

Pacific Petroleum Geologist

NEWSLETTER



Pacific Section • American Association of Petroleum Geologists

May & June • 2007



AAPG Post-Convention Field Trip
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Pacific Section • American Association of Petroleum Geologists

May & June • 2007

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Message from the President

Mike Wracher

munication. Jon Schwalbach has pulled together an amazing technical program, one that made me tear my hair out trying to figure out what to miss! Field trip logistics for a national meeting are quite complicated and Gene Fritsche did an outstanding job. Without a doubt, the most important person to thank is Dalton Lockman. Under diverse and considerable pressure, Dalton has kept smiling while calmly making good decisions. Under his leadership it all came together! Congratulations to Dalton and everyone involved on a job well done!

I'd like to announce a new scholarship in the geology department at the California State University, Bakersfield. The Weddle Scholarship was started by James Weddle in memory of his father Herm Weddle. Herm was a longtime Chevron geologist, who became district geologist and made a big impact on those around him, especially his son James who followed in his footsteps. The first \$450 scholarship will be awarded this spring. If you would like to donate to the Weddle Scholarship or are a student interested in qualifying please contact Dr. Janice Gillespie at CSUB.

- Mike

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Members – Your attention is required on this important matter for the upcoming election!

At the January meeting of the Executive Committee, after careful consideration a motion was unanimously passed whereby it was proposed that the Editor-in-Chief be elevated to an elected position of the Executive Committee. As such the new Editor-in-Chief position will have all the duties and responsibilities pertaining to full standing on the executive committee. If the membership approves this change, the first election for this two year position will occur next year.

It became apparent to the Executive Committee that as the Newsletter Editors position increased in scope and responsibility, it was time to elevate this job. This position now includes growing and maintaining the functionality of our new website in addition to our longstanding newsletter. In recognition of this we changed the title of this job from Newsletter Editor to Editor-in-Chief.

It is necessary that the membership approve this change, therefore suggested bylaws have been posted on our website. Please review these new by-laws and vote during the upcoming election.

Mike Wracher
President PSAAPG



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Donald Clarke

Donald D. Clarke is a Geological Consultant. His clients include Vintage California, Tidelands Oil Production Company, Signal Hill Petroleum Company and Glamour Magazine. Don, a native of the Los Angeles basin, received his bachelor's degree in geology from California State University, Northridge and did additional graduate studies at California State Universities, Northridge, Los Angeles and Long Beach.

Don has been an active member of the Los Angeles Basin Geologic Society since 1974, and served as president from 1996 to 2002. He has been active in the Pacific Section, AAPG, serving as the General Chairman for the 1993 Annual Meeting and as the Co-General Chairman for the year 2000 Joint PSAAPG Western Regional SPE Annual Meeting. He served as program chairman for the 1989 Annual Meeting. He served as the Pacific Sections representative on the American Association of Petroleum Geologists, Advisory Council (2001-2003).

Don began his career in 1974 as an Energy and Mineral Resources Engineer with the California State Lands Commission, where he worked extensively on the giant Wilmington oil field and the California offshore. In 1981 he took a position as senior geologist with the City of Long Beach Department of Oil Properties, which acts as the unit operator for the Wilmington oil field. He served as chairman of the Long Beach Unit Equity Geology and Sand Volume Subcommittees. Other work included Division Engineer of Subsidence, geological hazards and some environmental geology. He continued to work for Oil Properties as Division Engineer in charge of geology until he retired in December 2004.

Over the years Don has focused on community outreach and education. He has spoken on geology to every high and middle school and many elementary schools in Long Beach and the surrounding areas. He has also spoken at most of the universities and to many community organizations. He has led dozens of geology field trips for community, university and other groups. Don recently retired from teaching geology at Compton Community College.

He joined the AAPG in 1986. For Annual Meetings Clarke has conducted field trips (1987 and 1996) and served as a session chair (1990 and 1996). He has been a member of the House of Delegates in 1988-1991, 1992-1995, 1996 (alternate) and 1997-2002. From 1994 to 1995 he was a member of the Constitution and Bylaws Committee of the House of Delegates. Clarke is currently serving on the Reservoir Development Committee (1998-2004) and chaired the Geotours Committee (2002-2004), Chairman of the Sections Committee (2004-2005) and the HOD Resolutions Committee (2002-2004). In 1997 he participated in the

Bryan Bell

Bryan Bell has been the Regional Manager for Core Laboratories in Bakersfield, California since 2003. This is Bryan's second go round with Core Lab. He started in the industry in 1978, working his way up from Assistant Lab Supervisor to Lab Manager in 1988. From 1988 to 2003, Bryan owned Goode Core Analysis which was also located in Bakersfield.

Bryan received his Bachelors of Arts in 1976 from California State University, East Bay. Over the years, he has been an active member in the San Joaquin Geological Society, the Society of Petroleum Engineers, the Society of Core Analyst and the San Joaquin Well Logging Society. He also has held various positions with these societies. •

AAPG Summit on Sections in Denver Colorado. He participated in the AAPG-EAGE Research Symposium held in Spain in 1998 and the AAPG/SPWLA Hedberg Research Symposium on "Horizontal wells-Focus on the Reservoir" at the Woodlands, Texas in 1999. He presented a paper at the AAPG International Meeting in Birmingham, England in 1999. Clarke is a charter member of the DEG. Mr. Clarke stood for AAPG Treasurer in 2000 and Chairman-elect of the House of Delegates in 2001 and 2004. In 2004-2005 he was elected Chairman-Elect of the AAPG House of Delegates. Don served as Chairman of the AAPG House of Delegates (2005-2006) and as such was also a member of the AAPG Executive Committee (2005-2006). He returned to the AAPG Advisory Council and serve as a member at large for the 2006-2007-term. Don is also served on the organizing committee for the 2007 AAPG Annual Meeting in Long Beach.

Mr. Clarke received the AAPG Distinguished Service Award in 2002 and the AAPG Division of Environmental Geosciences Public Outreach Award in 2004. In 2003 he received the Pacific Section AAPG Honorary Life Membership. In 2007 he was elected to the Russian Academy of Natural Sciences, United States Branch.

Don Clarke has published or presented over sixty technical papers on topics that include computer mapping, sequence stratigraphy, horizontal drilling, structural geology and reservoir evaluation. He served on the National Research Councils Committee on the Preservation of Geoscience Data and Collections. The findings were published in October 2002 as "Geoscience Data and Collections, Natural Resources in Peril." In September 2002 Mr. Clarke presented a paper entitled "Exploration and Production in an Urban Environment" in Washington DC to Congressional staff for the AAPG Presidents Summit on Energy which was subsequently published by AAPG. •

Karen E. Blake

Karen E. Blake began her career in the industry with Occidental Petroleum Company in 1997 working in Bakersfield as a geologic technician. In 1998, she was transferred with Oxy to Houston for the next couple of years. An opportunity to relocate back to Bakersfield presented itself and she took a technical position with Berry Petroleum. Her first professional position was with Paulsson Geophysical Services, Incorporated in Brea, California first as a geophysical analyst, and later as a geologist. After working on the service side of the industry, Karen wanted to move back to the production side. Plains Exploration & Production Company offered this opportunity. The first couple of years, she worked as a technician and was promoted to a geologist in 2005. She currently works two properties in Midway-Sunset.

Karen is serving as the Editor-in-Chief, an appointed position of the Pacific Section AAPG. This position now oversees the newsletter and website. Prior to this position, she held the Secretary position of the Pacific Section AAPG for 2004-2005. Her involvement with the national AAPG included serving as a House of Delegate member for LABGS in 2004-2005. She served on the HoD's Rules and Procedures Committee in 2005 and the Nomination Committee in 2004.

