NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **November 28, 2012**

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

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

SPEAKER: **Dr. Patrick Muffler, US Geological Survey, Geologist Emeritus**

Lassen Volcanic National Park -- a wonderland of volcanoes and thermal features

This talk will summarize 37 years of USGS volcanic and hydrothermal investigations in and around Lassen Volcanic National Park, primarily by my colleague Mike Clynne and me. Much of this presentation is based on our 1:50,000 Geologic Map of Lassen Volcanic National Park and Vicinity (USGS Scientific Investigations Map 2899, published in 2010) and on our geologic database of the 1:100,000 Lake Almanor sheet.

The Lassen volcanic region is located in the southernmost part of the Cascade Range, where the southern part of the Gorda plate is slowly being subducted beneath the North American plate. Volcanism in this region starts at ~3.5 Ma. There is a pronounced unconformity between the Quaternary volcanic rocks and the underlying Cretaceous Chico Formation and the Mesozoic plutonic and metamorphic rocks of the Sierra Nevada and the Klamath Mountains.

Quaternary volcanism in the Lassen Region built a broad platform comprising hundreds of coalescing small- to medium-sized mafic volcanoes derived from two distinct parental magmas: calc-alkaline basalt, and low-potassium olivine tholeiite basalt. Intercalated within these regional mafic rocks are a few voluminous long-lived volcanic centers that erupt the full compositional range from basalt to rhyolite. The youngest of these volcanic centers is the Lassen Volcanic center, which consists of the Rockland caldera complex (~825 to 609 ka), Brokeoff Volcano (590 to 390 ka), and the Lassen domefield (315 ka to the present). The youngest eruptions were Chaos Crags at 1,100 years B.P., Cinder Cone in 1666 C.E., and an eruption from the top of Lassen Peak in 1915. Associated with the Lassen domefield is an extensive hydrothermal system, by far the largest in the Cascade Range. Changes in intensity and location of fumarolic activity provide continuing logistic challenges to Lassen Volcanic National Park, particularly along Calif. Hwy 89 at Sulphur Works.

…Continued on back….

NCGS 2010 – 2011 Calendar

November 28, 2012
Dr. Patrick Muffler, US Geological Survey, Geologist Emeritus
Lassen Volcanic National Park -- a wonderland of volcanoes and thermal features

Our Usual December Break

January 30, 2013
Scott Bennett, PhD Candidate and NCGS Richard Chambers Memorial Scholarship Awardee, UC Davis
Testing the Role of Rift Obliquity in the Formation of the Gulf of California

February 27, 2013
Dr. David A. Osleger, UC Davis
Paleo-precipitation records from Lake Tahoe cores

March 27, 2013
Dr. Greg Balco, Berkeley Geochronolgy Center
Applications of cosmogenic-nuclide geochemistry and low-temperaturethermochronometry to Earth surface processes

April 19 to 25 April 2013 **No April NCGS Meeting!**
Pacific Section AAPG Convention
Monterey, CA

May 29, 2013 NCGS Dinner Meeting

June 26, 2013
Dr. Lester McKee and Sarah Pearce, San Francisco Estuary Institute
TBA

Upcoming NCGS Events

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.

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

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, November 15, 2012 Watch Live at 7pm PDT; USGS, Conference Room A, Bldg 3, Menlo Park, California

- **Understanding Climate-Wildlife Relationships --are American pikas harbingers of changing conditions? By** SGS Research Ecologist Erik Beever (**See November Flyer)**

2012-2013 RICHARD CHAMBERS MEMORIAL SCHOLARSHIPS

The Northern California Geological Society is pleased to announce the availability of their **Richard Chambers Memorial Scholarships** to help support graduate–level student research in geology during the 2012-2013 academic year. More than one scholarship may be awarded at each academic level.

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

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

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

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

NCGS and AAPG 2011 – 2012 K-12 EARTH SCIENCE TEACHER OF THE YEAR AWARD

$750 Northern California Geological Society
$500 Pacific Section AAPG
$5,000 National AAPG
Call for Nominations for 2012 - 2013 NCGS Competition

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

The Northern California Geological Society (NCGS) is seeking applications from candidates in Northern California for the 2011 - 2012 Earth Science Teacher of the Year Award. The $750 NCGS award is intended to recognize pre-college earth science programs already in place, and to encourage their organization in districts where they have not been fully developed. Nominations of qualified K-12 teacher candidates are solicited from teachers, school administrators, teacher outreach programs, and other interested parties. The NCGS award will be announced February 2013.

