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MEETING ANNOUNCEMENT

DATE: **March 27, 2013**

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. Greg Balco, Berkeley Geochronolgy Center**

Applications of cosmogenic-nuclide geochemistry to Earth surface processes

Dr. Balco will be giving an introduction to cosmogenic-nuclide geochemistry with some example applications to surface exposure dating of glacial and other deposits, erosion rate measurement, and "burial dating" of clastic sediments. Dr. Balco indicates that he will try to keep it fairly concise so that there will be plenty of time for questions. If past experience is any guide it is likely that one of the attractions of the talk is that many professional geologists have likely heard of this technique, are wondering if it's applicable to any of their work, and would be most interested in getting questions answered in that regards.

Speaker Biography: **Dr. Greg Balco** is a research scientist at the Berkeley Geochronology Center. Greg is a glacial geologist, geomorphologist, and geochemist focusing on applications of cosmogenic-nuclide geochemistry and low-temperature thermochronometry to Earth surface processes. He received a B.A, magna cum laude, at Williams College in Williamstown, MA; an M.S in geological sciences from the University of Maine; and an M.S. in Applied Mathematics and a Ph.D. from the University of Washington, Seattle; both in 2004. His thesis concerned Quaternary and glacial geology, surface processes, cosmogenic-nuclide geochemistry, quantitative geomorphology, and GIS applications in geology. He has received Fellowships from the U.S. National Science Foundation, the Fannie and John Hertz Foundation, DOSECC, the American Federation of Mineralogical Societies, ARCS, the Dean John A. Knauss Sea Grant Marine Policy, the National Science Foundation, and Conoco Corporation. He been on the Quaternary Geochronology editorial board, and conducted peer reviews for Science, Nature Geoscience, Earth and Planetary Science Letters, Geology, Geosphere, Quaternary Research, Quaternary Geochronology, Quaternary Science Reviews, Tectonics, Earth Surface Processes and Landforms, Journal of Geophysical Research, Journal of Quaternary Science, G-Cubed, Journal of Human Evolution,

…Continued on back….

NCGS 2012 – 2013 Calendar

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

April 19 to 25 April 2013 **No April NCGS Meeting!**
Pacific Section AAPG Convention
Information and Registration:
http://psaapg.org/upcoming-events/
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.

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/

Communicating Rocks: Writing, Speaking, and Thinking about Geology

By Peter Copeland, 2012
Upper Saddle River, NJ: Pearson Prentice Hall
[ISBN: 978-0-321-68967-2. 160 pages. US$41.67; softcover]

Review by Patrick Lufkin

Communicating rocks: writing, speaking, and thinking about geology is a concise handbook and style guide tailored to meet the geologist's specialized communication needs. It should prove valuable both to students and young scientists launching their careers and to seasoned professionals who want to become even more effective by honing their written and oral presentation skills.

Peter Copeland is a fellow of the Geological Society of America (GSA), and has been a professor in the Department of Earth Sciences at the University of Houston since 1990. During 2000-2004 he was editor of the GSA bulletin. Drawing on his experience working, teaching, and editing, Copeland argues that good scientific work requires not just asking questions and gathering data, but effectively communicating data and conclusions to others. Unfortunately, he says, "too many people who love rocks don't love writing about them or never learned the best way to do so"

Useful both as a handbook and as a reference, *Communicating Rocks* lays out what one needs to know, and makes the case for why it is important. In brief, Copeland argues, "communication equals thinking". If the communication is poorly done, you may hurt your reputation for knowing what you are talking about. Perhaps worse, he says, you may become less able to think clearly about your subject.

Copeland opens with practical advice for handling the main types of communication geologists must master for professional success. He covers writing abstracts, research proposals, and research results reports. Under proposal writing, he discusses the major proposal types—investigation (something needs a closer look), tool and technique development and testing, and hypothesis testing. For each writing task, he discusses pitfalls to avoid, and how to improve your chances of success.

As a style guide, *Communicating Rocks* includes a comprehensive alphabetized collection of short articles. While many of the usual English language usage issues are included, the coverage is heavily weighted toward topics and terms important to Earth science writing. One finds entries explaining terms and abbreviations, clarifying confusable terms ("crevice" vs. "crevasse," "terrane" vs. "terrain"), discussing commonly misused technical language, and explicating special interest topics such as the systems used to denote geologic time.

Copeland covers manuscript preparation—handling figures and so on—and offers advice on such things as citing professional affiliations and making acknowledgements following the scientific community's unique etiquette.

