NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

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MEETING ANNOUNCEMENT

DATE: **Wednesday, October 27, 2004**

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 member**

RESERVATIONS: **Leave your name and phone number at 925-424-3669 or at *danday94@pacbell.net* before the meeting.**

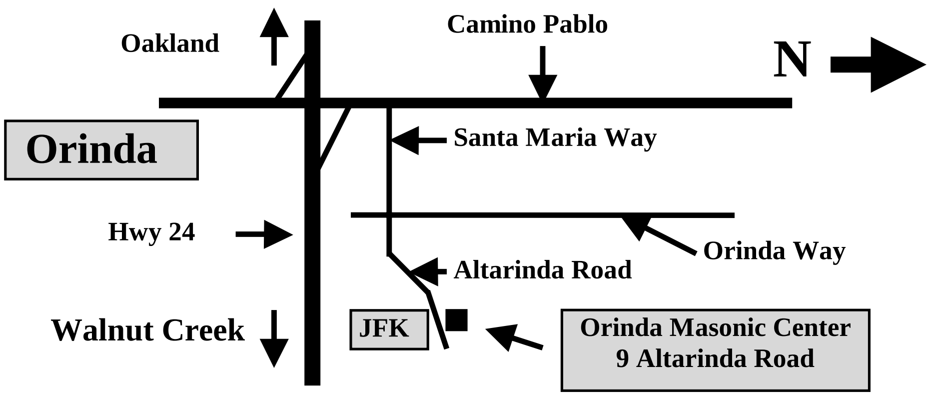
Speaker: **Dr. Roland Burgmann**, University of California, Berkeley

Slipping and Sliding on the Hayward Fault

Measurements of surface displacements in the San Francisco Bay area using GPS and InSAR reveal the dynamic nature of deformation in the Earth's crust. The dominant deformation signal is related to strain accumulation across the San Andreas fault system, which can be interpreted and modeled in the context of fault slip rates on the major faults in the area. Assuming that deformation of the crust over short time scales is dominantly elastic, we can invert the deformation field along the Hayward fault for the distribution of aseismic faulting and locked patches at depth. The inferred slip-rate distribution is consistent with a fault that creeps aseismically at a rate of about 5 mm/yr to a depth of 4 to 6 km, below which some larger completely locked asperities are inferred. We calculate that the entire fault is accumulating a slip rate deficit equivalent to a Mw=6.8 earthquake per century, which provides an upper bound on the earthquake potential along the Hayward fault. In addition to active tectonics the InSAR data also reveal active surface motions from non-tectonic processes, such as deep seated landsliding, land subsidence and uplift above aquifers, and rapid settling of unconsolidated Bay muds.

Please Renew Your Membership – A Membership Form is Attached!!

Meeting Location



BIOGRAPHY

Dr. Roland Burgmann's research interests include active tectonics and crustal rheology. He uses the Global Positioning System and Synthetic Aperture Radar Interferometry to measure crustal deformation near active faults, volcanoes, and landslides. Dr. Burgmann also models crustal deformation through the earthquake cycle along major fault zones. Dr. Burgmann received his Vordiplom in Geology, Paleontology and Mineralogy from the Universitaet Tubingen, Germany, in 1987, his M.S. in Structural Geology at the University of Colorado, Boulder, in 1989, and his Ph.D. at Stanford University, in 1993. He is currently an Associate Professor in the Department of Earth and Planetary Science at the University of California, Berkeley.

Northern California Geological Society
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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 **Dan Day** at danday94@pacbell.net to sign up for this service.

