NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **November 18, 2009** **EARLY DATE!!**

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

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

SPEAKER: **Dr. Robert Dahlgren, Adjunct Professor,** Department of Physics & Astronomy, San Jose State University, San Jose, CA

Air Ionization at Rock Surfaces and Pre-Earthquake Signals

Pre-earthquake signals have been widely reported, including perturbations in the ionosphere. These precursory signals, though highly diverse, may be caused by just one underlying physical process: activation of highly mobile electronic charge carriers in rocks that are subjected to ever increasing levels of stress. The charge carriers are defect electrons associated with O^{-} in a matrix of O^{2-}. Known as positive holes or pholes $h^{\bullet}$, they flow out of the stressed rock into the unstressed rock volume, traveling meters in the laboratory, probably kilometers in the field. At the rock-air interface they cause: (i) positive surface potential, (ii) field-ionization of air molecules, (iii) corona discharges. The rate of formation of airborne ions can exceed 10^{9} cm^{-2} sec^{-1}. Massive air ionization prior to major earthquakes increases the electrical conductivity in the air column and may cause ionospheric perturbations, earthquake lights, and unusual animal behavior as well as infrared emission.

Biography: Unfortunately we do not have a biography for **Dr. Dahlgren**, so you'll need to attend the meeting to get these details! We do know that he is working with **Dr. Friedemann T. Freund**, who was planning on giving the presentation until conflicts developed. Dr. Freund is with NASA Ames Research Center, Earth Science Division at Moffett Field. Dr. Freund is also an Adjunct Professor, Department of Physics, San Jose State University, San Jose, and Principal Investigator at the Carl Sagan Center, SETI Institute, Mountain View, CA. Dr. Freund came to NASA Ames in 1985 after a 20-year career as professor in Germany at the universities of Göttingen and Cologne. His field of interest started with defects in crystals. This led him to questions related to the origin of Life and, as a spin-off, to the physics of pre-earthquake signals.

NCGS 2009 – 2010 Calendar

Have You Renewed Your Membership??
For a copy of the renewal form, please see your September Newsletter, or go to our website.

Wednesday November 18, 2009
EARLY DATE!!
Massive Ionization at the Air-to-Ground Interface as Possible Pre-Earthquake Indicator – **Dr. Robert Dahlgren**, Department of Physics & Astronomy, San Jose State University, San Jose
7:00 pm at Orinda Masonic Lodge

December 2009 - As usual no meeting!

Wednesday January 27, 2010
The Earthquake of 1868 and the Birth of Seismically Resistant Architecture in California
Dr. Stephen Tobriner, Professor Emeritus of Architecture, UC Berkeley
7:00 pm at Orinda Masonic Lodge

Wednesday February 24, 2010
TBA
7:00 pm at Orinda Masonic Lodge

Wednesday March 31, 2010
TBA
7:00 pm at Orinda Masonic Lodge

Upcoming NCGS Field Trips

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 John Christian at: **jmc62@sbcglobal.net**.

Peninsula Geologic Society

Upcoming meetings

For an updated list of meetings, abstracts, and field trips go to http://www.diggles.com/pgs/. The PGS has also posted guidebooks for downloading, as well as photographs from recent field trips at this web address. Please check the website for current details, they were not yet posted at press time.

- Dec. 1, 2009, ***Rupturing Continental Lithosphere in the Main Ethiopian Rift: A Hot Plume Meets a Cold Craton***, Simon Klemperer, Stanford University. Dinner in Hartley(?), lecture in Geology Corner (Braun Hall Room 105)
- Jan. 12, 2010, Dr. Brian Hausback, California State University, Sacramento, Brian will be talking about the Sutter Buttes.

Association of Engineering Geologists San Francisco Section

Upcoming meetings

Meeting locations rotate between San Francisco, the East Bay, and the South Bay. Please check the website for current details:
November 19, 2009 at 6:00 pm
Spenger's Fresh Fish Grotto, 1919 Fourth Street, Berkeley
CALIFORNIA PARK HILL TUNNEL: A Multi-Modal Transportation Project,
David Crouthamel and Erin Hohenshelt
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. The speakers are encouraged to thoroughly explain the subject matter being presented, and to define any words or terms that may be unfamiliar to those not having a background or familiarity with the material being presented.

