets elsewhere in the universe.

Speaker Biography: Dr. Geoff Marcy is a Professor of Astronomy at UC Berkeley and an Adjunct Professor of Physics and Astronomy at San Francisco State University. He is the Director of Berkeley's "Center for Integrative Planetary Science", a research unit designed to study the formation, geophysics, chemistry and evolution planets. He is an elected member of the National Academy of Sciences and has been the recipient of numerous awards, including the NASA Medal for Exceptional Scientific Achievement. He was named Discovery Magazine's Space Scientist of the year 2003. He was also co-recipient of the prestigious Shaw Prize. He received his PhD in 1982 from UC Santa Cruz.

Geoff is one of the pioneers and leaders in the discovery and characterization of planets around other stars. He and his collaborators have discovered nearly half of the 450 known exoplanets. They found the first system of multiple planets around a normal (main sequence) star, and also found the first Saturn mass planet and the first Neptune-like planet. They also found the first transiting planet (a co-discovery with T. Brown and D. Charbonneau). His group is now searching for Earth-like planets using NASA's Kepler Mission and the Keck telescope in Hawaii.

NCGS 2010 – 2011 Calendar

May 30, 2012 **(Dinner Meeting!)**
Dr. Goeff Marcy, UC Berkeley; **(Early Time!)**
The Hunt for Another Earth
(See April Newsletter for Form!)
6:00 pm at Orinda Masonic Lodge

June 27, 2012
Dr. Donald L Gautier, US Geological Survey
Volumes, Uncertainty and Costs of Undiscovered Arctic Petroleum
7:00 pm at Orinda Masonic Lodge

Upcoming NCGS Events

April 2012 (Date Remains Tentative)	***Caldecott Fourth Bore Project*** **CalTrans and Dr. Gerhard Neuhuber**
June 2, 2012	***Ocean Floor to the Shelf; The Lower Tertiary Sequences on the Flanks of the Mt. Diablo*** **Dr. Ray Sullivan SF State University, Emeritus**
July 14, 2012	***Stroll to Subduction: Geology of Sunol Regional Wilderness*** **Dr. John Wakabayashi, Fresno State**

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.**

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.

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).

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/

Thursday, May 31, 2012 Watch Live at 7pm PST
USGS, Conference Room A, Bldg 3, Menlo Park

- **Restoring the Wild Heart of South San Francisco Bay --The South Bay Salt Pond Restoration Project; Laura Valoppi, Lead Scientist**

U.S. Geological Survey Open House Menlo Park, May 19 & 20, 2012

The 10th USGS Triennial Open House is coming up in May! World leaders in research on earthquakes, water quality, volcanoes, coastal and marine geology, mineral and energy resources, geography, and the San Francisco Bay ecosystem will be present.

Exhibits and presentations will illustrate the diversity of projects in which USGS employees are engaged. Bring your family and take advantage of this unique

opportunity to interact with USGS scientists, enjoy hands-on exhibits, and gain a greater appreciation of our connection to the natural systems of our dynamic planet.

There is no admission charge. Although nearby parking lots are expected to be adequate, local residents are encouraged to walk or bicycle to the event.

- Pets will not be allowed, other than Service Animals.
- All exhibits will be wheelchair accessible.
- Handicapped parking will be available .
- Limited food service will be available each day. Alternatively, many restaurants are nearby in downtown Menlo Park and Palo Alto, both of which are less than a mile away.

For a full size flyer and more details visit: http://openhouse.wr.usgs.gov/2012/index.html.

Humans and Climate Contributed to Extinctions of Large Ice Age Mammals, New Study Finds

Nov. 2, 2011 — The genetic history of six large herbivores -- the woolly rhinoceros, woolly mammoth, wild horse, reindeer, bison, and musk ox -- has shown that both climate change and humans were responsible for the extinction or near extinction of large mammal populations within the last 10,000 years. The study, which is the first to use genetic, archeological, and climatic data together to infer the population history of large-bodied Ice Age mammals, will be published in the journal *Nature*.

The musk ox is one of the species studied by Beth Shapiro and her team. (Credit: Beth Shapiro lab, Penn State)

The study was led by Professor Eske Willerslev of the Centre for GeoGenetics at the University of Copenhagen and includes an international team of paleontologists, geologists, geneticists and climate modelers including Beth Shapiro, the Shaffer Associate Professor of Biology at Penn State University. The study's findings are expected to shed light on the possible fates of living species of mammals as our planet continues its current warming cycle. The paper will be posted on the journal's Advance Online Publication website on 2 November 2011 at 2:00 p.m. U.S. Eastern time.

"Our findings put a final end to the single-cause theories of these extinctions," said Willerslev. "Our data suggest care should be taken in making generalizations regarding past and present species extinctions; the relative impacts of climate change and human encroachment on species extinctions really depends on which species we're looking at."