She was adjunct faculty in 1996 at Unity College, Maine teaching Environmental Geology. She was the instructor for a PC-Based Seismic Manipulation & Interpretation and Introduction to UNIX courses offered through the Geologic Technical Training Center at CSU, Bakersfield in the 2001-2003 timeframe. She taught Physical Geology in the summer of 2003 at Compton College. She also served as a Distinguished Mentor for the Geological Society of America during the Cordilleran Section Meeting in May, 2006.

Karen received a B.S. degree in Geology from Sam Houston State University (1993) and an A.A. degree in Computer and Information Science from North Harris County College (1990). She is currently working on a M.S. in Geology at California State University, Bakersfield. She holds a license from the Texas Board of Professional Geoscientists (#5936). •

Jonathan Lange

Jonathan received a BS degree in geology from Kansas State University in 2001 and a MS in geology from the University of Kansas in 2003. His undergraduate and graduate research while working at the Kansas Geological Survey included gas field analog work in the Hugoton Embayment, reservoir geology for CO2 pilot flooding, and linking depositional environments to coal quality and gas content of Pennsylvanian coals.

Jonathan started his career 4 years ago with Chevron in Bakersfield, California. Since then he has worked as a development geologist in shallow-heavy oil and with Chevron's California Non-Operated Joint Venture's. Involvement in AAPG started at Kansas State University as a student chapter president and more recently with the San Joaquin Geological Society while holding the offices of secretary, vice-president, and president. •

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Don Miller

Don received his B.A. in 1976 from The Colorado College and his M.S. in 1979 from the University of Illinois. After graduating with his Ph.D. from Stanford University, Don went on to work as a Exploration Geologist for Homestake Mining Company in Gunnison in 1976.

Don's career in the petroleum industry started when he went to work for Mobil Oil Corporation. For the next seventeen years, Don worked as an Exploration and Production Geologist, relocating from Denver, to Dallas and finally to Bakersfield. In 1997, Don joined Aera Energy as a Senior Production Geologist. Since leaving Aera, he has continued working as a Senior Geologist for BreitBurn Energy and Bankers Petroleum before striking out as a Consulting Geologist.


Professional activities include working on the AAPG National Convention in Long Beach, contributing his talents to the Technical Program as a Poster Program

Bryan Jolley

Bryan Jolley received a Bachelors of Science in Geological Engineering from Brigham Young University in 1978. After graduating, Bryan accepted a position with Shell Oil Company.

Bryan worked as a geologist for Shell Oil in New Orleans until his transfer to Bakersfield in 1983. He has continued to work for Shell and has transitioned over to Aera Energy, LLC and continues to work as a petroleum geologist. •


Co-chair and a Session Chair in the Technical Program. In prior years, Don served as the Technical Program Co-chair for the 2004 Pacific Section-AAPG, a Session Chair for the 2003 Pacific Section AAPG-SPE, and the Technical Program Co-chair for the 2000 Pacific Section AAPG-SPE conventions. In 1999, Don was the Vice President for the San Joaquin Geological Society. He is a member and advocate of both the AAPG and GSA. •



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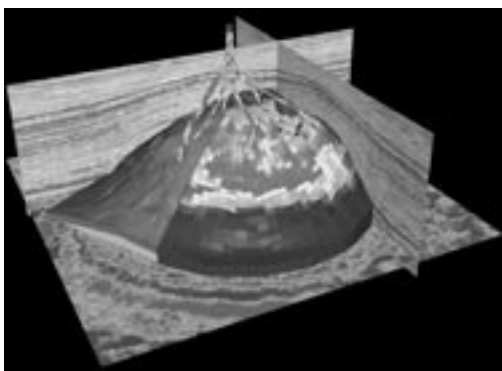
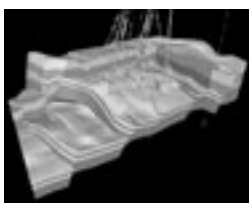
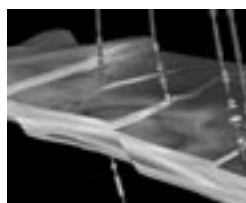
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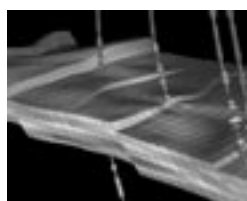




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Cynthia Huggins

Cynthia Huggins is a graduate of California State University, Bakersfield. Her career began with Getty and continued with Texaco and Chevron as the companies merged. She worked as a geologist on the Kern River Field Thermal Recovery Heavy Oil team.

After leaving Chevron in 2002, Cynthia worked as a geologist for Occidental Petroleum Company at Elks Hills. In 2004, she was assigned to VanYoganneft Joint Venture Occidental and TNK-BP Nizhnevartovsk, Russia where as a geologist. She worked 31 stacked reservoirs gas, condensate, light to heavy oil.

Since returning to the States, Cynthia has been working at Vintage Production California LLC Subsidiary of Occidental Petroleum. She works as a geologist in the Heavy Oil Group. Her properties are the Mount Poso and North Antelope Hills fields, outside of Bakersfield.

Cynthia has served as the Vice President and Secretary for the Pacific Section AAPG. She also held the position of President, President-Elect, Vice President and Secretary for the San Joaquin Geological Society. She is an active member of the AAPG and Pacific Section AAPG. •

Michelle R. Glascock

Michelle Glascock attended the University of Oklahoma Norman, Oklahoma, earning her Bachelors of Science in 1985.

Michelle spent the next ten years working as a geologist for Conoco, Inc. out of Lafayette and Houston. In 1995, she went to work for Petrophysical Solutions, Inc. and then the following year, Ryder Scott.

Michelle went to work for Aera Energy, LLC initially as a Landmark Geological Consultant. After leaving Landmark, she continued to work for Aera as an independent consultant. In 2003, she accepted full-time employment with Aera as a geologist.

Michelle has been an active member of the Pacific Section AAPG and the Society of Professional Well Logging Analyst. She has served as the Vice President for the San Joaquin Geological Society in 2005 through 2007. •



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Mark Wilson

Mark Wilson graduated from the University of Utah in 1970, earning a Bachelors of Science degree. He first job in the industry was as a Exploration Geologist for Minerals Exploration, where he worked for twelve years.

In 1982, Mark was a Development Geologist for Gulf Oil. He accepted a position with Bechtel Petroleum in 1985. In 1997, Mark began working for Chevron. Since 2004, Mark has worked as a consulting geologist.

Mark's professional activities include serving as the Pacific Section AAPG President in 1995-1996; as the San Joaquin Geological Society President in 1997-1998; as the Pacific Section AAPG Foundation Chair since 2000; as as AAPG Delegate representing SJGS since 2001; and as an AAPG Oversight Committee Member since 2003. He is an Pacific Section Honorary Life Member since 2001. •



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AAPG Post Convention Field Trip

Stratigraphic and Structural Controls on Fracture Distribution: Examples from California's Coastal Basins (Coast Geological Society)



Industry Getting Heat on Climate Positions

Ken Silverstein, EnergyBiz Insider

The major oil companies are changing gears. They are expressing less skepticism with regard to whether global warming represents a threat to the environment. But, most are still not doing enough to remedy the matter, leading critics to say that the only way the energy conglomerates will move decisively on the issue is to enact mandatory rules.

ExxonMobil and Chevron are among the big oil companies to acknowledge the concerns raised by scientists and citizen activists that the release of greenhouse gas emissions will cause coastal erosion and droughts. But their slow reconciliation is more a function of continued public pressure to do something and the very real possibility that U.S. lawmakers will eventually demand cuts in carbon dioxide (CO₂) emissions and other gases tied to global warming.

Both ExxonMobil and Chevron make the legitimate point that oil and gas will continue to dominate energy markets for the next two decades and that most of their resources will go toward the exploration of those commodities. ExxonMobil's CEO Rex Tillerson said at an industry conference that his company has invested \$82 billion over five years and on six continents to find new fossil fuels,

expand refining capacity and develop alternative fuel sources that are more environmentally friendly.