The NCGS awardee's application will be submitted to a regional competition sponsored by the American Association of Petroleum Geologists (AAPG) Pacific Section. The Pacific Section winner will receive a $500 award at the Pacific Section regional meeting in Monterey, CA, April 2013, plus up to $250 toward meeting expenses. The regional winner's project will be submitted to AAPG headquarters for the national contest. The national award winner will receive an expense-paid trip to attend the AAPG meeting in Denver, CO, June, 2014.

At the national level, the AAPG Foundation presents an annual $5,000 award to a K-12 teacher for Excellence in the Teaching of Natural Resources in the Earth Science. The award recognizes balanced incorporation of natural resource extraction and environmental sustainability concepts in pre-college Earth science curricula. It includes $2,500 to the teacher's school for the winning teacher's use, and $2,500 for the teacher's personal use.

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

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

NCGS 2013 K-12 $500 GEOSCIENCE TEACHING AWARD
Two Categories:
Grades K-8 and Grades 9-12

Call for Applications for 2012 - 2013

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

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

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

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

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

Tabletop Fault Model Reveals Why Some Earthquakes Result in Faster Shaking

The more time it takes for an earthquake fault to heal, the faster the shake it will produce when it finally ruptures, according to a new study by engineers at the

University of California, Berkeley, who conducted their work using a tabletop model of a quake fault.

Gregory McLaskey (L) and Steven Glaser examine a tabletop model of a fault at UC Berkeley. (Credit: Preston Davis photo)

"The high frequency waves of an earthquake -- the kind that produces the rapid jolts -- are not well understood because they are more difficult to measure and more difficult to model," said study lead author Gregory McLaskey, a former UC Berkeley Ph.D. student in civil and environmental engineering. "But those high frequency waves are what matter most when it comes to bringing down buildings, roads and bridges, so it's important for us to understand them."

While the study, to be published in the Nov. 1 issue of the journal *Nature* and funded by the National Science Foundation, does nothing to bring scientists closer to predicting when the next big one will hit, the findings could help engineers better assess the vulnerabilities of buildings, bridges and other structures when a fault does rupture.

"The experiment in our lab allows us to consider how long a fault has healed and more accurately predict the type of shaking that would occur when it ruptures," said Steven Glaser, UC Berkeley professor of civil and environmental engineering and principal investigator of the study. "That's important in improving building designs and developing plans to mitigate for possible damage."

To create a fault model, the researchers placed a Plexiglas slider block against a larger base plate and equipped the system with sensors. The design allowed the researchers to isolate the physical and mechanical factors, such as friction, that influence how the ground will shake when a fault ruptures.

It would be impossible to do such a detailed study on faults that lie several miles below the surface of the ground, the authors said. And current instruments are generally unable to accurately measure waves at frequencies higher than approximately 100 Hertz because they get absorbed by the earth.

"There are many people studying the properties of friction in the lab, and there are many others studying the ground motion of earthquakes in the field by measuring the waves generated when a fault ruptures," said McLaskey. "What this study does for the first time is link those two phenomena. It's the first clear comparison between real earthquakes and lab quakes."

Noting that fault surfaces are not smooth, the researchers roughened the surface of the Plexiglas used in the lab's model.

"It's like putting two mountain ranges together, and only the tallest peaks are touching," said McLaskey, who is now a postdoctoral researcher with the U.S. Geological Survey in Menlo Park.

As the sides "heal" and press together, the researchers found that individual contact points slip and transfer the resulting energy to other contact points.

"As the pressing continues and more contacts slip, the stress is transferred to other contact points in a chain reaction until even the strongest contacts fail, releasing the stored energy as an earthquake," said Glaser. "The longer the fault healed before rupture, the more rapidly the surface vibrated."

"It is elegant work," said seismologist John Vidale, a professor at the University of Washington who was not associated with the study. "The point that more healed faults can be more destructive is dismaying. It may not be enough to locate faults to assess danger, but rather knowing their history, which is often unknowable, that is key to fully assessing their threat."