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 our speakers. Also, the November and December lectures are scheduled earlier in the month to avoid conflicting with speaker and customer plans during the holiday season

Lectures are held at the USGS Menlo Park Science Center in Building 3, 2nd floor conference room A, Menlo Park, California. Click on Campus Map for building location and directions.
Upcoming Public Lecture Schedule
November 19 -- Geohazards in the Aleutian Islands -- Great Earthquakes, Great Waves, and Great Volcanic Explosions!
A discussion of Aleutian Island earthquake history, the generation of large earthquakes in that region, and resultant tsunamis affecting Pacific Basin shoreline areas, presented by USGS geologists Steve Kirby and David Scholl
December 10 -- The new and improved online version of The National Map by Mark DeMulder

Milestones to Note – Tridib Guha

We have received word that NCGS Councilor and Field Trip Coordinator Extraordinaire Tridib Guha has been a member of AAPG for 30 years! Next time you see Tridib, don't forget to congratulate him on achieving this milestone! And don't forget to thank him for all of those NCGS field trips, including his most recent endeavor, The Bay Bridge Tour!!

NCGS Gold Country Field Trip

Lead by Ross Smith
Report by Anne Sanquini

Introduction

Over twenty five "NCGS miners" headed for the Gold Country June 13th and 14th, 2009, to trace the Mother Lode, a zone of gold-bearing quartz veins, from Placerville to Mariposa.

The Mother Lode, which runs along beautiful Highway 49 in the Sierra foothills, is known geologically as the Melones Fault. It is considered to be a crustal suture separating continental rocks of the Shoo Fly and Calaveras Complexes to the east from oceanic rocks, including the Mariposa Formation, to the west.

Our trip leader, Ross Smith, enjoyed a 30-year career in international oil exploration. For the past 10 years, he has been a precious minerals consulting geologist. Ross provided each of us with a 35-page field trip guide that includes several maps, a road log with descriptions of each feature and ideas for subsequent visits to the area.

Day One: Gold Bug and Kennedy Mines

We left a drizzly bay area, and headed east on Highway 80, then Highway 50 to Placerville, home of the Gold Bug mine. The mine entrance is a drift, indicating that this mine is drilled horizontally. A self-guided tour took us 350 feet into the drift.

After quartz ore is drilled, blasted and taken out of the mine, it goes to stamp mill, the next stop on our tour, for crushing. The local guide started up a small-scale version of the mill for us, and even that was loud enough to be able to understand how miners often lost their hearing working under these conditions.

Figure 1. "NCGS miners" at the Kennedy Mine. Trip leader Ross Smith is in the center on the lawn. The mine headframe is in the background.

Following the tour and optional gold panning in the local trough, we had lunch at picnic tables by the creek. The sun came out and weather for the rest of the trip was lovely.

The NCGS miners chased the quartz vein south on Hwy 49 through the towns of El Dorado, Drytown (which apparently was anything but), Amanor City and Sutter Creek. Along the way, we noted geomorphic evidence of the Melones fault, and the locations of old mines.

At the Kennedy Mine near Jackson, famous for being one of the deepest mines in the country at almost 6,000 feet, we were given a very informative presentation and tour by one of the volunteer docents, Al Sklensky.

Al walked us through a diagram of the mine that includes the fault location and the date each level opened as the mine operators pursued gold-laden quartz veins deeper and deeper into the earth. Beneath the 125-foot steel headframe, there are large skips used to transport men and equipment down into the mine. The same skips brought out the ore and also carried out about 70,000 gallons of water each night from lower mine levels.

We overlooked a field of huge stamp mills. Here, quartz ore is pounded into fine particles that are sent over mercury-coated plates. The mercury binds with the gold, forming an amalgam. Next was a trip up to the mine office, where the retort process is done, converting the amalgam to gold ingots.