NCGS 2003-2004 Calendar

Wednesday September 29, 2004
Greg Croft, Consulting Geologist
Regional Trends in World Oil Production
7:00 PM at Orinda Masonic Center

Wednesday October 27, 2004
Dr. Rob Twiss, University of California, Davis
Slipping and Sliding on the Hayward Fault
7:00 pm at Orinda Masonic Center

Wednesday January 26, 2005
Dr. Cheryl Smith, U. S. Geological Survey
Geochemical Investigation of the Distribution of* Arabis macdonaldiana *in the Josephine Ophiolite, Six Rivers National Forest, Del Norte County, California
7:00 pm at Orinda Masonic Center

Wednesday February 23, 2005
Dr. Robert Tilling, U.S. Geological Survey
Confronting Volcanic Hazards
7:00 pm at Orinda Masonic Center

Wednesday March 30, 2005
Dr. Barbara Bekins, U. S. Geological Survey
Hydrogeology and the Weak nature of Plate Boundary Faults
7:00 pm at Orinda Masonic Center

Wednesday April 27, 2005
Dr. Michael Manga, University of California, Berkeley
An Explosive Theory About Volcanoes
7:00 pm at Orinda Masonic Center

Wednesday May 25, 2005
TBA
7:00 pm at Orinda Masonic Center

Wednesday June 29, 2005
TBA
7:00 pm at Orinda Masonic Center

Upcoming NCGS Field Trips

October 30, 2004	***The Winemaker's Dance: Exploring Terroir in the Napa Valley, California*** **David G. Howell** U.S. Geological Survey
Spring (March) 2005	***Colorful Geology of the Fremont Area*** **Joyce Blueford and Paul Belasky**
Spring (May) 2005	***Robert Sibley Volcanic Regional Preserve in Berkeley Hills*** **Stephen Edwards,** Director, Tilden Regional Botanic Garden

Upcoming Meetings of Interest – Bay Area Geophysical Society

October 26, 2004
William Daily, Lawrence Livermore National Laboratory

The Yucca Mountain Project for the Nations Nuclear Waste: Perspective of a Geophysicist

- **Location**: California State University, Hayward
- **Lunch**: 12:00 noon, TBA
- **Talk**: 1:00 p.m., Science North 3
- **Directions**: CSU Hayward Campus
- **Map**: CSU Hayward Campus

November 19, 2004
Heloise Lynn, Lynn Incorporated
AAPG/SEG 2004 Fall Distinguished Lecture

The Winds of Change: Anisotropic Rocks, Their Preferred Direction of Fluid Flow and Their Associated Seismic Signatures

Location: Stanford University, 450 Serra Mall, Stanford
Lunch: TBA
Talk: 12:00 noon, Auditorium of Building 320 (Braun Hall, Geology Corner)
Directions: Stanford School of Earth Sciences Maps & Directions
Map: Stanford University Campus [PDF]

Abstracts, biographies, directions, and maps can be found at:
http://sepwww.stanford.edu/bags/calendar

A BRIEF GUIDE TO GEOLOGIC LITERATURE*

The following phrases, frequently found in technical writings, are defined below for your enlightenment.

It has been long known: I haven't bothered to check the references.

It is known: I believe.

It is believed: I think.

It is generally believed: My colleagues and I think.

There has been some discussion: Nobody agrees with me.

It can be shown: Take my word for it.

It is proven: It agrees with something mathematical.

Of great theoretical importance: I find it interesting.

Of great practical importance: This justifies my employment.

Of great historical importance: This ought to make me famous.

Some samples were chosen for study: The others didn't make sense.

Typical results are shown: The best results are shown.

Correct within order of magnitude: Wrong.

The values were obtained empirically: The values were obtained by accident.

The results are inconclusive: The results seem to disprove my hypothesis.

Additional work is required: Someone else can work out the details.

*Source Unknown

Earth Science Week
Living on a Restless Earth
October 10-16, 2004

Recent Natural Disasters Serve as Reminders of the Importance of Understanding Earth Science

With Mount St. Helens in Washington venting off steam and Florida experiencing one of the worst hurricane seasons since 1886, newscasts remind us of the restless nature of our dynamic planet. To raise awareness of the importance of Earth sciences to society, Earth Science Week will be held from Oct. 10 through Oct. 16, 2004, celebrating the theme "Living on a Restless Earth: Natural Hazards."