Shapiro explained that all six of the species the team studied flourished during the Pleistocene Epoch -- the period of geological time that lasted from about 2 million to 12,000 years ago. "During this time, there were lots of climatic ups and downs -- oscillations between long, warm intervals called interglacial periods, during which the climate was similar to what we have today, followed by long, cold intervals called glacial periods, or ice ages," Shapiro said. "Although these cold-adapted animals certainly fared better during the colder, glacial periods, they still managed to find places where the climate was just right -- refugia -- so that they could survive during the warmer, interglacial periods. Then, after the peak of the last ice age around 20,000 years ago, their luck started to run out. The question is, what changed? Why were these mammals no longer able to find safe refugia where they could survive in a warm climate?"

To answer these questions, the team collected many different types of data to test hypotheses about how, when, and why the woolly rhinoceros, woolly mammoth, and wild horse all went extinct after the last ice age, and why the reindeer, bison, and musk ox were able to survive -- albeit in much more restricted ranges than they could inhabit during the ice ages. "One source of information we used was DNA from the animals themselves," Shapiro explained. "With genetic data, it's possible to estimate when and how much populations were able to grow and shrink as the climate changed and their habitat started to disappear." The team also collected climatic data -- temperature and precipitation patterns -- from both glacial and interglacial periods, as well as archeological data, which they used to study the extent to which early humans may have influenced the survival of these six mammal species. "For example, in locations where animal bones had been cooked or converted into spears, we know that humans lived there and were using them as a resource," Shapiro said. "Even where we don't find evidence that humans were using the animals, if humans and the animals lived in the same place and at the same time, humans could have had some influence on whether the animals survived or not."

In the case of the now-extinct woolly rhinoceros, the scientists found that, in Europe, the ranges of humans and woolly rhinoceros never overlapped. "These data suggest that climate change, and not humans, was the

main reason why this particular species went extinct in present-day Europe," Shapiro said. "Still, we expect humans might have played a role in other regions of the world where they did overlap with woolly rhinos, and so further studies will be necessary to test this hypothesis." Much clearer was the evidence that humans did influence, and not always negatively, the population sizes of the five other species -- the woolly mammoth, wild horse, reindeer, bison, and musk ox.

Shapiro explained that population fluctuations for all six species continued until the end of the last ice age -- around 14,000 years ago -- when many of the species simply disappeared. "The take-home message is that during the most recent warming event, when the last ice age faded into the warm interval we have today, something kept these animals from doing what they had always done, from finding alternative refugia -- less-than-ideal, but good-enough chunks of land on which to keep their populations at a critical mass," Shapiro said. "That 'something' was probably us -- humans." During the period when these animals were declining, the human population was beginning its boom, and was spreading out across not only the large-bodied mammals' cold-climate habitats, but also across their warm-climate refuges, changing the landscape with agriculture and other activities. Many large-bodied, cold-adapted mammals, including the horse -- which is considered extinct in the wild and now survives only as a domesticated animal -- suddenly had no alternative living spaces, and, as such, no means to maintain their populations.

"The results of our study suggest that although past warm periods caused these animal species to go through periodic bottlenecks -- evolutionary events during which the size of a population diminishes substantially and stays small for a long time -- they always seemed to bounce back, and to return to their previous habitats as soon as the Earth became cooler again. Then, during the most-recent warming cycle, that trend changed," Shapiro said.

As the climate became warmer after the last ice age, the woolly rhinoceros, woolly mammoth, and wild horse became extinct, and the reindeer, bison, and musk ox may have just been fortunate in avoiding extinction, according to Shapiro. "We couldn't pinpoint what patterns characterize extinct species, despite the large and varying amount of data analyzed," said Eline Lorenzen, from the University of Copenhagen and the first author of the study. "This suggests that it will be challenging for experts to predict how existing mammals will respond to future global climate change -- to predict which species will go extinct and which will survive."

Reindeer managed to find safe habitat in high arctic regions and, today, have few predators or competitors for limited resources. Bison are extinct in Asia, where their populations were extensive during the ice ages, and today they are found only in North America, although a related species survives in small numbers in Europe. Cold-adapted muskoxen now live only in the arctic regions of North America and Greenland, with small introduced populations in Norway, Siberia, and Sweden. Interestingly, if humans had any impact on musk-ox populations, it may have been to help sustain them. Musk-ox populations first became established in Greenland around 5,000 years ago, after which they expanded rapidly, despite having been a major resource for the Paleo-Eskimo population. Today, the animal species survives in large numbers.