The business decision is a rational one, with Tillerson noting that the U.S. Department of Energy projects global oil demand to rise to 118 million barrels a day by 2030. That's compared to the roughly 85 million barrels demanded today by consumers. The CEO makes a point to say that ExxonMobil has committed to giving \$100 million over 10 years to Stanford University's Global Climate and Energy Project. Last year, the company earned nearly \$40 billion.

"There is no significant alternative to oil in coming decades and ExxonMobil will continue to make oil and natural gas its primary products," says Tillerson, at a conference sponsored by Cambridge Energy Research Associates. "The scale advantages of oil and natural gas across a broad array of applications provide economic value unmatched by any alternative."

There is no significant alternative to oil in coming decades and ExxonMobil will continue to make oil and natural gas its primary products," says Tillerson, at a conference sponsored by Cambridge Energy Research Associates.

CGS Field Trip - cont.



“The scale advantages of oil and natural gas across a broad array of applications provide economic value unmatched by any alternative.”

The electric generation and transportation industries are the leading sources of CO₂ emissions followed by the industrial, residential and commercial sectors, says a 2004 report issued by the U.S. Environmental Protection Agency. Generating electricity accounts for 39 percent of those emissions.

As fossil fuels are combusted, the carbon stored in them is emitted almost entirely as CO₂. Coal contains the largest amount of carbon per unit of energy while petroleum and natural gas have about 25 percent and 45 percent less carbon than coal, respectively. Demand for all energy forms is expected to climb as developing nations continue to industrialize and as the United States economically expands.

Political Winds

While global warming and the potential fallout posed by the phenomenon has it doubters, the public is becoming increasingly concerned about it. That trepidation has been heightened now that the Intergovernmental Panel on Climate Change, a leading panel of international scientists and reviewers, concluded that there is 90 percent certainty that human activity is to blame in changing the global climate.

The culmination of public concern, along with definitive studies showing the detriments of warming, has caused every U.S. presidential contender to declare a position on the subject. Sen. John McCain, R-Ariz., would require utilities and other industrial operations to cut their CO₂ emissions, in part, through caps. That's a sharply divergent view from the current administration's position that the technologies do not yet exist to capture CO₂ emissions, necessitating a more flexible approach.

The problem now is that the interest groups have taken intractable positions when it comes to American energy policy -- differences that must be bridged, says David O'Reilly, CEO of Chevron. But the facts are that the demand for energy is rising and that oil and gas will be integral to world economic growth. The private sector,

along with policymakers and the scientific community, must develop a rational and cost-effective way to deal with CO₂ emissions.

“Hydrocarbons are the most plentiful and economic forms of energy that we have,” says O'Reilly, at the Cambridge conference. “And the fact is, even if the use of renewable sources doubles or triples over the next 24 years, we will still depend on fossil fuels for more than 80 percent of global energy demand.”

The oil companies are not just getting heat from environmentalists. They are also getting pressure from investors who have accused them not only of neglect but also of funding causes that try to debunk global warming science. The Investor Network on Climate Risks made up of institutional investors says that big oil's lackluster mindset will eventually hurt profits because it has forsaken investments in cleaner alternatives.

The group targeted not just ExxonMobil but also ConocoPhillips, Allegheny Energy, Dominion Resources and TXU Corp. for not doing enough. For their part, utilities are using different strategies to address global warming. Those tactics range from developing carbon sinks to recapture the emissions, to switching to cleaner energy forms, to joining exchanges that facilitate the buying and selling of pollution credits.

“Investors want to know whether companies are prepared to meet the challenge of reducing CO₂ in their operations and products,” says Leslie Lowe, director of the Energy and Environment Program at the Interfaith Center on Corporate Responsibility, in a statement. “They want companies to set voluntary reduction goals and tell the market how they plan to meet those goals.” Another shareholder group, Ceres, supports federal legislation to force companies to make mandatory cuts in carbon emissions.

It's not just that the natural climate is changing. It's that the political climate is also evolving. And that means that oil companies and utilities must acquiesce to the will of the people and address the very real worries over the effects of global warming. •

Reprinted from February 23, 2007 issue.

Subsurface Characterization of the Potrero-Ryer Island Thrust System, Western Sacramento-San Joaquin Delta,
Northern California

Part III : The Kinematics of Seismogenic Deformation and Structural Model

Principal Investigators:

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(ph: 510-256-6070; email: unruh@lettis.com)

and

Scott Hector, Paul Graham Drilling, Rio Vista, CA 94571

EDITOR'S NOTE: This is the third and final newsletter article on the Potrero-Ryer Island Thrust System. Please refer to the previous two articles for discussions of the regional geology and on the structural geology of natural gas-productive anticlinal structures and associated faults of the Suisun Bay/ Western Delta area. Please refer to the original report for a detailed analysis of the seismogenic source characterization, which includes maximum earthquake estimates for the major faults in the area. Our research indicated that the maximum likely earthquakes in the Western Delta Region would be in the order of magnitude (6.0) that occurred in the Pittsburg-Antioch area in 1889. In this final paper, the details of the seismogenic deformation of the area and the structural model for the thrust system are discussed.

Kinematics of Seismogenic Deformation in the Western Delta Region

The western Delta area in general, and the Kirby Hills area in particular, is a region of high background seismicity relative to surrounding areas. Previous workers (Ellsworth et al., 1982; Hector and Unruh, 1992; McCarthy et al., 1994; Weber-Band, 1998) have recognized a north-south-trending alignment of epicenters that can be traced from the Pittsburg area northward across the Sacramento River to eastern Chippis Island, then northward through the Van Sickle gas field to the Kirby Hills. The seismicity terminates as a well-defined north-trending alignment near the latitude of the Potrero Hills. The alignment of epicenters generally coincides with the trace of the Pittsburg-Kirby Hills fault zone as mapped through the Van Sickle and Kirby Hills gas fields). Hypocenters of these events are located at depths ranging from 18-22 km or greater, which represents some of the deepest seismicity recorded in northwestern California (Ellsworth et al., 1982).

We evaluated the kinematics of seismogenic deformation in the western Delta study region by inverting focal mechanisms from small and moderate magnitude earthquakes for components of a reduced incremental strain tensor using the method of Twiss et al. (1993). Focal mechanisms were obtained via the Internet from the Northern California Earthquake Data Center at UC Berkeley. We separated the focal mechanisms into groups associated with specific structures using the program SELECT by D. Oppenheimer (USGS), then calculated seismic P and T axes for the mechanisms using the program PTFROMDAT (UC Davis). We used an automated grid-searching algorithm called FLTSLP (R. Twiss and L. Guenther, UC Davis) to find an incremental deformation tensor that minimizes the misfit between the observed seismic P and T axes, and the P and T axes associated with the final best-fit model parameters. The inversions provide the orientations of the maximum extensional principal incremental strain (d_1); the maximum contractional principal incremental strain (d_3); a scalar parameter (D) that characterizes the relative magnitudes of the principal strains; and a scalar parameter (W) that characterizes the contribution of independent block rotations to patterns of seismogenic slip. A detailed description of the analytical approach and the inversion parameters are given in Unruh et al. (1997b); examples of the application of this method to analysis of seismogenic deformation can be found in Unruh et al. (1996; 1997b) and Unruh and Lettis (1998).



