NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **November 17, 2010** **EARLY DATE!!**

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

TIME: **6:30 p.m. social; 7:00 p.m. talk (no dinner) Cost: $5 per regular member; $1 per student or K – 12 teachers**

SPEAKER: **Philip Johnson, Cotton Shires & Associates, Los Gatos**

Concurrent growth of uplifts with dissimilar orientations in the southern Green River Basin, Wyoming: implications for Paleocene-Eocene patterns of foreland shortening

The diverse orientations of Precambrian-cored and fault-bounded uplifts in the Rocky Mountain foreland region seem difficult to reconcile with the inferred Paleocene-Eocene shortening direction and plate convergence. Some have hypothesized that the shortening direction rotated as much as 90° over time, whereas others have hypothesized a relatively stable strain field involving concurrent oblique slip on faults with varied strikes.

The stratigraphic thicknesses of the synorogenic Paleocene through Eocene Fort Union, Wasatch, and Green River formations in the southern Green River Basin of Wyoming were used to define the pattern of basin subsidence and to interpret the timing of movement on two contractional structures with contrasting orientations. Isopachous maps and cross sections of three sequential time-stratigraphic intervals show thinning around the N-S oriented Rock Springs uplift and regional southward thickening of these three stratigraphic intervals. The southward thickening evidently resulted from flexural subsidence in response to loading from the adjacent E-W oriented Uinta uplift. Stratigraphic thinning in the vicinity of the Rock Springs uplift demonstrates that growth of the underlying blind thrust system produced an area of comparatively low accommodation space within the subsiding Green River basin.

The concurrent growth of the Rock Springs and Uinta uplifts does not support a rotation of shortening direction from E-W to N-S. The margin of a Neoproterozoic rift basin may have controlled the orientation of the thrust faults bounding the north flank of the Uinta uplift, and Late Cretaceous through Eocene compression caused oblique slip on these faults during structural inversion. A N-S-trending blind reverse fault

…continued on the back…

NCGS 2010 – 2011 Calendar

Wednesday November 17, 2010 (Early Date!)
Philip Johnson, Cotton Shires & Associates, Los Gatos; ***Laramide Orogeny in the Green River Basin***
7:00 pm at Orinda Masonic Lodge

Our Normal December Break

Wednesday January 26, 2011
Dr. John Parrish, State Geologist, California Geological Survey; ***California Geological Survey - Staying Relevant After 150 Years***
7:00 pm at Orinda Masonic Lodge

Wednesday February 23, 2011
TBA
7:00 pm at Orinda Masonic Lodge

Wednesday March 30, 2011
TBA
7:00 pm at Orinda Masonic Lodge

Wednesday April 27, 2011
TBA
7:00 pm at Orinda Masonic Lodge

Upcoming NCGS Events

November 13, 2010	The Geology of the Abandoned Mt. Diablo Mine; Joe Lovenitti & Paul Horton, with Fredrick Ousey & Edward Hamilton
March / April 2011	Geology of the Iron Mountain Mine Superfund Site, Redding, CA
Early 2011	Cantua Creek II; Dr. Mel Erskine
June 25 & 26, 2011	Geology of Lake Tahoe Region, Dr. Rich 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.

- November 9, 2010 – Darcy Ogden, Stanford
- December 7, 2010 - Open
- January 11, 2011 - Jessica Oster, Stanford

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:

- November 18, 2010 Joint ASCE / AEG Meeting; TBA

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/

- November 18, 2010; 7 pm; ***New Technology in Remote Sensing***; Rian Bogle
- December 9, 2010, 7 pm; ***Forecasting Volcanic Eruptions in Alaska***; Stephanie Prejean Alaska
- January 27, 2011, 7 pm; ***Geologic Sequestration of Carbon Dioxide: Minimizing Environmental Impacts***; Yousif Kharaka

A Note Regarding the October Meeting Projector Fiasco

Mark Sorensen, NCGS President

The NCGS Board wishes to express our regret for the lack of projection capability at the last meeting. I have personally sent a letter of apology to Dr. Marcy for the mishap, as well as expressing our appreciation for a great talk presented under trying circumstances. We plan to address this incident so that it will not happen again (of course, as geologists, we can't really give guarantees, but we can minimize our chances of failure). I have appointed an audiovisual committee to assess what went wrong, and to recommend any acquisitions, if needed, for not only a functional projector, but for backup connectors or components in case of failure of the primary components. The committee will report to the board on November 11, in time for the board to evaluate the recommendations and give the committee a quick approval to proceed with any acquisitions that are deemed necessary, in time for the next meeting on November 17. As a professional society, we want to be sure that we treat our speakers well, and that they will recall their experience with us in the most positive light.

NCGS 2010-2011 COLLEGIATE SCHOLARSHIP PROGRAM

The Northern California Geological Society is pleased to announce the availability of scholarships for undergraduate and graduate students for the 2010-2011 Academic Year as follows:

Undergraduate Scholarship Awards of $ 500

Funding is for seniors working toward completion of a Senior Thesis and/or Honors Research Program. Funding is provided for projects implemented during the 2010-2011 Academic Year. Application deadline is November 1, 2010 with an award date on or about December 10, 2010.