Shapiro also said that the findings could help to predict the fate of populations threatened by the climate change and habitat alteration that is happening today. "Our results provide direct evidence that something changed between the most-recent glacial cycle, when many of these species went extinct, and previous glacial cycles, through which they all managed to survive. Although it is clear that climate change drives the dynamics of these species, we, as humans, have to take some of the blame for what happened during this most-recent cycle. It seems that our ancestors were able to change the landscape so dramatically that these animals were effectively cut off from what they needed to survive, even when the human population was small," Shapiro said. "There are many more humans today, and we have changed and are continuing to change the planet in even more important ways."

In addition to Shapiro, Willerslev and Lorenzen, many other scientists contributed to this study. In the United States, contributing authors are from institutions in Utah, California, Texas, Missouri, Maryland, Colorado, Massachusetts, Oregon, and Kansas. The study's international contributors are from institutions in Denmark, Australia, Sweden, Spain, the United Kingdom, the Netherlands, Germany, Norway, Russia, China, and Canada.

The research was funded, in part, by the Leverhulme Trust, the Awards Fund, the Danish National Research Foundation, the Lundbeck Foundation, the Danish Council for Independent Research, and the U.S. National Science Foundation.

Journal Reference: Eline D. Lorenzen, David Nogués-Bravo, Ludovic Orlando, Jaco Weinstock, Jonas Binladen, Katharine A. Marske, Andrew Ugan, Michael K. Borregaard, M. Thomas P. Gilbert, Rasmus Nielsen, Simon Y. W. Ho, Ted Goebel, Kelly E. Graf, David Byers, Jesper T. Stenderup, Morten Rasmussen, Paula F. Campos, Jennifer A. Leonard, Klaus-Peter Koepfli, Duane Froese, Grant Zazula, Thomas W. Stafford, Kim Aaris-Sørensen, Persaram Batra, Alan M. Haywood, Joy S. Singarayer, Paul J. Valdes, Gennady Boeskorov, James A. Burns, Sergey P. Davydov, James Haile, Dennis L. Jenkins, Pavel Kosintsev, Tatyana Kuznetsova, Xulong Lai, Larry D. Martin, H. Gregory

McDonald, Dick Mol, Morten Meldgaard, Kasper Munch, Elisabeth Stephan, Mikhail Sablin, Robert S. Sommer, Taras Sipko, Eric Scott, Marc A. Suchard, Alexei Tikhonov, Rane Willerslev, Robert K. Wayne, Alan Cooper, Michael Hofreiter, Andrei Sher, Beth Shapiro, Carsten Rahbek, Eske Willerslev. **Species-specific responses of Late Quaternary megafauna to climate and humans**. *Nature*, 2011; DOI: 10.1038/nature10574

Evidence for a Geologic Trigger of the Cambrian Explosion

Apr. 18, 2012 — The oceans teemed with life 600 million years ago, but the simple, soft-bodied creatures would have been hardly recognizable as the ancestors of nearly all animals on Earth today.

Then something happened. Over several tens of millions of years -- a relative blink of an eye in geologic terms -- a burst of evolution led to a flurry of diversification and increasing complexity, including the expansion of multicellular organisms and the appearance of the first shells and skeletons.

Cambrian trilobite, with a shell made of calcium carbonate. (Credit: Shanan Peters)

The results of this Cambrian explosion are well documented in the fossil record, but its cause -- why and when it happened, and perhaps why nothing similar has happened since -- has been a mystery.

New research shows that the answer may lie in a second geological curiosity -- a dramatic boundary, known as the Great Unconformity, between ancient igneous and metamorphic rocks and younger sediments.

"The Great Unconformity is a very prominent geomorphic surface and there's nothing else like it in the entire rock record," says Shanan Peters, a geoscience professor at the University of Wisconsin-Madison who led the new work. Occurring worldwide, the Great Unconformity juxtaposes old rocks, formed billions of years ago deep within Earth's crust, with relatively young Cambrian sedimentary rock formed from deposits left by shallow ancient seas that covered the continents just a half billion years ago.

Named in 1869 by explorer and geologist John Wesley Powell during the first documented trip through the Grand Canyon, the Great Unconformity has posed a longstanding puzzle and has been viewed -- by Charles Darwin, among others -- as a huge gap in the rock record and in our understanding of Earth's history.

But Peters says the gap itself -- the missing time in the geologic record -- may hold the key to understanding what happened.

In the April 19 issue of the journal Nature, he and colleague Robert Gaines of Pomona College report that the same geological forces that formed the Great Unconformity may have also provided the impetus for the burst of biodiversity during the early Cambrian.

"The magnitude of the unconformity is without rival in the rock record," Gaines says. "When we pieced that together, we realized that its formation must have had profound implications for ocean chemistry at the time when complex life was just proliferating."

"We're proposing a triggering mechanism for the Cambrian explosion," says Peters. "Our hypothesis is that biomineralization evolved as a biogeochemical response to an increased influx of continental weathering products during the last stages in the formation of the Great Unconformity."

