NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **January 29, 2014**

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. Barbara Romanowicz, UC Berkeley Seismological Laboratory**

Imag(in)ing the Earth's Interior

Earthquakes, tsunamis, volcanic eruptions: all are dramatic consequences of plate tectonics with important societal impact. They remind us of the powerful internal forces that drive the motions of plates at the surface of the earth. In order to understand the internal dynamics of the earth and their evolution, seismic imagery, which uses seismic waves generated by natural earthquakes to illuminate the earth's internal structure, is an ever improving tool for mapping regions where upwelling and downwelling flow occurs at the present time and provide information for the development of models of the thermal evolution of the earth and understanding why our planet is the only one in our solar system to have plate tectonics.

I will explain how global mantle seismic imaging works, how it has improved in recent years owing to new capabilities for the computation of the seismic wavefield through the earth, what we have learned about the earth's interior structure and the challenges ahead of us to achieve the required sharpness of the images we can obtain.

Biography:

Dr. Barbara Romanowicz was born and educated in France, where she studied mathematics at the Ecole Normale Supérieure. She holds a PhD degree in Geophysics from the University of Paris 7. Between 1982 and 1990, as a researcher at the CNRS, she developed GEOSCOPE, a then state-of-the-art global network of digital seismic stations for the study of earthquakes and the structure of the earth's interior. In 1991, she was appointed Director of the Berkeley Seismological Laboratory and professor in the Department of Earth and Planetary Science at UC Berkeley. During her directorship (until 2011), she helped establish a joint real time earthquake notification system for northern California between the BSL and the US Geological Survey. Her research interests include the study of deep earth structure and dynamics using seismological tools, and recently, implementing numerical seismic wavefield computations in seismic tomography. She also has an interest … *Continued on the back…*

NCGS 2012 – 2013 Calendar

January 29, 2013
Dr. Barbara Romanowicz
UC Berkeley Seismological Laboratory
Imag(in)ing the Earth's Interior

February 26, 2013
Tess Menotti, PhD Candidate, Department of Geological and Environmental Sciences, Stanford University,
3-d computer model of the evolution and petroleum system of the Salinas basin

March 26, 2013
Tom MacKinnon, Consultant
Revisiting the Monterey Formation

April 30, 2014
Stephen D. Reynolds, California Geological Survey,
Reclamation of the abandoned Spenceville Copper Mine

May 28, 2014
DINNER MEETING; TBA

June 25, 2014
Jason Utas, PhD Candidate at UCLA; Meteorites

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

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). Go to: http://www.bayareascience.org/

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/.

Seeking Member Write-Ups

Have you recently gone to, or seen an interesting geologic feature, event, or…? Let us know! NCGS would like to diversify the content of the newsletter and we want to make sure you know that your articles are welcome. There may be some editing for length, content, or grammar, but we want to welcome your articles.

NCGS at the Concord Gem & Rock Show

Phil Garbutt

The **Contra Costa Mineral & Gem Society** held its 54th Annual Show and Sale on November 2nd and 3rd, 2013. **Harry Nichandros**, a NCGS member, was the show manager. The show was held at the Centre Concord – California on Clayton Road in Concord. The NCGS was provided space where we could present information and talk about the NCGS, such as "Who we are" and "What we do". We were also able to provide information about NCGS scholarships and teacher programs. In addition we were able to recruit members and sold out of publications that we brought for the day. NCGS members **John Christian** and **Bill Motzer** took the lead and were assisted by **Dan Day, Barbara Matz, Mark Petrofsky, and Phillip Garbutt**. John Christian brought many of his rocks, minerals, and fossils for display, most of which had been collected in northern California. The specimens as well as pictures from some of our field trips brought visitors to our tables and inquiries about who we are and what we do.

Photograph taken by CCMGS member Harry Short and provided by Harry Nichandros

Photograph taken by John Christian

Photograph taken by Phillip Garbutt

Photograph taken by Phillip Garbutt

NCGS at the American Geophysical Union Convention

It's been a banner year for conferences and shows for the new NCGS banner! Here are a few photographs of NCGS member **John Karachewski** taking the new banner out for a spin at the American Geophysical Conference in San Francisco in December 2013.

Sorry the editor doesn't remember the source of the photos! He has no doubt someone will step up!

INHIGEO AT ASILOMAR July 2014

39th Symposium of the **International Commission on the History of Geological Sciences**, co-sponsored by the Geological Society of America. Asilomar Conference Grounds, Pacific Grove, California. Sunday 6 July (p.m.) through Thursday 10 July, 2014.

Everyone interested in the history of the geosciences is invited to this meeting, *the first INHIGEO symposium held in the U.S. since 1989*.