Glaser and McLaskey teamed up with Amanda Thomas, a UC Berkeley graduate student in earth and planetary sciences, and Robert Nadeau, a research scientist at the Berkeley Seismological Laboratory, to confirm that their lab scenarios played out in the field. The researchers used records of repeating earthquakes along the San Andreas fault that Nadeau developed and maintained. The data were from Parkfield, Calif., an area which has experienced a series of magnitude 6.0 earthquakes two to three decades apart over the past 150 years.

Thomas and McLaskey explored the records of very small, otherwise identically repeating earthquakes at Parkfield to show that the quakes produced shaking patterns that changed depending on the time span since the last event, just as predicted by the lab experiments.

In the years after a magnitude 6.0 earthquake hit Parkfield in 2004, the small repeating earthquakes recurred more frequently on the same fault patches.

"Immediately after the 2004 Parkfield earthquake, many nearby earthquakes that normally recurred months or

years apart instead repeated once every few days before decaying back to their normal rates," said Thomas. "Measurements of the ground motion generated from each of the small earthquakes confirmed that the shaking is faster when the time from the last rupture increases. This provided an excellent opportunity to verify that ground motions observed on natural faults are similar to those observed in the laboratory, suggesting that a common underlying mechanism -- fault healing -- may be responsible for both."

Understanding how forcefully the ground will move when an earthquake hits has been one of the biggest challenges in earthquake science.

"What makes this study special is the combination of lab work and observations in the field," added Roland Burgmann, a UC Berkeley professor of earth and planetary sciences who reviewed the study but did not participate in the research. "This study tells us something fundamental about how earthquake faults evolve. And the study suggests that, in fact, the lab setting is able to capture some of those processes correctly."

Glaser said the next steps in his lab involve measuring the seismic energy that comes from the movement of the individual contact points in the model fault to more precisely map the distribution of stress and how it changes in the run-up to a laboratory earthquake event.

The above story is reprinted from materials provided by University of California - Berkeley. The original article was written by Sarah Yang.

Journal Reference: Gregory C. McLaskey, Amanda M. Thomas, Steven D. Glaser and Robert M. Nadeau. ***Fault healing promotes high-frequency earthquakes in laboratory experiments and on natural faults,*** *Nature*, October 31, 2012

New Study Shows Effects of Prehistoric Nocturnal Life On Mammalian Vision

Since the age of dinosaurs, most species of day-active mammals have retained the imprint of nocturnal life in their eye structures. Humans and other anthropoid primates, such as monkeys and apes, are the only groups that deviate from this pattern, according to a new study from The University of Texas at Austin and Midwestern University.

The findings, published in a forthcoming issue of *Proceedings of the Royal Society B*, are the first to provide a large-scale body of evidence for the "nocturnal bottleneck theory," which suggests that mammalian sensory traits have been profoundly influenced by an extended period of adaptation to nocturnality during the Mesozoic Era. This period lasted from 250 million years ago to 65 million years ago.

Eagle Owl, Bubo bubo. (Credit: © Kletr / Fotolia)

To survive in the night, mammals had a host of visual capabilities, such as good color vision and high acuity, which were lost as they passed through the nocturnal "bottleneck."

"The fact that nearly all living mammals have eye shapes that appear 'nocturnal' by comparison with other amniotes [mammals, reptiles and birds] is a testament to the strong influence that evolutionary history can have on modern anatomy," says Chris Kirk, associate professor of anthropology at The University of Texas at Austin.

According to Kirk, early mammals were predominantly nocturnal during the Mesozoic partly as a strategy for avoiding predation by day-active dinosaurs.

"It's a bit surprising to still see the effects of this long period of nocturnality on living mammals more than 65 million years after non-avian dinosaurs went extinct, but that's exactly what we found," Kirk says.

The research team, led by Margaret Hall, an evolutionary biologist at Midwestern University's Arizona College of Osteopathic Medicine, analyzed one of the largest datasets on eye morphology ever assembled. Using a sample of eyeballs from 266 mammal species, the researchers used a multivariate statistical method to show that mammals active by day or night show only minor differences in eye morphology.