Moving beyond the "dos and don'ts," Copeland critiques an extensive set of examples of prose taken from the geological literature, showing how they could be improved.

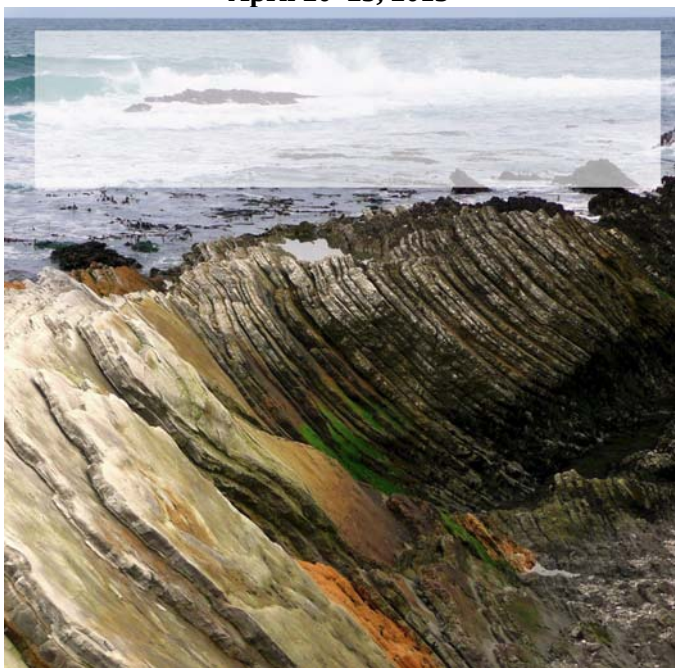
Because geological communication often takes the form of oral presentations—either PowerPoint talks or poster presentations—Copeland gives practical advice on organizing talks and speaking in public. He also gives nuts-and-bolts advice on such things as handling slides, picking fonts, and when to distribute handouts.

An interesting, eclectic reference section points the reader to geology papers, useful articles and books, and to a number of excellent guides to grammar, usage, and style.

Patrick Lufkin is a member of the Northern California Geological Society, and an Associate Fellow of the Society for Technical Communication. A modified version of this review originally appeared in the STC's quarterly journal, *Technical Communication*.

REGISTRATION IS OPEN!

2013 SPE Western Regional / Pacific Section AAPG Joint Technical Conference in Monterey, California; April 20–25, 2013



Please follow this link to the PSAAPG / SPE websites:

http://psaapg.org/upcoming-events/

https://sites.google.com/site/wnar2013/

Registration Fee goes up March 15

Portola Hotel Room Rates subject to increase after March 27

Short Course & Field Trip sign-up Deadline April 1

Conference Online Registration Deadline April 15

Garniss Curtis, pioneer of precision fossil dating, has died at 93

By Robert Sanders, UC Berkeley News Center, Media Relations | February 26, 2013

BERKELEY —

Geologist Garniss H. Curtis, a professor emeritus of earth and planetary science at the University of California, Berkeley, whose pioneering use of radioactive isotopes to date relatively young rocks provided the first solid timeline for human evolution, died Dec. 19* in Orinda, Calif., at the age of 93.

Curtis collaborated with late UC Berkeley professors John Reynolds, a physicist, and Jack Evernden, a seismologist, to take advantage of the radioactive decay

of potassium into argon in volcanic rock to determine how long ago the rock formed. Using this potassium-argon method, they established precise dates for recent geologic time periods that allowed Curtis to assign dates to fossilized human remains and prove they were much older than once thought.

Garniss Hearfield Curtis, professor emeritus of earth and planetary science

"Reynolds developed a precise way to date meteorites in the 1950s, but it was Garniss who adapted the technique to work on geological problems," said G. Brent Dalrymple, emeritus professor and former dean of the College of Earth, Ocean and Atmospheric Sciences at Oregon State University in Corvallis. He first met Curtis while obtaining his Ph.D. at UC Berkeley in the 1960s.

Since the late 19th century, radioactive isotopes such as uranium and potassium have been used to date billion-year-old rocks, but dating young rocks was a challenge because the radioactive decay products in such rocks are present in minuscule quantities. Using then-new ultra high vacuum systems combined with mass spectrometry, UC Berkeley researchers were finally able to count these atoms and provide precise dates on young rocks.