Dual conference themes:

(1) *Doing the History of the Earth Sciences: What, Why, and How?*

Keynote speakers: **Claudine Cohen** (École des Hautes Études en Sciences Sociales, Paris) & **Ernst Hamm** (York University, Toronto).

(2) *California's Place in the History of the Earth Sciences*

Keynote speakers: **Eldridge Moores** (University of California–Davis) & **William R. Dickinson** (University of Arizona).

For full details, visit the GSA Meetings webpage: http://community.geosociety.org/INHIGEO2014/Home/

THE GEOLOGICAL SOCIETY OF AMERICA®
HISTORY AND PHILOSOPHY OF GEOLOGY DIVISION

BayNature; Exploring Nature in the San Francisco Bay Area

How the Monterey Shale came to be

by Sarah Phelan on September 02, 2013 in Climate Change, Geology, Habitats: Land

On the Map

There has been so much talk of a potential fracking boom in California. But how, exactly, did the Monterey shale formation become so valuable?

To help me understand why oil is trapped in this formation and why hydraulic fracturing and other methods of extreme energy extraction have been used to release it, UC Berkeley-trained geologist Mel Erskine meets me one day at the Tilden Botanical Gardens. He is carrying a geologic map of California showing the Monterey shale.

Monterey Shale formation in Berkeley hills. Photo: Sarah Phelan.

"It's a formation that accumulated in deep structural basins during the mid-Miocene period," says Erskine, an expert in the Monterey formation's geography. "It's very young. It's six million years old or less."

Geologist Mel Erskine. Photo: Sarah Phelan.

He unrolls the map, which is highly detailed and shows the Monterey Formation extending beneath central California to the coast and the Santa Barbara Channel.

Erskine explains that the Monterey formation is the source rock for a great deal of oil produced in California, which has been generated over millions of years by the conversion of tiny, dead marine organisms, known as diatoms, into hydrocarbons.

When these organisms died, they fell to the bottom of what was then an ocean and decomposed. The remaining biological sludge was covered by layers of sand and silt, and as the depth of the sediments reached 10,000 feet, pressure and heat transformed the organic compounds into crude oil. The formation doesn't easily release the oil because the oil is sealed inside "a very tight shale."

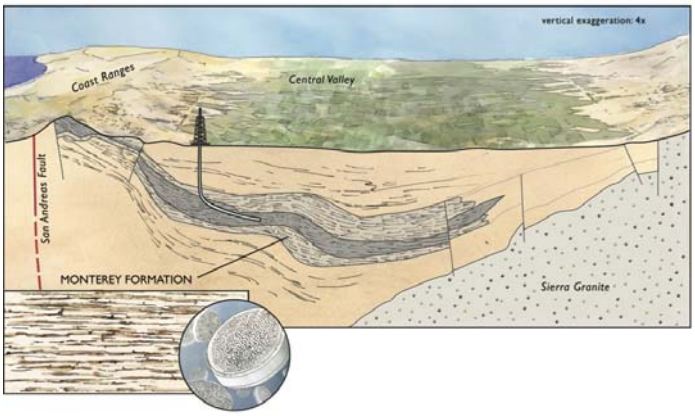
The purpose of fracking then is to break up the formation enough to insert a mix of chemical and coarse, well-sorted sandstone under high pressure into the new fractures. The sand sticks in cracks formed by the high pressure injection, creating fractures so that oil can flow to the wellhead. And the chemicals help to break up the shale and release the oil trapped within.

Fracking fluids often contain chemicals listed as hazardous pollutants, including benzene, lead and methanol. But because of legal trade secrets, oil companies typically do not disclose all the chemicals they use. The lack of transparency has outraged farmers, ranchers and environmentalists, who fear the contamination of water supplies.

Compared to more famous and heavily developed shales like North Dakota's Bakken Formation or the Northeast's Marcellus, the Monterey Formation is younger, with more internal folding.

"All the black lines you see on a geologic map of California are fault zones, so it's very complex," Erskine says.

You would think that all the tremors would make it easy to get the oil out.



The Monterey Formation, showing hydraulic fracturing and tiny diatoms that decompose into oil. Illustration: Emily Underwood.

But Erskine explains that the Monterey Formation is like a continually flowing subterranean creature: new fractures heal quickly as California's active faults push and pull the rock. The process of fracking keeps the fractures open as long as is needed to extract the oil. To illustrate his point, Erskine takes me on a 5 minute drive to Grizzly Peak Road in the Berkeley Hills. He parks and grabs a small metal pick from his trunk. The roadside offers dramatic views of San Francisco Bay, but Erskine is drawn instead to a rock outcropping on the opposite side of the road.

