

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



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## MEETING ANNOUNCEMENT

**DATE:** Wednesday, November 19, 2003

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

**TIME:** 6:30 p.m. Social; 7:00 p.m. talk (no dinner)

Cost is \$5 per regular member; \$1 per student member

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

**Speaker:** Dr. John W. Williams, Department of Geology, San José State University

*Engineering Geology Contributes to Living Safely in the Geologically Dynamic San Francisco Bay Area*

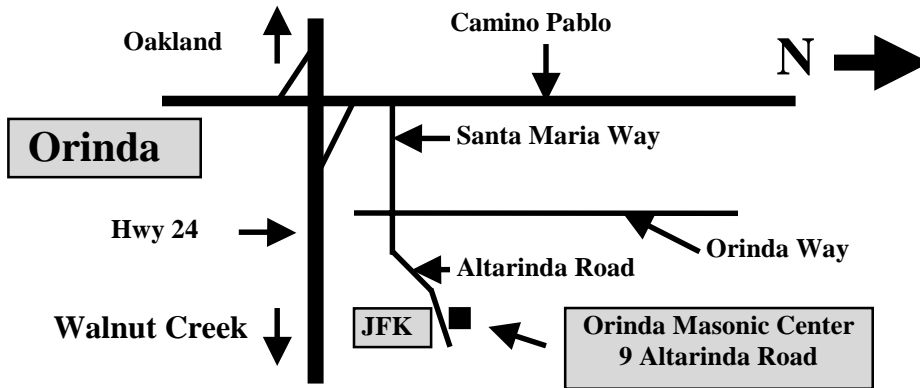
The San Francisco Bay Area is astride one of the major plate boundaries of the world, the dynamic San Andreas Fault system. Thirty years ago, the California Division of Mines and Geology (today the California Geological Survey) published their forecast for losses associated with geological processes in the California. During the period 1970-2000, \$55 billion dollars (1970 dollars) in geologically related losses were projected to occur. Clearly the losses in the Bay Area resulting from the Loma Prieta earthquake, El Niño, etc. confirm the reality and correct order of magnitude of these predictions of loss. The nine Bay Area counties' population of 6.7 million people is living in 101 cities with the geological aspects considered in that study; earthquake shaking, loss of mineral resources, landsliding, flooding, erosion, expansive soil, fault displacement, volcanic eruption, tsunami, and subsidence.

A team effort is required for Bay Area citizens to live safely with these geologic processes. An effective team consists of engineering geologists, public officials including the legislature, media representatives, educators, an involved public, and others. The engineering geologist's contribution must include technically good and effectively communicated data on the question of what, where, and when relative to potential geologic threats. Questions that must be answered are:

- a) Where and when will the next fault ruptures occur?
- b) What will be the intensity of ground shaking at a particular location?
- c) What areas are more susceptible regions to landslide failure?
- d) Where are the deposits of mineral resources needed by an ever-expanding society?

The specifically educated, state-licensed professional, engineering geologist has many more tools and a much greater understanding of these processes to deal with these problems today compared to the 1970's. In the last 50 years, the knowledge gathered through the research efforts of organizations such as the US Geological Survey, California Geology Survey, and academic institutions has grown exponentially. Geologic events such as the Loma Prieta earthquake, debris flows stimulated by record rainfall events, etc. have provided opportunities to study and better understand the questions of why, where, and when these events occurred.

## Meeting Location



Scientific knowledge of these geological processes is only part of the program needed to help protect the public. Unless public officials develop regulations and laws requiring the incorporation of geological aspects into building codes, zoning ordinances, etc. the knowledge will not be put to use. The public must appreciate the need to consider geology and insist that it be appropriately included in their daily activities. It is encouraging to note that California's legislature has been aggressive in implementing geologically oriented programs such as the Alquist-Priolo Act, Seismic Hazard Mapping Program, etc. In addition, scarce resources have been committed to the upgrading of critical infrastructure components such as the Golden Gate Bridge, the Bay Bridge, and the Embarcadero Freeway.

