NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

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MEETING ANNOUNCEMENT

DATE: **Wednesday, February 23, 2005**

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 student member**

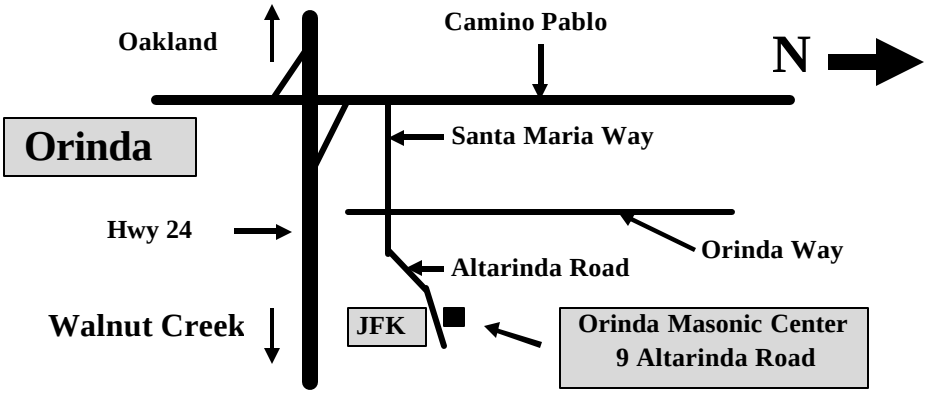
RESERVATIONS: **Leave your name and phone number at 925-424-3669 or at *danday94@pacbell.net* before the meeting.**

SPEAKER: **Robert I. Tilling**, ***Volcano Hazards Team, U.S. Geological Survey, Menlo Park, California***

CONFRONTING VOLCANIC HAZARDS

On average worldwide, 50 to 60 volcanoes are in eruption each year—counting both continuing and new activity. During the past millennium, volcano-related hazards have killed more 300,000 people and have caused billions of dollars of economic loss. Most (all?) eruptions are preceded and accompanied by geophysical and (or) geochemical changes in the state of the volcano. With emergence of modern *volcanology* early in the 20th century, instruments and techniques have been developed to monitor such precursory changes as the volcano builds toward possible eruption. Even though geochemical monitoring is being increasingly applied, to date seismic and geodetic techniques still constitute the most diagnostic and robust ***real-time*** volcano-monitoring tools. Yet, despite continuing advances in instrumentation and the acquisition, processing, and interpretation of monitoring data, with rare exception (e.g., 1991 eruption of Mount Pinatubo, Philippines), the capability to routinely and reliably predict explosive eruptions still eludes volcanologists. Nonetheless, most volcanologists are confident that improved predictive capability can be achieved, if a volcano is fully monitored in ***real time***. A serious challenge, however, is that there are far more active or potentially active volcanoes to monitor than there are scientists and funding available to conduct the needed volcano-monitoring and related hazards-mitigation studies. For the foreseeable future, the volcano still will call the shots, not the scientists and emergency managers.

Meeting Location



Biography

In 2004, **Dr. Tilling** retired after working 42 years with the USGS, mostly on studies of eruptive phenomena and their associated hazards. Interspersed with project research during his career, he also served in various management positions: Scientist-in-Charge of the Hawaiian Volcano Observatory (1975-1976); Chief of the Office of Geochemistry and Geophysics (1976-1981); and, most recently, as Chief Scientist of the Volcano Hazards Program (1996-1999). He received his BA in geology from Pomona College (1958) and a Ph.D. from Yale University (1963). Currently, Dr. Tilling is a Scientist Emeritus with the USGS and continuing volcano-hazards studies, including work at Mount Hood Volcano, Oregon.

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 service.

NCGS 2004-2005 Calendar

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

Wednesday March 9, 2005 ***Recently Added!!***
AAPG Distinguished Lecturer ***Details Below!***
David Jennette, Bureau of Economic Geology
Austin, Texas
Making Sense of Turbidite Reservoirs: A Multi-Basin Perspective on What Drives Architecture and Rock Properties
Lunch: 11:30 a.m., ChevronTexaco Cafeteria
Talk: 12:30 p.m. Building D, Room D2193
ChevronTexaco Park, 6001 Bollinger Canyon Road, San Ramon, CA 94583

(In order to get visitor access to ChevronTexaco campus we ask that you contact Will Schweller at WJSA@chevrontexaco.com preferably a day or more ahead of the talk. We'll need to request a visitors badge for you which can be picked up at the front desk in the main lobby the day of the talk.)