A cross section of the Monterey shale. Photo: Sarah Phelan.

"This is the Monterey shale," he says, pointing at a yellowish-orange outcropping that looks like the ruins of an ancient miniature city and once lay thousands of feet below the surface of the Earth, until geological activity exposed it to the elements.

The shale is very brittle, Erskine says, pointing to rows of vertical fractures that mark the outcropping's surface. This brittleness is one reason the formation can be fracked, he adds, breaking off a small chunk with his pick. A thin dark seam of oil glistens, then fades, like jelly oozing out of a peanut-butter-and-jelly sandwich.

"This is what we are trying to get to through hydraulic fracturing," says Erskine, indicating the thin seam.

Could this ridge in the Berkeley Hills get fracked one day, if oil gets scarce enough? Erskine looks from the outcropping to the cliff edge, the steep drop, and the breathtaking views of the Bay, and shakes his head. The search, he says, is for areas where the formation is nearly horizontal.

"[The oil companies] can handle some dips," Erskine says. "But basically they are going horizontally because they want to inject uniform pressure over a large area. In a steep dip like this there is no way to control the fractures."

Erskine recalls how early on in his college career, he heard a geophysicist saying that the U.S. was close to peak oil production.

"That was 60 years ago, and the peak of oil and gas has been migrating through time," he said. "What the development of the shales demonstrates is that you no longer need a reservoir of oil. You can make your own reservoir with these production methods."

Erskine says his biggest concern about fracking is making sure that the process is well monitored.

"The operator has every incentive to keep the process completely under control," he says. "Getting careless …. is a very expensive process."

About.com

Geology

Mima Mounds: A Report from AGU

By Andrew Alden, (*NCGS Member*)
December 10, 2013

I'm in the middle of a week at the Fall Meeting of the American Geophysical Union, in San Francisco. This is typically a whirl of talks, posters, refreshment breaks (coffee in the morning, beer in the afternoon) and throngs of geoscientists. I typically don't cover the meeting like a journalist does, although I share the press room with them. A lot of what I seek out is background stuff that I hope is ahead of the cutting edge—at least, it's ahead of *my* cutting edge. A talk I saw yesterday was not like the others.

Manny Gabet, of San Jose State University, has been studying the odd landscape features known as mima ("meema") mounds. They're piles of dirt, a meter or two high, and range in area from dinner-table to living-room size. They occur bunched up together in big groups, and are widespread in the American West. Gabet cited two special facts about them: they're found where the winter

rains regularly saturate the ground, and they're occupied by pocket gophers, one on each mound, with the unusual habit of pushing the dirt from their burrows uphill. He made a computer model of a bunch of gophers and set them loose on a flat computer landscape, showing that their behavior, over several centuries, turned the ground into fields of mima mounds.

The advantage of a mound is that it sits above the winter rains, making large areas of marginal land inhabitable for gophers. Gabet told us that by his reckoning, mima mounds are the largest set of animal-made structures on Earth—other than our own, of course. It intrigues me that a single change in behavior brought this about—pushing dirt uphill instead of downhill. That probably arose from a very small genetic change, one that doesn't make a difference east of the Mississippi, where mima mounds aren't found.

Mima mound field from the air — Washington Department of Natural Resources

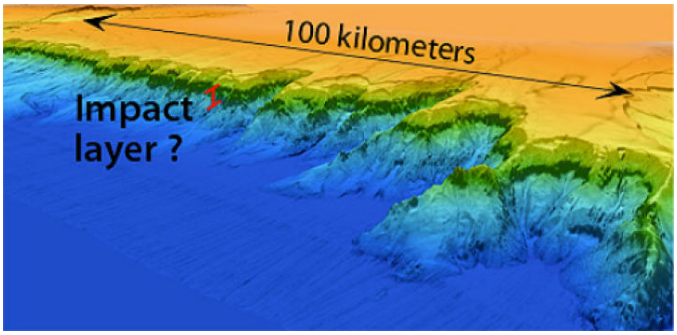
Geology in Action!

John Christian forwarded this great landslide video from an Indonesian mine. He says that it reminds him of the many nightmares that he has had, but always much closer or in the action! *The editor agrees!*

http://www.landslideblog.org/2008/05/sichuan-what-does-landslide-look-like.html

Mapping the Demise of the Dinosaurs

About 65 million years ago, an asteroid or comet crashed into a shallow sea near what is now the Yucatán Peninsula of Mexico. The resulting firestorm and global dust cloud caused the extinction of many land plants and large animals, including most of the dinosaurs. At this week's meeting of the American Geophysical Union (AGU) in San Francisco, MBARI researchers will present evidence that remnants from this devastating impact are exposed along the Campeche Escarpment -- an immense underwater cliff in the southern Gulf of Mexico.