The Richard Chambers Memorial Scholarships for Graduate Degree Programs

$ 1,000 scholarships for students working toward the Masters Degree

$ 2,000 scholarships for students working towards the Doctorate Degree

Funding is provided for projects scheduled for completion during the 2011 calendar year. Application deadline is December 15, 2010 for an award date on or about January 31, 2011.

Multiple scholarships may be awarded at each academic level.

Funding priorities for these scholarships will be directed towards research focused on topics including general geology, geologic mapping, structural, economic, engineering, and/or environmental geology, geophysics, stratigraphy, paleontology or paleo-ecology, implemented in northern California or states immediately adjacent to northern California. Recipients may be invited to present their research (either lecture or poster) at a regular evening NCGS meeting in Orinda, California.

Individual scholarship announcements with instructions can be found on the Northern California Geological Society's web-site http://www.ncgeolsoc.org. They may also be requested from:

Phillip Garbutt, Chair;
email: plgarbutt@comcast.net
NCGS Scholarship Committee;
voice: (510) 581-9098
6372 Boone Drive, Castro Valley, CA 94552-5077

Previous scholarship recipients and their projects may be viewed on the Northern California Geological Society's web-site:
http://www.ncgeolsoc.org

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.). One of the editors for the website accompanied NCGS hands and local teachers on the Teacher's Day Workshop which NCGS organized for National Earth Science Week (October 16th; ***A Walk Along the Old Bay Margin in Downtown San Francisco – Tracing the Events of the 1906 Earthquake & Fire***; lead by **Dr. Raymond Sullivan**, Professor Emeritus, SFSU) to learn about the events of 1906 and how the old bay margin affected those events. We traded information and of course wanted to make members aware of this great resource. What follows is from the Bay Area Science website:

> With leading universities, dozens of professional research laboratories, cutting edge museums,

word-class corporations, and an inventive populace like none other, the Bay Area is uniquely situated as an unparalleled leader in innovative science & technology.

All of these institutions are dedicated to engaging the public in their exploration of the scientific frontier. Whether its lectures, science cafes, tours of cutting edge facilities, or large science festivals, these institutions have so much to offer to local residents. And now it's all at your fingertips….

On this site, you can:

- Search public science events ranging from interactive discussions to tours.
- Take advantage of incredible local online science content.
- Find a local museums, science cafes, hikes, and tours in your neighborhood.
- Signup for our weekly newsletter with our editor's picks each week.

Whether you want to go to a local museum, watch a science video, or attend a discussion, it's all available on BayAreaScience.org.

If you'd like to submit an event for the calendar, please use our calendar submission page. For more information, please contact us anytime: info@bayareascience.org

Geology in Action!

Another tidbit of internet excitement also came to our attention recently; this time a rather large landslide caught in action. AEG has been looking for photos showing geology in action; I'd nominate this one! See: http://sorisomail.com/email/42722/ja-viram-desmoronar-uma-montanha.html

Offshore San Andreas Fault and Associated Ecosystems Mapped

ScienceDaily — For the first time, scientists are using advanced technology and an innovative vessel to study, image, and map the unexplored offshore Northern San Andreas Fault from north of San Francisco to its termination at the junction of three tectonic plates off Mendocino, Calif.

The team includes scientists from NOAA's National Marine Fisheries Service, Oregon State University, the California Seafloor Mapping Program, the U.S. Geological Survey and Woods Hole Oceanographic Institution. The expedition which concludes October 3 is sponsored by NOAA's Office of Ocean Exploration and Research.

While the fault on land is obscured by erosion, vegetation and urbanization in many places, scientists expect the subsea portion of the fault to include deep rifts and high walls, along with areas supporting animal life. The expedition team is using high-resolution sonar mapping, subsurface seismic data and imaging with digital cameras for the first-ever three-dimensional bathymetric-structural map that will model the undersea Northern San Andreas Fault and its structure. Little is known about the offshore fault due to perennial bad weather that has limited scientific investigations.

"By relating this 3-D model with ongoing studies of the ancient record of seismic activity in this volatile area, scientists may better understand past earthquakes -- in part because fault exposure on land is poor, and the sedimentary record of the northern California offshore fault indicates a rich history of past earthquakes," said Chris Goldfinger, co-principal investigator and marine geologist and geophysicist at Oregon State University in Corvallis, Ore. "The model will also benefit geodetic studies of the buildup of energy to help better understand the potential for earthquakes."

More than a century after the 1906 Great San Francisco Earthquake, the science team is also exploring the fault for lessons associated with the intertwined relationships between major earthquakes and biological diversity. Evidence shows that active fluid and gas venting along fast-moving tectonic systems, such as the San Andreas Fault, create and recreate productive, unique and unexplored ecosystems.