The researchers then compared the eyes of mammals, birds and lizards using the ratio of cornea size and eye length -- two functionally important measures of the eye's ability to admit light and form sharp images. These analyses showed that diurnal (only active by day) and cathemeral (active by both day and night) mammals don't differ in their eye shapes. At the same time, both groups have eye shapes that are very similar to those of

nocturnal birds and lizards. These results reveal that most day-active mammals have eye shapes that appear "nocturnal" when compared with other vertebrates.

One likely reason for these findings, Kirk says, is that after the extinction of non-avian dinosaurs, some nocturnal mammals became day-active and there was less pressure to evolve eye shapes for acute diurnal vision like those of other day-active vertebrates.

Anthropoid primates are the only mammalian group that re-evolved eye shape for fine detailed daytime vision. Like diurnal birds and lizards, most anthropoids have small corneas relative to eye length as an adaptation for enhanced visual acuity.

Kirk says the study provides a deeper understanding of human sensory systems and our intrinsic connection with our closest living primate relatives: the monkeys and apes.

"Humans and other anthropoid primates are so dependent on vision for everything that they do," Kirk says. "In this case, we are radically different from other mammals. We found that the distinctive eye shapes that set humans apart from most other mammals evolved a long time ago -- way back with the origin of anthropoid primates."

The above story is reprinted from materials provided by University of Texas at Austin.

Journal Reference: M. I. Hall, J. M. Kamilar, E. C. Kirk. **Eye shape and the nocturnal bottleneck of mammals**. *Proceedings of the Royal Society B: Biological Sciences*, 2012; DOI: 10.1098/rspb.2012.2258

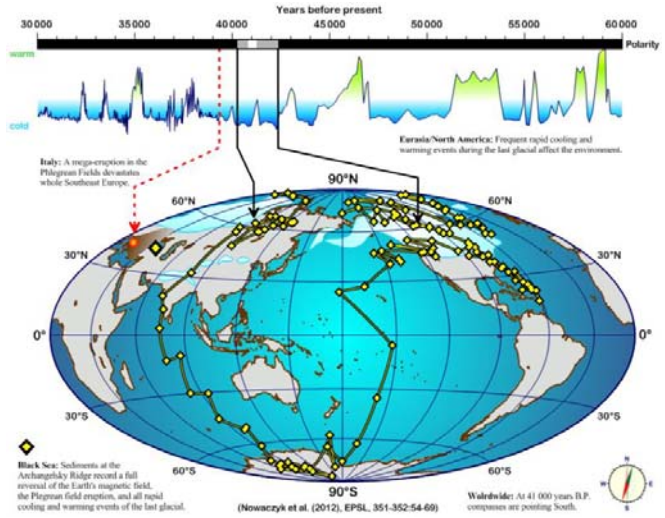
Ice Age Polarity Reversal Was Global Event: Extremely Brief Reversal of Geomagnetic

Field, Climate Variability, and Super Volcano

Some 41,000 years ago, a complete and rapid reversal of the geomagnetic field occured. Magnetic studies of the GFZ German Research Centre for Geosciences on sediment cores from the Black Sea show that during this period, during the last ice age, a compass at the Black Sea would have pointed to the south instead of north.

Moreover, data obtained by the research team formed around GFZ researchers Dr. Norbert Nowaczyk and Prof. Helge Arz, together with additional data from other studies in the North Atlantic, the South Pacific and Hawaii, prove that this polarity reversal was a global event. Their results are published in the latest issue of the scientific journal *Earth and Planetary Science Letters*.

What is remarkable is the speed of the reversal: "The field geometry of reversed polarity, with field lines pointing into the opposite direction when compared to today's configuration, lasted for only about 440 years, and it was associated with a field strength that was only one quarter of today's field," explains Norbert Nowaczyk. "The actual polarity changes lasted only 250 years. In terms of geological time scales, that is very fast." During this period, the field was even weaker, with only 5% of today's field strength. As a consequence, Earth nearly completely lost its protection shield against hard cosmic rays, leading to a significantly increased radiation exposure.



The polarity reversal was a global event. (Credit: © Dr. habil. Norbert R. Nowaczyk / GFZ)

This is documented by peaks of radioactive beryllium (^{10}Be) in ice cores from this time, recovered from the Greenland ice sheet. ^{10}Be as well as radioactive carbon (^{14}C) is caused by the collision of high-energy protons from space with atoms of the atmosphere.