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Focal mechanisms for events located in the north-northeast-trending reach of the alignment of seismicity between Pittsburg and Kirby Hill predominantly reflect strike-slip faulting (Figure 15). A lower hemisphere Kamb plot indicates that the majority of seismic P and T axes are subhorizontal, consistent with right-lateral shear on north-northwest-striking nodal planes (Figure 16). These events directly underlie the mapped trace of the Pittsburg-Kirby Hills fault (Figure 15). The kinematic inversion of these data show that the deformation is an approximately horizontal plane strain (Figure 16). The maximum contractional principal strain (d3) is subhorizontal and oriented northeast-southwest, and the maximum extensional principal strain (d1) is subhorizontal and oriented northwest-southeast. This strain geometry is consistent with the predominance of strike-slip focal mechanisms along this reach.

Between the Kirby Hills gas field and the Potrero Hills, many focal mechanisms are thrust events (Figure 17). A lower hemisphere Kamb plot indicates that the majority of seismic P axes in this region are subhorizontal and trend northeast-southwest, similar to the orientation of P axes along the seismicity trend to the south. The majority of T axes are steeply dipping to subvertical, however, indicating that the deformation is dominated by reverse slip on east-west-striking nodal planes (Figure 17). Inversion of these focal mechanisms reveals that the maximum contractional principal strain (d3) is subhorizontal and oriented northeast-southwest, and the maximum extensional principal strain (d1) is moderately plunging to the southeast, indicating that the seismogenic deformation accommodates components of both horizontal shearing and vertical thickening of the crust. The “transpressional” deformation indicated by the focal mechanisms generally is consistent with the presence of small folds in the Kirby Hills region, and the general east-west strike of the nodal planes is similar to the orientation of the Potrero Hills anticline.

The simplest interpretation of the subsurface and seismicity data is that the Pittsburg-Kirby Hills fault is a steeply-dipping to subvertical right-lateral strike-slip fault in the reach between Pittsburg and the Kirby Hills gas field. This interpretation is consistent with seismic reflection profiles across the

Pittsburg-Kirby Hills fault in the Sacramento River, which appear to show a subvertical structure at depth (McCarthy et al., 1994). We interpret the predominance of reverse and thrust focal mechanisms in the vicinity of the Potrero Hills to reflect localized contraction driven by a restraining bend geometry at the northern end of the Pittsburg-Kirby Hills fault. Specifically, we interpret that the Pittsburg-Kirby Hills fault primarily is a high angle, right-lateral strike-slip fault that bends west in the vicinity of the Kirby Hills and intersects the south-dipping thrust fault beneath the Potrero Hills anticline (Figure 15). The similarity in the patterns of strain accommodated by small earthquakes along the trend of aligned seismicity indicates that the deformation geometry is relatively uniform along the Pittsburg-Kirby Hills fault, and is consistent with large-scale macroscopic dextral shear oriented north-northwest. The Pittsburg-Kirby Hills fault also can be viewed as a tear fault or lateral ramp that forms the eastern structural boundary of the western Delta region and accommodates differential northeast-southwest shortening between the eastern and western Delta areas.

Structural Model for the Western Delta Region

As discussed previously, contractional structures in the western Delta region represent the northern continuation of the late Cenozoic Mt. Diablo fold-and-thrust belt. Based on surface geologic mapping and structural geologic analysis, Unruh and Sawyer (1997) concluded that asymmetric folds of the Mt. Diablo fold-thrust belt are underlain by blind, northeast-dipping thrust faults. In the following section, we present a model for the geometry of blind thrust faults beneath the folds in the western Delta study region, and evaluate the kinematics of contractional deformation.



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The Roe Island anticline has the same trend and vergence as the Los Medanos Hills anticlinorium to the south-southeast (Figure 15). Both structures are interpreted to be underlain by northeast-dipping thrust faults, and have accommodated similar amounts of post-Domengine horizontal shortening (i.e., about 2.4 km). Although it is possible that the Roe Island anticline is simply the northwestern continuation of the Los Medanos Hills anticlinorium, the axes of the two folds are not continuous across the northeast-striking tear fault along the eastern margin of the Roe Island anticline. Also, the tip lines of the northeast-dipping thrust faults beneath the two structures may be offset in a right-lateral sense across the tear fault. Note that the axis of the Concord anticline is interpreted to lie near or above the tip of the blind thrust fault that dips beneath the Los Medanos Hills anticlinorium (Figure 18). Projected to the northwest along strike, across the northeast-striking tear fault, the tip of the blind Los Medanos thrust fault appears to be located about 3 km southeast of the tip of the Roe Island thrust fault. If this apparent offset between the structures continues to depth, then the thrust faults do not share a common, continuous surface. We therefore conclude that although the two folds accommodate similar styles and amounts of deformation, they should be treated as independent structures.

North of the Roe Island and Los Medanos Hills structures, the vergence of the contractional structures changes from southwest to northeast, as evidenced by the asymmetry of the Grizzly Island, Honker Bay and Potrero Hills anticlines. The change in structural vergence occurs across the axis of a broad syncline that coincides with the Sacramento River north of Pittsburg, and trends west through Suisun Bay north of Ryer Island (Figure 15). We refer to this structure informally as the Sacramento River syncline. The north-vergent anticlines north of the syncline axis have significantly lower structural relief and have accommodated less shortening than the southwest-vergent Los Medanos Hills and Roe Island anticline. Also, it is interesting to note that both the Sacramento River syncline axis, as well as the axes of the Grizzly Island anticlinorium and the Honker Bay anticline, appear to be slightly offset or deflected in a right-lateral sense across the northeastward projection of the tear fault that we interpret to separate the Los Medanos Hills and Roe Island anticlines.

As discussed previously, the Los Medanos Hills and Roe Island anticlines are fault-propagation folds developed above blind, northeast-dipping thrust faults. The Suisun-Grizzly and Honker Bay anticlines to the north are contained within the hanging walls of these structures, and are underlain by south-dipping thrust faults. Because the southwest-vergent folds are significantly larger and have accommodated greater shortening, we infer that the northeast-dipping thrust faults probably extend as discrete, continuous structures to the base of the seismogenic crust. We thus propose two models to account for the interaction of the north- and south-dipping thrust faults at depth (Figure 18):

- (1) The south-dipping thrust faults extend into the subsurface at moderate angles and root into the northeast-dipping thrust faults at depth; or
- (2) The south-dipping faults have formed primarily as flexural slip "out-of-syncline" thrust faults and sole into bedding at shallow depths.

In both cases, we believe that the southwest-dipping thrust faults beneath the Grizzly Island anticline and the Honker-Van Sickle structure are shallowly rooted, do not extend to depths at which moderate to large magnitude earthquakes typically nucleate (i.e., 10-15 km; Sibson, 1982), and thus probably are not independent seismic sources. We suggest that the faults may move sympathetically during large events on the northeast-dipping faults, or that they may accommodate post-seismic deformation of the hanging-wall blocks of the northeast-dipping thrust faults (see discussion and examples in Hitchcock and Kelson, in press). As such, the faults may be sources of aftershock seismicity.

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The subsurface extent of the south-dipping thrust fault that we infer to underlie the Potrero Hills anticline (Figure 15) is difficult to evaluate because the geometry of the fold is incompletely constrained by the data available for this study. We cannot ascertain the full width, structural relief and asymmetry of the fold to determine whether the thrust faults in the core of the fold extend to significant depths. An indirect way of estimating total wavelength or width of the fold is to assume that the back limb extends from the crest of the Potrero Hills anticline south to the axis of the Grizzly Island syncline. If the structure map in Figure 15 is accurate, then the width of the Potrero Hills anticline is similar to that of the Roe Island anticline. We emphasize that this approach produces highly uncertain results because there are no data to accurately locate the axis of the Grizzly Island syncline (Figure 15). In lieu of additional well data or north-south seismic reflection profiles across the Potrero Hills anticline to verify the geometry, we assume that a south-dipping thrust fault probably is present at significant depth beneath the fold.