Peters and Gaines looked at data from more than 20,000 rock samples from across North America and found multiple clues, such as unusual mineral deposits with distinct geochemistry, that point to a link between the physical, chemical, and biological effects.

During the early Cambrian, shallow seas repeatedly advanced and retreated across the North American continent, gradually eroding away surface rock to uncover fresh basement rock from within the crust. Exposed to the surface environment for the first time, those crustal rocks reacted with air and water in a chemical weathering process that released ions such as calcium, iron, potassium, and silica into the oceans, changing the seawater chemistry.

The basement rocks were later covered with sedimentary deposits from those Cambrian seas, creating the boundary now recognized as the Great Unconformity.

Evidence of changes in the seawater chemistry is captured in the rock record by high rates of carbonate mineral formation early in the Cambrian, as well as the occurrence of extensive beds of glauconite, a potassium-, silica-, and iron-rich mineral that is much rarer today.

The influx of ions to the oceans also likely posed a challenge to the organisms living there. "Your body has to keep a balance of these ions in order to function

properly," Peters explains. "If you have too much of one you have to get rid of it, and one way to get rid of it is to make a mineral."

The fossil record shows that the three major biominerals -- calcium phosphate, now found in bones and teeth; calcium carbonate, in invertebrate shells; and silicon dioxide, in radiolarians -- appeared more or less simultaneously around this time and in a diverse array of distantly related organisms.

The time lag between the first appearance of animals and their subsequent acquisition of biominerals in the Cambrian is notable, Peters says. "It's likely biomineralization didn't evolve for something, it evolved in response to something -- in this case, changing seawater chemistry during the formation of the Great Unconformity. Then once that happened, evolution took it in another direction." Today those biominerals play essential roles as varied as protection (shells and spines), stability (bones), and predation (teeth and claws).

Together, the results suggest that the formation of the Great Unconformity may have triggered the Cambrian explosion.

"This feature explains a lot of lingering questions in different arenas, including the odd occurrences of many types of sedimentary rocks and a very remarkable style of fossil preservation. And we can't help but think this was very influential for early developing life at the time," Gaines says.

Far from being a lack of information, as Darwin thought, the gaps in the rock record may actually record the mechanism as to why the Cambrian explosion occurred in the first place, Peters says.

"The French composer Claude Debussy said, 'Music is the space between the notes.' I think that is the case here," he says. "The gaps can have more information, in some ways, about the processes driving Earth system change, than the rocks do. It's both together that give the whole picture."

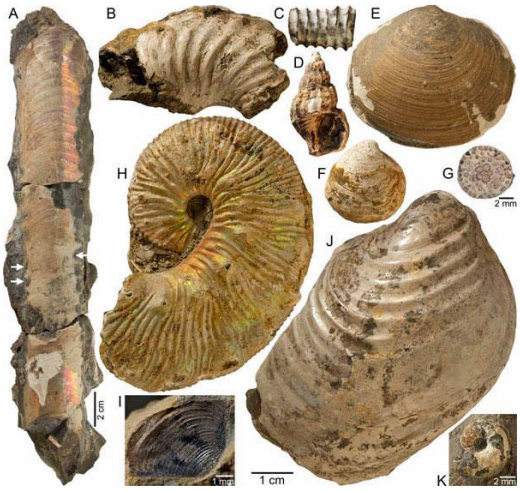
The work was supported by the National Science Foundation.

Journal Reference: Shanan E. Peters, Robert R. Gaines. **Formation of the 'Great Unconformity' as a trigger for the Cambrian explosion**. *Nature*, 2012; 484 (7394): 363 DOI: 10.1038/nature10969

Ammonites Found Mini Oases at Ancient Methane Seeps

Apr. 16, 2012 — Research led by scientists at the American Museum of Natural History shows that ammonites-an extinct type of shelled mollusk that's closely related to modern-day nautiluses and squids-made homes in the unique environments surrounding methane seeps in the seaway that once covered America's Great Plains. The findings, published online this week in the journal *Geology*, provide new insights into the mode of life and habitat of these ancient animals.

Geologic formations in parts of South Dakota, Wyoming, and Montana formed as sediments were deposited in the Western Interior Seaway-a broad expanse of water that split North America into two land masses-during the Late Cretaceous, 80 to 65 million years ago. These formations are popular destinations for paleontologists looking for everything from fossilized dinosaur bones to ancient clam shells. In the last few years, groups of researchers have honed in on giant mounds of fossilized material in these areas where, many millions of years ago, methane-rich fluids migrated through the sediments onto the sea floor.