This close-up image of the Campeche Escarpment from the 2013 sonar survey shows a layer of resistent rock that researchers believe may contain rocks formed during an impact event 65 million years ago. (Credit: Copyright 2013 MBARI)

The ancient meteorite impact created a huge crater, over 160 kilometers across. Unfortunately for geologists, this crater is almost invisible today, buried under hundreds of meters of debris and almost a kilometer of marine sediments. Although fallout from the impact has been found in rocks around the world, surprisingly little research has been done on the rocks close to the impact site, in part because they are so deeply buried. All existing samples of impact deposits close to the crater have come from deep boreholes drilled on the Yucatán Peninsula.

In March 2013, an international team of researchers led by Charlie Paull of the Monterey Bay Aquarium Research Institute (MBARI) created the first detailed map of the Campeche Escarpment. The team used multi-beam sonars on the research vessel *Falkor*, operated by the Schmidt Ocean Institute. The resulting maps have recently been incorporated in Google Maps and Google Earth for viewing by researchers and the general public.

Paull has long suspected that rocks associated with the impact might be exposed along the Campeche Escarpment, a 600-kilometer-long underwater cliff just northwest of the Yucatán Peninsula. Nearly 4,000 meters tall, the Campeche Escarpment is one of the steepest and tallest underwater features on Earth. It is comparable to one wall of the Grand Canyon -- except that it lies thousands of meters beneath the sea.

As in the walls of the Grand Canyon, sedimentary rock layers exposed on the face of the Campeche Escarpment provide a sequential record of the events that have occurred over millions of years. Based on the new maps, Paull believes that rocks formed before, during, and after the impact are all exposed along different parts of this underwater cliff.

Just as a geologist can walk the Grand Canyon, mapping layers of rock and collecting rock samples, Paull hopes to one day perform geologic "fieldwork" and collect samples along the Campeche Escarpment. Only a couple of decades ago, the idea of performing large-scale geological surveys thousands of meters below the ocean surface would have seemed a distant fantasy. Over the last eight years, however, such mapping has become almost routine for MBARI geologists using underwater robots.

The newly created maps of the Campeche Escarpment could open a new chapter in research about one of the largest extinction events in Earth's history. Already researchers from MBARI and other institutions are using these maps to plan additional studies in this little-known area. Detailed analysis of the bathymetric data and eventual fieldwork on the escarpment will reveal fascinating new clues about what happened during the

massive impact event that ended the age of the dinosaurs -- clues that have been hidden beneath the waves for 65 million years.

In addition to the Schmidt Ocean Institute, Paull's collaborators in this research included Jaime Urrutia-Fucugauchi from the Universidad Nacional Autónoma de Mexico and Mario Rebolledo- Vieyra of the Centro de Investigación Científica de Yucatán. Paull also worked closely with MBARI researchers, including geophysicist and software engineer Dave Caress, an expert on processing of multibeam sonar data, and geologist Roberto Gwiazda, who served as project manager and will be describing this research at the AGU meeting.

Story Source: The above story is based on materials provided by Monterey Bay Aquarium Research Institute.

Solution to Cloud Riddle Reveals Hotter Future: Global Temperatures to Rise at Least 4 Degrees C by 2100

Global average temperatures will rise at least 4°C by 2100 and potentially more than 8°C by 2200 if carbon dioxide emissions are not reduced according to new research published in *Nature*. Scientists found global climate is more sensitive to carbon dioxide than most previous estimates.

Scientists have revealed the impact of clouds on climate sensitivity. Global average temperatures will rise at least 4 degrees C by 2100 and potentially more than 8 degrees C by 2200 if carbon dioxide emissions are not reduced, according to new research. (Credit: © Maksim Shebeko / Fotolia)

The research also appears to solve one of the great unknowns of climate sensitivity, the role of cloud formation and whether this will have a positive or negative effect on global warming.

"Our research has shown climate models indicating a low temperature response to a doubling of carbon dioxide from preindustrial times are not reproducing the correct processes that lead to cloud formation," said lead author from the University of New South Wales' Centre of Excellence for Climate System Science Prof Steven Sherwood.

"When the processes are correct in the climate models the level of climate sensitivity is far higher. Previously, estimates of the sensitivity of global temperature to a doubling of carbon dioxide ranged from 1.5°C to 5°C. This new research takes away the lower end of climate sensitivity estimates, meaning that global average temperatures will increase by 3°C to 5°C with a doubling of carbon dioxide."

The key to this narrower but much higher estimate can be found in the real world observations around the role of water vapour in cloud formation.