"Garniss was the first to show that you could date things younger than a couple of million years, and he teamed up with the Leakeys to date their finds in Olduvai gorge in Kenya," said Curtis's former student Paul Renne, now director of the Berkeley Geochronology Center, which Curtis founded. "His major contribution was putting numbers on the timescale of human evolution."

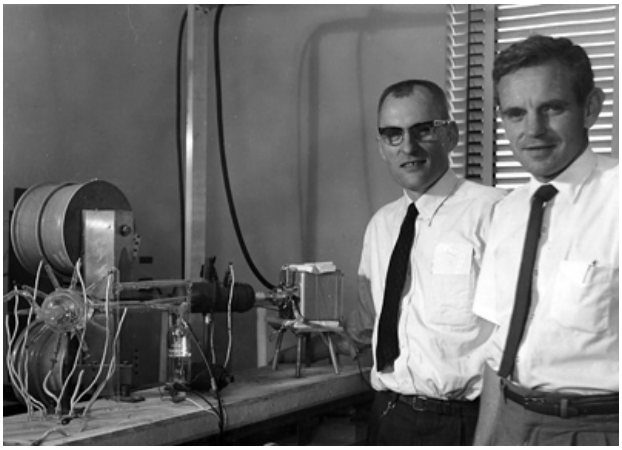
"This work formed the quantitative ground work for paleoanthropology and human evolutionary history by providing a set of 'clocks' with which to read and hence interpret past events in proper sequence," wrote geologist George Brimhall in a 1989 letter recommending Curtis for a Berkeley Citation, an honor bestowed by the chancellor for distinguished or extraordinary service to the university.

Java Man

Among Curtis's accomplishments was a discovery in the late 1990s with UC Berkeley geologist Carl Swisher that startled paleoanthropologists. They determined that the million-year-old human ancestor *Homo erectus* survived in Asia until some 50,000 years ago, meaning that this hominid species and modern humans, *Homo sapiens*, coexisted. The idea that humans did not evolve along one single lineage, but instead, branched off into ancestors that included some dead ends, with only modern humans surviving to the present, is well established today.

The story of this discovery and its implications was detailed in the 2001 book "Java Man: How Two Geologists Changed Our Understanding of Human Evolution," by Swisher, Curtis and writer Roger Lewin.

Once he had adopted Reynolds' techniques, Curtis "was always coming up with ideas about new things to date, from geological periods to glaciation," Dalrymple said. He would seek out colleagues with fossils from eras he was interested in and then date the volcanic rocks above and below the remains' deposits to assign a precise date.



Garniss Curtis (right) and Jack Everndon with a mass spectrometer they used to determine the age of rocks, ca. 1960. Photo by J. Hampel/UC Berkeley

In 1960, for example, Curtis and Evernden rocked the anthropological world when they used the potassium-argon method to establish the 1.85 million year age of Mary Leakey's 1959 Olduvai Gorge fossils of the early human ancestor Zinjanthropus, pushing back the then-accepted age of the Pleistocene by 1 million years.

Upon his retirement in 1989, Curtis joined paleoanthropologist Donald Johanson at the Institute of Human Origins in Berkeley, where Curtis established a geochronology laboratory to continue his work with potassium-argon dating and a refinement called argon-argon dating. He and his colleagues provided dates for Johanson's discoveries of human ancestors in Africa, as well as for discoveries by Mary and Richard Leakey and UC Berkeley paleoanthropologist Tim White. The Berkeley Geochronology Center, as the laboratory was

called, became independent of the institute in 1994, and is today one of the top laboratories for dating in the world.

Curtis's friendship with philanthropists Gordon and Ann Getty ensured continued support for the center after the institute and Johanson left for Arizona in 1997.

"Ann and I met Garniss in the mid-1970s at Leakey meetings, and we became close friends and sometimes vacationed together," said Gordon Getty. "I remember him at Machu Picchu a few years ago, hiking before we woke and spry as a mountain goat. A heck of a scientist, and a heck of a man."

From volcanoes to radioactive dating

Curtis was born on May 27, 1919, in San Rafael, Calif. He was originally christened Chester Alphonse Kemp, but upon his parents' divorce, his mother changed his name to Garniss Hearfield Kemp. He later took the surname Curtis after his stepfather. He obtained his B.Sc. in mining engineering from UC Berkeley in 1942. Following stints as a geologist for the Christmas Copper Corp. and Shell Oil Co., he returned to UC Berkeley to complete his Ph.D. in geology in 1951. He immediately joined the geology faculty.