To summarize, we interpret that northeast-southwest contraction across the western Delta region is associated with transpressional development of the Mt. Diablo fold and thrust belt. The folds exhibit a well-defined right-stepping en echelon geometry, and they accommodate distributed right-lateral shear between the Concord-Green Valley fault on the west and the Pittsburg-Kirby Hills fault on the east. Northeast-dipping thrust faults beneath the Roe Island and Los Medanos Hills anticlinoria accommodate the majority of shortening in this region and probably extend to seismogenic depths. Southwest-dipping thrust faults beneath Grizzly Island and Honker Bay anticlines are shallowly rooted and unlikely to be significant seismic sources. Based on available data, we conclude that a southwest-dipping thrust fault is present beneath the Potrero Hills anticline and probably extends to seismogenic depths.

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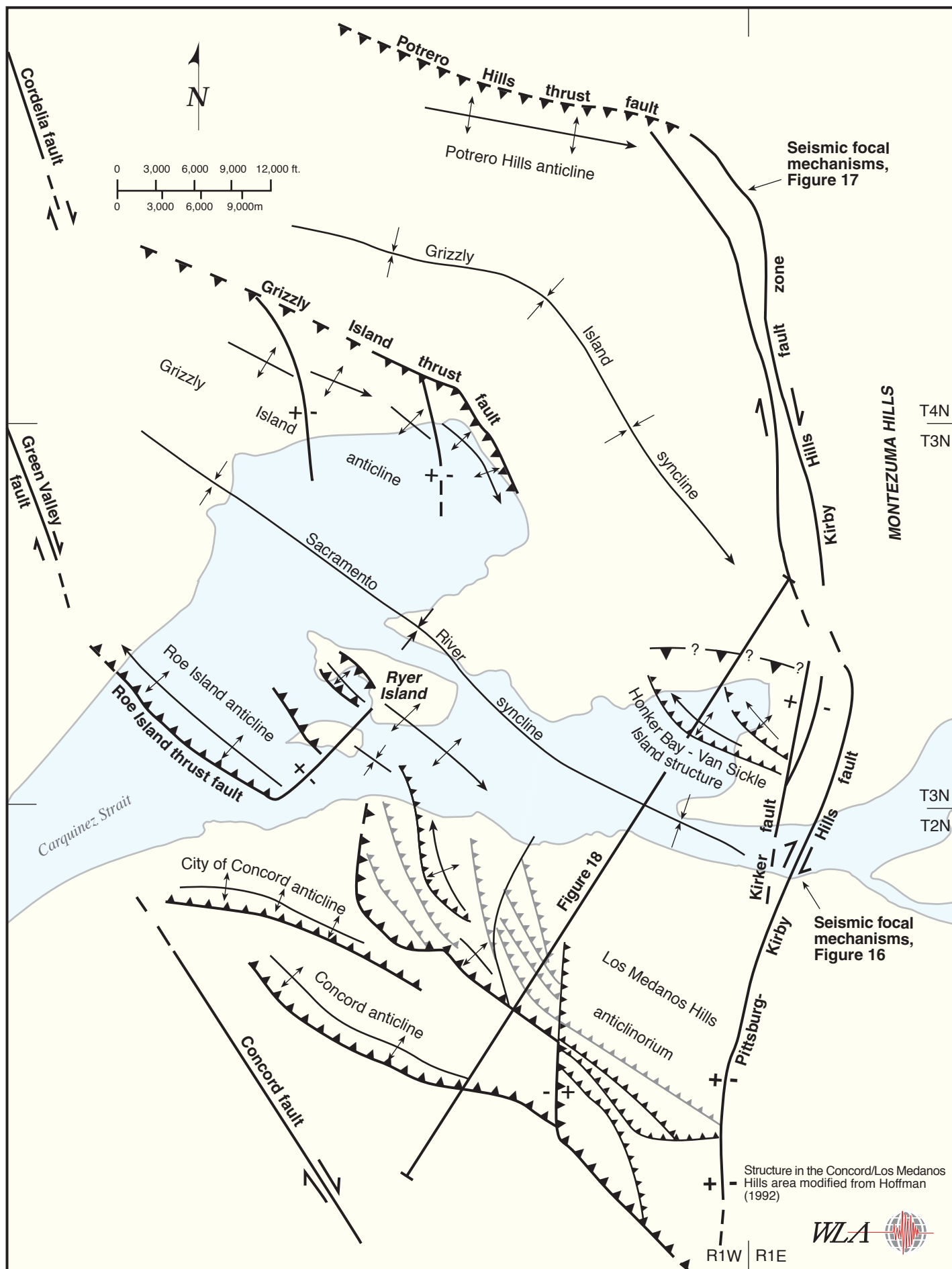
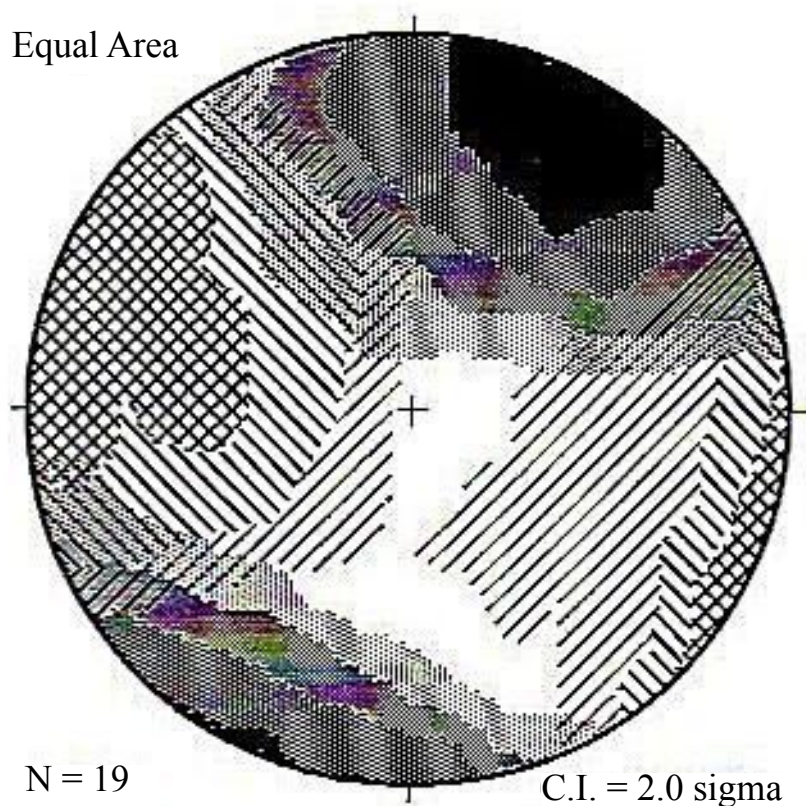


Figure 15. Map of major structures in the western Delta study region.



