NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS Newsletter & Website Editor:
Mark Detterman
mdetterman@blymyer.com

Secretary:
Dan Day: danday94@pacbell.net
***NCGS Voice Mail:* 925-424-3669**

Website: www.ncgeolsoc.org

NCGS OFFICERS

President:
David Bero,
dbsquare@earthlink.net

***President-Elect*:**
Bill Perkins,
weperkins@comcast.net

Field Trip Coordinator:
Tridib Guha,
tridibguha@sbcglobal.net

Treasurer:
Phil Reed, philecreed@msn.com

Program Chair:
Randy Kirby,
rkirby.geosci@usa.net

Scholarship:
Phil Garbutt,
phillip.garbutt@csueastbay.edu

K-12 Programs:
John Stockwell,
kugeln@msn.com

Membership:
Barb Matz,
barbara.matz@shawgrp.com

COUNSELORS

Programs:
Mel Erskine,
mcerskine@comcast.net

Don Lewis, donlewis@comcast.net

Ray Sullivan,
sullivan@lucasvalley.net

Greg Bartow, gbartow@sfwater.org

MEETING ANNOUNCEMENT

DATE: **Wednesday, February 22, 2006**

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: ***Dr. Richard T. Buffler*, Retired, University of Texas, Austin**

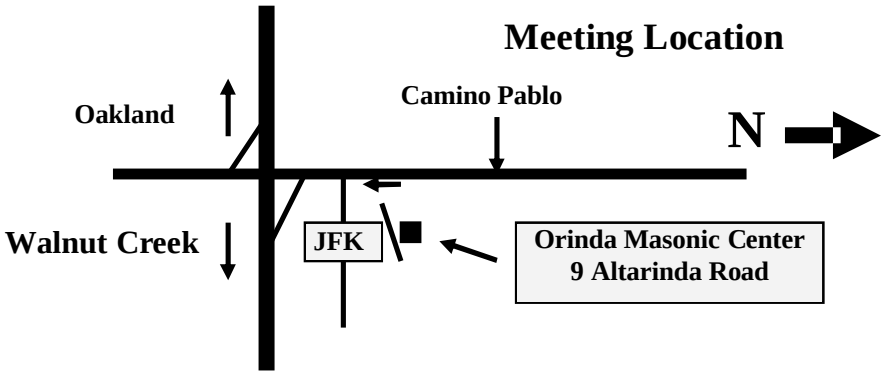
Geologic Setting of the Abdur Archaeological Site, Southern Red Sea Coast, Eritrea, Africa

Stone tools discovered within uplifted marine terraces along the southern Red Sea coast of Eritrea, near the small village of Abdur, are dated to 125+/- ka. These tools represent the earliest well-dated evidence for human occupation of coastal marine environments (Walter, et al., 2000). The Abdur Archaeological Site lies along the northern extension of the Danakil Depression in an active rift graben system that extends from Bada northwest to the Gulf of Zula (Zula-Alid-Bada graben). The Site is located on the Buri Peninsula along the eastern shoreline of the Gulf of Zula and covers an area approximately 6.5 km by 1 km. Three main stratigraphic units are defined:

1. The **Buri Sequence** is a series of estuarine and fluvial-deltaic sediments consisting of limestones, mudstones, sandstones and conglomerates with ash and pumice beds. It is exposed only in Abdur North. Ar-Ar dating of pumice and tephras put the time of deposition of this unit from about 0.90-0.72my. These layers were faulted, folded and eroded prior to the deposition of the overlying Abdur Reef Limestone (ARL). Sedimentary deposits that we tentatively correlate with the Buri Sequence also occur north of the Abdur area on the Buri Peninsula, while rocks of similar age and origin occur further south along the base of the Eritrean escarpment, south of Alid volcano, where a hominid skull and numerous tools were discovered by an Italian research team.

2. The **Abdur Volcanic Complex** is a small basaltic shield complex that forms the highlands along the eastern part of the Abdur study area. Basaltic lavas from this center overlie the Buri Sequence and, in turn, are overlain and onlapped by the ARL. Basalt samples collected from the area, however, were dated from 0.16-2.14Ma, indicating that the Complex has been tectonically and magmatically active prior to, during and after deposition of the Buri Sequence.

3. The **Abdur Reef Limestone** (ARL) is the remnant of a shallow marine reef system deposited approximately 125,000 years ago (last glacial highstand, isotope stage 5e) along the margins of the Abdur volcanic highlands (Bruggemann, et al., 2004). The ARL consists of a basal transgressive lag deposit overlain by an extensive build-up of mollusks, echinoderms, bioclastic sands and corals up to 11m thick. It can be subdivided into 3 subunits related to different stages of the stage 5e sea level highstand.