Invertebrate fossils collected from the methane seep. The scale bar applies to all except A, D, H, and K. (Credit: by AMNH\S. Thurston)

"We've found that these methane seeps are little oases on the sea floor, little self-perpetuating ecosystems," said Neil Landman, lead author of the *Geology* paper and a curator in the Division of Paleontology at the American Museum of Natural History. "Thousands of these seeps have been found in the Western Interior Seaway, most containing a very rich fauna of bivalves, sponges, corals, fish, crinoids, and, as we've recently documented, ammonites."

In the Black Hills region of South Dakota, Landman and researchers from Stony Brook University's School of Marine and Atmospheric Science, the Black Hills Museum of Natural History, Brooklyn College, the South Dakota School of Mines and Technology, and the University of South Florida are investigating a 74-million-year-old seep with extremely well-preserved fossils.

"Most seeps have eroded significantly over the last 70 million years," Landman said. "But this seep is part of a cliff whose face recently slumped off. As the cliff fell

away, it revealed beautiful, glistening shells of all sorts of marine life."

Studying these well-preserved shells, the researchers tried to determine the role of ammonites in the unique seep ecosystem. By analyzing the abundance of isotopes (alternative forms) of carbon, oxygen, and strontium, the group made a surprising discovery. The ammonites at the seep, once thought to be just passersby, had spent their whole lives there.

"Ammonites are generally considered mobile animals, freely coming and going" Landman said. "That's a characteristic that really distinguishes them from other mollusks that sit on the sea floor. But to my astonishment, our analysis showed that these ammonites, while mobile, seemed to have lived their whole life at a seep, forming an integral part of an interwoven community."

The seeps, which the researchers confirmed through oxygen isotope analysis to be "cold" (about 27 degrees Celsius, 80 degrees Fahrenheit), also likely attracted large clusters of plankton Ð the ammonites' preferred prey.

With these findings in mind, the researchers think that the methane seeps probably played a role in the evolution of ammonites and other faunal elements in the Western Interior Seaway. The seeps might have formed small mounds that rose above the oxygen-poor sea floor, creating mini oases in a less-hospitable setting. This could be a reason why ammonites were able to inhabit the seaway over millions of years in spite of occasional environmental disturbances.

"If a nearby volcano erupted and ash covered part of the basin, it would have decimated ammonites in that area," Landman said. "But if these communities of seep ammonites survived, they could have repopulated the rest of the seaway. These habitats might have been semi-permanent, self-sustaining sites that acted as hedges against extinction."

Isotope analysis of strontium also revealed an interesting geologic finding: seep fluids coming into the seaway were in contact with granite, meaning that they traveled from deep in the Earth. This suggests that the Black Hills, a small mountain range in the area, already were beginning to form in the Late Cretaceous, even though the uplift wasn't fully complete until many millions of years later.

This research was supported by the American Museum of Natural History and a National Science Foundation Research Experience for Undergraduates grant for two students from Brooklyn College to participate in the field work.

Story Source: The above story is reprinted from materials provided by American Museum of Natural History.

Journal Reference: N. H. Landman, J. K. Cochran, N. L. Larson, J. Brezina, M. P. Garb, P. J. Harries. **Methane seeps as ammonite habitats in the U.S. Western Interior Seaway revealed by isotopic analyses of well-preserved shell material**. *Geology*, 2012; DOI: 10.1130/G32782.1

Ammonites at Ancient Methane Seeps: New Light Shed On Mollusks That Went Extinct 65 Million Years Ago

Oct. 13, 2010 — Although ammonites have been extinct for 65 million years, newly published data based on 35 years of field work and analysis is providing invaluable insights into their paleobiology. Ammonites, shelled mollusks closely related to modern day nautilus and squids, inhabited the oceans for nearly 350 million years. Specimens found in the rock record of the ancient seaway that covered North America during the Cretaceous Period demonstrate that these animals thrived at cold methane seeps at the bottom of the sea, consumed small prey, and often survived predation attempts.

This is a fossiliferous concretion containing a large macroconch of Hoploscaphites brevis, Inoceramus nebrascensis and Baculites cuneatus . This fossil, collected as AMNH 63467, was found in the Baculites cuneatus Zone, Pierre Shale, Meade County, South Dakota. (Credit: S. Thurston/AMNH)

"Our field work has resulted in the discovery of exceptionally well preserved ammonites at ancient methane seeps, which permit new insights into the mode of life and habitat of these organisms," says Neil Landman, curator in the Division of Paleontology at the American Museum of Natural History. "The picture that emerges is that these ammonites had little in common ecologically with either modern nautilus or most modern coleoids. This forces us to reexamine our thinking about the ecology of ancient marine systems and how the extinction of ammonites ultimately impacted the modern marine biota."