For the first time in U.S. history, the Director of the U.S. Geological Survey, Dr. Charles G. Groat, and the Under Secretary of Commerce for Oceans and Atmosphere (and National Oceanic and Atmospheric Administration (NOAA) Administrator) Admiral Charles Lautenbacher, Jr., have collaborated to write a statement on the "Importance of Earth Science Education." The statement, released in recognition of Earth Science Week, is addressed to the American Public. "By 2025, eight billion people will live on Earth," wrote Groat and Lautenbacher, "If we are to continue to maintain a high quality of life, we need to delve much more deeply into our planet-its processes, its resources, and its environment. Only through Earth science education can students come to understand and appreciate our complex planet."

Earth scientists, such as volcanologists, meteorologists and seismologists, work to understand and predict natural hazards to minimize their effects on people and property. During Earth Science Week, geoscientists work with students and the general public to help them discover the Earth sciences and become engaged in scientific exploration. Teachers and students explore Earth science with activities and experiments or by having scientists visit their classrooms. Earth Science Week was established by the American Geological Institute in 1998, and is sponsored by the U.S. Geological Survey and the American Association of Petroleum Geologists Foundation, with participation from NASA, NOAA, the National Park Service and many more organizations. For more information about Earth Science Week, visit www.earthsciweek.org.

For the entire text of Dr. Groat and Admiral Lautenbacher's statement, visit:

http://www.earthsciweek.org/proclamations/USGSNOAA.pdf.

The American Geological Institute is a nonprofit federation of 43 member societies that represents more than 120,000 geologists, geophysicists, and other Earth scientists. Founded in 1948, AGI provides information services to geoscientists, serves as a voice of shared interests in the profession, plays a major role in strengthening geoscience education, and strives to increase public awareness of the vital role the geosciences play in society's use of resources and interaction with the environment.

Regional Trends in World Oil Production
Presented at September 2004 Meeting
Reported by Dan Day

Petroleum is in the news nowadays and is a topic of discussion as major elections draw near. Its importance to America's economy and security is well publicized. However, those of us outside the oil industry know little about petroleum production on a global scale. At the September 29, 2004, NCGS meeting, **Greg Croft**, consultant and former Chevron Overseas Petroleum, Inc. employee, detailed these aspects of the petroleum industry in his talk ***Regional Trends in World Oil Production***.

Greg has been involved in oil production for several decades. After his tenure at COPI, he was a partner in Pantera Petroleum, Inc., specializing in Latin American petroleum development. He then joined Harrods, Inc. as exploration executive vice president, Harrods Energy Thailand, Ltd., and later became executive vice president of Harrods Natural Resources, Inc., before setting out on his own. In passing, he noted that the natural gas market is now in the state of development that the petroleum industry was in 40 years ago. Today, we know where the oil is; our current task is to develop these resources to fit our energy needs.

For discussion, Greg has divided the world into six regions: the Middle East, the Western Hemisphere, the former Soviet Union, Africa, the Asia-Pacific Region, and Europe. His paradigm looks at 5 year and 30 year production trends. From these he infers what future trends might be. On a global scale, world oil production was 55.2 million barrels per day (MBD) in 1973, 66.2 MBD in 1998, and 68.4 MBD in 2003. In 1973 the most important global producers were the U.S., the USSR, and Saudi Arabia, who accounted for one half of the world's production. In 2003 the same three ranked at the top, but in the order Saudi Arabia (8.6 MBD), Russia (8.2 MBD), and the U.S. (5.7 MBD). Saudi Arabia and Russia now produce one third of the world's oil. The dynamics of the former Soviet Union have changed since its collapse in the early 1990's, but it is still a useful gage of regional oil production because its constituent republics had a very similar resource developmental history until recently.