At Abdur North the ARL is uplifted and tilted 1-2 degrees in a seaward direction. The top of the terrace is now about 10m above sea level along the coast and rises to about 20m further inland. To the south the top of the terrace rises from near sea level at the coast to an average of 15m near the contact with the volcanics. The area is cut by numerous faults, mainly NNW-trending, that is part of the fault system forming the northeastern edge of the Zula-Alid-Bada graben system. At Abdur Central and South, the ARL overlies hard grounds capping older reef sequences of unknown age, but which likely represent previous sea level highstands. Equivalent reefs covered large parts of the adjacent Buri Peninsula and Dahlak Archipelago to the north.

Biography: Dr. Richard T. Buffler received his B.S. in Geology from the University of Texas at Austin in 1959 and his Ph.D. in Geology from U.C. Berkeley in 1967. After short stints with Shell Oil Co. and the University of Alaska, he joined the University of Texas Institute for Geophysics and Department of Geological Sciences, where he began his career as a marine geologist/geophysicist and his long-term studies of the geologic history of the Gulf of Mexico basin. Recently, he returned to his land roots with field projects in Eritrea, Africa, Eastern Java, and New Mexico/Arizona. Buffler retired from the University of Texas in early 2003 after 28 years of service. He currently lives in Berkeley, where he continues to pursue his geologic studies.

HAVE YOU RENEWED??? - PLEASE RENEW – SEE ATTACHED FORM !!

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 2005-2006 Calendar

Wednesday January 25, 2006
Sarah Andrews, Author, Em Hansen Forensic Geology Novels
Art Meets Science on the Cold Continent
7:00 pm at Orinda Masonic Center

Wednesday February 22, 2006
Dr. Richard Buffler, Retired, University of Texas at Austin *Geologic Setting of the Abdur Archaeological Site on the Red Sea Coast of Eritrea, Africa* 7:00 pm at Orinda Masonic Center

Tuesday March 21, 2006 AAPG Distinguished Lecture **Dr. Janok P. Bhattacharya,** University of Houston, Texas ***Applying Deltaic and Shallow Marine Outcrop Analogs to the Subsurface***
1:00 pm at Chevron, San Ramon --- Non-Chevron employees, please contact Beverly Reynolds at BeverlyReynolds@chevron.com by Monday March 20, 2006, in order to make arrangements to obtain a visitors pass.

Monday March 27, 2006 AAPG Distinguished Lecture **Dr. Peter B. Flemings,** Pennsylvania State University, ***Overpressure, Hydrocarbon Entrapment, Seafloor Venting, and Slope Stability: The Dynamic Flow Regime Beneath the Seafloor***,
1:00 pm at Chevron, San Ramon --- Non-Chevron employees, please contact Beverly Reynolds at BeverlyReynolds@chevron.com by Monday March 20, 2006, in order to make arrangements to obtain a visitors pass.

Wednesday March 29, 2006
Dr. Mary Lou Zoback, U.S. Geological Survey, Menlo Park ***The 1906 Earthquake – Lessons Learned, Lessons Forgotten, and Looking Forward***
7:00 pm at Orinda Masonic Center

Wednesday, April 26, 2006
Kathleen Burnham, Consultant
San Gregorio and Northern San Andreas Faults, Point Lobos to Point Reyes, CA
(This is a lead-in to the May 2006 field trip: ***Point Lobos to Point Reyes: Evidence of ~180 km Offset of the San Gregorio & Northern San Andreas Faults***)
7:00 PM at Orinda Masonic Center

Wednesday May 31, 2006
Dr. George Brimhall, UC Berkeley
A History of Field Geology at UC Berkeley, and Issues Facing Field Geology Training Programs Today
(This is a lead-in to field trip in September 2006: ***Field Geological Mapping Using Modern Technology***)
7:00 PM at Orinda Masonic Center

Wednesday June 28, 2006
Dr. Robert Kayen, US Geological Survey
Title TBA
7:00 pm at Orinda Masonic Center

Wednesday September 27, 2006
Dr. Doris Sloan, University of California, Berkeley
Dr. John Karachewski, Weiss Associates
Slide Show Lead-in to Book Publication **(*Geology of the San Francisco Bay Region,* UC Press; (http://www.ucpress.edu/books/pages/9237.html)**

Wednesday October 25, 2006
Dr. Richard Stanley, **Dr. Russell Graymer**, **Dr. Carl M. Wentworth**, U.S. Geological Survey, Menlo Park
Subsurface geology, hydrology, basin evolution, and climatic cyclicity of the Santa Clara Valley area
7:00 pm at Orinda Masonic Center

Wednesday November 15, 2006
Rebecca Latimer, Chevron Energy Technology Co,
Uses, Abuses, and Examples of Seismic-Derived Acoustic Impedance Data: What Does the Interpreter Need to Know? (Fall 2005 AAPG Distinguished Lecture Presentation)
1:00 pm at Chevron, San Ramon

1906 Earthquake Centennial

Seismological Society of America
100th Anniversary Earthquake Conference
Managing Risk in Earthquake Country
April 18 – 22, 2006
Moscone Center, San Francisco

The anniversary of the 1906 Earthquake is a valuable opportunity for earth scientist, engineers, policy makers, emergency responders and businesses to take stock of how well we are protecting our communities and mitigating the dangers associated with earthquakes. To

attend the premier disaster mitigation conference in 2006 visit the conference website (www.1906eqconf.org). Early registration prices end March 17th.