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

(For Additional Details See Following Pages)

March 12, 2005	***Colorful Geology of the Fremont Area*** **Dr. Joyce Blueford and D. Paul Belasky**
May 21, 2005	***Robert Sibley Volcanic Regional Preserve in Berkeley Hills*** **Stephen Edwards,** Director, Tilden Regional Botanic Garden
June 25 - 26, 2005	***Blueschists and Breweries ("BrewschistsII)*** **John Wakabayashi**, Consultant

We're Looking for Convention Volunteers!!

If you would like to help out at the Pacific Section AAGP / Cordilleran Section GSA Convention (April 29 to May 1, 2005) we are seeking volunteers for several positions. Since the January newsletter we have filled the Catering Chair. Currently our most pressing need is fore an experienced Power Point Projector Technician. We are also in need of a Judging Chair, no experience necessary because it is primarily a manager position.

Upcoming Meetings of Interest – Bay Area Geophysical Society

Wednesday February 24th, 2005
Dr. Philip Duffy, Lawrence Livermore National Lab
Climate Change: A Review of the Science, and Implications for California
Location: ChevronTexaco Park, 6001 Bollinger Canyon Road, San Ramon, CA 94583
Lunch: 11:20 a.m., ChevronTexaco Cafeteria
Talk: 12:20 p.m. Building D, Room D2193
In order to get visitor access to ChevronTexaco campus we ask that you contact either Warren King or Peeter Akerberg, preferably a day or more ahead of the talk. One of us will request a visitors badge for you which can be picked up at the front desk in the main lobby the day of the talk.
Directions: Please follow these directions!
Map: Map of ChevronTexaco Campus
Abstracts, biographies, directions, and maps can be found at: http://sepwww.stanford.edu/bags/calendar

UPCOMING FIELD TRIPS

(Please be aware that not all field trip details are known; however, since one is a two day trip, we thought it best to provide you with some advanced details.)

ROBERT SIBLEY VOLCANIC REGIONAL PRESERVE IN THE BERKELEY HILLS

Leader: ***Stephen Edwards***, Director Tilden Park Regional Botanical Garden
May 21, 2005

The volcanic rocks at Robert Sibley Volcanic Regional Preserve are all late Miocene Moraga Fm. Garniss Curtis has studied this formation and this site for decades and believes this is a piece of the Quien Sabe volcanics that has been transported north on the East Bay fault system. In terms of accessibility and exposure, Sibley is the showcase site for this volcanic complex, which is also represented by the Tolay Volcanics in Sonoma and probabley Burdell Mountain in Marin County. We will be looking primarily at basltic-andesitic rocks, but with considerable textural and structural variety. A basaltic volcano (Round Top) dominates the landscape. Kaiser quarrying and erosion have exposed its deep interior and underpinning like no other volcano in California. **Following the field trip, geoscience family & friends gathering with BBQ (Tentative).**

BLUESCHISTS AND BREWERIES ("BREWSCHISTS II).

Leader: ***John Wakabayashi***, Consultant
June 25 – 26, 2005

Many field trips celebrate wine and geology. The Coast Ranges ,whose geology is world famous because of the Franciscan Complex, is world famous for another fermented beverage besides wine---beer. Just as Franciscan blueschists have attracted the interest of geologists from around the world, the ales of US West Coast have won international acclaim as a regionally distinct style. One can make a good case that the small breweries of this region are as renowned among international beer enthusiasts as the wineries of the region are among wine lovers. This two-day field trip is a celebration of two things for which California is famous, blueschists of the Franciscan Complex, and wonderfully aromatic hoppy ales. There will be no private vehicles on this trip as participants will be transported by bus. All of the pubs on the schedule feature good food, so there is plenty to enjoy for individuals or families that do not wish to have beer. This trip reprises a trip that was run in 2001, but features a different camping spot, and a different Sunday lunch stop. The following is a tentative itinerary.