World oil focus is understandably on the Middle East. In 1973, this region produced 38% of the world's oil from Saudi Arabia, Iran, and the United Arab Emirates (UAR). In recent years, their contribution to world oil productivity has dropped off to 31.7% in 1998 and 30.4% in 2003. Today, the principle producers are Saudi Arabia (8.6 MBD), Iran (3.8 MBD), the UAR (2.3 MBD), Kuwait (2.2MBD), and Iraq (1.3 MBD). Iraqi production has been disrupted by the recent war. However, its proximity to Kuwait's substantial oil resources provided incentive for 1991's attack on that nation. The major oil plays on the Saudi peninsula are Jurassic carbonate platform reservoirs, well sealed by thick (200 meters) anhydrite layers. These deposits extend into the Qatar peninsula and the offshore island nation of Bahrain. The nature of these carbonates (excellent permeability provided by selective dissolution of constituent fossils) is responsible for the ideal reservoir characteristics. Most fields produce from one or two reservoirs, and waterflood recovery exceeds 50%. Horizontal drilling further enhances productivity in these shallow reservoirs. The typical product is sour crude. Greg noted that the high oil recovery rate from these reservoirs portends rapid declines in productivity; already experts have predicted decreases as high as 600,000 BPD from this region.

Another key play in the Middle East is the Zagros play, a steeply folded mountain belt straddling the Iran-Iraq border. Control of this oil-bearing region was a motivating force for the lengthy war between these two nations in the 1980's. The producing zone is in fractured Eocene to Miocene limestones. The production peak came in 1974, although the region still has good exploration potential. The pay zones are stacked reservoirs in deep carbonates, yielding shallow heavy oil. Underlying Cretaceous sands provide a natural water drive for production. These reservoirs are not as permeable as the Arabian plays, and hence production rates are slower. Iraq has suppressed exploration in this region, boosting its exploration potential.

Middle Eastern Cretaceous rudistid (bivalve) bioherms provide yet another oil source in this region. Production from these low permeability, compartmentalized reservoirs is at a high. They are also good candidates for recovery by CO_2 flushing.

The Western Hemisphere provides 25% of the world's oil. Key resources include the Gulf of Mexico (U.S. and Mexico), Venezuela, the Campos Basin off Brazil, and the emerging oil sand deposits in Alberta, Canada. The USGS recently projected reserves of 14 billion barrels in Suriname (formerly Dutch Guyana, located on South America's Caribbean coast just north of Brazil). Although regional production is down from 26.8% in 1998 to 24.9% in 2003, the Albertan tar sand production has been increasing by 300,000 to 350,000 barrels per year, supplementing Canada's overall decrease in oil production. Oil sands are tapped in the Peace River, Athabasca, Cold Lake, and Wabaska districts, the latter two benefiting from natural gas-fueled steam injection recovery. Oil sand reserves are estimated to be 1400 billion barrels.

Venezuelan plays yield a heavy oil produced from depths of 1000 to 4000 feet. Reservoirs deeper than 1800 feet require steam flooding technology to remove the oil. Original estimates placed reserves at 1250 billion barrels, or approximately one-third of the world's known oil reserves. The biggest production challenge is lowering the oil's heavy metal content. Steam injection promotes good flow rates. Canada also has abundant oil shale, an immature source rock that requires considerable effort to extract its hydrocarbons. This reserve would be one of the last to be tapped based on the processing steps needed to extract usable petrochemicals.

The northern reaches of the Western Hemisphere offer additional reserves. The Alaskan North Slope, particularly the Beaufort Sea area, has been producing for decades, but is on the decline. The Canadian Svedrup basin has excellent, well-established reserves, but is hampered by winter sea ice. Another enticing petroleum source is off the eastern shore of Greenland, estimated by the USGS to contain 47 billion barrels of undiscovered oil. Its development is also plagued by winter sea ice, but the recent ice sheet retreat, attributed by some scientists to global warming, favors future recovery.