"This is a tectonically and chemically active area," said Waldo Wakefield, co-principal investigator and a research fisheries biologist at NOAA's Northwest Fisheries Science Center in Newport, Ore. "I am looking for abrupt topographic features as well as vents or seeps that support chemosynthetic life -- life that extracts its energy needs from dissolved gasses in the water. I'm also looking at sonar maps of the water column and images of the seafloor for communities of life."

A variety of sensors and systems are being used to help locate marine life including a NOAA autonomous underwater vehicle (AUV) named 'Lucille.' Elizabeth Clarke, a NOAA fisheries scientist, is coordinating Lucille's operations and obtaining photographic information about fauna associated with the fault. The AUV and its sensors can dive to nearly one mile (1,500 meters), but

depths associated with this expedition will range between approximately 230 to 1100 feet (70 to 350 meters).

Early in the expedition, scientists collected bathymetric and subsurface seismic reflection data to guide them to specific areas of interest for follow-on and more detailed operations. The AUV's high-definition cameras are obtaining multiple images to be stitched into "photo mosaics" showing detailed fault structure and animal life.

The first part of the expedition is operating from Research Vessel Derek M. Baylis, a "green" research vessel primarily powered by sail and owned by Sealife Conservation, a nonprofit organization. The expedition will track the carbon footprint of the 65-foot energy efficient Baylis and compare results to conventional vessels.

AUV operations are being conducted aboard the Research Vessel Pacific Storm, operated by Oregon State University's Marine Mammal Institute. The ship and AUV team joined the expedition offshore of Fort Bragg on Sept. 25.

As the expedition progresses, NOAA's Ocean Explorer website features maps and images of the fault and associated ecosystems, logs from scientists at sea, and lesson plans that align with National Science Education Standards at three grade levels.

Story Source:

The above story is reprinted (with editorial adaptations) from materials provided by National Oceanic and Atmospheric Administration**.**

Big Quakes More Frequent Than Thought on San Andreas Fault, Research Shows

ScienceDaily — Earthquakes have rocked the powerful San Andreas fault that splits California far more often than previously thought, according to UC Irvine and Arizona State University researchers who have charted temblors there stretching back 700 years.

The findings, to be published in the Sept. 1 issue of *Geology*, conclude that large ruptures have occurred on the Carrizo Plain portion of the fault -- about 100 miles northwest of Los Angeles -- as often as every 45 to 144 years. But the last big quake was in 1857, more than 150 years ago.

UCI researchers said that while it's possible the fault is experiencing a natural lull, they think it's more likely a major quake could happen soon.

"If you're waiting for somebody to tell you when we're close to the next San Andreas earthquake, just look at the data," said UCI seismologist Lisa Grant Ludwig, principal investigator on the study.

An associate professor of public health, she hopes the findings will serve as a wake-up call to Californians who've grown complacent about the risk of major earthquakes. She said the new data "puts the exclamation point" on the need for state residents and policymakers to be prepared.

For individuals, that means having ample water and other supplies on hand, safeguarding possessions in advance, and establishing family emergency plans. For regulators, Ludwig advocates new policies requiring earthquake risk signs on unsafe buildings and forcing inspectors in home-sale transactions to disclose degrees of risk.

Sinan Akciz, UCI assistant project scientist and the study's lead author, was part of a team that collected charcoal samples from carefully dug trenches in the Carrizo Plain, along with earlier samples that Ludwig had stored for decades in her garage. The charcoal forms naturally after wildfires, then is washed into the plain by rains, building up over the centuries in layers that are fragmented during earthquakes. Akciz dated the samples via recently developed radiocarbon techniques to determine time frames for six major earthquakes, the earliest occurring about 1300 A.D.

The field data confirmed what Ludwig had long suspected: The widely accepted belief that a major earthquake happened on the fault every 250 to 400 years was inaccurate. Not all quakes were as strong as originally thought, either; but they all packed a wallop, ranging between magnitude 6.5 and 7.9.

"What we know is for the last 700 years, earthquakes on the southern San Andreas fault have been much more frequent than everyone thought," said Akciz. "Data presented here contradict previously published reports."

"We've learned that earthquake recurrence along the San Andreas fault is complex," agreed co-author Ramon Arrowsmith, a geology professor at Arizona State. "While earthquakes may be more frequent, they may also be smaller. That's a bit of good news to offset the bad."

Ken Hudnut, a geophysicist with the U.S. Geological Survey, said the research is significant because it revises long-standing concepts about well-

spaced, extremely strong quakes on the 810-mile fault.

"I believe they've done a really careful job," he said, adding that the work was rigorously field-checked by many scientists. "When people come up with new results challenging old notions, others need to see the evidence for themselves."

Upending previous San Andreas fault modeling is part of a broader shift in seismic research. Experts are increasingly tracking webs of trigger points, smaller faults and more frequent quakes rather than focusing on large, single faults where they assumed there would be well-spaced shakers.

As for the 153-year hiatus since the magnitude 7.8 Fort Tejon quake, Ludwig said: "People should not stick their heads in the ground. There are storm clouds gathered on the horizon. Does that mean it's definitely going to rain? No, but when you have that many clouds, you think, 'I'm going to take my umbrella with me today.' That's what this research does: It gives us a chance to prepare."