SATURDAY

Stop 1: Ring Mountain, Tiburon Peninsula (long stop). This stop visits the dazzling crown jewel of Bay Area geology to view beautiful blueschists, eclogites and amphibolites.

First pub: Marin Brewing Company, Larkspur (short stop). Marin's Mt. Tam Pale Ale and IPA are benchmark beers, award-winning beers, and the pub food selection here is among the best of Bay Area brewpubs.

Stop 2 Blueschist facies metagraywacke off of Atherton Ave. exit, Novato. Although blueschist facies, these rocks demonstrate that "most of what is blueschist facies in the Franciscan is neither blue nor schist"

Lunch (2nd pub): Bear Republic Brewing Company, Healdsburg. This brewery has won a Great American Beer Festival gold medal with its Racer 5 IPA, but the legendary Hop Rod, is hoppier still and was the favorite beer of Brewschists 2001 participants. The food is noteworthy, especially the incomparable herb-garlic fries, that feature melted parmesan over fries with tons of garlic, rosemary and parsley--all this and they're not greasy or overly salty, either. Best garlic fries on the planet, bar none! Bear Republic was the clear favorite for participants in Brewschists 2001.

Stop 3: Skaggs Springs schist near Lake Sonoma. This is the classic exposure of this schist. The road cuts across this schist for 4 km, and the outcrop is part of a 70 km long belt. Interesting field relations between this schist and coarse grained garnet-bearing blueschists and amphibolites are exposed as well.

Camping spot: Lake Sonoma. There is some fine geology in the vicinity of this campground. With time we may be able to explore some. One of the highlights is a nearby remnant of the Coast Range ophiolite.

SUNDAY

Stop 1: Jenner. This is arguably the second finest Franciscan high-grade block spot (after Ring Mountain) in all of the Franciscan. Some participants are more impressed with Jenner than Ring Mtn. because this place features a veritable pile of spectacular eclogite boulders in a beautiful setting where the Russian River enters the Pacific Ocean.

Stop 2: Low grade blueschist grade metabasalts, Occidental. Here we see some basalt that barely show hand specimen evidence of blueschist facies metamorphism.

Lunch (pub no. 3): Russian River Brewing Company, Santa Rosa. This will be a serious upgrade from the lunch stop for Brewschists 2001. Russian River Brewing Company produces one of the areas best IPAs, and their double IPA, "Pliny the Elder" is something not to be missed. Russian River Brew Company brew award-winning Belgian style ales including some rather adventurous ones. Russian River Brewing Company specializes in fine pizzas.

Afternoon stop. Moylan's Brewing Company, Novato. Moylan's produces some fine ales, particularly some of their specialty beers. Their Imperial Stout and barleywine are consistently among the best, but the legendary brew here is the famed Moylander double IPA, a brew made (geologically) famous on various Friends of the Pleistocene field trips.

In conclusion these two days will feature the two most dazzling blueschist, eclogite, and amphibolite localities in the Franciscan, Jenner and Ring Mountain, and four of the greatest small breweries in the world. Isn't it great to live in this area?

Please contact Tridib Guha at aars@netscape.com **for reservation.**

Dibblee Geology Center Announcement and Appeal

The Dibblee Geology Center of the Santa Barbara Museum of Natural History has released a publishing schedule for Dibblee maps that will be available at the 2005 Annual Meeting, Cordilleran GSA & Pacific Section AAPG, April 29-May 1, at the Fairmont Hotel in San Jose. As you will note below, the list includes some maps from the Parkfield area and the SF Bay Area. In addition to releasing Tom Dibblee's maps in color to replace the older black and white Open File maps, the Dibblee Geology Center has recently been working with Earl Brabb, Carl Wentworth, Russ Graymer, and various other USGS authors in an effort to publish their maps of the SF Bay Area. It is intended that both the Dibblee and USGS maps will be published in color and at 1:24,000 scale. Tom's USGS Open File maps for the SF Bay area have been the only integrated set at 1:24,000-scale for much of the area since 1966, but these maps are now difficult to obtain from the USGS in Denver. The USGS maps benefit from the donation of about 25,000 newly released paleontologic determinations from Chevron, Unocal, and Exxon, and they also have a complete revision of the Quaternary geology suitable for predicting some of the effects of major earthquakes. Both sets of maps will be a valuable addition to your library. For this to happen, funding must be raised to facilitate the publishing of the USGS maps. As is customary with the Dibblee maps, individual contributions of $500 or more and corporate contributions of $1000 or more will be recognized in print on one or more of either of the maps. Sponsorship and Dedications are also possible for all of the maps. All proceeds from map sales will benefit future Dibblee map making. Send your donations payable to the Dibblee Geology Center, SBNHM, 2559 Puesta del Sol Road, Santa Barbara, CA 93105. Indicate on the check for Dibblee or USGS maps.