Curtis initially focused on volcanoes and conducted seminal studies in the Valley of Ten Thousand Smokes in Alaska and in the Sutter Buttes in California's Central Valley. He also helped delineate faults and evaluate earthquake hazard potential in the San Francisco Bay Area. His interest in the age of lava flows led him into radioactive dating.

He was admired for mentoring students as well.

"Garniss was supportive, a mentor and an all-around nice guy; a wonderful man who treated everybody well," Dalrymple said.

Among his honors was the Newcomb Cleveland Award of the American Association for the Advancement of Science.

According to his daughter Penelope Curtis, he was an avid hiker, birder and fly fisherman, and loved classical music, opera and accompanying friends to explore the geology of the mountainous areas of South America and Asia.

Curtis is survived by his brother Ralston Curtis, daughters Penelope Curtis of Grass Valley and Ann Pierpont Curtis of Orinda, son Robin Hearfield Curtis of San Rafael, Calif., seven grandchildren and five great-grandchildren. His wife of 45 years, Dorette Davis Curtis, died in 1987.

A memorial is planned for the spring. Donations in Curtis's memory can be made to the Berkeley Geochronology Laboratory, the California Audubon Society or The Nature Conservancy.

* The original obituary incorrectly stated the date of Curtis's death. He died the morning of Dec. 19, 2012.

Earthquake deaths predicted to soar

David Perlman
February 26, 2013

With populations growing in the world's earthquake-prone regions, catastrophic quakes will kill more people during this century than ever before, scientists at the U.S. Geological Survey warn.

Thomas L. Holzer, an engineering geologist at the survey's Menlo Park offices, and James Savage, a retired survey seismologist, estimate that 21 earthquakes with death tolls greater than 50,000 - the kind they term "catastrophic" - will occur around the world before the end of this century, while only seven such killer quakes were recorded during the 20th century.

"It's not that we're having more earthquakes, it's that more people are living in seismically vulnerable buildings in the world's earthquake zones," Holzer said.

Earthquake fatalities around the world will reach at least 3.5 million in the 21st century - more than double the 1.5 million in the 20th century, the scientists forecast.

"And unless we take this issue of vulnerable buildings seriously, we're going to see even more catastrophes before the end of this century," Holzer said.

The current century began "most ominously," the scientists noted, when at least 700,000 people died in just seven deadly quakes within the first 10 years - an unprecedented decade of catastrophe, they reported.

The scientists based their forecast on U.N. estimates that the world's population will reach 10 billion by the end of this century. They combined that number with historic records of earthquake-prone regions where building standards are known to be weakest. Fatalities from major quakes have been estimated as far back as A.D. 1500, and modern records of quake deaths are known to be reasonably accurate.

"California and Japan have shown slow progress in designing quake resistance in their buildings," Holzer noted. "But in countries like China and Iran, and all along the front region of the Himalayan range, entire cities from Kathmandu to Delhi are particularly vulnerable to catastrophic quakes."

Their statistical study is published in the current issue of Earthquake Spectra, the journal of the Earthquake Engineering Research Institute, a national organization operating out of Oakland.

"There is no question that we are currently seeing a rapid increase in the number of catastrophes from earthquakes," said Richard Allen, director of UC

Berkeley's Earthquake Engineering Laboratory, who was not involved in the study. "Therefore, we should not be complacent about the earthquake risks we face in the coming decades and ensure that we are taking reasonable actions to push back on the increasing trend in the number of fatalities."

The study, "Global Earthquake Fatalities and Population," is available online.

Read more:

http://www.sfgate.com/science/article/Earthquake-deaths-predicted-to-soar-4310954.php#ixzz2MJsaMUoA

Has fabled Viking sunstone been found?

By Raphael Satter

Researchers claim that a crystal found in a shipwreck at the bottom of the English Channel may be a secret tool that helped early seafarers navigate without compasses.

A rough, whitish block recovered from an Elizabethan shipwreck may be a sunstone, the fabled crystal believed by some to have helped Vikings and other medieval seafarers navigate the high seas, researchers say.

In a paper published earlier this week, a Franco-British group argued that the Alderney Crystal — a chunk of Icelandic calcite found amid a 16th-century wreck at the bottom of the English Channel — worked as a kind of solar compass, allowing sailors to determine the position of the sun even when it was hidden by heavy cloud, masked by fog, or below the horizon.

That's because of a property known as birefringence, which splits light beams in a way that can reveal the direction of their source with a high degree of accuracy. Vikings may not have grasped the physics behind the phenomenon, but that wouldn't have presented a problem.