The Laschamp event

The polarity reversal now found with the magnetisation of Black Sea sediments has already been known for 45 years. It was first discovered after the analysis of the magnetisation of several lava flows near the village Laschamp near Clermont-Ferrand in the Massif Central, which differed significantly from today's direction of the geomagnetic field. Since then, this geomagnetic feature is known as the 'Laschamp event'. However, the data of the Massif Central represent only some point readings of the geomagnetic field during the last ice age, whereas the new data from the Black Sea give a complete image of geomagnetic field variability at a high temporal resolution.

Abrupt climate changes and a super volcano

Besides giving evidence for a geomagnetic field reversal 41,000 years ago, the geoscientists from Potsdam discovered numerous abrupt climate changes during the last ice age in the analysed cores from the Black Sea, as it was already known from the Greenland ice cores. This ultimately allowed a high precision synchronisation of the two data records from the Black Sea and Greenland.

The largest volcanic eruption on the Northern hemisphere in the past 100,000 years, namely the eruption of the super volcano 39,400 years ago in the area of today's Phlegraean Fields near Naples, Italy, is also documented within the studied sediments from the Black Sea. The ashes of this eruption, during which about 350 cubic kilometers of rock and lava were ejected, were distributed over the entire eastern Mediterranean and up to central Russia.

These three extreme scenarios, a short and fast reversal of Earth's magnetic field, short-term climate variability of the last ice age and the volcanic eruption in Italy, have been investigated for the first time in a single geological archive and placed in precise chronological order.

Story Source: The above story is reprinted from materials provided by Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences, via AlphaGalileo.

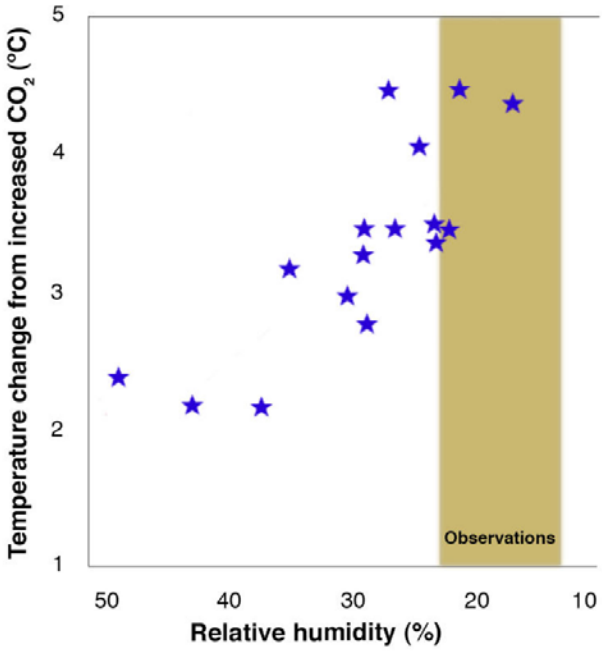
Journal Reference: N.R. Nowaczyk, H.W. Arz, U. Frank, J. Kind, B. Plessen. **Dynamics of the Laschamp geomagnetic excursion from Black Sea sediments**. *Earth and Planetary Science Letters*, 2012; 351-352: 54 DOI: 10.1016/j.epsl.2012.06.050

Future Warming Likely to Be On High Side of Climate Projections, Analysis Finds

Climate model projections showing a greater rise in global temperature are likely to prove more accurate than those showing a lesser rise, according to a new analysis by scientists at the National Center for Atmospheric Research (NCAR). The findings, published in this week's issue of *Science*, could provide a breakthrough in the longstanding quest to narrow the range of global warming expected in coming decades and beyond.

NCAR scientists John Fasullo and Kevin Trenberth, who co-authored the study, reached their conclusions by analyzing how well sophisticated climate models reproduce observed relative humidity in the tropics and subtropics.

The climate models that most accurately captured these complex moisture processes and associated clouds, which have a major influence on global climate, were also the ones that showed the greatest amounts of warming as society emits more greenhouse gas into the atmosphere.