Funding for the study was provided by the National Science Foundation, U.S. Geological Survey and Southern California Earthquake Center.

Science News

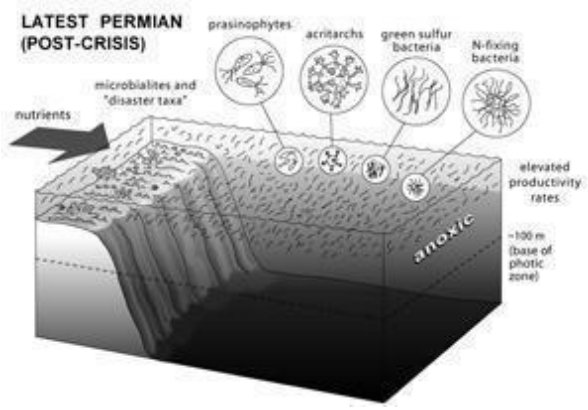
Tracking Evidence of 'The Great Dying'

ScienceDaily — More than 251 million years ago, at the end of the Permian period, Earth almost became a lifeless planet. Around 90 percent of all living species disappeared then, in what scientists have called "The Great Dying."

Thomas J. Algeo, has spent much of the past decade investigating the chemical evidence buried in rocks formed during this major extinction. The University of Cincinnati professor of geology has worked with a team of scientific colleagues to understand the ancient catastrophe. Algeo will present his latest findings at the annual meeting of the Geological Society of America, Oct. 31 to Nov. 3, in Denver.

The world revealed by Algeo's research sounds horrific and alien -- a devastated landscape, barren of vegetation, scarred by erosion from showers of acid rain, huge "dead zones" in the oceans and runaway greenhouse gases leading to sizzling temperatures. This was Earth, 251 million years ago.

The more famous "K-T" extinction between the Cretaceous and Tertiary periods -- in which the dinosaurs went extinct -- was triggered by a large meteoroid or bolide striking the Earth. The Great Dying, between the Permian and Triassic periods, has another culprit.



After massive erosion, runaway microbes depleted oceanic oxygen. (Credit: University of Cincinnati)

"The Permian-Triassic extinction event is still not fully understood," Algeo said. "It took some time, but it finally dawned on the geologic community that this was not caused by a bolide."

Algeo and his colleagues from around the world are building a better understanding of the events that all but erased life from our planet. The work involves five principal investigators in addition to Algeo. The National Science Foundation has provided several substantial grants to support the research.

The evidence Algeo and his colleagues are looking at points to massive volcanism in Siberia. A large portion of western Siberia reveals volcanic deposits five kilometers (three miles) thick, covering an area equivalent to the continental United States.

"It was a massive outpouring of basaltic lava," Algeo said. And, the lava flowed where it could most endanger life, through a large coal deposit.

Algeo noted that the dinosaur-killing bolide was lethal because it vaporized sulfur-rich sediments, resulting in extremely acidic rainfall. The effects of the Siberian lava eruption were likewise amplified by the coal deposit.

"The eruption released lots of methane when it burned through the coal," he said. "Methane is 30 times more effective as a greenhouse gas than carbon dioxide. We're not sure how long the greenhouse effect lasted, but it seems to be thousands of years, maybe tens of thousands of years."

A lot of the evidence ended up being washed into the ocean, and that is where Algeo and his colleagues look for it. Today, those oceanic deposits are found in Canada, China, Vietnam, Pakistan, India, Spitsbergen and Greenland.

In Denver, Algeo, with Margaret Fraiser of the University of Wisconsin-Milwaukee, will chair a

session on "New Developments in Permian-Triassic Paleoceanography" to review some of the newly analyzed evidence. For this session, Algeo contributed to two presentations that suggest the Siberian lava eruption may not have been the only agent of global death during the late Permian.

An analysis of the carbon content of marine sediments at 33 locations around the world shows similar patterns, except for rocks now preserved in southern China. While most rocks deposited during the extinction show increased concentrations of total organic carbon and higher organic carbon accumulation rates, the Chinese samples show the opposite effect.

"It's probable that we're seeing evidence of an explosive regional volcanic eruption," Algeo said. "The sediments there are just sterilized. It may be that the combined effects of this local volcanism and global climate change were especially lethal."

Algeo will also present research on the conditions leading to oxygen depletion in the oceans during the late Permian. Warm global climates certainly played a part as uniformly hot conditions stifled turnover by ocean currents. However, Algeo believes that chemical weathering by acid rain and similar processes also contributed. When erosion seven times the normal rate sent large flows of nutrients into the ocean, it created conditions much like the over-fertilization we see today near the outlets of large rivers. As it does today, this condition led to a microbial feeding frenzy and the removal of oxygen -- and life -- from the late Permian ocean.

"If there is a lesson to all this," Algeo said, "it is a reminder that things can get out of whack pretty quickly and pretty seriously. We are used to a stable world, but it may not always be so stable."