Observations show when water vapour is taken up by the atmosphere through evaporation, the updraughts can either rise to 15 km to form clouds that produce heavy rains or rise just a few kilometres before returning to the surface without forming rain clouds.

When updraughts rise only a few kilometres they reduce total cloud cover because they pull more vapour away from the higher cloud forming regions.

However water vapour is not pulled away from cloud forming regions when only deep 15km updraughts are present.

The researchers found climate models that show a low global temperature response to carbon dioxide do not include enough of this lower-level water vapour process. Instead they simulate nearly all updraughts as rising to 15 km and forming clouds.

When only the deeper updraughts are present in climate models, more clouds form and there is an increased reflection of sunlight. Consequently the global climate in these models becomes less sensitive in its response to atmospheric carbon dioxide.

However, real world observations show this behaviour is wrong.

When the processes in climate models are corrected to match the observations in the real world, the models produce cycles that take water vapour to a wider range of heights in the atmosphere, causing fewer clouds to form as the climate warms.

This increases the amount of sunlight and heat entering the atmosphere and, as a result, increases the sensitivity of our climate to carbon dioxide or any other perturbation.

The result is that when water vapour processes are correctly represented, the sensitivity of the climate to a doubling of carbon dioxide -- which will occur in the next 50 years -- means we can expect a temperature increase of at least 4°C by 2100.

"Climate sceptics like to criticize climate models for getting things wrong, and we are the first to admit they are not perfect, but what we are finding is that the mistakes are being made by those models which predict less warming, not those that predict more," said Prof. Sherwood.

"Rises in global average temperatures of this magnitude will have profound impacts on the world and the economies of many countries if we don't urgently start to curb our emissions.

Story Source: The above story is based on materials provided by University of New South Wales.

Journal Reference: Steven C. Sherwood, Sandrine Bony, Jean-Louis Dufresne. **Spread in model climate sensitivity traced to atmospheric convective mixing**. *Nature*, 2014; 505 (7481): 37 DOI: 10.1038/nature12829

Geoengineering Approaches to Reduce Climate Change Unlikely to Succeed

Reducing the amount of sunlight reaching the planet's surface by geoengineering may not undo climate change after all. Two German researchers used a simple energy balance analysis to explain how Earth's water cycle responds differently to heating by sunlight than it does to warming due to a stronger atmospheric greenhouse effect. Further, they show that this difference implies that reflecting sunlight to reduce temperatures may have unwanted effects on Earth's rainfall patterns.

Heavy rainfall events can be more common in a warmer world. (Credit: Annett Junginger, distributed via imaggeo.egu.eu)

The results are now published in *Earth System Dynamics*, an open access journal of the European Geosciences Union (EGU).

Global warming alters Earth's water cycle since more water evaporates to the air as temperatures increase. Increased evaporation can dry out some regions while, at the same time, result in more rain falling in other areas due to the excess moisture in the atmosphere. The more water evaporates per degree of warming, the stronger the influence of increasing temperature on the water cycle. But the new study shows the water cycle does not react the same way to different types of warming.

Axel Kleidon and Maik Renner of the Max Planck Institute for Biogeochemistry in Jena, Germany, used a simple energy balance model to determine how sensitive the water cycle is to an increase in surface temperature due to a stronger greenhouse effect and to an increase in solar radiation. They predicted the response of the water cycle for the two cases and found that, in the former, evaporation increases by 2% per degree of warming while in the latter this number reaches 3%. This prediction confirmed results of much more complex climate models.

"These different responses to surface heating are easy to explain," says Kleidon, who uses a pot on the kitchen stove as an analogy. "The temperature in the pot is increased by putting on a lid or by turning up the heat -- but these two cases differ by how much energy flows through the pot," he says. A stronger greenhouse effect puts a thicker 'lid' over Earth's surface but, if there is no additional sunlight (if we don't turn up the heat on the stove), extra evaporation takes place solely due to the increase in temperature. Turning up the heat by increasing solar radiation, on the other hand, enhances the energy flow through Earth's surface because of the need to balance the greater energy input with stronger cooling fluxes from the surface. As a result, there is more evaporation and a stronger effect on the water cycle.

In the new Earth System Dynamics study the authors also show how these findings can have profound consequences for geoengineering. Many geoengineering approaches aim to reduce global warming by reducing the amount of sunlight reaching Earth's surface (or, in the pot analogy, reduce the heat from the stove). But when Kleidon and Renner applied their results to such a geoengineering scenario, they found out that simultaneous changes in the water cycle and the atmosphere cannot be compensated for at the same time. Therefore, reflecting sunlight by geoengineering is unlikely to restore the planet's original climate.