John W. Williams is Professor of Engineering Geology and Chair of the Department of Geology at San Jose State University where he has served for 27 years. Before joining the San Jose State University faculty, he was a geologist with the California Division of Mines and Geology from 1971 until 1976. His education in geology includes BS (1967) from the College of William and Mary and an MS (1968) and PhD (1970) from Stanford University. He is licensed as a geologist, engineering geologist, and hydrogeologist in CA, OR, and VA. He was President of the Association of Engineering Geologists (AEG) and the National Association of State Boards of Geology (ASBOG) and is on state and national committees and boards many of which are involved in the implementation of professional licensure for geologists. His areas of geological expertise include general engineering geology with particular emphasis on slope stability, landuse planning, and professional ethics.

Northern California Geological Society  
C/o Mark Detterman  
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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](mailto:danday94@pacbell.net) to sign up for this service.

# NCGS 2003-2004 Calendar

Wednesday January 28, 2004

Dr. Ronald Olowin, Professor of Astronomy and Physics, Saint Mary's College, Orinda

*TBA (loosely on the origin of the solar system, and reported to have some incredible space-based views of the solar system and beyond!)*

7:00 PM at Orinda Masonic Center

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## *Upcoming Field Trips...*

**November 22, 2003**

*Mt. Burdell*

**Rick Ford**, SFSU Graduate Thesis

**Summer 2004 (TBA)**

*Northern California Gold Belt, Quincy*  
( BLM has put all travel on hold)

**Gregg Wilkerson**, BLM

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## **Bay Area Geophysical Society**

*No meetings are currently scheduled.*

Please check the BAGS website <http://sepwww.stanford.edu/bags/> regularly for meeting notices and updates.

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## **Association of Engineering Geologists San Francisco Section**

December 9, 2003

William Cole and Philip Johnson, Cotton, Shires and Associates, Inc.

*The Use of Large-Diameter Boreholes and Downhole Logging Methods in Landslide Investigations (Tentative Title)*

San Jose Area Venue to be Determined Later

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**Check out our Recently Updated Website!!**

It's under reconstruction, so please bear with us!

*www.ncgeolsoc.org*

# The Santa Clara Valley 3D Map Project

NCGS members were introduced to a unique 3D mapping project by USGS geologist **Dr. Carl Wentworth** at the September 24th meeting. Dr. Wentworth and his colleagues Drs. Bob Jachens, Don Gautier, **Randy Hanson** and others have spent the last four years compiling a variety of geophysical, seismic, drillhole, hydrologic, and stratigraphic data into a novel 3D map of a 45 km.-square section of the Santa Clara Valley to a depth of 14 km. Its unique features are ushering in a new era of digital mapping/database compilation.

Carl and his USGS team have been working closely with software company Dynamic Graphics of Alameda to develop not only a subsurface map of Santa Clara Valley, but a digital technology for constructing, visualizing, and evaluating 3D models of subsurface geological, geophysical, seismic, and hydrological properties, and releasing this information in map form. This kind of flexible digital database would be an invaluable tool for modeling subsurface contaminant transport, groundwater movement, and seismic shaking using a fundamental map architecture to evaluate various parameters. Carl's talk summarized work to date and discussed how the map is being assembled.

The 3D maps are assembled using earthVision geologic modeling and visualization software designed by Dynamic Graphics. This software allows the extension of two dimensional features on conventional geologic maps to three dimensions. Additionally, the 3D software allows one to include a continuum of data point uncertainties that can be only partially realized in traditional map representations. The construction of the 3D maps is rigorously controlled. Data points gleaned from surface mapping, well data, geophysical inversions, seismicity, basic geologic concepts, and other resources are assembled and a numerically-defined surface is fitted to the points. This is used to orient a specific geologic surface in the 3D map volume. These surfaces are then assembled into a 3D structure according to rules that specify how these surfaces interact; i.e., how they intersect, offset, or truncate one another. Essentially what emerges are fault blocks and geologic units with spatially assigned properties and uncertainties. Since the map is numerically generated, it is enormously flexible over a wide range of defining parameters. This allows modelers to test a variety of features and elicit responses like ground shaking or specific hydrological characteristics. The software allows the user to graphically present the 3D map, examine it from various perspectives, section it, disassemble its parts and examine them, cross compare one dataset with another GIS database, and perform other functions.