Science News

Flash Recovery Of Ammonoids After Most Massive Extinction Of All Time

ScienceDaily — After the End-Permian extinction 252.6 million years ago, ammonoids diversified and recovered 10 to 30 times faster than previous estimates. The surprising discovery raises questions about paleontologists' understanding of the dynamics of evolution of species and the functioning of the biosphere after a mass extinction.

The study, conducted by a Franco-Swiss collaboration involving the laboratories Biogéosciences (Université de Bourgogne / CNRS), Paléoenvironnements & Paléobiosphère (Université Claude Bernard / CNRS) and the Universities of Zurich and Lausanne (Switzerland), appears in the August 28 issue of *Science*.

The history of life on Earth has been punctuated by a number of mass extinctions, brief periods of extreme loss of biodiversity. These extinctions are followed by phases during which surviving species recover and diversify. The End-Permian extinction, which took place between the Permian (299 – 252.6 MY) and Triassic (252.6 – 201.6 MY), is the greatest mass extinction on record, resulting in the loss of 90% of existing species. It is associated with intensive volcanic activity in China and Siberia. It marks the boundary between the Paleozoic and Mesozoic Eras. Until now, studies had shown that the biosphere took between 10 and 30 million years to recover the levels of biodiversity seen before the extinction.

Ammonoids are cephalopod swimmers related the nautilus and squid. They had a shell, and disappeared from the oceans at the same time as the dinosaurs, 65 million years ago, after being a major part of marine fauna for 400 MY.

The Franco-Swiss team of paleontologists has shown that ammonoids needed only one million years after the End-Permian extinction to diversify to the same levels as before. The cephalopods, which were abundant during the Permian, narrowly missed being eradicated during the extinction: only two or three species survived and a single species seems to have been the basis for the extraordinary diversification of the group after the extinction. It took researchers seven years to gather new fossils and analyze databases in order to determine the rate of diversification of the ammonoids. In all, 860 genera from 77 regions around the world were recorded at 25 successive time intervals from the Late Carboniferous to the Late Triassic, a period of over 100 million years.

The discovery of this explosive growth over a million years takes a heated debate in a new direction. Indeed, it suggests that earlier estimates for the End-Permian extinction were based on truncated data and imprecise or incorrect dating. Furthermore, the duration for estimated recovery after other lesser extinctions all vary between 5 and 15 million years.

The result obtained here suggests that these estimates should probably be revised downwards. The biosphere is most likely headed towards a sixth mass extinction, and this discovery reminds us that

the recovery of existing species after an extinction is a very long process, taking several tens of thousands of human generations at the very least.

Arctic of old is gone experts warn

Warmer Greenland, low sea ice and huge glacier breakup cited in 2010 report card

The Arctic — an area described as Earth's refrigerator because its ice helps keep temperatures cool — continues to warm up and is unlikely to return to earlier conditions, according to an annual report card issued Thursday by top scientists.

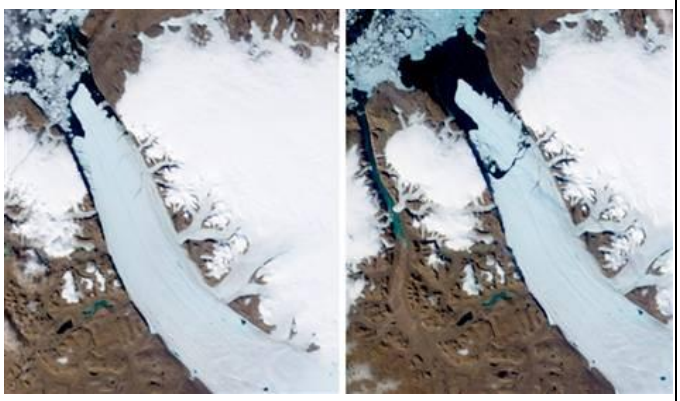
"Record temperatures across the Canadian Arctic and Greenland, a reduced summer sea ice cover, (and) record snow cover decreases" were cited as factors supporting the conclusion in the 2010 Arctic Report Card issued by the National Oceanic and Atmospheric Administration.

The report card "tells a story of widespread, continued and even dramatic effects of a warming Arctic," lead researcher Jackie Richter-Menge, an expert at the federal Cold Regions Research and Engineering Lab in Hanover, N.H., told reporters.

"It is increasingly unlikely, at least in the foreseeable future, that we will return to previous Arctic conditions," she said.

"It is very likely warming will continue" in the Arctic," she added, and "planning is urgent to adapt to the changes coming."

While 2009 saw a slowdown in Arctic warming, the report card stated, "the first half of 2010 shows a near record pace with monthly anomalies of over 4 degrees Centigrade (7 degrees Fahrenheit) in northern Canada."



Satellite images taken on July 28, left, and Aug. 5, right, shows the Petermann Glacier in northern Greenland before and after a 110-square-mile piece of ice broke off. The huge ice island is more than four times the size of New York's Manhattan Island. NASA via AP

Past report cards have also cited warming trends, the scientists acknowledged, but this last year has seen several anomalies: record temperatures in Greenland; the largest recorded loss of ice from a Greenland glacier, a 110-square-mile chunk that broke off Petermann Glacier; and a 2009-2010 winter that saw a blast of Arctic winds that went north-south instead of west-east — causing a deep freeze across the U.S. Northeast and Midwest.