Pittsburg-Kirby Hills Fault zone
(PKHF: NCEDC dataset: P shaded, T striped)

Inversion Results:

d1 (maximum extension) = 115 degrees, -22 degrees (trend, plunge)

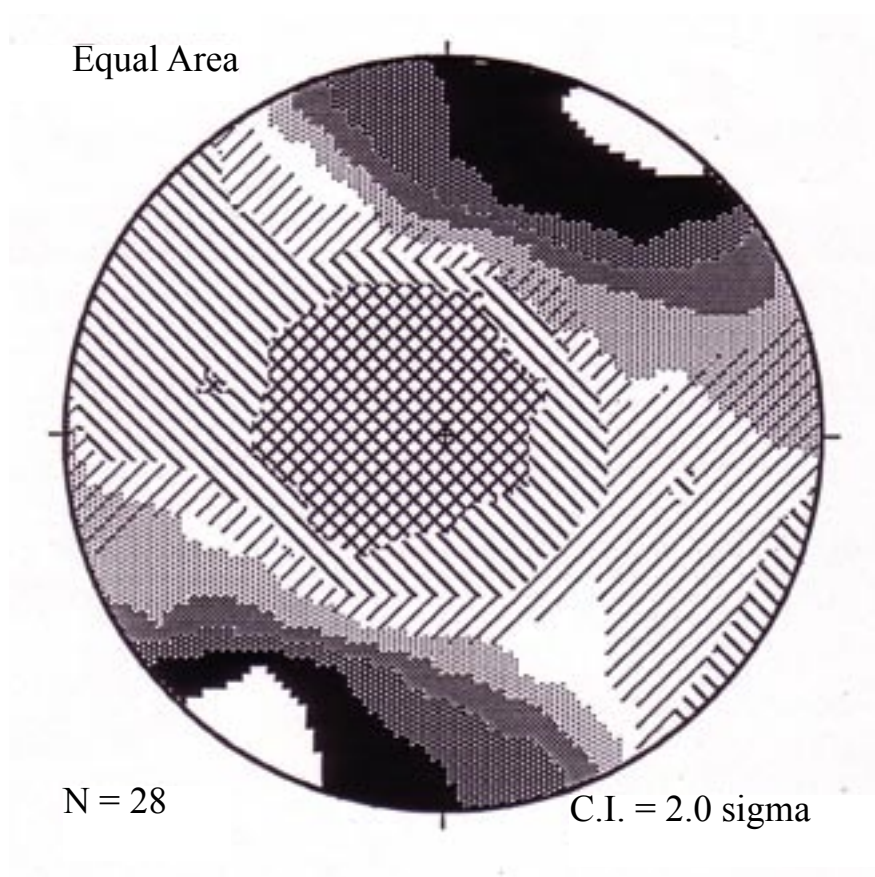
d3 (maximum shortening) = 26 degrees, 4 degrees

D (deformation parameter) = 0.4

W (net viscosity) = 0.1

Inverse Mean Cosine Error = 4.8972

Figure 16. Kamb contour plot seismic P axes (shaded) and T axes (striped) from focal mechanisms for events along the southern reach of the Pittsburg-Kirby Hills fault.



Seismicity in the Kirby Hills-Potrero Hills area
(KHPT: NCEDC dataset: P shaded, T striped)

Inversion Results:

d1 (maximum extension) = 120 degrees, 29 degrees (trend, plunge)

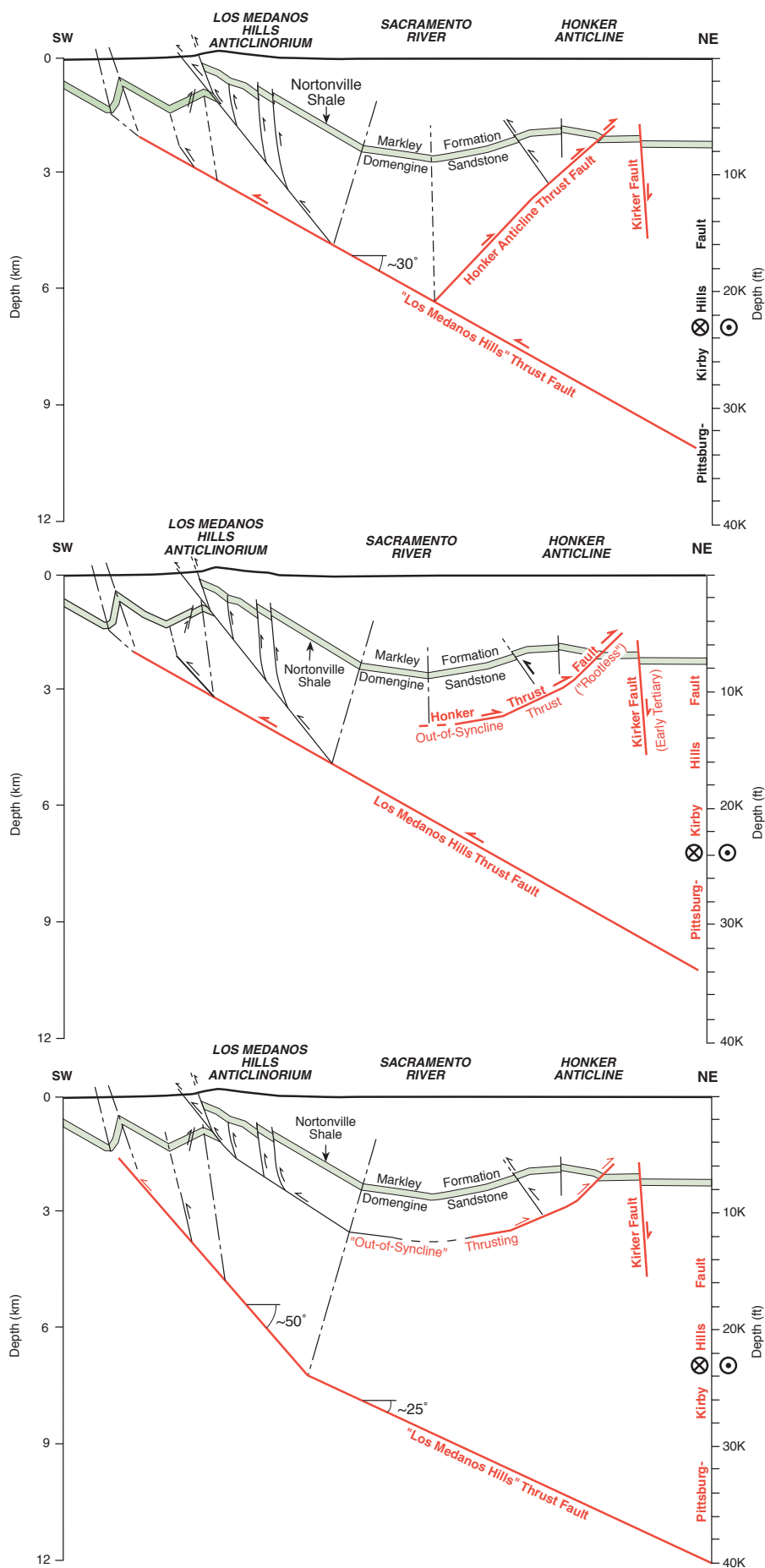
d3 (maximum shortening) = 24 degrees, 11 degrees

D (deformation parameter) = 0.3

W (net viscosity) = 0.25

Inverse Mean Cosine Error = 5.9842

Figure 17. Kamb contour plot seismic P axes (shaded) and T axes (striped) from focal mechanisms for events along the northern reach of the Pittsburg-Kirby Hills fault.



"Rooted Fault" Scenario:

1. Master Thrust dips $\sim 30^\circ$ northeast beneath Los Medanos Hills and western delta
2. Synthetic faults in the Los Medanos Hills anticlinorium and antithetic fault beneath Honker anticline are rooted in Master Fault (the "Los Medanos Hills Thrust fault")
3. Master Fault intercepts the Pittsburg - Kirby Hills Fault at approximately 10km depth.

"Partially Rooted" Fault Scenario:

1. Master Fault dips 30° beneath the Los Medanos Hills and western delta
2. Synthetic thrust faults in the Los Medanos Hills are rooted in the Master Fault
3. Honker Thrust is a "Rootless" out of syncline thrust.

"Deep Fault" Scenario:

1. Master Fault beneath Los Medanos Hills anticlinorium dips more steeply than 30° .
2. Los Medanos Hills anticline is a fault propagation fold above a hinge in the Master Fault.
3. Master Fault intersects the Pittsburg-Kirby Hill and beneath Honker Anticline are out-of-syncline faults, and not rooted in the Master Fault.
4. Master Fault intersects the Pittsburg-Kirby Hills Fault at approximately 12km depth.



Figure 18. Models for the structural and kinematic relationship between the northeast-dipping Los Medanos thrust fault and the south-dipping thrust fault or faults beneath the Honker Bay-Van Sickle Island structure.