About 70 million years ago, dinosaurs roamed the continents, the Atlantic Ocean was much narrower than today, and what is now North America was divided in half by a broad inland sea that covered much of the continent. This epicontinental sea was, according to new discoveries, partly covered by cold methane seeps of gas bubbling up from sediments below. These seeps were like underwater oases that attracted a host of organisms -- bacteria, sponges, gastropods, bivalves, sea urchins, and even sea lilies that attached to the veneer of calcite that formed on the bottom at the seep sites. Ammonites were also abundant at the seeps.

"What astonishes me is that I have walked over these fossil deposits for years without ever realizing that they were the sites of cold methane seeps," says Landman.

At one locality in South Dakota, the fossilized methane seeps are exposed on the side of a steep cliff of black rock. Landman and his team criss-crossed the cliff with bright white ropes, forming a grid-like pattern onto which the team mapped the distribution of fossils.

"The result looked like an enormous Christo installation," says Landman. "You have to imagine the underwater scene 70 million years ago: a cloud of zooplankton, with ammonites flocking to the vents, forming isolated communities surrounded by the muddy sea floor. Because the sedimentation rates in the seaway were so rapid, the ammonites and other organisms were buried quickly after death, preserving exquisite details of their morphology."

The new research, published in the *Bulletin of the American Museum of Natural History*, redescribes the type specimens (holotypes) of two of the most common ammonite species that lived at the time: *Hoploscaphites nodosus* and *H. brevis*. The original specimens were collected over 150 years ago from what is probably South Dakota. *Hoploscaphites nodosus*, previously *Jeletzkytes nodosus*, is reassigned to *Hoploscaphites* because new, large fossil collections show that the traditional separation of robust, coarsely ornamented specimens from more slender, finely ornamented specimens is arbitrary. The paper also helps reconstruct the paleogeography of the epicontinetal sea that covered North America at the time as well as other seaways that covered parts of Europe.

Landman and colleagues argue that these ammonites were probably not fast swimmers. They lacked strong muscles which would have been required for strong propulsion. In addition, their jaws could only accommodate small prey and, as a result, they were probably sluggish filter feeders. Many of the ammonites also show injuries. Some of the injuries were healed during life but others resulted in death. Landman argues that the predators were probably fish, reptiles, crustaceans, and other cephalopods.

"There were probably millions of individuals in the seaway, which gives you an idea of the importance of ammonites in the marine ecosystem," says Landman.

In addition to Landman, authors of this paper include W. James Kennedy of the Oxford Museum of Natural History, William A. Cobban of the U.S. Geological Survey, and Neal L. Larson of the Black Hills Museum of Natural History. The research was funded by Nathalie Quay, the Normal D. Newell Fund at the American Museum of Natural History, and the National Science Foundation.

Journal Reference: Landman, Neil H.; Kennedy, W. J. (William James); Cobban, William Aubrey; Larson, Neal L. **Scaphites of the 'nodosus group' from the Upper Cretaceous (Campanian) of the Western Interior of North America**. *Bulletin of the American Museum of Natural History*, 2010; 342 [link]

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS DINNER MEETING

"The Hunt for Another Earth"

Speaker: Dr. Geoffrey W. Marcy, Professor of Astronomy
University of California, Berkeley

Wednesday May 30, 2012
6:00 PM at Orinda Masonic Center
(Reservations are required by May 22, 2012, 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. Geoffrey Marcy**. 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: ***The Hunt for Another Earth*** The new Kepler spaceborn telescope is hunting for Earth-size planets, with hundreds in its sights. Kepler has already found definitively rocky planets, like earth, and is now hunting for habitable ones. This talk will present up-to-the-minute results from the Kepler Team. Biologists are working with astronomers to assess the environmental conditions necessary for life, especially intelligent life, on planets elsewhere in the universe.

Speaker Biography: Dr. Geoff Marcy is a Professor of Astronomy at UC Berkeley and an Adjunct Professor of Physics and Astronomy at San Francisco State University. He is the Director of Berkeley's "Center for Integrative Planetary Science", a research unit designed to study the formation, geophysics, chemistry and evolution planets. He is an elected member of the National Academy of Sciences and has been the recipient of numerous awards, including the NASA Medal for Exceptional Scientific Achievement. He was named Discovery Magazine's Space Scientist of the year 2003. He was also co-recipient of the prestigious Shaw Prize. He received his PhD in 1982 from UC Santa Cruz.

Geoff is one of the pioneers and leaders in the discovery and characterization of planets around other stars. He and his collaborators have discovered nearly half of the 450 known exoplanets. They found the first system of multiple planets around a normal (main sequence) star, and also found the first Saturn mass planet and the first Neptune-like planet. They also found the first transiting planet (a co-discovery with T. Brown and D. Charbonneau). His group is now searching for Earth-like planets using NASA's Kepler Mission and the Keck telescope in Hawaii.