Computer models that more accurately depict dry conditions in a key part of the subtropical atmosphere are also more likely to predict greater climate warming from increased greenhouse gases. In this graphic, each star indicates one of 16 leading global climate models. The left axis ("warming") corresponds to equilibrium climate sensitivity (ECS) in degrees C, which is the amount of warming produced by each model when carbon dioxide concentrations in the atmosphere are doubled over preindustrial values. The bottom axis shows May-to-August relative humidity for a portion of the upper atmosphere between about 20,000 to 30,000 feet in height and between about 10° and 25° latitude south in the southern subtropics. (Credit: ©UCAR. Image by Carlye Calvin, based on Fasullo and Trenberth, Science, 2012)

"There is a striking relationship between how well climate models simulate relative humidity in key areas and how much warming they show in response to increasing carbon dioxide," Fasullo says. "Given how fundamental these processes are to clouds and the overall global climate, our findings indicate that warming is likely to be on the high side of current projections."

Moisture, clouds, and heat

The world's major global climate models, numbering more than two dozen, are all based on long-established physical laws known to guide the atmosphere. However, because these relationships are challenging to translate into software, each model differs slightly in its portrayal of global climate. In particular, some processes, such as those associated with clouds, are too small to be represented properly.

The most common benchmark for comparing model projections is equilibrium climate sensitivity (ECS), or the amount of warming that eventually occurs in a model when carbon dioxide is doubled over preindustrial values. At current rates of global emission, that doubling will occur well before 2100.

For more than 30 years, ECS in the leading models has averaged around 5 degrees Fahrenheit (3 degrees Celsius). This provides the best estimate of global temperature increase expected by the late 21st century compared to late 19th century values, assuming that society continues to emit significant amounts of carbon dioxide. However, the ECS within individual models is as low as 3 degrees F and as high as 8 degrees F (, leaving a wide range of uncertainty that has proven difficult to narrow over the past three decades.

The difference is important to reconcile, as a higher temperature rise would produce greater impacts on society in terms of sea level rise, heat waves, droughts, and other threats.

Clouds are one of the main sticking points, say the NCAR authors. Although satellites observe many types of clouds, satellite failure, observing errors, and other inconsistencies make it challenging to build a comprehensive global cloud census that is consistent over many years.

However, satellites perform better in measuring water vapor, and estimates of the global distribution of relative humidity have become more reliable. Relative humidity is also incorporated in climate models to generate and dissipate clouds.

Fasullo and Trenberth checked the distribution of relative humidity in 16 leading climate models to see how accurately they portray the present climate. In particular, they focused on the subtropics, where sinking air from the tropics produce very dry zones where most of the world's major deserts are located. The researchers drew on observations from two NASA satellite instruments -- the Atmospheric Infrared Sounder (AIRS) and Clouds and Earth's Radiant Energy System (CERES) -- and used a NASA data analysis, the Modern-Era Retrospective Analysis for Research and Applications (MERRA).

The seasonal drying in the subtropics and the associated decrease in clouds, especially during May through August, serve as a good analog for patterns projected by climate models.

"The dry subtropics are a critical element in our future climate," Fasullo says. "If we can better represent these regions in models, we can improve our predictions and provide society with a better sense of the impacts to expect in a warming world."

Accurate humidity yields higher future temperatures

Estimates based on observations show that the relative humidity in the dry zones averages between about 15 and 25 percent, whereas many of the models depicted humidities of 30 percent or higher for the same period. The models that better capture the actual dryness were among those with the highest ECS, projecting a global temperature rise for doubled carbon dioxide of more than 7 degrees F. The three models with the lowest ECS were also the least accurate in depicting relative humidity in these zones.

"Because we have more reliable observations for humidity than for clouds, we can use the humidity patterns that change seasonally to evaluate climate models," says Trenberth. "When examining the impact of future increases in heat-trapping gases, we find that the simulations with the best fidelity come from models that produce more warming."

The authors focused on climate models used for the 2007-08 assessment by the Intergovernmental Panel on Climate Change. The next-generation models being used for the upcoming 2013-14 IPCC assessment were found to behave in a similar fashion, as described in a preliminary analysis by the authors in a supplement to their paper.

"In addition to providing a path forward and focus for improving models, results strongly suggest that the more sensitive models perform better, and indeed the less sensitive models are not adequate in replicating vital aspects of today's climate," write the authors in the paper.

Story Source: The research was funded by NASA. The above story is reprinted from materials provided by National Center for Atmospheric Research/University Corporation for Atmospheric Research.