The former Soviet Union has enjoyed a significant increase in world production, up from 10.6% in 1998 to 14.3% in 2003. Russia has substantial reserves in the Western Siberian Basin, the largest sedimentary basin in the world. The Caspian Sea is a well-known petroleum resource, having been the major world oil producer at the turn of the Twentieth Century. The fractured Paleozoic platform carbonate in Kazakhstan is producing from the onshore Tengiz play. The larger Kashagan play in the offshore Caspian shallows faces some production challenges with winter ice rafts that batter the platforms. These sources are very deep and high in sulfur. Offshore Sakhalin Island north of Japan is another promising Russian reserve that may top 1 million barrels per day in production. It also suffers from winter ice obstruction. Azerbaijan on the western shore of the Caspian Sea, a former Soviet republic, produced heavily one hundred years ago, and will enjoy production rates exceeding 1 million barrels a day when its offshore Caspian plays are fully developed. The Arctic Barents and Kara Sea regions are prospective gas and oil basins with similar climatic risks. Currently, Russian produces 8.2 MBD and Kazakhstan slightly under 1 MBD.

African production has increased from 10.4% in 1998 to 11.0% in 2003. The major producers are Nigeria (2.1 MBD), Libya (1.4 MBD), Algeria (1.1 MBD), and Angola (0.9 MBD). Africa contains many rift basins aside from the well-known eastern rift valley that transects the continent from the mouth of the Red Sea to Mozambique. Rift basins not fully explored occur in Libya, Sudan, and Chad. The major producing areas are located offshore in the prograding deepwater Niger delta, the Congo paleodelta off Angola, and in Mauritania. Some of these plays are highly compartmentalized. Africa's undeveloped petroleum resources will be more important in the future. However, China has shown considerable interest in the Dark Continent's potential and is currently purchasing land rights.

The Asian-Pacific region has remained essentially unchanged from 1998 to 2003 at 10.7% of world production. Increases in China (3.4 MBD) and Vietnam offset a drop in Indonesian (1.0 MBD) productivity. Malaysia also has significant reserves in offshore Borneo.

European production is declining, down in 2003 at 8.8% of world production from 9.8% in 1998. The North Sea provides most of Europe production, but its numbers are declining due to high waterflood recovery rates. The major producers are Norway (3.1 MBD) and the U.K. (2.1 MBD), with Denmark yielding 0.37 MBD. Romania on the Black Sea is the only significant producer in eastern Europe. Favorable exploration sites are the Barents Sea east of northern Scandinavia and the deepwater North Sea west of the Shetland Islands.

Greg summarized by noting that the major global producing areas are maturing, and that the Middle Eastern and European fields are on the decline. In the future, capital exploration expenditures will be higher, the risks greater, and development more challenging. Right now only North America offers pure play investments to the passive investor. There are several exploration frontiers available, one being the Arctic shelf region. As oil prices rise, exploration will increase. Heavy oil production and secondary recovery from mature fields will also increase. Reserves are often inflated by nations to boost their bargaining power, and methods for determining reserves can vary significantly from country to country. In the near future, Greg sees two peaks in productivity: the first in the light to medium gravity crudes, followed by heavy oil development driven by the peak in the lighter grades. Currently the total world production is going up in response to rising oil prices, and it will continue to do so until needs are fulfilled.

The NCGS sincerely thanks **Greg Croft** for sharing his views on world oil production with its members. His presentation helped to put our current petroleum situation in perspective, and provided some guidelines for what to expect in the future.

Geology and Ground-Water Resources of the Merced Formation
July 2004 NCGS Field Trip

Reported by Richard Cardwell

On Saturday, July 10, NCGS members and friends examined a mile-thick, nearly continuous section of Plio-Pleistocene deposits of the Merced Formation exposed along the coast between Lake Merced and Mussel Rock. Field trip leaders were **H. Edward Clifton** and **Ralph E. Hunter**, both retired from the U. S. Geological Survey, and **Gregory Bartow** with the San Francisco Public Utilities Commission.