John Powell
PO Box 2309
Camarillo, CA 93011
805-231-8080
Dibbleemap@adelphia.net

Maps to be released by GSA - AAPG Convention Date: Mare Island, Benicia, Richmond, Briones Valley, Walnut Creek, Parkfield, Cholame Hills, Cholame, Cholame Valley, Orchard Peak, Newark, Niles, La Costa Valley, Milpitas, Calaveras Reservoir, San Jose East, Lick Observatory, Los Gatos, Santa Teresa Hills, and Morgan Hill.

Maps to be released in June 2005: Oakland East, Las Tramplas Ridge, Diablo, Hayward, Dublin, Mt Sizer, Laurel, Loma Prieta, Mt. Madonna, and Gilroy.

Rugged Plants Struggle to Survive on Barren Serpentine Soil

Contributed by Dan Day

Ultramafic rocks are scattered throughout the California Coast Range, the Trinity Mountains, and the Sierra Nevada foothills. That serpentine is the state rock proves it has caught the eye of California geologists. However, many are perhaps unaware that serpentinites have spawned a unique flora specially adapted to survive on their nutrient-poor soils. The adaptive characteristics of one such species was explored in **Cheryl Smith's** January 26, 2005, NCGS talk **Geochemical Investigation of the Distribution Habitat of *Arabis macdonaldiana* (McDonald's Rock Cress) in the Six River National Forest, Del Norte County, California.**

Cheryl, current President of the Peninsula Geological Society, did field work in remote Del Norte county on the California-Oregon border studying the geochemical characteristics of soils supporting isolated communities of this rare endanger plant, pictured below.

Arabis macdonaldiana

Botanical and ecological data on this and other hardy plants surviving on ultramafic soils are voluminous, but to date, the actual adaptive relationships between the plants and their environment are vague. California is an excellent place to study these interrelationships because of its quite varied plant life—over 5,000 plant species grow in the Golden State, more than the combined total of the central and eastern United States and adjacent parts of Canada. Additionally, 30% of California's flora occur nowhere else in the world. By comparison, only 13% of the flora in the Northeastern U.S. are endemic, and only 1% in the British Isles. One reason for California's prolific flora is its remarkably varied habitats. The latter provide conditions for a plant's successful survival and reproduction.

California has a multitude of climatic conditions as well as a wide variety of rock types to support its complex floral communities. Similar habitats have been grouped into landform provinces based on their comparable topographic and climatic conditions. Each province, however, often contains a diversity of unique habitats, in large part a result of California's complex and active geological processes. Landscape evolution and the accompanying cooler, drier climate, for instance, gradually transformed some of the Tertiary sub-tropical habitats in central and southern California into semi-arid and desert communities. Lush forests were restricted to the wetter areas along the temperate northern California coast. Subsequent uplift of the Sierra Nevada range provided wet, higher elevation habitats on its western slopes and parched deserts in the rain-shadow to the east. Glacial-induced climate fluctuations yielded even more microenvironments that survived in sheltered areas until today. Other important factors influencing a plant's survival include its ability to interact with other plant species, compete with them for nutrients, protect itself from indigenous fauna, and successfully reproduce. All of these geological changes drove evolutionary mechanisms to fill the new habitats, as existing species were forced to occupy restricted habitats called *refugia*. California's tectonic activity and numerous microclimates have heavily influenced plant distribution in the state. Some restricted habitats are disappearing while others are emerging, but both support rare plant species. Isolated seasonal habitats likewise spawn unusual flora, often differing from one location to another.