Figure 2. Inspecting a "jaw crusher" at the Kennedy mine.

The Kennedy mine was operational until 1942, when all mines were closed to free up labor for the war effort. During its operation, it produced $34,280,000 of gold. See http://www.kennedygoldmine.com/ for more information.

Figure 3. The retort room, where the amalgam of gold and mercury was converted into solid gold ingots for shipment to San Francisco.

Barbeque dinner, origin of gold

Just past Angels Camp, the group pulled into the Glory Hole Recreation area. Dinner was barbequed chicken, grilled corn on the cob and macaroni salad. Thank you to Rob Nelson's mom for marinating the chicken and making the salad. All scrumptious.

After dinner, as twilight was falling, Ross gave us a talk on the origin and occurrence of gold.

Figure 4. BBQ at the campsite. Perfect weather, view over the New Melones Lake, on the Stanislaus River.

How gold formed:

Shortly after the big bang, about 13.5 billion years ago, hydrogen was formed. Stars process hydrogen as fuel towards heavier elements, up to iron. Since iron is at the peak of nuclear binding activity, the fusion process stops there. However, big stars can end their lives with a supernova explosion and during such an explosion, heavy elements such as gold are made.

Where gold is found:

Along mid-ocean ridges, "black smoker" vents discharge mineral-laden very hot water. These gold-bearing fluids migrate into rocks of the oceanic crust. The crust travels via plate tectonics until it meets its fate and is subducted. As the down-going oceanic plate reaches great depths, dewatering occurs, releasing mineral-rich fluid. These fluids move upwards, following pathways formed by faults and fractures. When this fluid reaches the level of 1-3 kbars and cools to 300 to 500°C it is at the precious minerals horizon, where gold and other minerals precipitate along with quartz. Gold mining along the Mother Lode essentially consists of chasing these quartz veins.

Day Two: Quarries, Placer Deposits and the California State Mineral Museum

The group was on the road by 7:30, headed for Carson Hill, one of the richest areas along the Mother Lode. Here, gold is found in auriferous schist on the sides of the quartz veins. We stopped at the Carson Hill Mine. Reopened about 20 years ago, the mine operates as a "decorative rock" quarry that also happens to have ancillary gold production.

South of Tuttletown, the group pulled off the road at what appeared to be simply small fields of big limestone boulders. In fact, this is the exhumed Columbia limestone karst topography of the Calaveras Formation. Gold is heavy, durable and chemically stable. It erodes from the surrounding mountains and is transported by water. In this area it made its way to the potholes and crevices of irregularly eroded limestone. Between 1853 and 1870, about $55,000,000 in gold was excavated by hand within an area of about a one mile radius from this field stop.

Piles of rounded boulders curiously line some sections of Highway 49. We stopped at Moccasin Creek to understand why. The specific gravity of gold is 19.3 g/cm^3; for sand and gravel only 2.6. Gold migrates to the lowest point in an area, often a streambed, where it settles at the bottom. The most obvious way to get at it is to redirect the stream if needed, then manually take out every single rock, dig up all the sediments, and scoop up the thin layer of gold.

Figure 5. Mystery of the displaced rounded rocks.

At the Mariposite Quarry, owner Louis Bickford greeted us. The mineral mariposite is a green chromium mica formed by the alteration of serpentine by hydrothermal fluids. The rock of the same name includes quartz and brown ankerite, a carbonate.

Louis led us on a beautiful hike about a mile up the mine road past a drift mine and large serpentinite outcrops. We were allowed to climb all around the area, rock hammers swinging, and collect hand samples.