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

Meeting Details: Social Hour: 6:00 – 7:00 pm; Dinner: 7:00 – 8:00 pm **Presentation**: 8:00 – open
Time: May 30, 2012, 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA. **Cost**: **$25/person**

**********REGISTRATION FORM (Dr. Goeff Marcy's 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@yahoo.com Phone: (925) 451-1999

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP
Saturday June 2, 2012

OCEAN FLOOR TO THE SHELF - THE LOWER TERTIARY SEQUENCES ON THE FLANKS OF THE MT. DIABLO

Raymond Sullivan, Professor Emeritus, San Francisco State University

The main objective of the field trip is to view the lower Tertiary depositional sequences defined in the Sacramento basin in the outcrops on the flanks of Mt Diablo. The lower Tertiary succession is composed of a cyclic succession of bathyal shales and sandstones and shallow marine sandstones. The succession attains a maximum thickness of about 2440 meters (8,000 feet) in the depocentral graben in the southwestern part of the basin. The Eocene succession is composed of at least five unconformably bounded depositional sequences. These include the Meganos and Markley submarine canyons filled with bathyal shales; the thick succession of submarine fan deposits that make up the Markley Sandstone; and fluvial/estuarine sandstones and neritic shales that comprise the Hamilton/Capay and Domengine/ Nortonville sequences. These sequences can be correlated with equivalent units that outcrop along the flanks of the Mount Diablo uplift.

The first stop on the field trip will at Castle Rock to view the submarine fan deposits of high-density turbidites that are equivalent in age to the Domengine Formation. The second stop will be at Lime Ridge where shallow water Domengine Formation is exposed on the east side of the Concord fault. The third stop will be at Keller Canyon Landfill where a thin stratigraphic section of Sidney Flat Shale (about 100 feet or so thick) is unconformably overlain by the Upper Tertiary. The Sidney Flat Shale thickens eastward to over 1000 feet at our fourth stop in the Black Diamond Mines. Underlying the Sidney Flat Shale in the Preserve is 2,500 feet of Markley Sandstone.

After lunch, we will drive to the south end of the Black Diamond Mines Preserve to view the Eocene sequences. We will be able to view the fluvial/estuarine deposits of the Domegine Formation and the underlying succession that includes the Meganos submarine canyon fill deposits. Time permitting, a brief stop will be made along Lone Tree Way where the Meganos submarine canyon produces a wide topographic depression as it is traced southward to the Brentwood Oil Field. The final stop of the trip will be at the sand pits in the Domengine Formation at Byron. If permission is granted, we will view the glass sand operation of a subsidiary of Gallo Wines. These are the last outcrops of the Coast Ranges as the succession descends into the Sacramento Valley. The middle Eocene succession at this location differs from the equivalent units at Black Diamond Preserve in several important ways. First, the Meganos submarine canyon mud fill is only thinly represented and we must be outside of the canyon. Second, the Domengine Formation has thickened from 800 feet to over1000 feet and a brown sandstone member in the upper part of the formation is missing in the section. Lastly the 2500 feet of Markley Sandstone is absent in the 10 miles or so that we observed the formation in the Preserve, and Sidney Flat Shale equivalent rests directly on Nortonville Shale.

We will conclude the field trip with a discussion on the stratigraphic relationships between the Eocene sequences, together with a broad over view of the Eocene history of the Sacramento basin. In addition, we will discuss the role of tectonism and eustasy in the timing and distribution of the lower Tertiary deposition sequences.

The field trip will cover a lot of territory and we need to minimize the number of vehicles. The Keller Canyon Landfill and the Byron Mines management as well as the Black Diamond Mines Preserve administration are very concerned about the number of vehicles that we plan to use on the field trip. As a result, we are limited to 30 participants and a maximum of 2 vans and 2 SUVs. The traffic in the Highway 4 corridor is very congested and we need to drive with a great deal of care.

THIS FIELD TRIP WILL BE LIMITED TO 30 PEOPLE.

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

Time & Departure: June 2, 2012, 8:00 am, Southwest corner paring lot Sun Valley Mall, Concord

Cost: $40/person (includes transportation, guidebook, lunch, refreshments, soft drinks)

**********REGISTRATION FORM (Field Trip)**********

Name:_____ E-mail:_____

Address:_____ Phone (day):____ _____ Phone (evening):_____

Lunch: 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@yahoo.com Phone: (925) 370-0685 (evening) (925) 451-1999 (day)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP
Saturday July 14, 2012