Unique habitats often occur as "islands" surrounded by more common vegetation. Many of these isolated ecological communities exist because of the local geology. Complex intermixtures of rock types provide very distinctive soils that are home to rare plant life. Because they lack many key elements that support the usual floral species, and are enriched in harmful elements, serpentine soils are home to a variety of uniquely adapted plants. The soils are rich in heavy metals and barren of vital elements needed to support conventional plant life. They are shallow, low in calcium, high in magnesium, and do not hold water well.

Serpentine flora provide an exciting opportunity for botanists and ecologists to probe adaptive evolutionary mechanisms. The soils that develop on these ultramafic rocks contain some elements, like nickel and chrome, which are toxic to most plant species. The stresses induced by their extreme compositional characteristics have actually selected traits and mutations that allow

certain hardy plants to adapt to serpentine soils. Some plants actually become tolerant to these toxic elements and are capable of assimilating large quantities without ill effects, a phenomenon known as *hyperaccumulation*. Mutation may play a role in this adaptive process.

Cheryl's thesis study was conducted in a very remote part of the Six River National Forest in Del Norte County. Her field area was located on the Josephine ophiolite atop serpentine and ultramafic rocks. The area is isolated and inhabited by a very private rural population, wary of strangers. Cheryl needed to exercise caution as she hiked the backcountry with her trusty dog in search of *Arabis macdonaldiana* colonies. Serpentine chaparral interspersed with evergreen woodlands dominate the rugged landscape. The tiny magenta flowers hug the ground and are unobtrusive except in localized colonies where they form thick carpets. Cheryl sampled the soils around the plants, being careful not to disturb them. The samples were used to determine the soil mineralogy and its elemental composition. Another element in high concentration at the plant sites is barium. Adaptation to the toxic influences of barium may be a key factor for flora that exist on serpentine soils. Toxins and growth inhibitors drive natural selection by favoring certain mutations. Some of these selective processes may involve changes in only a single gene. Cheryl's studies, though not conclusive, have provided trace element data that can be used to further characterize the environmental effects surrounding *Arabis macdonaldiana*.

Audience discussion following the talk mentioned the pioneering work of California botanist Arthur Kruckeberg on serpentine flora. He summarized his studies in his 1984 publication ***California Serpentines: Flora, Vegetation Geology, Soils, and Management Problems.*** This treatise, and additional research being conducted at the U.C. Davis McLaughlin Reserve in the California Coast Range north of the Napa Valley, have made significant contributions to understanding the mechanisms that control the state's diverse vegetation. Kruckeberg echoes many of the reasons mentioned above that make serpentine soils so infertile: their high magnesium, nickel, and chromium contents, low levels of soluble calcium and nitrogen, and poor water retention. Included in the "serpentine" category are soils derived from partially serpentinized peridotite (an ultramafic rock), gabbro (the plutonic equivalent of basalt), and basalt greenstones (metabasalts of ophiolitic origin). All these soil derivatives share similar soil characteristics with the serpentinites and also support unusual plant life.

Kruckeberg described plant responses to serpentine soils as avoidance, indifference, and endemism. Indigenous taxa that cannot survive on serpentine substrates are the *avoiders*; the flora that can endure both serpentine and nonserpentine soils are *indifferent*; and the *endemic* species are restricted to serpentine soils. It is the latter (endemic) species that have caught the eye of evolutionary biologists. Theories regarding the origin of the endemics are twofold. One champions the paleoendemic hypothesis, which propose that ancestral species occupied several habitats until climate changes caused extinction of the nonserpentine populations. The other is the neoendemic theory, which suggests the "insular" taxa with extremely limited ranges evolved from ancestors living on adjacent nonserpentine soils. Botanists have shown that the endemics will grow on nonserpentine soils if carefully nurtured, and that they will flourish there if cultivated alone. This would imply that competition with other species on the nonserpentine substrates forced them to occupy the more harsh conditions of the serpentine soils. The degree of plant endemism is also variable, from 100% serpentine restriction to only partial restriction, depending on the local geology. Reduced restriction is exhibited by "indicator" taxa, which are serpentine-restricted in only part of their ranges. Kruckeberg estimated an approximately equal count of serpentine endemic and serpentine indicator species, totaling over 425 taxa. He also noted that the Northern Coast Range serpentinites are particularly rich in plant life. Continuing serpentine flora research is being conducted at the McLaughlin Reserve, and is methodically revealing the survival strategies of these unusual plants.