A limiting factor in this study is the type of data available. The USGS team does not have the luxury of 3D seismic information, and well data is limited and often poorly described. Seismic line data plays a key role in extrapolating surface geological features into the subsurface, or in linking critical surfaces between well sites. Here oil and gas prospect surveys have proven to be valuable resources. Earthquake "hypocenters" can help locate active faults that have no surface expression. And finally, magnetic and gravity survey

data can be used to determine the probable lithology and extent of subsurface crystalline rock units, or sediment-bedrock contacts at depth. Because these surveys often cover wide geographical areas, gravity and magnetic data is a useful tool to interpolate subsurface information between widely scattered data points.

Scoping out the map began with defining the fundamental 3D architecture of the Santa Clara Valley and identifying the surfaces that needed to be included in the finished map. This preliminary survey drew heavily on the works of other USGS researchers like Russ Graymer, Earl Brabb, and their colleagues. The basic framework of the subsurface map was outlined in a tree diagram to help visualize where data was missing. Then the group rolled up their sleeves and began to fill in the gaps.

The Santa Clara Basin is a confined to unconfined basin that has been experiencing surface subsidence due to excessive groundwater pumping. Its extent is well-defined by differential surface subsidence monitored by radar imaging techniques. The map region encompasses two subsidiary basins: the Cupertino Basin on the west and the Evergreen basin on the east. The former is bounded to the west by the Santa Cruz Mountains and the latter on the east by the Diablo Range. The majority of the valley fill is gravelly detritus shed off the Santa Cruz range. The Survey group used two deep exploratory oil wells in the Los Gatos area and 10 deep groundwater monitoring wells to supplement their dataset. Combined geologic, geophysical, and hydrologic data allowed them to locate 11 faults in the map region, some defined solely by localized differences in groundwater hydraulic head. The region has about 120 groundwater wells, but only five with good geophysical data. These resources are being explored, but their usefulness at this point is still questionable. Paleomagnetic data is being used to help define the subsurface stratigraphy, and geotechnical bores from highway interchange construction to pin down the Pleistocene-Holocene boundary. Other vital information has been obtained from groundwater monitoring wells like the 1,000 foot deep well jointly managed by the USGS and the Santa Clara Water District begun in September 2000. This well and six planned deep monitoring wells in the Santa Clara Valley will be continuously cored to 100 feet and spot-cored thereafter for analysis at the Survey. This program was instigated to supplement the existing database and provide important information on the regional hydrology and seismic behavior. Both can be used for civic planning and disaster mitigation. Each addition piece of information is incorporated into the 3D Santa Clara Valley map. Fortunately the software can accept data revisions without significantly affecting general structural features. As more information is acquired, Carl and his coworkers continue to refine this unique mapping project, and its impact on one of America's major technology centers.

The NCGS offers its sincerest thanks to Carl Wentworth and Randy Hanson for their excellent presentation of ground-breaking work on an integrated 3D geological map system. This novel digital process not only allows an enormous regional database to be stored electronically, it can also be manipulated to extract regional seismologic and groundwater responses to specific input parameters. We wish them and their colleagues good luck with their future research.

## **Black Diamond Mines Teachers' Day Celebrates National Earth Science Week**

The annual Black Diamond Mines Teachers' Day event was held on Saturday, October 25, 2003. As in past years, the NCGS and the East Bay Regional Parks District teamed up to provide the attending K-12 teachers an exciting glimpse at the geology and history of northern California's only major source of coal in the late Nineteenth Century. Teachers' Day has been held the last several years to celebrate National Earth Science Week. It provides a unique exposure to the complex geology associated with Mount Diablo, a tutorial on a moderately large scale mining operation, and a poignant look at the rich history of a major Contra Costa County population center that all but disappeared at the turn of the century.

The day began early in the morning in the underground Hazel Atlas room, part of a mining operation at Black Diamond Mines in the 1920's-1940's that exploited the pure silica sand in the Eocene Domengine Formation as a raw material source for glass manufacturing and foundry casting molds. NCGS Past President Don Lewis welcomed the teachers and gave a brief introduction to the NCGS, followed by a discussion of the annual Teacher of the Year Award sponsored by AAPG, and our affiliation with this international petroleum geological society.