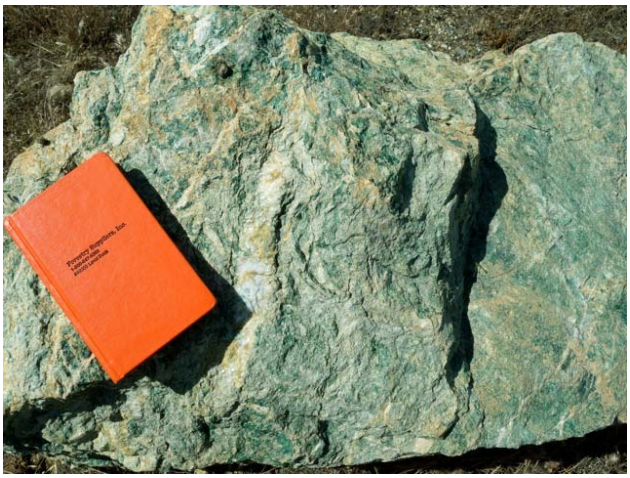


Figure 6. Mariposite Quarry specimen

Our mariposite treasures safely stowed, the successful miners headed to Coulterville for a stop at the Fielding Trading Post, owned by Louis and his wife, Karin. They carry an interesting offering of native jewelry, hats and gold-mining pans.

Figure 7. NCGS miners prepare to hike up to the Mariposite Quarry.

The town of Mariposa was our final stop. The California State Mining and Mineral museum is here, having been moved to this location in 1983, after 100 years in San Francisco. It includes thousands of mining artifacts, displays of mining processes, and stunning gem and mineral specimens. Behind glass in a vault is the Fricot Nugget, a 13.8-pound mass of crystalline gold. The trip wrapped up with optional stops at the History Museum in Mariposa and Dial's Rock Shop at Cathey's Valley on Highway 140.

Figure 8. View of to the north of where we came on Hwy 49, along strike of the Mariposa Formation. Note serpentinite in roadcut to the east just past the Bagby Bridge over the Merced River.

The Northern California Geological Society thanks **Ross Smith** for designing and leading this wonderful trip. He mentioned that he and his wife drove this area four times, talking with mines owners and deciding the best route and stops for us. We sincerely appreciate the thoughtfulness and effort that was put into the trip, including tips for finding gold! We also thank **Rob Nelson** for organizing the trip.

Raining Rubies and Sapphires: Rocky Exoplanet Has Bizarre Atmosphere, Simulation Suggests

ScienceDaily

So accustomed are we to the sunshine, rain, fog and snow of our home planet that we find it next to impossible to imagine a different atmosphere and other forms of precipitation.

However, according to models by scientists at Washington University in St. Louis, COROT-7b's atmosphere is made up of the ingredients of rocks and when "a front moves in," pebbles condense out of the air and rain into lakes of molten lava below.

The work, by Laura Schaefer, research assistant in the Planetary Chemistry Laboratory, and Bruce Fegley Jr., Ph.D., professor of earth and planetary sciences in Arts & Sciences, appears in the Oct. 1 issue of The Astrophysical Journal.

Astronomers have found nearly 400 extra-solar planets, or exoplanets, in the past 20 years. But because of the limitations of the indirect means by which they are discovered, most are Hot Jupiters, chubby gas giants orbiting close to their parent stars. (More than 1,300 Earths could be packed inside Jupiter, which has 300 times the mass of Earth.)

COROT-7b, on the other hand, is less than twice the size of Earth and only five times its mass. It was the first planet found orbiting the star COROT-7, an orange dwarf in the constellation Monoceros, or the Unicorn. (This priority is designated by the letter b.)

Solid as a Rock

In August 2009 a consortium of European observatories led by the Swiss reported the discovery of COROT-7c, a second planet orbiting COROT-7.

Using the data from both planets, they were able to calculate that COROT-7b has an average density about the same as Earth's. This means it is almost certainly a rocky planet made up of silicate rocks like those in Earth's crust, says Fegley.

Not that anyone would call it Earth-like, much less hospitable to life. The planet and its star are separated by only 1.6 million miles, 23 times less than the distance between the parboiled planet Mercury and our Sun. Because the planet is so close to the star, it is gravitationally locked to it in the same way the Moon is locked to Earth. One side of the planet always faces its star, just as one side of the Moon always faces Earth.