The NCGS gratefully acknowledges Cheryl Smith for sharing her research on the major and trace element geochemistry of serpentine soils and its potential impact on the endangered plant *Arabis macdonaldiana* (McDonald's rock cress). The botanical research surrounding this and other endemic serpentine soil inhabitants is making major contributions to evolutionary biology. However, the soil mineralogy and elemental chemistry, as pointed out by Cheryl, needs further clarification to identify its specific role in the survival of these hardy plants.

Note: The biological commentary on serpentine floral species and their evolutionary development was taken from the McLaughlin Reserve website, and from a short article called **Why Rare Species?** authored by Susan Cochrane and posted on the Ceres website.

2004-05 AAPG Distinguished Lecture

Abstract

DAVID C. JENNETTE
Bureau of Economic Geology
Austin, TX

Funded by the AAPG Foundation

Making Sense of Turbidite Reservoirs: A Multi-basin Perspective on What Drives Architecture and Rock Properties

Our knowledge of turbidite reservoirs has advanced rapidly over the past 15 years, owing largely to the petroleum industry's acquisition of ever larger and higher frequency 3-D marine seismic surveys. These surveys provide a stunning portfolio of high-resolution snapshots of ancient and modern submarine landscapes and illustrate the intricate details of their accompanying turbidite systems. As 3-D volumes are stitched together and time-stratigraphy across large parts of continental slopes established, subsurface workers can reconstruct characteristics of the ancient shelf, shelf edge, slope, and basin floor environments and deduce the suite of processes and controls that led to the development of the spectrum of turbidite reservoirs. Understanding these basic controls improves our ability to generate models that better predict the broad range of attributes required to ensure commerciality in costly offshore operating environments and/or settings where resolution of the objective is compromised by salt or deep burial.

Subsurface systems like those encountered in the Paleogene of the North Sea and the Tertiary of the Gulf of Mexico, offshore West Africa, and offshore Egypt, together with the outcropping systems of the Permian of West Texas and the Carboniferous Claire Group of western Ireland, provide comparative data sets from which to evaluate the principal mechanisms that establish turbidite reservoirs. We observe contrasting styles of architecture (channel-dominated to sheet-dominated), pattern (straight versus highly sinuous, dendritic versus lobate), sand percent, bed thickness, and grain size and sorting. These characteristics can be tied to (1) the sediment delivery system that, in conveyer belt fashion, controls the composition and volume of sediment available to the shelf edge, (2) triggering mechanisms at the shelf edge that control the volume, feed rate, and concentration of the flows, and (3) sea floor gradients that influence the acceleration, steadiness, or deceleration of flows. Within any one system, much of the reservoir architecture we observe can be tied back to the sand:mud ratio of flows and to sea floor gradient. A fourth factor influencing final architectural character, particularly on the upper slope, is modification by slumping or headwardly migrating erosional nickpoints.

Amid all of the volume-based characterization tools, classical seismic sequence stratigraphy remains one of the stratigrapher's most important characterization tools. Whether applied to outcrops or subsurface data sets, it provides a method to establish reservoir properties of genetically related deposits. Increasing seismic resolution allows subsurface stratigraphers to identify a highly detailed array of reservoir building blocks and systems tracts that lead to better prediction of individual fluid flow units. Sequence stratigraphy also helps identify changes in reservoir characteristics that occurred over a longer unit of geologic time. Such evolutionary changes record systematic variations in the sediment delivery system, shelf edge character that may be driven by a eustasy, climate, or accommodation space.