"You don't have to understand how it works," said Albert Le Floch, of the University in Rennes in western France. "Using it is basically easy."

Vikings were expert navigators, using the sun, stars, mountains and even migratory whales to help guide them across the sea, but some have wondered at their ability to travel the long stretches of open water between Greenland, Iceland, and Newfoundland in modern-day Canada.

Le Floch is one of several who've suggested that calcite crystals were used as navigational aids for long summer days in which the sun might be hidden behind the clouds. He said the use of such crystals may have persisted into the 16th century, by which time magnetic compasses were widely used but often malfunctioned.

Le Floch noted that one Icelandic legend, the Saga of St. Olaf, appears to refer to such a crystal when it says that Olaf used a "sunstone" to verify the position of the sun on a snowy day.

But that's it. Few other medieval references to sunstones have been found, and no such crystals have ever been recovered from Viking tombs or ships. Until the Alderney Crystal was recovered in 2002, there had been little if any hard evidence to back the theory.

Many specialists are still skeptical. Donna Heddle, the director of the Center for Nordic Studies at Scotland's University of the Highlands and Islands, described the solar compass hypothesis as speculative.

"There's no solid evidence that that device was used by Norse navigators," she said Friday. "There's never been one found in a Viking boat. One cannot help but feel that if there were such things they would be found in graves."

She acknowledged that the crystal came from Iceland and was found near a navigation tool, but said it might just as easily have been used as a magnifying device as a solar compass.

Le Floch argued that one of the reasons why no stones have been found before is that calcite degrades quickly. It's vulnerable to acid, sea salts, and to heat. The Alderney Crystal was originally transparent, but the sea water had turned it a milky white.

Le Floch's paper — written with Guy Ropars, Jacques Lucas, and a group of Britons from the Alderney Maritime Trust, appeared Wednesday in the Proceedings of the Royal Society A.

Theory of Crystal Formation Complete Again

Exactly how a crystal forms from solution is a problem that has occupied scientists for decades. Researchers at Eindhoven University of Technology (TU/e), together with researchers from Germany and the USA, are now presenting the missing piece. This classical theory of crystal formation, which occurs widely in nature and in the chemical industry, was under fire for some years, but is saved now. The team made this breakthrough by detailed study of the crystallization of the mineral calcium phosphate -the major component of our bones.

The team recently published their findings in the online journal *Nature Communications*.

Crystallization is the formation of a solid ordered substance, such as happens when water freezes. In nature, crystals are mostly formed from ions which are dissolved in water, as for example in the formation of shells or bone. This involves the clustering of ions into increasingly large nuclei, until a crystal is formed when a certain size is reached. However, the details of this growth process have been the subject of discussion for many years.

Apatite, a form of calcium phosphate and the major component of bone. (Credit: Copyright Eindhoven University of Technology/Wouter Habraken.)

According to the existing theories, it is individual ions that group together to form crystal nuclei. But in 2009 chemists led by dr. Nico Sommerdijk (TU/e) showed the presence of an intermediate step in the growth process of calcium carbonate crystals. The ions were thought to first form small clusters, which then grow into crystal nuclei. This finding, which was the cover story of *Science*, caused controversy because it appeared to contradict the classical crystallization theories which did not allow for such an intermediate step.

Now Sommerdijk is having second thoughts about his 2009 conclusions. At least, the answer now turns out to be more subtle than was thought at that time. Together with researchers from the Max Planck Institute in Germany and the Lawrence Berkeley National Laboratory in the USA, he looked more closely at the role of these so-called pre-nucleation clusters in the growth process of the mineral calcium phosphate. Using a cryo-electron microscope, which makes images of deep-frozen samples, he was able to identify the precise components of the clusters and study the growth process in detail.

In their article in *Nature Communications* Sommerdijk concludes that the clusters do not form a clearly defined intermediate step, but instead are part of a gradual growth process. Sommerdijk refers to the formation of clusters as a 'false start' by the ions, because the clusters already start to organize themselves step by step while still in solution, without actually forming growth nuclei. This new understanding means the existing theories no longer need to be overturned. Sommerdijk's team now complete the theory by describing alternative 'pathways' along which crystals can form. Sommerdijk's new conclusions have since been confirmed in a second study into crystal formation in the mineral magnetite, which was published online this month in *Nature Materials.*

In recent years both the role and the composition of the pre-nucleation clusters were the subject of intense scientific discussions, for example last summer during the Faraday Discussions. There were also disagreements within the team itself about Sommerdijk's new interpretation. Some team members held onto the original scenario, even after numerous new experiments had confirmed that the clusters did not have the same composition and role as believed earlier. Finally it was decided to submit the article, which after four years of experimenting and revision had reached a final length of almost 100 pages, without the names of the team members who were unable to accept the new ideas.