For a full listing of centennial events visit the website of the ***1906 Earthquake Centennial Alliance*** (http://www.06centennial.org/). Events will range from professional meetings, multiple museum exhibits, commissioned music to be played by the Contra Costa Wind Symphony, and much more. NCGS events (below) will be posted to the website shortly.

NCGS Centennial Events

(The field trips are now listed on the 1906 Centennial Website)

March 2006 — **Field Trip** - ***A Walk Along The Old Bay Margin in Downtown San Francisco - Tracing The Events of The 1906 Earthquake and Fire,*** **Dr. Ray Sullivan,** Emeritus, San Francisco State University

See Attached Field Trip Flyer

March 29, 2006 — **Monthly Meeting** - ***The 1906 Earthquake – Lessons Learned, Lessons Forgotten, and Looking Forward***, **Dr. Mary Lou Zoback**, U.S. Geological Survey, Menlo Park

April 2006 — **Family Field Trip** - ***Tracing the Hayward Fault – A Potential Disaster Area,*** **Dr. Joyce Blueford and Others,** Fremont Math Science Nucleus and California Geological Survey, respectively

See Attached Field Trip Flyer

April 26, 2006, — **Monthly Meeting** - ***San Gregorio and Northern San Andreas Faults, Point Lobos to Point Reyes, CA*** **Kathleen Burnham,** Consultant

May 20 – 21, 2006 — **Field Trip** - ***Point Lobos to Point Reyes: Evidence of ~180 km Offset of the San Gregorio & Northern San Andreas Faults,*** **Kathleen Burnham**, Consultant

See Attached Field Trip Flyer

Other Upcoming NCGS Field Trips

(See Also – NCGS Centennial Events)

September 2006 — ***Field Geological Mapping Using Modern Technology*** **Dr. George Brimhall,** U.C. Berkeley

For questions regarding these field trips, please contact Tridib Guha at: tridibguha@sbcglobal.net

Volunteer Opportunity – Still Looking

Throughout the month of April, the **Exploratorium** will be commemorating the 100th Anniversary of the 1906 earthquake with a range of public programs that will cover the science of earthquakes (causes / fault lines / differences between 1906 & 1989 / etc.), earthquake preparedness, emergency response and engineering / retrofitting. It is an incredibly exciting opportunity to address this timely and important topic! We hope to reach family audiences in English, Spanish and Chinese with hands-on demonstrations and activities. We are looking for geologists or earthquake experts/educators who would be able to communicate the science of earthquakes to a lay public in the languages mentioned above. Any suggestions would be much appreciated! Please send inquiries to donnaw@exploratorium.edu

The Search for Evidence of Subduction Zone Seismic Activity in the Rock Record

Reported by Dan Day

Subduction zones have long been recognized as a major source of seismic activity. The potential magnitude of these events and the resulting damage was underscored by the devastating late December 2004 Sumatran earthquake in the eastern Indian Ocean. The subduction underthrust system has been carefully modeled by seismologists, geodeticists, geophysicists, and hydrologists. A major obstacle to model refinement is the lack of macroscopic geological evidence to help researchers select appropriate thermal, mineralogical, and spatial parameters. Features related to subduction zone seismic activity preserved along exhumed thrust faults were discussed by U.C. Santa Cruz graduate student Christen Rowe in her September 28, 2005 NCGS talk Searching for Subduction Zone Seismogenesis in the Rock Record.

Christen has been actively investigating Franciscan complex geology throughout her college career. She has assisted NCGS 2005-2006 President David Bero with

his work on the Tiburon peninsula, recently interpreted as a low angle thrust of apparent subduction origin separating upper plate high grade ultramafic rocks assemblages from underlying Franciscan cherts, sandstones, shales, siltstones, and volcanics. For her doctoral thesis, Christen has been working under **Dr. Casey Moore** interpreting thrust fault features on Alaska's Kodiak Island. Dr. Moore and colleagues Francesca Meneghini of the University of Pisa and Alexander McKiernan of the University of Wyoming collaborated to study the accretionary terrains exposed on the island. Dr. Moore has spent most of his academic career unraveling the complexities of this region.