After these introductions, Dr. Ray Sullivan of San Francisco State University commenced his discussion of the evolution of the Domengine formation, precursed by a brief discussion of the global plate tectonic scenario as the southern Pangean subcontinent Gondwanaland began to fragment in the late Mesozoic. This segued into a discussion of Bay Area geology and in particular the lower Tertiary section exposed on the northwest flank of Mount Diablo that has been conveniently bisected by Markley canyon. The sediments here trend NW-SE and dip steeply to the NE. The canyon exposes a 6000-foot section of rock beginning with the 50 million year-old Domengine Formation through the Nortonville Shale to the volcanic sand-rich Kirker Formation at 11 million years of age. The Domengine is near the same age as the Ione Formation exposed in the western foothills of the Sierra Nevada Range. Both units were or are being mined for their clean silica sand and pure kaolin clay. Similarities between the two indicate a common origin. Ray displayed a map showing the reconstructed continental margin in northern California at 50 m.y. ago, and noted that the Pacific shoreline was at the Sierran foothills and that Concord, California, lay at the edge of the continental shelf. Nearly four decades of research at Black Diamond Mines have provided Ray with evidence indicating that the Domengine (and Ione far to the east) was formed in a fluvial-estuarine environment rather than along a coastal beach setting. An excellent analogy to this is the current Bay of Fundy between the Canadian maritime provinces of Nova Scotia and New Brunswick. Ray proceeded to contrast the structures exposed in the Domengine strata with similar features in the Bay of Fundy sediments. He also gave an excellent tutorial on the mechanics of estuarine sedimentation and the various features that occur in the

subtidal, intratidal, and supratidal zones as a function of daily tidal fluctuations.

Next Ray discussed the coal seams located within the Domengine and their historical significance. The discovery of coal in this area immediately after the 49er Gold Rush fueled a migration of coal miners to the area and the establishment of five mining communities: Somersville, Nortonville, Stewartville, West Hartley, and Judsonville. Ray, being of Welsh origin, has a particular interest in this area, which was inhabited by Welsh miners. His slides tell the story of how the miners constructed their coal mines and transported the coal to the surface. Some also speak of mining tragedies and the tough lives of the miners. Once mining died out at the turn of the century, the area reverted back to ranching and the mining towns were abandoned.

Following this geological and mining introduction, the group set off with EBRPD naturalist Bob Kanagaki to explore the well-engineered tunnels left by the sand mining operations. The tunnel walls provided textbook examples of sedimentary features that Ray uses to illustrate his paleoenvironmental reconstruction of the estuarine Domengine sand units. After the mine tour, the hungry participants and their leaders convened in the picnic area for lunch—a delicious chicken and salmon barbecue prepared by NCGS Past President Tridib Guha, assisted by Treasurer Phil Reed and Secretary Dan Day. This repast has always been popular with those who have attended past Teachers' Day functions. Suffice it to say that Tridib's barbecuing prowess grows each year! Hardly a morsel was left when the meal was finished!

The well-fed teachers then took to the road with Traci Parent, who led them to Rose Hill Cemetery. This historical burial ground contains much information about the coal mining communities. And Traci has done an admirable job searching through newspaper archives to help determine some of the historical events and personal relationships—some tragic—that are alluded to on the gravestones. Her deep interest in the history of the mining communities has enriched our knowledge of the early days of Contra Costa County and the East Bay.

Many thanks to all who helped out with this year's Teachers' Day at Black Diamond Mines Preserve. The NCGS gratefully acknowledges Ray Sullivan, Don Lewis, Tridib Guha, Phil Reed, and Dan Day. And the event would not have been possible without the coordination and help of Bob Kanagaki, Traci Parent, and the supporting staff—including lay volunteers—of the East Bay Regional Park District. Their contribution to the park natural habitat, mining operations, and the local history completes the picture of this unique Preserve.