"It's like putting a lid on the pot and turning down the heat at the same time," explains Kleidon. "While in the kitchen you can reduce your energy bill by doing so, in the Earth system this slows down the water cycle with wide-ranging potential consequences," he says.

Kleidon and Renner's insight comes from looking at the processes that heat and cool Earth's surface and how they change when the surface warms. Evaporation from the surface plays a key role, but the researchers also took

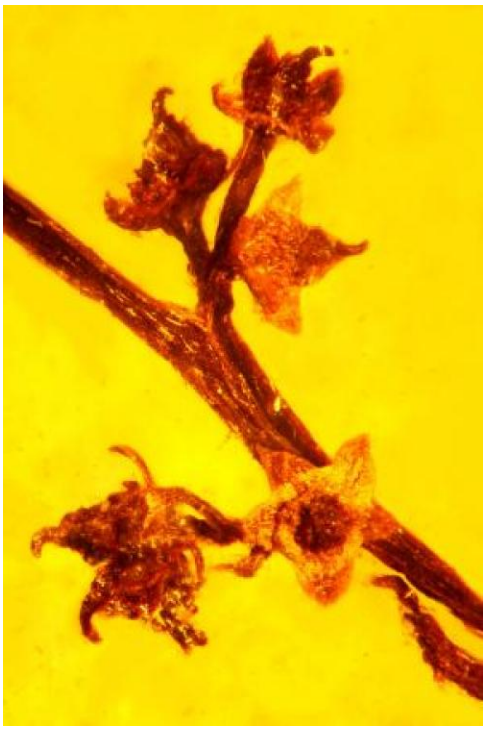
into account how the evaporated water is transported into the atmosphere. They combined simple energy balance considerations with a physical assumption for the way water vapour is transported, and separated the contributions of surface heating from solar radiation and from increased greenhouse gases in the atmosphere to obtain the two sensitivities. One of the referees for the paper commented: "it is a stunning result that such a simple analysis yields the same results as the climate models."

Story Source: The above story is based on materials provided by European Geosciences Union (EGU).

Journal Reference: A. Kleidon, M. Renner. **A simple explanation for the sensitivity of the hydrologic cycle to global climate change**. *Earth System Dynamics Discussions*, 2013; 4 (2): 853 DOI: 10.5194/esdd-4-853-2013

Amber Fossil Reveals Ancient Reproduction in Flowering Plants

A 100-million-year old piece of amber has been discovered which reveals the oldest evidence of sexual reproduction in a flowering plant -- a cluster of 18 tiny flowers from the Cretaceous Period -- with one of them in the process of making some new seeds for the next generation.



Ancient flower. (Credit: Image courtesy of Oregon State University)

The perfectly-preserved scene, in a plant now extinct, is part of a portrait created in the mid-Cretaceous when flowering plants were changing the face of the Earth forever, adding beauty, biodiversity and food. It appears identical to the reproduction process that "angiosperms," or flowering plants still use today.

Researchers from Oregon State University and Germany published their findings on the fossils in the *Journal of the Botanical Institute of Texas.*

The flowers themselves are in remarkable condition, as are many such plants and insects preserved for all time in amber. The flowing tree sap covered the specimens and then began the long process of turning into a fossilized, semi-precious gem. The flower cluster is one of the most complete ever found in amber and appeared at a time when many of the flowering plants were still quite small.

Even more remarkable is the microscopic image of pollen tubes growing out of two grains of pollen and penetrating the flower's stigma, the receptive part of the female reproductive system. This sets the stage for fertilization of the egg and would begin the process of seed formation -- had the reproductive act been completed.

"In Cretaceous flowers we've never before seen a fossil that shows the pollen tube actually entering the stigma," said George Poinar, Jr., a professor emeritus in the Department of Integrative Biology at the OSU College of Science. "This is the beauty of amber fossils. They are preserved so rapidly after entering the resin that structures such as pollen grains and tubes can be detected with a microscope."

The pollen of these flowers appeared to be sticky, Poinar said, suggesting it was carried by a pollinating insect, and adding further insights into the biodiversity and biology of life in this distant era. At that time much of the plant life was composed of conifers, ferns, mosses, and cycads. During the Cretaceous, new lineages of mammals and birds were beginning to appear, along with the flowering plants. But dinosaurs still dominated the Earth.

"The evolution of flowering plants caused an enormous change in the biodiversity of life on Earth, especially in the tropics and subtropics," Poinar said.

"New associations between these small flowering plants and various types of insects and other animal life resulted in the successful distribution and evolution of these plants through most of the world today," he said. "It's interesting that the mechanisms for reproduction that are still with us today had already been established some 100 million years ago."