Alaska is ideally suited for dissecting subduction zone morphology. The state is composed of multiple accretionary terrains in response to long-standing subduction processes along the northern edge of the Pacific plate. Kodiak Island features excellent exposures of an accretionary prism complex. Christen began with a schematic cross section of a subduction zone thrust plane. The seafloor trench is the beginning of the underthrust. The initial few kilometers of the thrust plane are aseismic. It transitions into a seismically active surface or seismogenic zone, followed by very low seismicity to aseismic behavior into the lithosphere. The seismogenic zone, a locked portion of the fault plane, periodically releases energy as earthquakes. Structural geologists search for evidence of subduction zone slippage in the rock record. In order to support seismicity the accretionary prism sediments must be cohesive enough to accumulate elastic strain. The fault plane coefficient of friction has to be large enough to allow strain accumulation. And the coefficient of friction must *decrease* when seismic slip begins, thus propagating seismicity by *velocity weakening*. Once the strain energy is released the coefficient of friction increases and the slip action terminates. Current research focuses on determining the mineralogical, structural, and hydrodynamic controls of subduction zone seismicity.

Using carefully placed thermocouples that intersected the subduction fault plane, it has been shown that seismic activity begins at about the 100ºC to 150ºC isotherms, and ends at about 300ºC. An acceptable mechanism for the lower temperature seismic threshold has been proposed, but the upper temperature seismic cut-off is not well understood. Mineral assemblages along subduction zone fault planes are in the low grade prehnite-pumpellite and pumpellyite-actinolite zeolite metamorphic facies. Cores piercing the subduction fault plane help clarify these geochemical processes. Initially, diagenetic activity strips potassium ions from detrital potassic feldspar during the albitization phase (albite is the pure sodic plagioclase feldspar). Smectite-illite clay minerals dewater and react to a muscovite (potassic) mica. Carbonate cementation scavenges calcium ions from pore fluids. As the geothermal gradient rises with depth, silica cementation replaces the carbonate cement. Silica pressure solution contributes to sediment lithification. Vitreous psuedotachylite streaks in rock cores are thought to represent discrete seismic events. As burial depth and temperatures increase, brittle fabrics evolve into ductile ones and the sediments pass into the greenschist metamorphic facies. This paragenesis can be traced in the rock record where undisturbed exhumed outcrops preserve these delicate features.

Laboratory experiments are being conducted at Pennsylvania State University to study the effects of the smectite-illite clay transition on sediment mechanical properties. The transition from smectite to illite, a dewatering reaction, occurs between 100ºC and 150ºC. Illite is velocity strengthening at room temperature and pressure. However, since subduction occurs under pressure, scientists are attempting to repeat this mineralogic transformation in a pressurized vessel, hoping to observe velocity weakening.

Another hypothesis suggests that silica mobility plays an important role in subduction zone slip plane behavior. Silica dissolved from detrital material is reprecipitated in fracture veinlets that strengthen compacted sediments. Experimental studies on wet quartz show that the coefficient of friction as a function of temperature reaches a minimum between 150ºC to 300ºC, then increases. This behavior could have a significant influence on seismic response along the subduction surface.

Kodiak Island, where Dr. Casey Moore and his students have worked for decades, exposes a structurally coherent accretionary wedge complex that was emplaced during Alaska's Wrangellian Orogeny. The exposed sequence traced across the island from SE to NW begins with what is interpreted as an exhumed shallow seismogenic zone (the Ghost rocks). To the NE lies a lower prehnite-pumpellyite grade black shale sequence punctured by plutonic intrusions. The adjacent block consists of lower greenschist facies rocks equivalent to the Marin Headlands oceanic crust assemblage of pillow basalts, feeder dikes, and seafloor sediments. Metamorphic grade increases to blueschist facies toward the island's northern shore. Each increment of recurring continental accretion took about 7 million years. Careful mapping indicates that major faults in the region have been still for 55 million years. Excellent outcrops, continuous lithologic sequences, and superb textural preservation makes Kodiak Island an ideal site to study subduction processes.

The Kodiak Island accretionary prism complex is exposed with increasing depth from SW to NE. The rocks are Cretaceous-Tertiary age, radiometrically dated

at 63 to 67 m.y. old. The complex is locally intruded by post-deformation plutons. A shallow décollement (gently dipping thrust plane) with numerous shear zones and a low temperature (100ºC to 150ºC) prehnite-calcite mineral assemblage is replaced at depth by a 220ºC to 280ºC zone of silica remobilization, quartz veining, and pressure solution-cemented detrital quartz grains. The veinlets and cementation may act as a fault-locking mechanism.

The outcrops mapped by Dr. Moore and his colleagues are fault-bounded blocks that include a melange zone, and a 6 to 10 km. thick sequence of shear zones that contain seams of an unidentified vitreous material. The seams are up to 20 cm. thick, are flow banded, and contain feldspar, rutile, and pyrite inclusions. They are in contact with low grade metasediments. These perplexing glassy streaks have been interpreted as friction-generated pseudotachylites, or melt sheets formed along a décollement/subduction zone thrust plane by intense frictional heating during an earthquake event. It is further hypothesized that the psuedotachylite accumulates along the subduction zone because it reduces friction there until the seismic stress energy has been released. The disappearance of pseudotachylite seams along the subduction zone marks the transition from shallow to deeper thrust plane activity.