This star-facing side has a temperature of about 2600 degrees Kelvin (4220 degrees Fahrenheit). That's infernally hot—hot enough to vaporize rocks. The global average temperature of Earth's surface, in contrast, is only about 288 degrees Kelvin (59 degrees Fahrenheit).

The side in perpetual shadow, on the other hand, is positively chilly at 50 degrees Kelvin (-369 degrees Fahrenheit). Perhaps because they were cooked off, COROT-7b's atmosphere has none of the volatile elements or compounds that make up Earth's atmosphere, such as water, nitrogen and carbon dioxide.

"The only atmosphere this object has is produced from vapor arising from hot molten silicates in a lava lake or lava ocean," Fegley says. What might that atmosphere be like? To find out Schaefer and Fegley have used thermochemical equilibrium calculations to model COROT-7b's atmosphere.

The calculations, which reveal which mineral assemblages are stable under different conditions, were carried out with MAGMA, a computer

program Fegley developed in 1986 with the late A. G. W. Cameron, a professor of astrophysics at Harvard University.

Schaefer and Fegley modified the MAGMA program in 2004 in order to study high-temperature volcanism on Io, Jupiter's innermost Galilean satellite. This modified version was used in their present work.

Raining Rocks

Because the scientists didn't know the exact composition of the planet, they ran the program with four different starting compositions. "We got essentially the same result in all four cases," says Fegley.

"Sodium, potassium, silicon monoxide and then oxygen — either atomic or molecular oxygen — make up most of the atmosphere." But there are also smaller amounts of the other elements found in silicate rock, such as magnesium, aluminum, calcium and iron.

Why is there oxygen on a dead planet, when it didn't show up in Earth's atmosphere until 2.4 billion years ago, when plants started to produce it? "Oxygen is the most abundant element in rock," says Fegley, "so when you vaporize rock what you end up doing is producing a lot of oxygen."

The peculiar atmosphere has its own singular weather. "As you go higher the atmosphere gets cooler and eventually you get saturated with different types of 'rock' the way you get saturated with water in the atmosphere of Earth," explains Fegley. "But instead of a water cloud forming and then raining water droplets, you get a 'rock cloud' forming and it starts raining out little pebbles of different types of rock."

Even more strangely, the kind of rock condensing out of the cloud depends on the altitude. The atmosphere works the same way as fractionating columns, the tall knobby columns that make petrochemical plants recognizable from afar. In a fractionating column, crude oil is boiled and its components condense out on a series of trays, with the heaviest one (with the highest boiling point) sulking at the bottom, and the lightest (and most volatile) rising to the top.

Instead of condensing out hydrocarbons such as asphalt, petroleum jelly, kerosene and gasoline, the exoplanet's atmosphere condenses out minerals such as enstatite, corundum, spinel, and wollastonite. In both cases the fractions fall out in order of boiling point.

Elemental sodium and potassium, which have very low boiling points in comparison with rocks, do not rain out but would instead stay in the atmosphere, where they would form high gas clouds buffeted by the stellar wind from COROT-7.

These large clouds may be detectable by Earth-based telescopes. The sodium, for example, should glow in the orange part of the spectrum, like a giant but very faint sodium vapor streetlamp. Observers have recently spotted sodium in the atmospheres of two other exoplanets. The atmosphere of COROT-7b may not be breathable, but it is certainly amusing.

Adapted from materials provided by Washington University in St. Louis.

Pushing Earth With a Breath of Air

By Phil Berardelli
*Science*NOW Daily News

Shakespeare's character Macbeth could have been speaking about Slumgullion when he mentioned tomorrow creeping in a petty pace from day to day. This relatively loose, nearly 4-kilometer-long tongue of soil and rocks is indeed creeping: It's moving down a slope in southwestern Colorado at about a centimeter every 24 hours. But several times a day, according to new research, a surprising force pushes it at a faster rate.

Earthquakes and torrential rains typically start landslides. Most break away suddenly, releasing thousands or even millions of cubic meters of material and crushing anything in their path. But others, like Slumgullion--which is technically known as an earthflow--move at a sluggish but inexorable pace.