Michael B. Mickey
August 25, 1945 - April 5, 2007

Michael B. Mickey died on April 5, 2007 in San Diego. He was born, raised and educated in southern California but he was truly a man of the world. Mobil Oil Co. hired Mike as he was completing his M.S. at San Diego State University in 1971. At Mobil he honed his skills and learned the art of applying his science to the business of finding oil. After several years, he left Mobil to join a consulting biostratigraphic company. Mike truly loved his work, it was an integral part of his being. A few weeks before he died he said that he didn't ever want to fully retire because there were so many questions that he wanted to answer and by staying active he could stay current with the science and industry activity. He was most interested in the Arctic although he worked many other parts of the world. He collaborated with workers in Alaska, Canada, Europe and Russia.

Most important to Mike, along with his science, was his family. He would proudly chat about his wife Susan, their children Lisa and Gregory, and their four grandchildren. When he was away on his many business trips, he was always looking for presents to bring home to them. This was often a problem in the logistics of packing to go home.

The world has lost quite a man who will long be remembered and not forgotten.

Pete Barker
Friend and colleague

Editor's Note: View citation appears in the ?, Volume 37 Number 8

Burdette A. Ogle
May 25, 1919 - March 25, 2007



The extraordinary life of Burdette A. Ogle, Ph.D., ended peacefully on March 25, 2007. Dr. Ogle and his family resided in Santa Barbara, California from 1971 to 1989, Grand Junction, Colorado from 1989 to 1996, and returned to Santa Barbara in 1996. Dr. Ogle, "Bud" to his friends, lived a magnificent, full life, rich with experience, adventures, prosperity, love and laughter.

Bud earned his B.A. in Geology from U.C. Berkeley in 1941 and went on to become a leader in California's oil and gas industry. In his early years, while with Ross Cabeen & Associates and Cabeen Exploration Corp., Bud managed the exploration of basins in the Rockies, Canada and South America. In the 1960's and 70's, Bud and his partners in Argonaut Oil & Gas Co. and its affiliated companies originated oil and gas prospects in the Rockies, California, and a number of foreign countries. Bud's later ventures, Ogle Petroleum Inc. and its affiliated companies, remained active throughout California and the Rockies, but were perhaps most noted for spearheading large data acquisition and bidding groups through which several independent oil and gas companies joined forces and achieved notable success in highly competitive federal lease sales offshore California in the Santa Barbara Channel and Santa Maria Basin. From the 1988 acquisition of the Ogle companies until present day, Dr. Ogle remained an active independent investor in oil and gas and real estate.

Bud is survived by his wife Jean, his daughter Scotia of Grand Junction, Colorado, his son Zedford of Akron, Colorado and his wife, Pam, his son Flint of Grand Junction, Colorado and his wife Barbara, and many loving grandchildren and relatives.

Eugene Dial McCraw
July 15, 1920 - Feb. 5, 2007

Eugene Dial McCraw died Monday, Feb. 5, 2007, at his home in Woodland, of cancer. Mr. McCraw was born on July 15, 1920, to Bessie (Hattan) and John Asbury McCraw in Peerless, Texas.

Mr. McCraw was accepted to Texas Tech on a football scholarship and later, in 1940, tried to enlist in the Navy but he was rejected due to his minor color blindness. In 1942, Mr. McCraw was able to enlist in the Navy. He was later stationed in Pear Harbor. In 1944, he was transferred to Bremerton Naval Yard in Washington to the USS Killen. On Oct. 25, 1944, the USS Killen was credited with helping to sink the Japanese Battleship Yamashiro and an unnamed cruiser in the Suriigao Straits, Philippine Islands. After being discharged from the Navy following VJ Day, Mr. McCraw went to work driving an oil and gas cementing truck for Byron Jackson Inc., in Avenal. Later, it became BJ Hughes, an international company and Mr. McCraw stayed with the company for 40 years, retiring in 1985 as a superintendent.

Mr. McCraw was a member of the Yolo Fliers Club and served on its board of directors. He was also a member of the Woodland Elks Lodge, U.S. McCraw Family Association and past president of the Sacramento Petroleum Association, aka SPA. He and his wife, Carol, often traveled throughout the U.S.

Mr. McCraw is survived by his wife of 31 years, Carol (McCune) McCraw; daughter, Joan and her husband George Noell of Roseville; son, John and his wife Annie McCraw of Sacramento; their mother, Gene's former wife, Irene; stepdaughter, Beth Hoffman of Woodland; sisters, Ann Brooks, Jane Riley, Barbara Thompson, all of Texas; and Becky Hendricks of Medford, Ore.; grandchildren, Sarah and husband Tim Mayhew, David and his wife Chandra Reimer; great-grandchildren, Carah Reimer, Mckayla and Connor Mayhew; and step-great grandson whom Gene helped raise, Ryan Overbo; step-grandson Steve Fong and wife Natalie and their son Alex, and many nieces and nephews. Gene was predeceased by his parents, Bessie (Hattan) and John Asbury McCraw; sisters, Hazel Parker, Leta Faye Palmer; brothers, Leonard and John McCraw.

John Hubert Mee, Jr.
October 8, 1915 - April 2, 2007



John Hubert Mee, Jr. Passed away at home peacefully on Tuesday, April 2, 2007, surrounded by his family. He was born on October 8, 1915, the elder of two sons of Erna St. Goar Mee and John Hubert Mee, whose parents came from Ireland, arriving during the Gold Rush in San Francisco in July 1850.

Hubert attended school in San Francisco and graduated in 1939 from the University of California at Berkeley, where he was a member of the Delta Kappa Epsilon fraternity. Shortly after graduation, he entered the Navy and served for more than four years in the combat areas of the Central and South Pacific. He survived the sinking of the heavy cruiser U.S.S. Quincy at Guadalcanal in 1942. He earned eight battle stars before retiring as a lieutenant commander in December 1945. Soon after, he went to work for Standard Oil Company of California and was assigned duties in the Exploration and Land departments in both the San Joaquin and Sacramento Valleys. Upon completion of 30 years with Standard, he and Henry Cavigli founded an oil and gas consultancy, representing a variety of land owners and corporations for more than 30 years.

Hubert was married to the former Sally Cheek of Oakland in January 1943, settling first in Piedmont, CA. After living in Sacramento and Bakersfield, the Mee family settled permanently in Sacramento in 1962. Hubert is survived by his wife Sally; son, John of Sacramento, former daughter-in-law, Miri and their son Ron; daughter, Nancy and husband, Dennis Evans of Seattle, WA; and daughter, Catherine of Dillon, MT. Also surviving is his extended clan of cousins, nieces and nephews who remember him with great fondness.

Obituary: Robert E. Wallace pioneered study of earthquake geology at USGS
by Marion Softky

The public face of Dr. Robert E. Wallace was standing with Dan Rather, on top of a van, in front of the collapsed Cypress Freeway in Oakland, explaining to the world on the CBS Evening News what had happened in the 1989 Loma Prieta earthquake.

Dr. Wallace, a longtime resident of Portola Valley, earned that place through 50 years with the U.S. Geological Survey, where he pioneered the study of earthquake geology and hazards along the San Andreas Fault and around the world. "Bob was one of the pioneers of earthquake science," says geophysicist Bill Ellsworth of the Earthquake Hazards Team at the USGS in Menlo Park.



Dr. Wallace died Jan. 8 of kidney failure in Reno, where he and his wife Trudy moved in 1998. He was 90.

Bob Wallace was born in New York City, raised in New Jersey, and received his bachelor's degree from Northwestern University. He first studied the San Andreas fault for his doctor's thesis at the California Institute of Technology. He mapped the fault near Palm-dale, camping out, playing his violin for the coyotes, and eating cold canned beef stew, he reported in an oral history, "Earthquakes, Minerals and Me," published in 1999 and available on the USGS Web site: quake.usgs.gov. That study showed the fault had slipped 75 miles — a startling conclusion at the time.