Accretionary prism architecture influences seismic activity. The accretion process stacks younger sediments against older ones in a seaward progression, the individual sediment packages separated by listric faults fanning upward off the downward plunging subduction thrust plane. Often seismicity follows the listric thrust plane up into the accretionary prism. Such was the case in the 1964 Alaskan earthquake.

Christen summarized observations made on the relatively intact, undeformed Kodiak Island accretionary complex. She feels the silica mobility plays a role in initiating fault movement at the lower end of the seismogenic zone. Laboratory experiments with wet quartz show a friction reduction or velocity-weakening behavior at pressure in the 150ºC to 300ºC temperature range, roughly coinciding with seismogenic zone isotherms. At depth seismicity is halted by dewatering reactions and the formation of low grade metamorphic silicates.

The intact, undeformed Alaskan accretionary terranes provide information vital to understanding the more complexly deformed and dismembered California Franciscan complex. Christen has attempted to interpret the field relationships that she and David Bero have mapped at Ring Mountain Preserve on San Francisco Bay's Tiburon peninsula. Ring Mountain is a low angle thrust terrane with an ultramafic sheet emplaced above bleached, brecciated, and heavily veined Franciscan cherts, bedded graywackes, and volcanics. The thrust plane separates highly sheared, deformed Franciscan assemblages from high pressure-low temperature ultramafic metamorphic blocks surrounded by serpentine in the hanging wall. Underlying cherts take on a bleached appearance, are strongly brecciated, and abundantly veined approaching the fault plane. The thin but well developed alteration zone suggests high pressure fluid metasomatism occurred along the thrust/subduction plane while it was active.

Christen's strategy for attacking the complex Tiburon terrane includes field mapping, petrographic (thin section) analysis, and X-ray diffraction studies. Quartz vein fluid inclusions in the thrust footwall can be used to determine pressure-temperature conditions during subduction. The hanging wall rocks of the ultramafic thrust sheet are structurally more complex than the footwall assemblages. X-ray diffraction revealed more complex mineralogies in the hanging and footwall rocks bordering the thrust plane. A more detailed examination of these relationships would help structural petrologists understand how these two diverse tectonic units (the ultramafics and the underlying Franciscan units) and the thrust fault between them relate to the emplacement of the Coast Range ophiolite.

The footwall cherts are a prime structural element in this tectonic scenario. The undeformed cherts outside the thrust fault plane are red radiolarian cherts, only slightly veined. As deformation increases, the cherts take on a muted color and develop an incipient crenulation (shearing) texture. The more deformed cherts are recrystallized to quartz and display strong tensional veining. Higher grade metamorphism favors coarser recrystallization, strong mineralization, bedding plane stylolite intergrowths, and solution bleaching. The highest grade cherts are blueschist facies.

Christen has constructed a terrane map and a shearing zone map of the Tiburon peninsula. Her attempts to determine the last motions along the shear thrust plane were inconclusive. Future research involves fluid inclusion studies to pinpoint quartz veinlet crystallization temperatures, and publishing her collaborative efforts on Ring Mountain with **David Bero**.

The NCGS sincerely thanks **Christen Rowe**, past scholarship recipient, for sharing her studies of Alaskan accretionary prism terranes, and the structural geology and petrology of the Tiburon peninsula with its members. Her work, and that of **Dr. Casey Moore** and colleagues on Kodiak Island, Alaska, is shedding light on subduction zone seismic processes preserved in the geologic record.

2005-06 AAPG Distinguished Lecture

Abstract

Tuesday, March 21, 2006

JANOK P. BHATTACHARYA

University of Houston, Texas
(Formerly University of Texas at Dallas)

Funded by the AAPG Foundation

Applying Deltaic and Shallow Marine Outcrop Analogs to the Subsurface

A fundamental problem in subsurface reservoir characterization is determining the continuity of flow units and flow barriers (i.e. sandstones, shales and cements). In any given field, there will typically exist a combination of field wide-elements, elements that may extend between wells, but not across the entire field, and elements that do not extend between wells.

Our outcrop analog data bases provide:

1. Regional and field-scale studies of reservoir and non-reservoir elements associated with shallow marine, deltaic reservoir types.
2. Detailed 3D facies architectural studies of small-scale, intra-well heterogeneity (cements and "stochastic" shales) in specific depositional sub-environments (e.g. delta front facies) that may be incorporated into reservoir models.
3. Conceptual re-evaluations of shoreline and deltaic facies models that may be applied by geologist interpreting or correlating seismic, well log or core data.

The subsurface geologist must use facies models and sequence stratigraphic concepts to correlate well data. We show several examples of deltaic reservoirs depicted as consisting of horizontal layers (layer-cake). Our outcrop examples suggest that sandstones within the delta front dip seaward. This fundamentally challenges reservoir models that invoke flat versus dipping beds and we demonstrate how this can be applied to correlation of core and well log data sets. Our regional-scale stratigraphic results study also suggest very different exploration models in the search for basin-distal reservoir sandstones.