In Sommerdijk's view the most important questions about the formation of crystals have now been answered. This theoretical knowledge is important in many fields, because of the widespread occurrence of crystallization in nature and in the

chemical industry. Just a few examples are the formation of coral in the sea, the production of pharmaceuticals and the design of nanoparticles. It could for example help to make production processes less costly, faster or more energy-efficient.

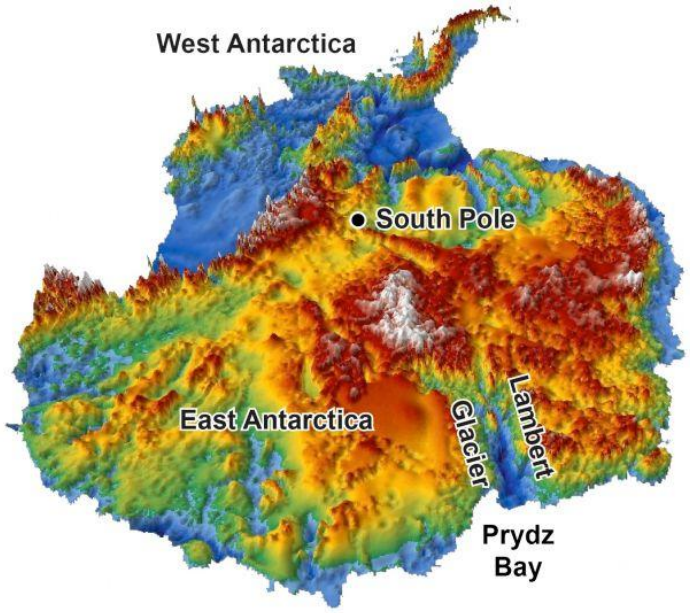
Story Source: The above story is reprinted from materials provided by Eindhoven University of Technology, via EurekAlert!, a service of AAAS.

Journal References: Jens Baumgartner, Archan Dey, Paul H. H. Bomans, Cécile Le Coadou, Peter Fratzl, Nico A. J. M. Sommerdijk, Damien Faivre. **Nucleation and growth of magnetite from solution**. *Nature Materials*, 2013; DOI: 10.1038/nmat3558

Wouter J. E. M. Habraken, Jinhui Tao, Laura J. Brylka, Heiner Friedrich, Luca Bertinetti, Anna S. Schenk, Andreas Verch, Vladimir Dmitrovic, Paul H. H. Bomans, Peter M. Frederik, Jozua Laven, Paul van der Schoot, Barbara Aichmayer, Gijsbertus de With, James J. DeYoreo, Nico A. J. M. Sommerdijk. **Ion-association complexes unite classical and non-classical theories for the biomimetic nucleation of calcium phosphate**. *Nature Communications*, 2013; 4: 1507 DOI: 10.1038/ncomms2490

The Making of Antarctica's Hidden Fjords

Antarctica's topography began changing from flat to fjord-filled starting about 34 million years ago, according to a new report from a University of Arizona-led team of geoscientists.



This 3-D reconstruction of the topography hidden under Antarctica's two-mile-thick coating of ice was made using data from radar surveys. Glaciers started carving Antarctica into the current mountain-and-fjord landscape 34 million years ago, according to new findings from UA geoscientist Stuart N. Thomson and his colleagues. (Credit: Image courtesy of Stuart N. Thomson/UA department of geosciences)

Knowing when Antarctica's topography started shifting from a flat landscape to one with glaciers, fjords and mountains is important for modeling how the Antarctic ice sheet affects global climate and sea-level rise.

Although radar surveys have revealed a rugged alpine landscape under Antarctica's two-mile-thick ice sheet, the surveys tell nothing about when the continent's deep valleys formed.

"We have worked out how the landscape under the ice has changed through time," said lead author Stuart N. Thomson.

"People have speculated when the big fjords formed under the ice," he said. "But no one knows for sure until you sample the rocks or the sediments."

He and his colleagues sampled East Antarctica's rocks by examining the sediments that built up off-shore for millions of years as rocks and dirt eroded off the continent into Prydz Bay.