To study the nature of that movement, a team led by geologist William Schulz of the U.S. Geological Survey in Denver, Colorado, set up shop atop Slumgullion about 6 years ago. They noticed that the earthflow seemed to move at different rates at different times of day. So the researchers installed motion sensors at several locations that could detect less than a millimeter's worth of displacement. They also monitored the barometric pressure of the air and the hydraulic pressure of the groundwater within the landslide to determine if any changes correlated with movement.

It turns out that Slumgullion doesn't slide continuously, the team reports online this week in *Nature Geoscience*. Rather, the earthflow stops and starts several times a day. And for short periods--usually 20 seconds or so--it moves at up to 400

millimeters an hour, a breakneck speed for such a mass of rubble.

Reviewing the barometric and hydraulic pressure data, the team found that Slumgullion's accelerations always tracked daily drops in barometric pressure, known as atmospheric tides. The discovery was "very surprising to us for several reasons," Schulz says. For one thing, the best-known triggers for landslides are earth tremors and increased groundwater pressure from torrential rains--factors that don't affect Slumgullion. For another, he says, the changes in atmospheric pressure are incredibly small--amounting to only about 0.5%.

The team's hypothesis is that the drop in air pressure, caused each day by the warming effect of sunlight, gently siphons some of the groundwater upward through the rocks, thereby slightly reducing the friction between the landslide material and the base soil. That allows the whole mass to move a little more easily.

Slumgullion is one of hundreds of such slow-moving landslides around the globe, and Schulz says they all could be nudged by drops in atmospheric pressure as well. Such drops might even trigger earthquakes where stress has pushed the situation "close to the failure level," says seismologist Leonardo Seeber of the Lamont-Doherty Earth Observatory in Palisades, New York, who was not affiliated with the research.

It's a significant study, because it represents "the first time that such an effect has been noted," says geologist and landslide blogger David Petley of the University of Durham in the United Kingdom. The findings could be particularly useful in the study of landslides caused by typhoons and other severe storms, he adds, because they bring on very low-pressure conditions, "far more so than these atmospheric tides."

The Mountains That Froze the World

By Phil Berardelli
*Science*NOW Daily News

The rise of the Appalachians plunged Earth into an ice age so severe that it drove nearly two-thirds of all living species extinct. That's the conclusion of a new study, which finds that the mountains' rocks absorbed enough greenhouse gas to freeze the planet.

The Appalachians, a heavily forested mountain range stretching more than 1500 kilometers from Georgia to Maine, were not always so tranquil. In fact, about 460 million years ago during the Ordovician period, they were the site of one of the most violent volcanic events in Earth's history. As the eastern edge of what became the North American continental plate overrode the basin of an ancient ocean, numerous volcanoes sprang up in what are today the Taconic Mountains of New York state and New England. The volcanoes spewed enough lava to form mountains as high and rugged as the Alps. They also belched out more carbon dioxide (CO_2) than at any time in Earth's past, creating greenhouse-gas levels as great as 20 times higher than they are today.

That much CO_2 should have kept the climate warm for eons. But a mere 10 million years later, atmospheric levels of the gas began to plummet, and 5 million years after that Earth entered a severe ice age.

To find out what happened, geologist Seth Young of Indiana University, Bloomington, and colleagues analyzed three sedimentary rock formations in Nevada. If anything had washed down from the Appalachians 460 million years ago, it might be found there, in that once-shallow seabed.

The rock formations were mostly limestone, a good indication that the Appalachians had sequestered carbon from the atmosphere. That's because high levels of atmospheric carbon dioxide would have produced acid rain rich in CO_2; as the rain hit the mountain, the CO_2 would have combined with calcium in the volcanic basalt, forming calcium carbonate--i.e., limestone--runoff.

But the real clincher came when the researchers analyzed the ratio of two strontium isotopes in the limestone. Most sediments sport traces of seven parts strontium-87 to 10 parts strontium-86, a ratio of 0.7. But the Nevada limestone showed a ratio of 0.6, the biggest disparity ever recorded. Because basalt is rich in strontium-86, the most likely explanation, the researchers say, is heavy limestone runoff from the Appalachians.