From the perspective of general facies models, historically, "shorefaces: have been assumed to form homogenous, uniform reservoirs that require little effort to produce. These assumptions have not turned out to be valid in the production behavior of many so-called "shoreface" type reservoirs. We show that many wave-dominated shorefaces are actually delta front deposits. Our new model for wave-influenced coastlines suggests a distinct facies asymmetry with homogenous beach and shoreface sands accumulating on the updrift side of the river mouth with significantly more-heterogenous facies on the downdrift side. We have applied this facies model to the re- interpretation of Cretaceous "shoreface" deposits in Wyoming, New Mexico, and Utah and these examples should be applicable to other subsurface deltaic reservoirs.

Education:

1989 Ph.D. - McMaster University, Hamilton, Ontario, Canada
1981 B.Sc. (hons.) - Memorial Univ. of Newfoundland, St. John's, Canada

Experience:

2005-	Professor – University of Houston
2004	Technical Program Chair - AAPG National Conference
1998-2005	Associate Professor/Professor – University of Texas at Dallas
1997-98	Senior Research Geologist - ARCO, Plano, Texas
1995-97	Research Associate - Bureau of Economic Geology, UT Austin
1991-95	Research Geologist - ARCO, Plano, Texas
1989-91	Project Geologist - Alberta Research Council, Edmonton, Canada
1989	Sessional Instructor - Memorial University of Newfoundland, Canada
1981-84	Explorationist - Esso Resources Canada Ltd., Calgary, Alberta

Publications and Awards:

Authored or co-authored 40 scientific papers and over 100 abstracts.

2005 AAPG SW Section Distinguished Educator Award.
2004 Best Oral Presentation, CSPG Annual Meeting. Certificate of Merit, AAPG. Professional Service Award, Dallas Geological Society.
2002 Houston Geological Society, Best Oral Paper Award. Frank Kottlowski Memorial Presentation Award, AAPG/EMD.
2001 AAPG A.L. "Al" Cox Award, best poster.
1999 SEPM Appreciation Award.
1993 ARCO Exploration Research and Technical Services Award of Excellence.

Research Interests:

Sequence stratigraphy of shallow marine and fluvial depositional systems, deltaic sedimentology (terrestrial and martian), reservoir characterization, interplay between structure and stratigraphy and applications to exploration and production.

2005-06 AAPG Distinguished Lecture

Abstract

Monday March 27, 2006

PETER B. FLEMINGS

The Pennsylvania State University, University Park

Funded by the AAPG Foundation

Overpressure, Hydrocarbon Entrapment, Seafloor Venting, and Slope Stability: The Dynamic Flow Regime Beneath the Seafloor

Sedimentation, overpressure, fluid flow, seafloor venting, and submarine landslides are intimately related. Sandstone buried rapidly by low permeability mudstone has a characteristic pressure regime: the sandstone has a hydrostatic pore pressure gradient whereas the bounding low permeability mudstone can have a lithostatic pressure gradient. This simple behavior drives a myriad of exciting geological processes. In the deepwater Gulf of Mexico, reservoir pore pressures at the crest of the Popeye Genesis minibasin equal the least principal stresses and fluids are venting today. Mud volcanoes, gas hydrates, and biological communities overlie this leak point. In the Ursa Basin, Pleistocene sedimentation from the ancestral Mississippi River was so rapid that we find overpressure within a few meters of the seafloor. Permeable sand bodies transmitted this pressure laterally and these pressures contributed to large submarine landslides. The coupled study of stratigraphy and hydrodynamics can be used to predict pressure, estimate trap integrity and migration pathways, predict slope failure, and design safe and economic drilling programs.

Education

1984 Dartmouth College, B.A. Geology
1987 Cornell University, M.S. Geology
1990 Cornell University, Ph.D. Geology: minors in structural mechanics and geodynamics

Appointments

2003-present	Professor of Geosciences, The Pennsylvania State University
2002-2003	Visiting Scientist, M.I.T.., Dept. of Civil and Env. Engineering
1998-present	Director of the GeoSystems Initiative, The Pennsylvania State University
1997-2003	Associate Professor of Geosciences, The Pennsylvania State University
1994-2000	Adjunct Associate Research Scientist, - Lamont-Doherty Earth Observatory
1993-1997	Assistant Professor of Geosciences, The Pennsylvania State University
1993-1997	Shell Young Faculty Fellow, The Pennsylvania State University
1992-1993	Research Scientist and Crosby Lecturer, Massachusetts Institute of Technology
1991-1992	Associate Research Scientist, Lamont-Doherty Geological Observatory
1991	Visiting Scientist, Exxon Production Research Company
1990-1991	Post-Doc. Associate, Lamont-Doherty - Geological Observatory

Professional Interests

Crustal fluid flow at human and geological timescales. Integration of reflection seismology, petrophysics, and geotechnical analysis to study stress, pressure and fluid flow in basins. Interaction between sedimentation, flow, hydrocarbon migration/entrapment, slope stability, and seafloor vening.