"We use the sediments to trace what was happening under the ice in the past," said Thomson, a research scientist in the UA department of geosciences.

The team found that between 250 and 34 million years ago, erosion from the region now covered by the huge Lambert Glacier was slow, suggesting the area was relatively flat and drained by slow-moving rivers.

About 34 million years ago, at the same time the climate shifted and Antarctica was becoming covered with ice, the rate of erosion more than doubled, Thomson said.

"The only way that could happen is from glaciers," he said. "They started grinding and forming deep valleys."

Co-author Peter W. Reiners, a UA professor of geosciences, said, "East Antarctica's landscape changed dramatically when big glaciers appeared there.

"Glaciers can carve deep valleys quickly -- and did so on Antarctica before it got so cold that the most

of it got covered by one or two miles of thick, stationary ice."

The team's paper, "The contribution of glacial erosion to shaping the hidden landscape of East Antarctica," is published in the March issue of *Nature Geoscience*.

Other co-authors are Sidney R. Hemming of Columbia University's Lamont-Doherty Earth Observatory in Palisades, N.Y. and UA geoscientist George E. Gehrels. The National Science Foundation funded the research.

Geologists generally figure out a landscape's history by hiking around to look at the area's rocks and then toting some of them back to the lab for analysis.

"The trouble is, in Antarctica, 97 percent of the continent is covered in ice, and you can't directly access the rocks," Thomson said.

To reconstruct the history of East Antarctica's landscape, he and his colleagues instead studied bits of Antarctic rocks from cores of sediment taken just offshore of the Lambert Glacier by the Ocean Drilling Program.

The team used 1,400 individual sand-sized grains of minerals from various locations throughout three different cores to figure out how quickly the surface of Antarctica had eroded at various times in the past.

Because other researchers had used microfossils to pinpoint when in geological time each layer of the core had been deposited, Thomson and his colleagues knew when each of those 1,400 samples had been washed from Antarctica's surface into the sea.

To link a time in the landscape's history to an erosion rate, geologists can use the "cooling age" of rocks. The cooling age tells how fast the rock was uncovered from a particular depth in the Earth.

As a rock is moved deeper into the Earth, it warms, and as it moves toward the surface of the Earth, it cools. A particular depth in the Earth corresponds to a particular temperature. Minerals in the rock, apatite and zircon, record when they were last at a certain depth/temperature.

For each of the 1,400 samples, Thomson and his UA colleagues used three independent dating techniques to see how fast the mineral grain was exposed by erosion. Thomson's lab did the fission-track dating; Reiners' lab did the uranium-thorium-helium dating; and Gehrels' lab did the uranium-lead dating.

The different methods of analysis all point to the same answer.

Reiners said, "We can say when and in what way this mysterious sub-ice landscape changed and how. East Antarctica's landscape changed dramatically when big glaciers appeared there."

Knowing how the ice sheets changes in the past is important for predicting future changes in ice sheet growth, sea-level change and climate, Thomson said.

His next step is looking offshore in other regions of Antarctica to see if they show the same pattern.

Story Source: The above story is reprinted from materials provided by University of Arizona. The original article was written by Mari N. Jensen, College of Science.

Journal Reference: Stuart N. Thomson, Peter W. Reiners, Sidney R. Hemming, George E. Gehrels. **The contribution of glacial erosion to shaping the hidden landscape of East Antarctica**. *Nature Geoscience*, 2013; 6 (3): 203 DOI: 10.1038/ngeo1722

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS DINNER MEETING

"RESULTS FROM THE MARS SCIENCE LABORATORY ROVER CURIOSITY's GEOLOGICAL INVESTIGATIONS OF THE SURFACE OF MARS"

Speaker

Dr. David F. Blake, Principal Investigator

Mars Science Laboratory Rover Curiosity

NASA Ames Research Center

Wednesday May 29, 2013

6:00 PM at Orinda Masonic Center

(Reservations are required by May 24, 2013, Limit 100 persons)

We are sorry but we will not be able to accommodate "walk-ins"

Stepping out of our normal routine, the **Northern California Geological Society** is pleased to announce this *special dinner and evening* with **Dr. David Blake**. For this unique event, planned for our normal monthly meeting date, but starting one-half hour early, we are planning in typical NCGS style, a **Back Forty Texas BBQ dinner consisting of Pork Ribs and BBQ Chicken, Tossed Green Salad, BBQ Beans, Fresh Corn Cobettes. For vegetarian dinners a deluxe veggie burger will be served in place of BBQ. Desert will include assorted cookies and brownies. We may be again serving wines from California specials (90 pts +).** Please also note that a vegetarian option is available if notified ahead (please see the registration form below).