In the October issue of *Geology*, Young and colleagues propose the following scenario: As CO_2-laced acid rain fell on the rocks, it formed limestone that washed into the Nevada sea and locked away huge amounts of carbon from the atmosphere. Then, when the volcanism ended, about 450 million years ago, the sequestering continued, thinning CO_2 levels to maybe a few times higher than today. Back then, a dimmer sun couldn't keep the atmosphere warm without CO_2's help--hence, the eventual onset of the ice age.

Could these findings explain why, as some scientists think, the rise of the Himalayas about 35 million years ago were also followed by an ice age? Unlikely, says geochemist and co-author Lee Kump of the Pennsylvania State University, University Park. The strontium data from this study are "the opposite of that associated with Himalayan weathering," he says. That's because the Himalayas are primarily composed of granite, not basalt, and granite weathering cannot sequester carbon.

"What is really neat" about the current study, says geochemist Graham Shields of University College London, is that it solves the long-standing mystery about the timing of the ice age and the end of the Ordovician. One idea was that the Appalachian volcanoes themselves sparked the big chill by spewing sun-blocking ash into the air. But that didn't jibe with the fact that the ice age started 5 million years after the eruptions stopped. The new study shows, Shields says, how the cooling effect "really kicks in" when the volcanism ends.

Whence the Falklands Wolf?

By Virginia Morell
*Science*NOW Daily News

It's a mystery that stumped even Charles Darwin. How did a reddish, stocky wolf arrive on the Falkland Islands? This small archipelago nearly 500 kilometers off the coast of Argentina has no other endemic terrestrial mammals, not even rodents. Any hope of an answer seemed to die with the last Falklands Island Wolf, shot by a hunter in 1876. But now a research team has used DNA from museum specimens, including one that Darwin collected, to solve the puzzle.

The coyote-sized Falklands Island Wolf (*Dusicyon australis*) was strikingly different from smaller canids on the South American mainland, Darwin noted during his 1837 voyage on the *Beagle*. Since then, biologists have argued about whether the wolves were actually foxes (which is what Darwin called them) or, like the Australian dingo, descended from dogs that people had brought to the islands (*Science*, 30 September 1977, p. 1340).

To determine the wolf's ancestral lineage, Graham Slater, an evolutionary biologist at the University of California, Los Angeles, and colleagues compared DNA sequences from five museum specimens with those of living South American canids, including a group of foxlike animals that had been previously suggested as their most likely relatives. The team found that the Falklands wolves proved most similar to the maned wolf (*Chrysocyon brachyurus*), which hails from the South American savannas.

"That was a big surprise," says Slater, because of the pronounced difference between the two creatures. The maned wolf has much longer legs than the Falklands wolf and long jaws suited for catching rats and mice; the island wolf has shorter, Labrador retriever-like jaws designed for grabbing and shaking large prey, such as seals and penguins.

The study, published online tomorrow in *Current Biology*, points to a North American origin for all South American canids. The Falklands Island Wolf and the maned wolf diverged 6.7 million years ago, probably in North America given that the oldest fossils of canids in South America date back 2.5 million years, says Slater.

The findings rule out the idea that people played any role in the wolves' arrival on the islands. Instead, an analysis of the museum specimens' mitochondrial DNA shows that they shared a last common ancestor at least 70,000 years ago, suggesting that they reached the Falklands prior to the end of the last ice age; humans only set foot in the New World about 20,000 years ago.

Because the islands were never connected to the mainland, the Falklands wolf must have crossed the sea from South America by clinging to logs or an ice floe, the researchers conclude. "Their incredible journey shows the extraordinary adaptability and tenacity of canids," says David Macdonald, a conservation zoologist at the University of Oxford in the United Kingdom.

"It is a riveting paper and a fitting birthday present to Darwin," says Macdonald, because "the weirdly leggy maned wolf" that became the "somewhat doggy Falklands Island Wolf" shows how mutable species can be.