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP

Colorful Geology of the Fremont Area

Saturday March 12, 2005

Field Trip Leaders:
Dr. Joyce Blueford, Math Science Nucleus (formerly U. S.G. S.)
Dr. Paul Belasky, Ohlone College

After the orientation we will proceed to Tule Ponds at Tyson Lagoon Wetland Center to see the trace of the Hayward Fault. This area has been a site of extensive study by seismic stratigraphers who have looked back 4000 years. Then we proceed to Sabercat Creek to see the Irvingston Gravels - Pleistocene Vertebrate Fossil Collection Area. Also see the fossil collection at the Ohlone College. From Ohlone College we will walk up toward Mission Peak to view Miocene to Quatnary sedimentary rocks. Recent and ancient landslides will also be viewed. If time permits then we will head up toward Morrison Canyon to look at Cenozoic siliceous sedimentation and to view the watershed that drains into Tyson Lagoon.

THIS FIELD TRIP WILL BE LIMITED TO 40 PEOPLE. CARPOOL/VANPOOL IS A MUST

********** **Field Trip Logistics** **********

Time: Saturday March 12, 2005, 8:00 am

Departure: The gathering place at Math Science Nucleus, 4074 Eggers Drive, Fremont (http://msnucleus.org/mapegg.html); distribution of guide book, coffee and donuts, and overview of the trip.

Cost: $20 for members, $30 for non-members, and $10 for students

**********REGISTRATION FORM (Geology of Fremont Field Trip)**********

Name:_____ E-mail:_____

Address:_____ Phone (day):_____ Phone (evening):_____

Lunch: 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: aars@netscape.com Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)
People who are willing to drive their car or SUV please indicate.

Boot Up for Calgary!

AAPG Annual Convention

June 19–22, 2005
Calgary, Alberta, Canada

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- CSPG Core Conference
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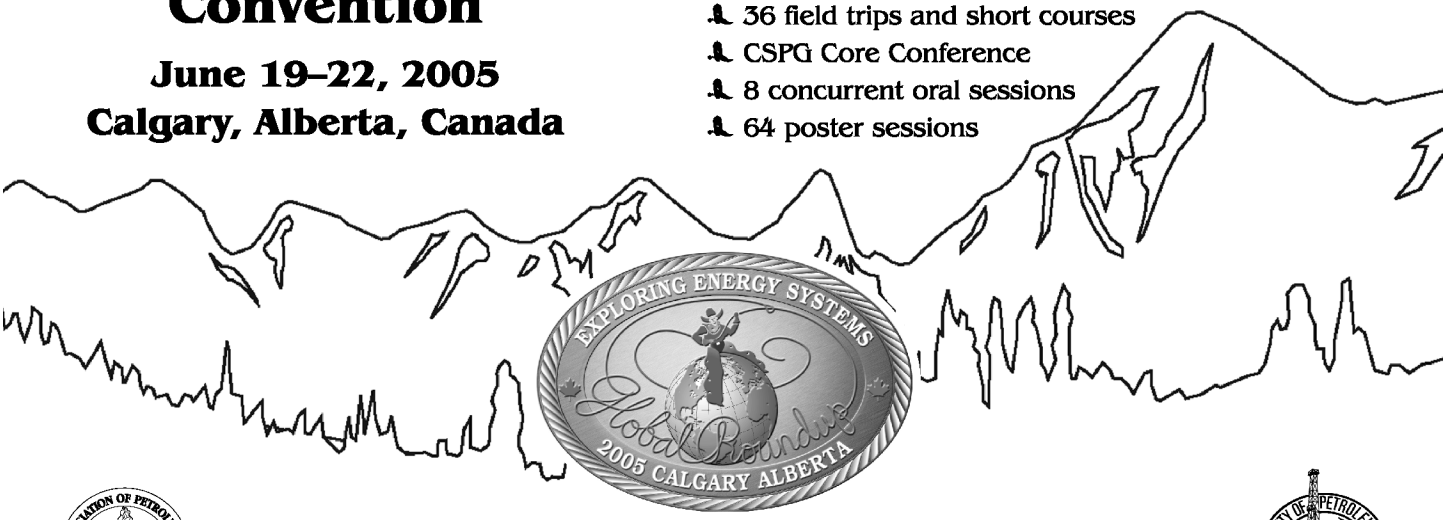
- 64 poster sessions



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