Committees and Activities

Director Penn State GeoFluids Consortium: 10 company consortium to study fluid flow in basins
Chairperson Integrated Ocean Drilling Program Engineering Development Panel.
Co-Director the Petroleum GeoSystems Initiative (http://hydro.geosc.psu.edu/geosystems.html), a cooperative effort between Penn State and industry to train the next generation of engineers and geoscientists for leadership in industry.
Participated in 5 Ocean Drilling Program research cruises
Co-Chief Scientist IODP Expedition 308: Gulf of Mexico Hydrogeology.
Associate Editor, GeoFluids, Basin Research

Honors

2003	Penn State EMS College Mitchell Award for Innovation in Teaching
2001	Best Paper Award, Computers and Geosciences
1994-1997	Shell Faculty Fellow
1996	Penn State EMS College Wilson Teaching Award
1995	Best Paper, J.C. Cam Sproule Memorial Award.
1992	Crosby Distinguished Lecturer at M.I.T.
1991	Best Paper Award, Mountain Geologist

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP IN COMMEMORATION OF 1906 EARTHQUAKE CENTENNIAL

A WALK ALONG THE OLD BAY MARGIN IN DOWNTOWN SAN FRANCISCO – TRACING THE EVENTS OF THE 1906 EARTHQUAKE & FIRE

Sunday March 19, 2006
Leader: Dr. Raymond Sullivan, Professor Emeritus, SFSU

The field trip follows the events that happened on the first day of the April 18, 1906 earthquake and fire. The walk will begin at the Civic Center located at the edge of the old Mission Bay marshland. Stops will be made along Sixth Street and the subsidence area in the South of Market. This part of the City was "ground zero" at dawn on that fateful day since this was the area of greatest damage, and many of the fires originated here. The walk follows the path of the fire as it moves onto Market Street. Stops will be made at some of the pre-1906 buildings along Market, as well as Lotta's Fountain, and the old shoreline marker of Yerba Buena Cove at Mechanics Monument. The walk continues along Montgomery Street following the path of the fire as it spread into the Financial District. A lunch is planned in a restaurant in Chinatown. After lunch, we will visit Portsmouth and Jackson squares ending up at the foot of Russian Hill. It planned as a fun trip. It would be of interest to families although it does involve quite a bit of walking.

THIS FIELD TRIP WILL BE LIMITED TO 20 PEOPLE.

**Field Trip Logistics **

Time & Departure: March 19, 2006, 9:00 am (sharp), outside Civic Center BART station at Market & Hyde Street.

Cost: $30/person

********************************REGISTRATION FORM (San Francisco Walk 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: tridibguha@sbcglobal.net Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP IN COMMEMORATION OF 1906 EARTHQUAKE CENTENNIAL

TRACING THE HAYWARD FAULT – A POTENTAIL DISASTER AREA

Saturday April 15, 2006
Leaders: Dr. Joyce Blueford, Math Science Nucleus, Fremont
Dr. Mitchell Craig, CSU East Bay, Hayward

The Hayward fault is a major branch of the San Andreas Fault system in northern California. Many geomorphic features that are indicative of active movement on the Hayward fault have been destroyed by urbanization. This field trip will center on two segments of the Hayward Fault where surface features can still be observed. The first part will center on the Fremont area near Tule Ponds and the second part will look at the Hayward area.

Tule Ponds at Tyson Lagoon has been a site of fresh water for at least the last 3700 years. This sag pond outlines the trace of the Hayward fault zone in this area. Observations of brittle deformation and liquefaction features in trenches just north of this area indicate there may have been 6-8 large earthquakes during the last 2000 years (Lienkaemper et al., 2002). Participants will be able to see a peel of one of the trenches to observe stratigraphic features. After walking along the two traces of the Hayward Fault, we will walk south of Tule Ponds to observe evidence of movement along Walnut Ave. The walk will continue toward Lake Elizabeth to observe other geomorphic and structural features.

We will leave Fremont and drive north along Mission Blvd. to Hayward. For most of this stretch, the active trace of the fault runs parallel to Mission Blvd. and is seldom more than a quarter mile away from the road. Abundant geomorphic evidence of the fault can be seen from the road, including linear ridges that block stream drainages. At Palisade St., creep of the fault has caused offset of sidewalk and curbing. At Spring Dr., the fault acts as a groundwater barrier and has created a natural spring. At Hayward Memorial Park, a stone wall built in the 1930s has been offset by fault creep. In downtown Hayward we will follow the active trace of the fault on foot and observe evidence of fault creep in offset sidewalk curbs, offset walls of buildings, and en-echelon cracks of asphalt pavement. The wall of one brick building is being pulled apart at its base but is still connected at its top. The old Hayward City Hall sits astride the active trace and has been damaged by fault creep. San Lorenzo Creek, which crosses the Hayward fault in downtown Hayward, has evidently been offset approximately one mile by accumulated slip and creep along the fault.