That latter event, which had been registered only three times in 160 years of records, "looks like it's connecting to the warming and ice loss in the Arctic," said Jim Overland, a NOAA scientist responsible for the report card's section on atmosphere.

"Normally we think of winds bottled up in the Arctic," he said, but now a north-south shift might become more common.

"As we lose more sea ice it's a paradox that warming in the atmosphere can create more of these winter storms," he added.

In Greenland, the warmth has meant accelerated flow of melt water from glaciers into the ocean, said Jason Box, a glaciologist at Ohio State University. As a result, he added, "sea level projections will need to be revised upward."

The fourth annual report card was compiled from data and analysis contributed by 69 scientists in eight countries.

"Beyond affecting the humans and wildlife that call the area home, the Arctic's warmer temperatures and decreases in permafrost, snow cover, glaciers and sea ice also have wide-ranging consequences for the physical and biological systems in other parts of the world," NOAA chief Jane Lubchenco said in a statement. "The Arctic is an important driver of climate and weather around the world and serves as a critical feeding and breeding ground that supports globally significant populations of birds, mammals and fish."

She also quoted a NOAA researcher in describing the Arctic's importance: "Whatever is going to happen in the rest of the world happens first, and to the greatest extent, in the Arctic."

Rare Melt Key to “Ring of Fire”

Rare Melt Key to ‘Ring of Fire’

ScienceDaily — Oxford University scientists have discovered the explanation for why the world's explosive volcanoes are confined to bands only a few tens of kilometres wide, such as those along the Pacific 'Ring of Fire'. Most of the molten rock that comes out of these volcanoes is rich in water, but the Oxford team has shown that the volcanoes are aligned above narrow regions in the mantle where water-free melting can take place. They publish a report of their research in the journal *Nature*.

Scientists investigated why the world's explosive volcanoes are confined to bands only a few tens of kilometres wide.

These volcanic chains have been responsible for the most devastating eruptions in history, such as that of Krakatoa in 1883, and the huge eruption of Toba about 74,000 years ago, whose aftermath may have come close to extinguishing the human race.

'It has been recognised for almost 50 years that the volcanic arcs form where one oceanic plate sinks beneath another,' said Professor Philip England of Oxford University's Department of Earth Sciences, an author of the report, 'but while many models of this process have been put forward, none has been able to explain the location, and narrowness, of the volcanic arcs.'

The eruptions of volcanoes in the Ring of Fire are extremely violent (in contrast with the relatively gentle eruption in Iceland that paralysed European air travel in April) because the molten rock contains a high proportion of water which, as superheated gas, provides the power for the explosive eruptions. This water is liberated from the plates descending beneath the volcanoes and lowers the melting point of rocks in the mantle.

'Most previous explanations for the origins of volcanoes suggested that this kind of 'wet' melting is responsible for getting a volcano started,' said Dr Richard Katz of Oxford University's Department of Earth Sciences, an author of the report. The difficulty with such explanations is that wet melting occurs over very broad regions of the mantle, inconsistent with the narrowness of the volcanic chains. 'However, we noticed that there is a very simple geometrical pattern in the distribution of the volcanoes which provides a powerful clue as to what is going on,' added Dr Katz.

Using a mathematical model of heat transport in the regions where two plates collide, the Oxford team showed that the observed geometrical pattern can only be explained if the volcanoes are localized above the narrow regions in which mantle melts in the absence of water. Melt rising from this region blazes a trail for more water-rich magma to follow all the way to the surface where it erupts to form volcanoes.

In addition to hosting devastating eruptions, the volcanic chains hold valuable clues to the evolution of the earth, because they are the surface expressions of a gigantic chemical factory in which molten rock separates from the mantle to solidify as the crust we live on, and from which significant volumes of gas are emitted into the atmosphere. The team now intends to investigate the implications of their results for the chemical processes happening deep beneath the volcanic chains.

A report of the research, 'Melting above the anhydrous solidus controls the locations of volcanic arcs', was published in Nature on 7 October.

Plants Kick-Started Evolutionary Drama of Earth's Oxygenation

ScienceDaily — An international team of scientists, exploiting pioneering techniques at Arizona State University, has taken a significant step toward unlocking the secrets of oxygenation of the Earth's oceans and atmosphere.

Evolution of the Earth's multitude of organisms is intimately linked to the rise of oxygen in the oceans and atmosphere. The new research indicates that the appearance of large predatory fish as well as vascular plants approximately 400 million years ago coincided with an increase in oxygen, to levels comparable to those we experience today. If so, then animals from before that time appeared and evolved under markedly lower oxygen conditions than previously thought.