Journal Reference: J. T. Fasullo, K. E. Trenberth. **A Less Cloudy Future: The Role of Subtropical Subsidence in Climate Sensitivity**. *Science*, 2012; 338 (6108): 792 DOI: 10.1126/science.1227465

Carbon Dioxide: Our Salvation from a Future Ice Age?

Humankind's emissions of fossil carbon and the resulting increase in temperature could prove to be our salvation from the next ice age. According to new research from the University of Gothenburg, Sweden, the current increase in the extent of peatland is having the opposite effect.

"We are probably entering a new ice age right now. However, we're not noticing it due to the effects of carbon dioxide," says researcher Professor Lars Franzén.

Looking back over the past three million years, Earth has experienced at least 30 periods of ice age, known as ice age pulses. The periods in between are called interglacials. The researchers believe that the Little Ice Age of the 16th to 18th centuries may have been halted as a result of human activity. Increased felling of woodlands and growing areas of agricultural land, combined with the early stages of industrialisation, resulted in increased emissions of carbon dioxide which probably slowed down, or even reversed, the cooling trend.

"It is certainly possible that mankind's various activities contributed towards extending our ice age interval by keeping carbon dioxide levels high enough," explains Lars Franzén, Professor of Physical Geography at the University of Gothenburg.

"Without the human impact, the inevitable progression towards an ice age would have continued. The spread of peatlands is an important factor."

Peatlands act as carbon sinks, meaning that they absorb carbon dioxide from the atmosphere. They are a dynamic landscape element and currently cover around four percent of Earth's land area. Most peatlands are found in temperate areas north and south of the 45th parallel.

Around 16 percent of Sweden is covered by peatland. Peatlands grow in height and spread across their surroundings by waterlogging woodlands. They are also one of the biggest terrestrial sinks of atmospheric carbon dioxide. Each year, around 20 grams of carbon are absorbed by every square metre of peatland.

"By using the National Land Survey of Sweden's altitude database, we have calculated how much of Sweden could be covered by peatlands during an interglacial. We have taken a maximum terrain incline of three degrees as our upper limit, and have also excluded all lakes and areas with substrata that are unsuitable for peatland formation."

The researchers found that around half of Sweden's surface could be covered by peat. In such a case, the carbon dioxide sink would increase by a factor of between six and ten compared with the current situation.

"If we accept that rising levels of carbon dioxide in the atmosphere lead to an increase in global temperature, the logical conclusion must be that reduced levels lead to a drop in temperature."

The relationship between carbon dioxide and temperature is not linear. Instead, lower levels result in a greater degree of cooling than the degree of warming achieved by a corresponding increase.

"There have been no emissions of fossil carbon during earlier interglacials. Carbon sequestration in peatland may therefore be one of the main reasons why ice age conditions have occurred time after time."

Using calculations for Swedish conditions, the researchers are also producing a rough estimate of the global carbon sink effect if all temperate peatlands were to grow in the same way.

"Our calculations show that the peatlands could contribute towards global cooling equivalent to five watts per square metre. There is a great deal of evidence to suggest that we are near the end of the current interglacial."

Professor Franzén and three other researchers have published their findings in the journal *Mires and Peat.*

Story Source: The above story is reprinted from materials provided by University of Gothenburg, via AlphaGalileo.

Journal Reference: Franzén, L.G., F. Lindberg, V. Viklander & A. Walther. **The potential peatland extent and carbon sink in Sweden, as related to the Peatland/Ice Age Hypothesis**. *Mires and Peat*, 2012

Mayan civilization's collapse linked to climate change

By Deborah Zabarenko of Reuters

WASHINGTON - For a clue to the possible impact of climate change on modern society, a study suggests a look back at the end of classic Mayan civilization, which disintegrated into famine, war and collapse as a long-term wet weather pattern shifted to drought.

An international team of researchers compiled a detailed climate record that tracks 2,000 years of wet and dry weather in present-day Belize, where Mayan cities developed from the year 300 to 1000. Using data locked in stalagmites - mineral deposits left by dripping water in caves - and the rich archeological evidence created by the Maya, the team reported its findings in the journal Science on Thursday.

A new study suggests Mayan civilization disintegrated into famine, war and collapse as a long-term wet weather pattern shifted to drought.

Unlike the current global warming trend, which is spurred by human activities including the emission of

atmosphere-heating greenhouse gases, the change in the Central American climate during the collapse of the Mayan civilization was due to a massive, undulating, natural weather pattern.