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



## *Miocene Volcanic Rocks at Burdell Mountain and Implications for Slip along the East Bay Fault System*

**Saturday, November 22, 2003**

**Trip Leader:**

**Eric Ford, SFSU Master's Student**

Burdell Mountain, located 50 km north of San Francisco, California, consists of Cretaceous and Jurassic Franciscan Complex and Great Valley Sequence rocks overlain by 65 m of Tertiary marine sandstone, and 200 m of Miocene volcanic rocks. The Burdell Mountain volcanics (BMV) are approximately 200 m thick and consist dominantly of flow-banded, porphyritic andesite, and lesser amounts of volcanic breccia, volcanoclastic mudflow deposits, and minor flow-banded rhyolite. The BMV together with the underlying Tertiary marine strata generally form a moderately, northeast-dipping (~30°) homocline that is truncated by the Burdell Mountain fault zone (BMFZ) to the east.

The age and petrology of the volcanics and stratigraphic relations of the Burdell Mountain area are important to ongoing studies of long-term right-lateral displacement along the East Bay portion of the San Andreas Fault system. McLaughlin et al. (1996) estimated a maximum offset of 175 km along the East Bay fault system (EBFS) based, in part, on a correlation between the BMV and similar rocks of the Quien Sabe volcanic field (QSV) in central California. However, previous radiometric ages (K/Ar and Ar/Ar) for the Burdell Mountain volcanics (11.8-13.6 ma) do not match those for the QSV (7.4-11.6 Ma). Three new Ar/Ar ages for the BMV cluster around 11.1 Ma establishing an age correlation to the QSV. The age and lithology of the rhyolite of the BMV are also similar to the Northbrae rhyolite in the Berkeley Hills suggesting a minimum right-lateral offset of 30 km between these two regions. We will test further the BMV-QSV correlation by focusing on petrographic and stratigraphic comparisons of the two regions.

Few studies have focused on the BMFZ, a complex, northwest-striking, 500 m-wide, subvertical, shear zone characterized by local hydrothermal alteration and silicification. Map relations suggest that the fault zone exhibits up to 10 km of right-lateral offset of the distinctive Cretaceous Novato Conglomerate of the Great Valley Sequence, implying that the BMFZ is an important component of the EBFS. Youthful tectonic geomorphic features along the (unzoned) fault suggest late Holocene movement. Future efforts will focus on locating a trench site suitable for providing information on the age of faulting.

*Abstract written by Eric W. Ford, S. John Caskey, David L. Wagner, and Robert J. Fleck*

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

**Time:** Saturday, November 22, 2003; leave Ferry Terminal @ 8:30 am (8:00 am coffee, pastries)

**Departure:** We will meet at Larkspur Ferry Terminal (no charge for parking), closest parking area to Sir Francis Drake Blvd.; and carpool from there to different stops showing along the Burdell Mountain fault. Most of this trip will be on the east side of Mt Burdell.

**Cost:** \$30; \$12 for adolescents; discount for students. Cost includes transportation, refreshments, lunch, and field guide.

\*\*\*\*\* **REGISTRATION FORM --- PLEASE RSVP by November 18** \*\*\*\*\*

Name \_\_\_\_\_ E-mail or Fax No. \_\_\_\_\_

Address (Street/City/Zip) \_\_\_\_\_

Phone (day) \_\_\_\_\_ Phone (evening) \_\_\_\_\_ Indicate if you are a nonmember (cost is \$35) \_\_\_\_\_

Regular Lunch \_\_\_\_\_ Vegetarian Lunch \_\_\_\_\_ (Please check one)

Please mail form and a check made out to NCGS to: **Jean Moran, P.O. Box 1861, Sausalito, CA. 94966**

If you have any questions or need additional information, e-mail Jean at [jeanm@stetsonengineers.com](mailto:jeanm@stetsonengineers.com), or call 415-331-6806 (evening)

# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



## 2003-2004 COLLEGIATE SCHOLARSHIPS PROGRAM

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The Northern California Geological Society is pleased to announce the availability of two scholarship awards for the 2003-2004 academic year:

### **Undergraduate Scholarship Award of \$500**

For candidates working toward completion of a senior thesis or honors research program