The researchers, including collaborators from Harvard, Denmark, Sweden and the United Kingdom, made use of a method developed at ASU by Ariel Anbar, a professor in the department of chemistry and biochemistry and the School of Earth and Space Exploration in the College of Liberal Arts and Sciences, and his research group. The method can be used to estimate global oxygen levels in ancient oceans from the chemical composition of ancient seafloor sediments.

Their important findings are presented in a paper published in the *Proceedings of the National Academy of Sciences* (PNAS), titled "Devonian rise in atmospheric oxygen correlated to radiations of terrestrial plants and large predatory fish."

"There has been a lot of speculation over the years about whether or not oxygen in the atmosphere was steady or variable over the last 500 million years," explained Anbar, who leads ASU's Astrobiology Program. "This is the era during which animals and land plants emerged and flourished. So it's a profound question in understanding the history of life. These new findings not only suggest that oxygen levels varied, but also that the variation had direct consequences for the evolution of complex life."

The Earth is 4,500 million years old. Microbial life has probably thrived in the oceans for most of that time. However, until about 2,300 million years ago, the atmosphere contained only traces of oxygen. During that time, some microbes in the oceans likely produced oxygen as a byproduct of photosynthesis. But the quantities they produced were insufficient to accumulate much in the atmosphere and oceans. The situation changed with the "Great Oxidation Event," 2,300 million years ago. Oxygen levels rose again around 550 million years ago. The first animals appear in the fossil record at this time, marking the beginning of an era that geologists call the "Phanerozoic" -- a Greek word meaning "evident animals." This new work explores how oxygen levels changed during the Phanerozoic.

The new study was led by Tais W. Dahl while he was a postdoctoral scholar at Harvard. Dahl spent several months in Anbar's lab at ASU during his graduate research learning how to make the necessary measurements from Gwyneth Gordon, Ph.D., who is also an author of this paper. Other authors include geochemist Don Canfield, Dahl's Ph.D. mentor at the University of Southern Denmark, and paleontologist Andrew Knoll, Dahl's postdoctoral mentor at Harvard.

Dahl returned to ASU to perform the measurements for this study, which involved measuring the relative amounts of different isotopes of the element molybdenum in rocks called "black shales." These rocks are formed from ancient ocean sediments.

Isotopes are atoms of an element, in this case molybdenum, that differ only in their mass and therefore can be easily distinguished from one another. Molybdenum has seven stable isotopes. Chemical reactions fractionate heavy from light isotopes. For example, carbon 12 is enriched by three percent in plants relative to the carbon in carbon dioxide in the atmosphere. Similarly, molybdenum isotopes are fractionated during their removal from seawater into ocean sediments. The magnitude of this fractionation is sensitive to the presence of oxygen.

The data Dahl obtained at ASU reveal that there were at least two stages of oxygenation during the Phanerozoic, separated by the oxygenation event 400 million years ago. This inference from molybdenum isotopes is corroborated by the appearance of large (up to 30 feet long) predatory fish in the fossil record 400 million years ago, coincident with the rise in oxygen. Animals of that size consume energy rapidly, requiring high levels of oxygen for their metabolism. "Tais's data indicate that early animals evolved in an environment with less oxygen than today," said Anbar. The newly discovered oxygenation event therefore explains the puzzling appearance of these fish in the fossil record. "It's always satisfying when we can demonstrate how an environmental change drove biological evolution," Anbar explained.

"But the real kicker is that these data also show us the reverse -- that biological innovation can drive environmental change" continued Anbar. He points to the fact that vascular plants also appear in the fossil record around 400 million years ago. The bodies of such plants decompose with difficulty, making it easier for organic carbon to be buried in sediments. When that happens, the organic carbon -- produced by photosynthesis -- is not available for reaction with oxygen. The consequence is a rise in the amount of oxygen in the environment.

"It's a push-me-pull-you situation," explained Anbar. The biological innovation of vascular plants led to more carbon burial, and therefore to more oxygen. Then, the rise in oxygen made it possible for larger animals to evolve. "This is a great example of what we call the "co evolution" of life and the environment," enthused Anbar "Geoscientists talk about this idea a lot, but we rarely find such nice examples."

This work was supported by the Danish National Research Foundation, Danish Council for Independent Research, the Swedish Research Council, the NASA Astrobiology Institute team at ASU and the NASA Exobiology Program.

Journal Reference:
T. W. Dahl, E. U. Hammarlund, A. D. Anbar, D. P. G. Bond, B. C. Gill, G. W. Gordon, A. H. Knoll, A. T. Nielsen, N. H. Schovsbo, D. E. Canfield. **Devonian rise in atmospheric oxygen correlated to the radiations of terrestrial plants and large predatory fish**. *Proceedings of the National Academy of Sciences*, 2010.

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

"GEOLOGY OF THE ABANDONED MOUNT DIABLO MINE"

NCGS FIELD TRIP - Saturday November 13, 2010

Leaders: **Joe Iovenitti, Alta Rock Energy**
Paul Horton, The Source Group, Inc.
Contributors: **Frederick Ousey, EnviroTech**
Edward Hamilton, McCampbell Analytical, Inc.