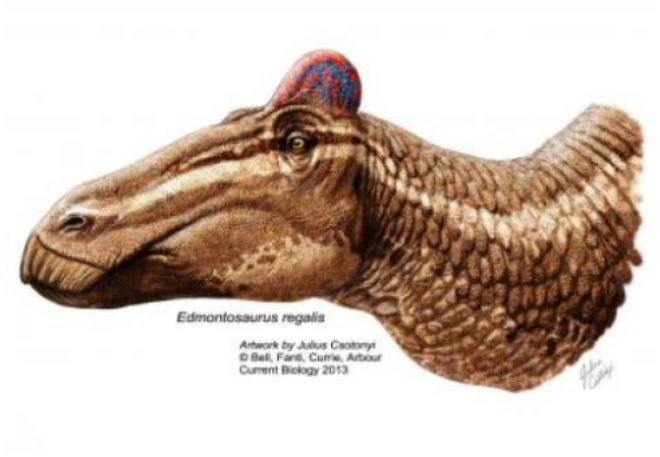
The fossils were discovered from amber mines in the Hukawng Valley of Myanmar, previously known as Burma. The newly-described genus and species of flower was named *Micropetasos burmensis*.

Story Source: The above story is based on materials provided by Oregon State University.

Journal Reference: George O. Poinar, Jr., Kenton L. Chambers, Joerg Wunderlich. **Micropetasos, a New Genus of Angiosperms Frommid-Cretaceous Burmese Amber**. *J. Bot. Res. Inst. Texas*, 7(2): 745 %u2013 750. 10 Dec 2013

Surprise: Duck-Billed Dinosaurs Had Fleshy Comb, Similar to Roosters' Crest

A rare, mummified specimen of the duck-billed dinosaur *Edmontosauraus regalis* described in the Cell Press journal *Current Biology* on December 12 shows for the first time that those dinosaurs' heads were adorned with a fleshy comb, most similar to the roosters' red crest.



This is an Edmontosaurus regalis reconstruction. (Credit: Artwork by Julius Csotonyi / Bell, Fanti, Currie, Arbour, Current Biology)

The most common dinosaurs in North America between 75 and 65 million years ago, duck-billed dinosaurs were gentle giants, about 12 meters long, and filled the same ecological role that kangaroos or deer play today. But no one had suspected that they -- or other dinosaurs, for that matter -- had fleshy structures on the tops of their heads.

"Until now, there has been no evidence for bizarre soft-tissue display structures among dinosaurs; these findings dramatically alter our perception of the appearance and behavior of this well-known dinosaur and allow us to comment on the evolution of head crests in this group," says Phil Bell from Australia's University of New England. "It also raises the thought-provoking possibility of similar crests among other dinosaurs."

The dinosaur specimen in question was found in deposits west of the city of Grande Prairie in west-central Alberta, Canada. Bell, along with Federico Fanti from the University of Bologna, Italy, knew they had something special when they found skin impressions on parts of the mummified body. But it wasn't until Bell put a chisel through the top of the crest that he realized they really had something incredible.

"An elephant's trunk or a rooster's crest might never fossilize because there's no bone in them," Bell explains. "This is equivalent to discovering for the first time that elephants had trunks. We have lots of skulls of *Edmontosaurus*, but there are no clues on them that suggest they might have had a big fleshy crest. There's no reason that other strange fleshy structures couldn't have been present on a whole range of other dinosaurs, including T. rex or Triceratops."

Of course, it's hard to tell what that cocks comb might have done for the duck-billed dinosaurs. In roosters and some other birds, bright red crests are a way to get the girls. "We might imagine a pair of male *Edmontosaurus* sizing each other up, bellowing, and showing off their head gear to see who was the dominant male and who is in charge of the herd," Bell says.

We may never know exactly, but the new study is a useful reminder of just how bizarre and amazing dinosaurs really were, the researchers say. There is much left to discover.

Story Source: The above story is based on materials provided by Cell Press, via EurekAlert!, a service of AAAS.

Journal Reference: Phil R. Bell, Federico Fanti, Philip J. Currie, Victoria M. Arbour. **A Mummified Duck-Billed Dinosaur with a Soft-Tissue Cock's Comb**. *Current Biology*, 2013; DOI: 10.1016/j.cub.2013.11.008

Oldest Large Body of Ancient Seawater Identified Under Chesapeake Bay

USGS scientists have determined that high-salinity groundwater found more than 1,000 meters (0.6 mi.) deep under the Chesapeake Bay is actually remnant water from the Early Cretaceous North Atlantic Sea and is probably 100-145 million years old. This is the oldest sizeable body of seawater to be identified worldwide.