After getting his doctorate, Dr. Wallace joined the USGS, and spent most of World War II in Alaska looking for minerals, including uranium. During this period, he met and married Trudy, his wife, companion, and best friend for 60 years. She died in 2005. After teaching at Washington College for four years after the war, Dr. Wallace rejoined the USGS in 1951, and moved to its new Menlo Park office in 1956. There he helped create the Office of Earthquake Studies and build it into one of the world's top earthquake centers. He was its first chief scientist. During more than 40 years with the USGS in Menlo Park, Dr. Wallace studied the geology of earthquakes and their hazards in California and around the world. He discovered a stream descending from the Carrizo Plain in Southern California that moved 30 feet sideways across the fault during a big earthquake in 1857, when the Pacific Plate of the earth's crust jerked northwest 30 feet. It is named Wallace Creek.

As one of the world's leading experts on earthquakes, Dr. Wallace has traveled to Turkey, Japan, the Soviet Union, the Philippines, the Middle East, and China. "Tracking earthquakes along the Great Wall of China" was the title of a 1985 Almanac article describing how a team of American and Chinese scientists learned about modern earthquakes by studying breaks and landforms caused by ancient earthquakes. "We coined the term paleo-seismology," Dr. Wallace said then. "They are really fossil earthquakes."

Over 42 years with the USGS in Menlo Park, Dr. Wallace published over 100 papers and a book. He also garnered numerous awards from major geologic, engineering and seismic organizations. He officially "retired" in 1987, but continued working for USGS for 11 more years before moving to Reno, where son Alan Wallace is a geologist with the USGS.

Dr. Wallace is survived by his sister, Harriet Wallace of Savoy, Illinois, and his son, Alan Wallace of Reno. As a career tribute, the USGS in 2000 dedicated the Robert E. Wallace Earthquake Center in Building 3A on its Menlo Park campus. At its dedication, Dr. Wallace said this would serve as his memorial, instead of a memorial service after his death.

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Luncheon meetings are held monthly September through May, usually on the third Thursday of the month, at the Anchorage Hilton (500 W. 3rd Avenue) from 11:30 a.m. to 1:00 p.m. The cost is \$17 (members with reservations) or \$20 (members without reservations and nonmembers). For reservations, call the AGS reservation voice mail at 907-258-9059 or contact **David Hite** at hiteconsult@acsalaska.net by noon on Monday before the meeting.

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Dinner meetings are held monthly September through June, usually on the third Tuesday of the month, at the Veterans of Foreign Wars Hall at 3801 Market Street in Ventura. Social hour starts at 6:00 p.m., dinner is served at 7:00 p.m., and the talk starts at 8:00 p.m. The cost of dinner is \$15 (with reservations), \$20 (without reservations), or \$8 (students and K-12 teachers); the talk is free. For reservations, contact **Dave Brown** at 805.653.7975 or make reservations online at www.coastgeologicalsociety.org. Reservations should be made by 4:00 p.m. on Friday before the meeting.

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Evening meetings are held monthly September through May, usually on the last Wednesday of the month, at the Masonic Center (9 Altarinda Road) in Orinda. Social hour starts at 6:30 p.m., and the talk starts at 7:00 p.m. (no dinner). The cost is \$5. For reservations, contact **Dan Day** at 925-294-7530 (leave your name on the voice recorder any time before the meeting).

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Contact: James Jackson
503-771-3887



Luncheon meetings are held monthly September through May, usually on the second Friday of the month, at the Multnomah Athletic Club (1849 SW. Salmon Street) in Portland. Meeting time is at 7:30 - 9:00 am. The cost is \$15. For information or reservations, contact **Shelley Thomas** at 503-848-2947 or **Treck Cardwell** at 503-226-4211 ext. 4681.

2007 - 2007 Officers

President	Jamie Schick	(503) 948-7726
Remaining Officers:	TBA	

Sacramento Petroleum Association

P. O. Box 571
Sacramento, CA 95812-0571

Contact: Rick Blake
925-422-9910



Luncheon meetings are held monthly January through November, on the third Wednesday of the month at the Hungry Hunter Restaurant (450 Bercut Drive) in Sacramento. The meetings starts at noon. The cost is \$16. For information or reservations, contact **Pam Ceccarelli** at 916-322-1110 or pceccare@consrv.ca.gov.

2007 - 2007 Officers

President:	Rick Blake	blake2@llnl.gov
Vice President:	Marc Brennen	marc.brennen@halliburton.com
Secretary/Treasurer/Editor	Pam Ceccarelli	Pam.Ceccarelli@conservation.ca.gov

San Joaquin Geological Society
www.sjgs.com

P. O. Box 1056
Bakersfield, CA 93302

Contact: Rob Negrini
rnegrini@csusb.edu



Dinner meetings are held monthly October through June, usually on the second Tuesday of the month, at the American Legion Hall (2020 H Street) in Bakersfield. The icebreaker starts at 6:00 p.m., dinner is served at 7:00 p.m., and the talk starts at 8:00 p.m. The cost of dinner is \$20 (with reservations) or \$23 (without reservations); the talk is free. For reservations, contact **Tracey Fleming-Reese** at Tracey_Fleming-Reese@oxy.com or phone her at 661.763.6523.

2007 - 2007 Officers

Acting President:	Jonathan Lange	jlange@chevron.com
President- Elect:	Dave Miner	dmmminer@aeraenergy.com
Vice President:	Jonathan Lange	JLange@chevron.com
Secretary:	Tracey Fleming-Reese	tracey_fleming-reese@oxy.com
Treasurer:	Linda Specht	linda.specht@corelab.com
Past-President	Rob Negrini	rnegrini@csusb.edu

The background of the advertisement is a black and white photograph of a desert landscape. A dirt road with tire tracks winds through the foreground towards the horizon. On the right side of the road, there are prominent, layered rock formations. The sky is clear. Overlaid on the top half of the image is a semi-transparent technical data grid. The grid has several columns with headers: 'Sample Depth', 'Petr. %', 'Core Anal. %', 'New Data Log', 'Log Rt.', and 'Resistivity Suppression'. The 'Sample Depth' column contains values like 13474, 13474, 13474, and 13474. The 'Petr. %' column contains values like 24, 26, 27, and 28. The 'Core Anal. %' column contains values like 25, 26, 26, and 28. The 'New Data Log' column contains values like 25, 25, 25, and 26. The 'Log Rt.' column contains values like 25, 25, 25, and 26. The 'Resistivity Suppression' column contains values like 25, 25, 25, and 26. The grid also includes a line graph with data points connected by lines, showing a downward trend.

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SJGS Sponsored Field Trip

La Brea Tar Pits

On February 9, 2007, the entire 3rd of the Cesar Chavez Science Magnet Elementary School went on a field trip to the La Brea Tar Pits. The trip was sponsored by a grant from the San Joaquin Geological Society. Normally there are no funds for 3rd grade field trips.

Rob Negrini, the Past-President of the SJGS, attended the trip and was impressed with how well the students behaved and, also, with how well prepared they were for the trip. They had just finished their first Earth Science unit and it showed. They were very attentive and had great questions for the well trained docents. The students will follow up the trip with a unit on evolution, so it was a well timed adventure. Money well spent by the SJGS. •



NCGS DINNER MEETING

The adventures of Clarence King
(First USGS Director)
and his survey of the 40th parallel

Wednesday May 30, 2007

Speaker: Dr. James G. Moore, U.S. Geological
Survey, Menlo Park (Retired)

6:00 pm at Orinda Masonic Center

(Reservations are required by May 25, 2007)

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