The Merced Formation is interesting and worth examining for several reasons. First it is a significant groundwater aquifer for San Francisco and San Mateo counties. Second it provides an excellent record of sea level variations in the Bay Area preserved in a series of 41 well-defined parasequences.

The day began in heavy fog with a cold wind blowing fiercely off the ocean, but by lunch time the fog had lifted and we had a beautiful day. We started the trip near Mussel Rock and over the course of the day hiked north along the coast for about 3 ½ miles to end our trip near the Fort Funston hang-glider park. We began by crossing the San Andreas Fault where it moves from onshore near Daly City to the offshore near Mussel Rock.

The Merced Formation is the aquifer for the Westside groundwater basin that underlies portions of San Francisco and San Mateo County. Groundwater was originally pumped from the Westside basin in San Francisco between the late 1800’s and 1930 for drinking water. Groundwater supplies were largely abandoned when imported Sierran water become available in the early 1930’s.

Today the basin provides up to 50% of the drinking water for 200,000 residents in northern San Mateo County. In San Francisco, groundwater is mainly pumped for irrigation. Water levels vary from 50 feet above sea level in the Sunset District in San Francisco to 200 feet below sea level in Daly City. As part of the San Francisco Public Utilities $3.6 billion capital improvement project, three groundwater-related projects are in the planning stage.

The first project is to drill water wells in the Sunset District. This area is the last customer on the Hetch Hetchy pipeline and needs to secure a more immediate water supply. A second project is to find supplemental water for Lake Merced. Lake Merced is a 300 acre fresh water lake that is the surface expression of the shallow ground water table. It originally had a small outlet to the Pacific that was dammed to make the present day lake. A third project is to store water in the unsaturated zone above the current ground water level in Daly City. Here the water level is 100-200 feet below sea level due to pumping. Up to 75,000 acre-feet would be stored. For comparison there are only 69,000 acre-feet in the Crystal Springs reservoir. In a form of ground water banking, Daly City would stop pumping ground water from the Merced Formation, and in return it would be supplied with water from San Francisco.

The Merced Formation is defined in the subsurface by numerous water wells, and surface outcrops are well exposed along the cliffs from Mussel rock to Fort Funston. The Merced Formation lies within the Westside basin on the peninsula and within the Eastern San Gregorio basin in the offshore. The bedrock in this area is the Franciscan Formation and it slopes westward beneath the Pacific. The Merced Formation overlies the Franciscan and thickens from the middle of the peninsula to the west beneath the ocean. The greatest thickness in the Westside basin is found in an elongate northwest-southeast trending trough. The trough is bounded on the southwest by the San Andreas Fault and on the northeast by the Serra Fault. The Serra Fault is a southwest dipping reverse fault with the west side thrust up relative to the east side. It has deformed the Merced Formation along the coast. The fault appears to be an impermeable barrier because the ground water level is lower in the Westside basin than to the west of the fault.

The uplift of the Merced Formation along the coast probably occurred within the last 100,000 years. The uplift was the result of compression on the plate margin due to oblique convergence of the Pacific and North American plates along the San Andreas Fault. The cliffs are being uplifted at a rate of about 1 mm per year.

The Merced Formation consists of an accumulation of sediments over one mile thick (1750 meters). The sediments were deposited almost continuously in the late Pliocene to early Pleistocene during the last two to three million years. The exact ages are uncertain because age dating is a problem in the section. There are many fossils, but most of them have no age significance. However, there are Pliocene age fauna in the lower portion of the section.

The formation has been divided into a series of 41 units labeled from Z at top decreasing to A in the middle of the section. Below A the labeling continues from ZZ decreasing to LL near the base of the section. Each of these units is a parasequence in the sequence stratigraphy framework.