Twice as salty as modern seawater, the ancient seawater was preserved like a prehistoric fly in amber, partly by the aid of the impact of a massive comet or meteorite that struck the area about 35 million years ago, creating Chesapeake Bay.

"Previous evidence for temperature and salinity levels of geologic-era oceans around the globe have been estimated indirectly from various types of evidence in deep sediment cores," said Ward Sanford, a USGS research hydrologist and lead author of the investigation. "In contrast, our study identifies ancient seawater that remains in place in its geologic setting, enabling us to provide a direct estimate of its age and salinity."

The largest crater discovered in the United States, the Chesapeake Bay impact crater is one of only a few oceanic impact craters that have been documented worldwide.

About 35 million years ago a huge rock or chunk of ice traveling through space blasted a 56-mile-wide hole in the shallow ocean floor near what is now the mouth of the Chesapeake Bay. The force of the impact ejected enormous amounts of debris into the atmosphere and spawned a train of gigantic tsunamis that probably reached as far as the Blue Ridge Mountains, more than 110 miles away.

The impact of the comet or meteorite would have deformed and broken up the existing arrangement of aquifers (water-bearing rocks) and confining units (layers of rock that restrict the flow of groundwater). Virginia's "inland saltwater wedge" is a well-known phenomenon that is thought to be related to the impact crater. The outer rim of the crater appears to coincide with the boundary separating salty and fresh groundwater.

"We knew from previous observations that there is deep groundwater in quite a few areas in the Atlantic Coastal Plain around the Chesapeake Bay that have salinities higher than seawater," said Jerad Bales, acting USGS Associate Director for Water. "Various theories related to the crater impact have been developed to explain the origin of this high salinity. But, up to this point, no one thought that this was North Atlantic Ocean water that had essentially been in place for about 100 million years."

"This study gives us confidence that we are working directly with seawater that dates far back in Earth's history," Bales continued. "The study also has heightened our understanding of the geologic context of the Chesapeake Bay region as it relates to improving our understanding of hydrology in the region."

The research study appears in the November 14 issue of the journal *Nature*.

Story Source: The above story is based on materials provided by **U.S. Geological Survey**.

Journal Reference: Ward E. Sanford, Michael W. Doughten, Tyler B. Coplen, Andrew G. Hunt, Thomas D. Bullen. **Evidence for high salinity of Early Cretaceous sea water from the Chesapeake Bay crater**. *Nature*, 2013; 503 (7475): 252 DOI: 10.1038/nature12714

And One Final Thought…

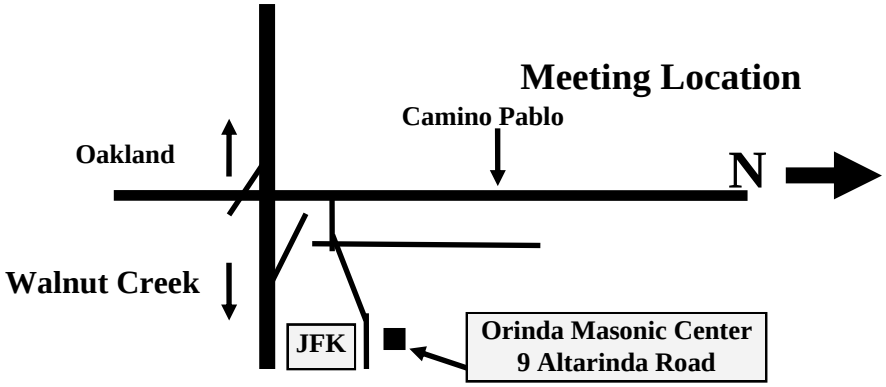
No matter which side of the debate you come down on, this is still worth repeating!

The American Medical Association has weighed in on Obama's new health care package. The Allergists were in favor of scratching it, but the Dermatologists advised not to make any rash moves. The gastroenterologists had sort of a gut feeling about it, but the Neurologists thought the Administration had a lot of nerve. Meanwhile, Obstetricians felt certain that everyone was laboring under a misconception, while the Ophthalmologists considered the idea shortsighted.

Podiatrists thought it was a step forward, but the Urologists were pissed off at the whole idea. Anesthesiologists thought the whole idea was a gas, and those lofty Cardiologists didn't have the heart to say no.

In the end, the Proctologists won out, leaving the entire decision up to some assholes in Washington.

But, the editor won't say who forwarded this final thought in order to protect the innocent!



Biography continued:

in earthquake processes and scaling laws, the development of modern broadband seismic and geophysical observatories on land and in the oceans. Among honors received, she was elected to the US National Academy of Sciences in 2005 and has recently been appointed to the chair of Physics of the Earth Interior at Collège de France in Paris.

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