STROLL TO SUBDUCTION: GEOLOGY OF SUNOL REGIONAL WIIDERNESS, CALIFORNIA

John Wakabayashi, Professor, California State University, Fresno

The title of this field trip honors the late Clyde Wahrhaftig, who wrote the marvelous field trip guide "Streetcar to Subduction"; here we will hike instead of take the bus, though. At Sunol Regional Wilderness we will view some fabulous exposures of the rock record of subduction preserved in the notorious Franciscan subduction complex as well as features that testify to the dynamic history of landscape evolution that followed the termination of subduction. These features are part of a rapidly changing understanding of the subduction process and the field relationships we see also have important practical ramifications in engineering geology. The geology we will see consists of Franciscan Complex rocks overlain by Miocene marine sedimentary rocks deposited during the early parts of the transform regime that followed the termination of Franciscan subduction. Multiple generations of landslides and strath terraces cover the bedrock in many places and the distinction between in-place Franciscan bedrock and landslide material poses challenges even to the experienced field geologist. The combination of strath terraces and landslides records a complex history of rock uplift and landscape response. All of the Franciscan bedrock has been subducted to depths sufficient to grow blueschist facies or higher grade metamorphic mineral assemblages. These Franciscan rocks record burial depths of ca. 30 km or more. Block-in-matrix units, or mélange, comprise most of the Franciscan exposures, and Sunol allows us exceptional views of the matrix in multiple localities. The matrix shows a gradation between unstrained sedimentary breccia (submarine debris flow deposits) to foliated matrix material that many have called typical "tectonic" mélange matrix. Matrix types include shale (probably most common), serpentinite, sandstone, and locally, mafic volcanic rocks. The gradation between undeformed sedimentary deposits and deformed matrix demonstrates that exotic blocks were introduced into the mélange by sedimentary processes rather than by extreme tectonic strain. Moreover, the blocks also show evidence of at least one earlier stage of high-pressure metamorphism that predates their sedimentation into the mélange. Some blocks may record two stages of pre-mélange high-pressure metamorphism. Given that the matrix itself has been metamorphosed at blueschist facies depths, all blocks record at least two partial subduction to surface exposure cycles. The recognition of the gradation between undeformed breccia and deformed matrix, as well as the recognition of sandstone as a common matrix type also has important implications for engineering characterization of mélanges, given that a block-in-matrix unit can grade from having little block-matrix strength contrast to having the significant block-matrix strength contrast that one expects for an "engineering mélange". This point is driven home by one locality where we find that breccia (i.e. "matrix") rather than a block, makes up one of the largest pinnacles of bedrock in the entire park! Yes, geology becomes ever more complicated for us. But without challenge, where would the fun be?

This field trip will be hiking field trip, and the hike will be moderate – something like 6-7 mi 2000' (gross, not net) of elevation or so. Participants will need to bring a lot of water and fairly rugged footwear, given that we will be doing some off trail hiking. We need to minimize the number of vehicles. Carpool is a must, we will circulate attendees list.

THIS FIELD TRIP WILL BE LIMITED TO 50 PEOPLE.

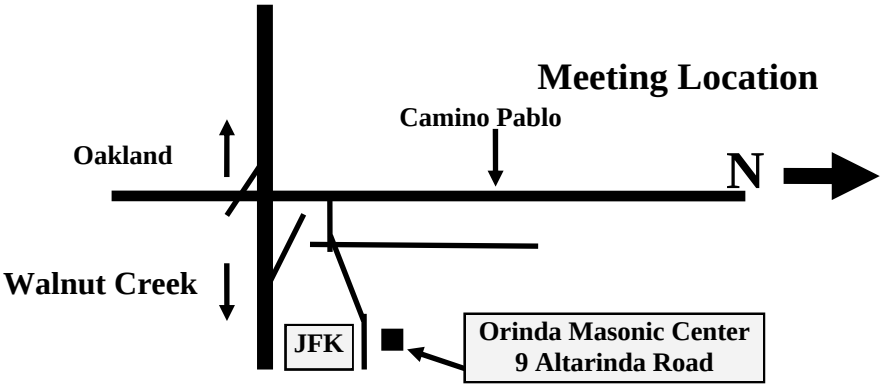
********** **Field Trip Logistics** **********

Time & Departure: July 14, 2012, 8:00 am, Sunol Regional Wilderness, parking lot

Cost: $40/person (guidebook, lunch, refreshments, soft drinks)

**********REGISTRATION FORM (Sunol Field Trip) **********

Name:_____ E-mail:_____
City Residence:_____ Phone: ____ _____ Phone (alternate):_____
Lunch: 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@yahoo.com Phone: (925) 370-0685 (evening) (925) 451-1999 (day)



THIS MONTH - NCGS DINNER MEETING

"The Hunt for Another Earth"

Speaker: Dr. Geoffrey W. Marcy, Professor of Astronomy
University of California, Berkeley

Wednesday May 30, 2012
6:00 PM at Orinda Masonic Center

SEE ATTCHED SIGNUP FORM!
Please Note - Walk-ins Cannot be Accommodated!

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

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