The sediments of the Merced Formation are weakly consolidated fine sandstones with secondary siltstones and claystones. They were deposited in environments thought to range from marine to non-marine. Individual depositional facies include shelf, nearshore, foreshore, embayment, backshore (sand flats), marsh, dune and alluvial facies. The lower 1300 meters of the section (below sequence J) are mainly marine facies while the upper 300 meters are mainly non-marine facies.

The facies in the Merced Formation are arranged in sequences that indicate alternate regressions and transgressions of the sea. The origin of the regressive-transgressive cycles in the Merced is uncertain.

The Merced section is dominated by shallowing-upward regressive sequences formed by a prograding shoreline, possibly in conjunction with a falling sea level. There is a systematic upward shallowing from shelf to nearshore to foreshore to backshore to eolian dune facies. In this section there are bioturbated silts of the outer shelf, followed by laminated silts and shell lags of the mid shelf, fine sands and shells of the inner shelf, pebbles and fine sand of the lower shoreface, cross-bedded sand and gravel of the upper shoreface, planar bedded sand and gravel of the foreshore, clean sand and root structures of the backshore (non-marine), and lignite at the bay flooding surface. Most sequences do not display all of the facies. However, 27 of the 41 sequences show evidence of upward shallowing in a coastal setting.

Most of the progradational sequences are bounded at the top by surfaces of erosion. These surfaces were formed during the marine transgressions that separated the progradational periods. The transgressive intervals are not marked by a simple reversal of the regressive sequences because the landward translation of the shoreface tends to cause the nearshore, foreshore, and non-marine deposits to be eroded. The hiatus is generally marked by a lag deposit of pebbles or shells. The transgressive surface of erosion is also known as the ravinement surface.

Overlying the erosion surfaces are sediments deposited in increasingly deeper water. These are deepening-upward transgressive sequences formed by the shoreline receding landward, possibly due to rising sea level.

We began our hike in the lower portion of the section near Mussel Rock and worked our way to the upper part of the section near Fort Funston. Several of the units had interesting and easily observable features that are worth noting.

In the shoreface section of unit MM we observed adhesion ripples that formed as dry sand sticks to small wet dunes and the dunes then grow in a windward direction.

Unit NN was a typical progradational sequence in the lower portion of the section containing shelf and nearshore depositional facies. At its base is a thick massive sand sequence deposited in deep water (100 meters?). At its top are shell hash beds also deposited on the shelf but above storm wave base (20-30 meters?).

Unit RR was a good example of transgressive deposition. It overlies bay or estuary facies of Unit QQ that contains lignite. At its base is mudstone with marine mollusks. This is overlain by a layer of shells in growth position possibly indicating a tidal channel. This in turn is overlain by marine gravel.

Near the top of the section in Unit P there is an abrupt mineralogical change. Below P the clasts in the section are derived from the Franciscan Formation, while above P the clasts are from Sierran granites. This change in clast origin is due to formation of the modern drainage of Sacramento and San Joaquin rivers. This modern drainage occurred when the ancient lake in what is now the San Joaquin Valley burst through the Golden Gate, and allowed sediments of the Sierra Nevada to be deposited offshore.

There are several ash beds in the section. Unit S contains an ash bed with a maximum thickness about six inches called the Rocklin ash. This ash was deposited by the eruption of ancient Mt. Tehama about 610,000 years ago. Mt. Tehama was eroded during the ice age and today Mt. Lassen (located about 300 kilometers to the northeast) is a volcanic plug located on the flank of the former volcano.

In the non-marine environments of the upper section near the Fort Funston hang-gliding park are faunal remains. This sub-aerial environment is an embayment facies (probably a sand flat). Here mammoth bones and teeth have been found, as well as footprints of large canines and elk- or deer-like animals.

The NCGS sincerely thanks Ed, Ralph, and Greg for leading this excellent field trip and providing the field guide describing the trip in detail. We thank **Tridib Guha** for organizing the trip, handling trip registration, and arranging transportation. We thank Tridib and **Dan Day** for their continued hard work getting coffee, donuts, lunches, and refreshments.