Abstract: Geological Investigations of the surface of the Mars

One of the principal goals of the Mars Science Laboratory rover Curiosity is to identify and characterize the early habitable environments of Mars, as recorded in the stratified rocks and soil of Gale crater. The suite of instruments aboard Curiosity will make measurements useful for determining the presence and lateral/vertical distribution of hydrated phases, the mineralogy and "preservation potential" of sediments and rocks, and the identity and isotopic composition of volatiles, organics, and other carbon-containing molecules, should they be present.

Curiosity's mast and arm instruments allow it to perform essentially the same functions as a field geologist would on Earth. Once a location is characterized, Curiosity's sample acquisition system can deliver samples of rock or soil to the "laboratory" instruments CheMin and SAM. CheMin, a powder X-ray Diffraction /X-ray Fluorescence (pXRD/XRF) instrument, determines the quantitative mineralogy of scooped soils and powders obtained from drilled rocks. Hydrated minerals can be identified, along with whole-rock mineralogy for characterizing the environment of formation and preservation potential for organic molecules. SAM consists of a gas chromatograph – mass spectrometer (GC-MS), and a tunable laser spectrometer (TLS). SAM will accept the same powdered rock and soil samples as CheMin, and will identify and measure trace organic carbon, as well as the elemental and isotopic composition of volatiles released during heating.

The overall progress of the mission, as well as mineralogical results from an analysis of the soil of an aeolian bedform ("Rocknest soil") and from a drilled bedrock sample ("Yellowknife Bay") will be described.

Speaker Biography:

Dr. David Blake is the Principal Investigator of the CheMin XRD/XRF instrument on the Mars Science Laboratory rover Curiosity, and is a member of the Principal Science Group that directs the activities of Curiosity during its 2-year mission.

He came to Ames Research Center as a NRC postdoctoral fellow, and became a research scientist in the Exobiology Branch at Ames in 1989. He was the Exobiology Branch Chief from 2000-2004. In nearly 25 years of research at Ames, he has studied astrophysical ices, interplanetary dust, Mars meteorites, lunar soils and stratopheric roots. He received a B.S.in Biological Sciences from Stanford University in 1973. After a stint in the US Navy, he attended graduate school at the University of Michigan, where he received a PhD in Geology & Mineralogy in 1983.

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

Meeting Details: Social Hour: 6:00 – 7:00 pm; Dinner: 7:00 – 8:00 pm **Presentation**: 8:00 – open

Time: May 29, 2013, 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA. **Cost**: **$25/person**

**********REGISTRATION FORM (Dr. David Blake's Dinner) **********

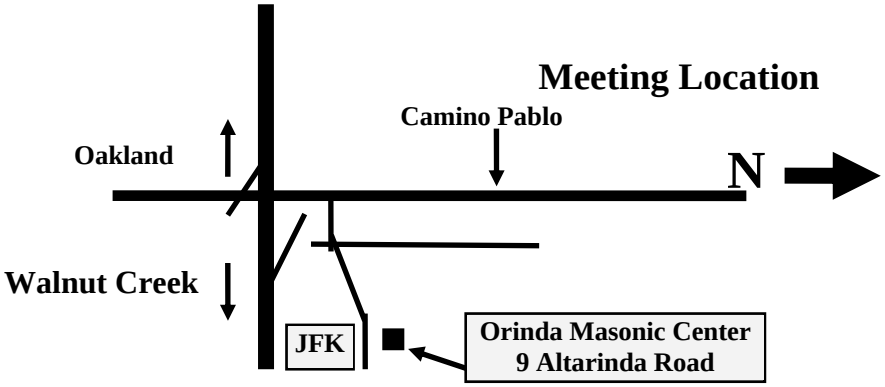
Name:_____ E-mail:_____

Phone (day):_____ Phone (cell) _____

Dinner: Regular:_____ Vegetarian: _____ (Please check one) Check Amount:

Please mail a check made out to **NCGS** to: **Tridib Guha**
5016 Gloucester Lane
Martinez, CA 94553

Questions: e-mail: tridibguha@yahoo.com Phone: (925) 451-1999



Speaker Biography (continued): Geophysical Research Letters, and Geological Society of America Bulletin. He has been cited for excellence in reviewing by EPSL and JGR-Earth Surface. He has been at the Berkeley Geochronology Center since 2007.

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