Funding is provided for projects implemented during the 2004 calendar year

*Application deadline is November 7, 2003 for a December 7, 2003 award date*

### **Graduate Scholarship Award of \$1,000**

For candidates working toward the MS or Ph.D degree

Funding is provided for projects implemented during the 2004 calendar year

*Application deadline is January 31, 2004 for a March 31, 2004 award date*

Applications can be requested from and submitted to:

**Randy E. Kirby**

Chair, NCGS Scholarship Committee

67 Brookwood Road, Unit 20

Orinda, CA 94563

*Voice:* (925) 288-2344

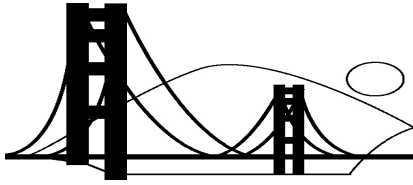
*Fax:* (925) 827-2029

*Email:* rkirby.geosci@usa.net

Funding priority will be directed to research programs focusing on topics in structural, stratigraphic, economic, engineering, or environmental geology, geophysics, mapping, stratigraphic paleontology, or paleoecology implemented within the State of California or immediately adjacent western states. Candidates will be evaluated based on submission of a cover letter requesting the award, a brief (no more than 2 page) summary of the proposed research topic, and a faculty signature confirming departmental approval of the application. Winners will be invited to speak or otherwise present their research at a regular evening NCGS meeting in Orinda, California.

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*Issue date:* September 5, 2003



## **CALIFORNIA'S COMPREHENSIVE GROUNDWATER MONITORING PROGRAM**

Presented by  
Ms. Sarah Raker, R.G., C.HG.; RWQCB

Ms. Raker will present a summary of the Groundwater Quality Monitoring Act of 2001 (Assembly Bill 599). The goal of AB 599 is to improve the groundwater monitoring in the state and increase the availability of information about groundwater quality to the public. AB599 requires that the State Water Resources Control Board (SWRCB), in coordination with an Interagency Task Force (ITF) and Public Advisory Committee (PAC), integrate existing monitoring programs and design new program elements, as necessary, to establish a comprehensive statewide groundwater quality monitoring program. Ms. Raker participated in PAC and ITF meetings in 2002 and 2003 and will present an overview of the process and proposed monitoring plan that was submitted to the governor and legislature in May.

Sarah Raker is an Engineering Geologist in the Groundwater Protection and Waste Containment Division at the California Regional Water Quality Control Board, San Francisco Bay Region. She is responsible for overseeing soil and groundwater cleanup at Treasure Island and Travis Air Force Base. She is also the region's coordinator for the SWRCB for the GAMA program and the AB599 California Groundwater Monitoring Act. Sarah has a MS in Geology from University of Nevada, Reno and a BS in Geology from Cal State San Diego. Prior to joining the Board in 2000, Sarah was a private consultant working on Superfund sites in Southern California and the Bay Area. She joined AWG in 1996.

### **DINNER / MEETING / PRESENTATION LOGISTICS**

Location: Washington Inn; 495 Tenth Street; Oakland CA 94607  
Date: Thursday, November 20, 2003

Timeline: 6:30 - 7:00 No Host Social and Registration  
7:00 - 8:00 Dinner Meeting  
8:00 - 8:45 Presentation  
8:45 - 9:00 Questions and Answers

### **Dinner Choices:**

- (1) Grilled Chicken, marinated in garlic and fresh herbs with mashed potatoes and seasonal vegetables;
- (2) Fettuccini Primavera tossed lightly in marinara with fresh vegetables and shaved pecorino cheese;
- (3) Grilled Salmon with a mango cognac coulis, lemon verbena basmati rice, fennel and asparagus.

### **RSVP REQUIRED:**

**PLEASE EMAIL RESERVATION BY 1 PM ON TUESDAY, NOVEMBER 18, 2003 with dinner choice to [jeanm@stetsonengineers.com](mailto:jeanm@stetsonengineers.com).**

Dinner costs \$30 for professionals and \$20 for students.

Questions? Please contact Holly Orndorff at [hollyanneo@yahoo.com](mailto:hollyanneo@yahoo.com) or, Jean Moran, at [jeanm@stetsonengineers.com](mailto:jeanm@stetsonengineers.com), or 415-331-6806 (evenings)