ABSTRACT

The Mt Diablo Mine is located about 5 miles southeast of Clayton, California at the northeast base of Mt. Diablo's North Peak. In 1863, cinnabar was discovered here and the first claim was filed in a flurry of prospecting activity that enveloped the Clayton area in the early 1860's. Subsequently, two mines, the Mount Diablo and the Ryne, were producing quicksilver (mercury) from geologically cogenetic deposits of cinnabar and metacinnabar. Only the Mt. Diablo Mine will be visited on this field trip.

The Mt. Diablo Mine is located in a 2,000 foot long lenticular body of silica-carbonate rock and serpentine that strikes northwest and dips 35 to 74 degrees northeast. This body lies in the boundary fault zone separating Franciscan Formation greywacke, with minor chert and shale, on the fault footwall from well-bedded mudstone and sandstone of Cretaceous age, on the hanging wall. The boundary fault surrounds the Franciscan core of Mt. Diablo and defines a more extensive thrust fault sequence that has uplifted subducted oceanic seafloor by a process known as cold intrusion. Tectonic activity along this and other regional faults has formed Mt. Diablo in the last 5 million years. Hydrothermally altered portions of the boundary fault serpentine yield the mineral deposits that enrich this area. The quicksilver formed by hydrothermal alteration of cinnabar and metacinnabar in the silica-rich rock. The Mt. Diablo mine produced both metacinnabar and cinnabar ore for smelting.

The Mt Diablo Mine had a series of owners before operations ceased in the 1950's. At the Mt. Diablo Mine, extensive tunnels and shafts were worked at five levels, or benches, until the area was open pit mined. Presently the quicksilver ore is exposed in open cut seams.

The current owner, Jack Wessman, purchased both the Ryne and the Mt. Diablo Mine properties in 1973, long after the mines had ceased operation. Shortly thereafter, the Mt. Diablo mine site was placed on the priority pollutants list for releasing mercury into the Marsh Creek Watershed. Mr. Wessman has spent a substantial sum of his own money to mitigate the mercury contamination associated with the abandoned mercury mines and their tailings.

In 2008, as part of the Federal Government's, Stimulus Package, Contra Costa County was funded $517,000 through the Army Corps of Engineers to help curtail mercury release into the watershed. Congressman George Miller's website indicates the Army Corps has completed Phase I of their Technical Planning Process under the Remediation of Abandoned Mine Sites (RAMS) program, and that the funding request will allow completion of the clean-up process.

THIS FIELD TRIP WILL BE LIMITED TO 30 PEOPLE. Hiking is required. Carpooling is required.

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

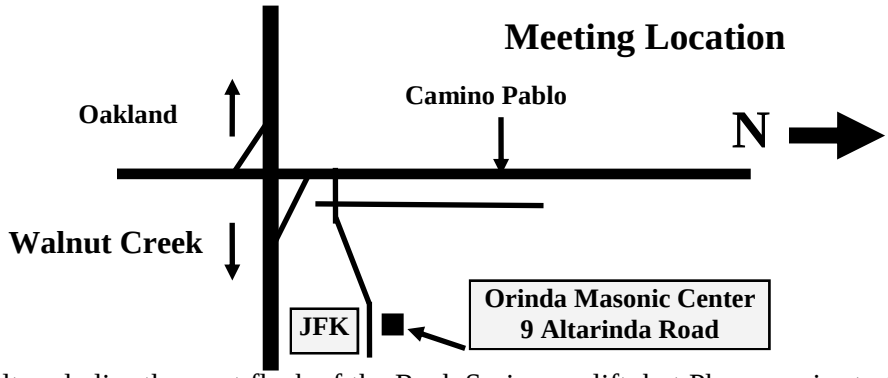
Time & Departure: November 13, 2010, 8:30 am (sharp), meeting place will be notified

Cost: $20/person includes, morning coffee and pastries, lunch and a guidebook (no refund for no show)

**********REGISTRATION FORM (Mount Diablo Mine Field Trip) **********

Name:_____ E-mail:_____
Address:_____ Phone:_____ Cell/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@sbcglobal.net Phone: (925) 370-0685 (evening) (925) 451-1999 (day)



fault underlies the west flank of the Rock Springs uplift, but Phanerozoic strata cover the Precambrian core of the uplift, so the structure within the Archean basement rocks is unknown. Despite contrasting strikes and different structural histories, the Uinta and Rock Springs uplifts responded concurrently to NE-SW- to ENE-WSW-directed shortening.

Biography: Phil Johnson received a BA in geology from San Francisco State University in 1987. After that, he studied sedimentary geology under David Andersen at San Jose State University where he completed his MS degree in 1990. Phil's MS thesis topic was the fluvial architecture of the Fort Union and Wasatch formations in the southern Green River Basin of Wyoming. Currently, Phil is a supervising geologist at Cotton, Shires and Associates in Los Gatos where he applies principles of geomorphology, sedimentology, and structural geology to problems of slope stability and seismic hazards. He has authored several full-length papers and abstracts on topics ranging from tectonics of the Rocky Mountain region to subsurface investigation of landslides.

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