Darwin predicted that the wolves would soon go extinct because they were being heavily hunted for the North American fur trade. (Indeed, another biologist named and described the species based on pelts found in a New York City fur store.) Its extirpation, says Macdonald, "should stiffen the world's resolve not to let today's rarest canids, the Ethiopian wolf and African wild dog, follow the Falklands wolf to extinction."

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY and AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

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 the Year 2009 - 2010 NCGS Competition

The Northern California Geological Society (NCGS) is pleased to announce that it will accept applications from candidates in the Northern California region for the Year 2009 - 2010 competition for the 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 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 Anaheim, California, May 27 - 27, 2010, plus up to $250 toward meeting expenses. The regional winner's project will be submitted to AAPG headquarters for the national contest. The national winner will receive an expense-paid trip to attend the national AAPG meeting in Houston, Texas, April 2011, to receive the national award.

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.

The deadline for application submittal by candidates for the $750 NCGS award is Monday, January 18, 2010

Interested candidates or nominators can request Application Information and an Entrant Application Form, or submit an application, by contacting:

Paul Henshaw
Chair, K – 12 Geosciences Education Committee
Northern California Geological Society
6 Rachel Ranch Court
Clayton, CA 94517
(925) 673-8745
candphenshaw@comcast.net

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

K-12 GEOSCIENCE TEACHING AWARD

$500 Northern California Geological Society

Call for Applications for the Year 2009 - 2010 NCGS Competition

The Northern California Geological Society (NCGS) invites applications from candidates in the Northern California region for the Year 2009-2010 competition for the K-12 Geoscience Teaching Award. Applications may be submitted by any teacher regardless of experience.

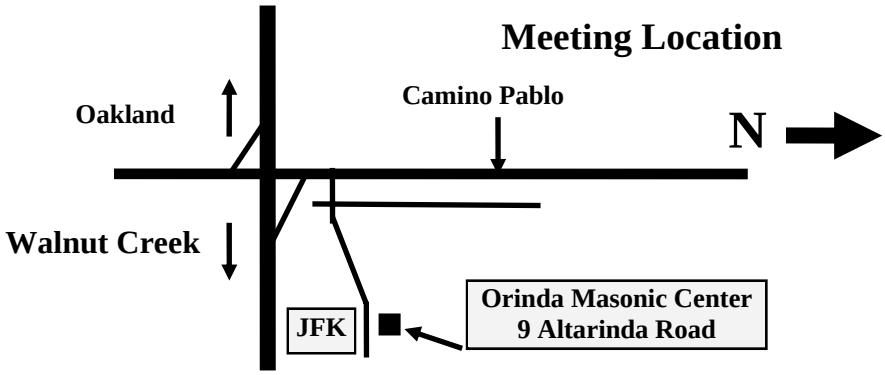
Applications reflecting teaching of units addressed to any of the earth or environmental sciences, including but not limited to mineralogy, petrology, economic geology, geomorphology, paleontology, hydrology, and planetary geology are invited from physical science, earth science, and geology teachers.

The deadline for application submittal by candidates for the $500 NCGS award is Monday, January 18, 2009. **The application process is uncomplicated**.

The winner will receive a $500 award at a Northern California Geological Society meeting in Orinda in late February 2010.

Interested candidates can request an *Application Information* and an *Entrant Application Form* or submit an application by contacting:

Paul Henshaw
Chair, K – 12 Geosciences Education Committee
Northern California Geological Society
6 Rachel Ranch Court
Clayton, CA 94517
(925) 673-8745
candphenshaw@comcast.net



It's time to renew your membership for the
2009 – 2010 NCGS Membership Year!
Please do so!!
Membership Forms can be obtained at our website.
www.ncgeolsoc.org
We'll all appreciate it!

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

Would you like to receive the NCGS newsletter by e-mail? If you are not already doing so, and would like to, please contact **Dan Day** at danday94@pacbell.net to sign up for this free service.