This weather pattern alternately brought extreme moisture, which fostered the growth of the Mayan civilization, and periods of dry weather and drought on a centuries-long scale, said the study's lead author, Douglas Kennett, an anthropologist at Penn State University.

The wet periods meant expanded agriculture and growing population as Mayan centers of civilization grew, Kennett said in a telephone interview. It also reinforced the power of the kings of these centers, who claimed credit for the rains that brought prosperity and performed public blood sacrifices meant to keep the weather favorable to farming.

ANALOGIES TO MODERN CIVILIZATION

When the rainy period gradually changed to dry weather around the year 660, Kennett said, the kings' power and influence collapsed, and correlated closely with an increase in wars over scarce resources.

"You can imagine the Maya getting lured into this trap," he said. "The idea is that they keep the rains coming, they keep everything together, and that's great when you're in a really good period ... but when things start going badly, and (the kings are) doing the ceremonies and nothing's happening, then people are going to start questioning whether or not they should really be in charge."

The political collapse of the Mayan kings came around the year 900, when prolonged drought undermined their authority. But Mayan populations remained for another century or so, when a severe drought lasting from the years 1000 to 1100 forced the Maya to leave what used to be their biggest centers of population.

Even during the Mayan heyday, humans had an impact on their environment, Kennett said, mostly by farming more land, which in turn caused greater erosion. During the dry periods, the Maya responded with intensified agriculture.

When the climate in the area shifted toward drought, in a long-running pattern called the intertropical conversion zone, it exacerbated human impact on environment, Kennett said.

"There are some analogies to this in the modern context that we need to worry about" in Africa or Europe, he said.

If there are changes in climate that undermine agricultural systems in some areas, it could create widespread famine, social instability and warfare that then draw in other populations, he said -- just as it may have happened in Mayan civilization.

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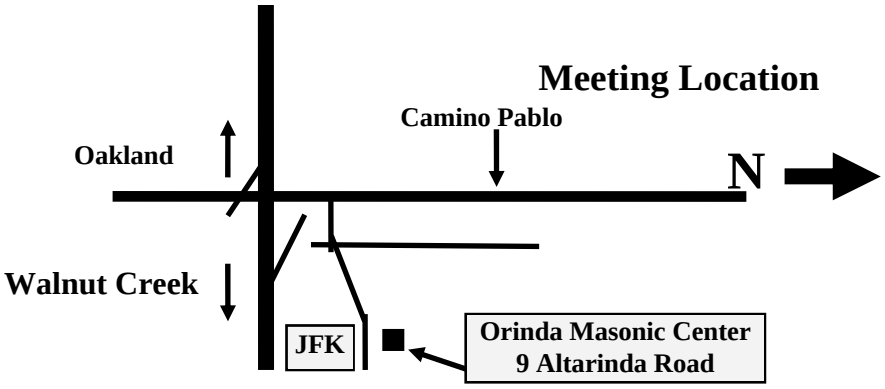

Speaker Biography: **Dr. Patrick Muffler** received a B.A. in geology from Pomona College, a M.A. from Princeton University, and a Ph.D. from Princeton Univiersity in 1962. He joined the U.S. Geological Survey in 1962 and has been a Scientist Emeritus with the Volcano Science Senter since retirement in 2001. He has specialized in the geology, geophysicis and geochemistry of geothermal systems, geothermal resource assessment, and volcanic geology. Principal areas of reserach have included the study of volcanic geology and geothermal phenomena in the Lassen region of northeastern California, the Cascade Range of the western United States, the Imperial Valley of southern California, Yellowstone National Park in Wyoming, the Larderello region of Italy, and the Taupo volcanic belt of New Zealand. He has acted as the coordinator of the USGS Geothermal Research Program between 1971and 1976 and then again between 1983 and 1987, the coordinator of the USGS Volcano Hazards Program between 1983 and 1987, and as the Western Regional Geologist, Senior Executive Service, USGS betwen 1997 and 2001. He has received meritorious and distinguished service awards of the Department of the Interior, and the Joseph W. Aidlin Award of the Geothermal Resources Council. He is currently a trustee of the Raymond M. Alf Museum of Paleontology, in Claremont, California.

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