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP

The Winemaker's Dance: Exploring Terroir in the Napa Valley, California

Saturday October 30, 2004

Field Trip Leader: David G. Howell, U.S. Geological Survey

Most people, when they think about the geology of California, focus first on earthquakes. Indeed, as the mountains and valleys of California have been shaped, earthquakes have been the pounding of the carpenter's hammer, a resounding echo from Earth forming processes. Thus, even though most of us are horrified by the prospect of another devastating earthquake, the great beauty and abundant resources in California are a direct consequence of the very events that trigger these periodic Earth shaking temblors.

Geology plays an important role in controlling the quality and nuances of California's wine. It affects the soils-their chemistry and texture, the topography-mountain slopes versus valley floors, and the climate-humidity, sun angle, and temperature. The three S's-soil, slope, and sun, helps us understand the principle factors that control wine quality. How the vintner manipulates these controls determines the specific attributes of each bottle of wine.

Understanding the geology of different California regions, and how it relates to wine growing, can be broken down into three basic categories: how the bedrock formed, evolution of the landscape, and relating these two factors to soil development and micro climatic conditions. These elements will be explored during a field trip as well as the wine that does indeed convey a 100 million years of earth history.

The Winemaker's Dance: Exploring Terroir in the Napa Valley, by Jonathan Swinchatt and David Howell, has just been published. In the book, we use the geology of the Napa Valley to provide a physical context for terroir and examine in this context how winegrowers and winemakers relate to this notion through their daily work. The book is based on investigations over many years by the US Geological Survey, and interviews with some 80 winegrowers and winemakers. The book is illustrated with 3D maps that provide views of the valley never before seen, created through a cooperative project with the US Geological Survey.

If you would like to read more about the book go to: --- http://www.winemakersdance.com/

** **Field Trip Logistics** **

Time: Saturday October 30, 2004, 10:00 a.m. to 4:30 p.m. ***Wine tastings are anticipated to be free***.

Meeting Place: TBA in Napa Valley **Departure**: Gather at 9:30 am for distribution of an ***autographed copy of the book*** and coffee, and leave by 10:00 a.m. **Cost**: $65 for members; $75 for non-members

********ASAP*************EMAIL REGISTRATION FORM ASAP (The Winemaker's Dance Field Trip)********ASAP********

Name:____ E-mail:_______________________________________

Address:______________________________ Phone (day):_______________________ Phone (evening):_____________________

Lunch: (***Catered with Wine***) Regular:________ Vegetarian: __________ (Please check one)

Check Amount: ________________

Please email form and call Tridib ASAP due to the short interval. Please mail a check made out to **NCGS** to: **Tridib Guha, 5016 Gloucester Lane, Martinez, CA 94553 or deliver on October 30.** Questions: e-mail: aars@netscape.com (**NEW EMAIL ADDRESS**)
Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

2004-2005 Renewal Form

Please fill out this form and attach your check made out to NCGS.

Mail to:
Phil Reed

NCGS Treasurer
488 Chaucer Circle
San Ramon, CA 94583-2542

Dues		
	Regular ($15)	**$__________**
	Student ($ 5)	**$__________**
Contribution		
	Scholarship	**$__________**
	Teacher Award	**$__________**
Total		**$__________**

<u>Please provide the following information</u>:

Name: ____

e-mail:____

I would like to receive the monthly newsletter via: E-mail _____ Regular mail ______

I can help with:

Programs_____ Field Trips_____ Newsletter_____ Web Site_____

K-12 Programs_____ Scholarships_____ AAPG Delegate_____ Membership_____

<u>Please complete the following *only* if there are changes since last year</u>:

Address ____

City, State, Zip____

Phone: Home (____)____________Work (____)_____________Fax (____)_______________

Employer: _______________________________**Job Title:**________________________________