THIS FIELD TRIP WILL BE LIMITED TO 30 PEOPLE.

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

Time & Departure: April 15, 2006, 8:30 am (sharp), at MSN, Fremont..
Cost: $35/person

**********REGISTRATION FORM (Hayward Fault 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

Carpool and vanpool is a must for this fieldtrip. Please let us know if you can drive and NCGS can reimburse your gasoline expenses.

Questions: e-mail: tridibguha@sbcglobal.net Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP IN COMMEMORATION OF 1906 EARTHQUAKE CENTENNIAL

Pt. LOBOS TO Pt. REYES: EVIDENCE OF ~ 180 Km OFFSET OF THE SAN GREGORIO & NORTHERN SAN ANDREAS FAULT

Saturday - Sunday May 20-21, 2006
Leader: Kathleen Burnham

NCGS member Kathleen Burnham will lead a two-day field trip, as part of NCGS' contribution to the 1906 Earthquake Centennial. Roughly 50 million years ago, the granitic rocks and conglomeratic turbidites of Point Lobos and Point Reyes were parts of a single deep submarine canyon system. During the past 27 million years, they've been separated approximately 180 km by dextral slip of the San Gregorio and northern San Andreas faults. Similarity of these rocks has been noted as far back as 1899, but Kathleen's research establishes details which nail down the correlation. Her paleogeographic reconstruction has proved predictive: since its first introduction, other geologists have proposed four geologic and geophysical correlations which fit her model. Point Reyes and Point Lobos are stunningly beautiful, and may be the only pair of localities on earth in which evidence of a large lateral offset is preserved in public parks at both ends.

On day one, participants will examine granitic rocks, conglomerate, and trace fossils at Point Lobos State Park, near Monterey, and then drive ~180 km along the San Gregorio and northern San Andreas faults to Olema, north of San Francisco. On day two, we will examine correlative rocks at Point Reyes National Seashore, as well as a 16 ft. (5m) offset of the 1906 San Francisco earthquake. This will be an interactive, rather than lecture-style field trip. This trip will be substantially different from Clark and Brabb's 1996 field trip.

Participants are requested to refrain from the use of aftershave, hand lotion, hair tonic, cologne, or other fragranced personal products, as the field trip leader is disabled by chemical sensitivity.

THIS FIELD TRIP WILL BE LIMITED TO 27 PEOPLE.

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

Time & Departure: TBA **Cost**: $125/person

**********REGISTRATION FORM (Pt. Lobos – Pt. Reyes 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: tridibguha@sbcglobal.net Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS DINNER
IN COMMEMORATION OF 1906 EARTHQUAKE CENTENNIAL

The 1906 Earthquake –
Lessons Learned, Lessons Forgotten, and Looking Forward

Wednesday March 29, 2006

Speaker: Dr. Mary Lou Zoback, U.S. Geological Survey, Menlo Park

6:00 pm at Orinda Masonic Center

(Reservations are required by March 15, 2006)

Stepping out of our normal routine, the **Northern California Geological Society** is pleased to announce this *special dinner and evening* with **Dr. May Lou Zoback**. Come listen to Dr. Zoback wax eloquent on the lessons the 1906 earthquake has provided us and what it may mean for the future. For this special event, planned for our normal monthly meeting date, but **starting one-half hour early**, we are planning in typical NCGS style, a delicious entrée of **Teriyaki sesame chicken,** with garden and Caesar salads, rice pilaf, rolls & butter, and cheese ravioli with a vegetarian marinara sauce. For vegetarian dinners **Eggplant Parmesan** will be served in place of the Teriyaki Chicken. Early reports are that we may be serving wines from **Rosenblum Cellars** of Alameda. Please note that a vegetarian option is only available if notified ahead (see attached form).

Abstract: The 1906 Earthquake – Lessons Learned, Lessons Forgotten, and Looking Forward

The 1906 Mw7.8 earthquake on the N. San Andreas Fault marked the birth of modern earthquake science. For the first time, the effects and impacts of a major seismic event were systematically investigated and documented. The resulting publication, the so-called "Lawson report" (named for the principal investigator), contained many "firsts":

- the entire 300-km-long surface rupture was mapped, surface offsets documented, and co-seismic surface displacements inferred from geodetic measurements
- analysis of local seismic data yielded an epicenter ~40 km NW of the current best location offshore from San Francisco - impressive considering how little was known of local velocity structure and that P and S waves had only been identified by seismologists <10 yrs before
- comprehensive mapping of intensity showed the strongest shaking occurred in areas of "made land" (fill) and soft sediment including China Basin and present day Marina district—two San Francisco neighborhoods heavily damaged again in 1989
- surveys of damage to structures showed destruction was closely related to building design and construction--a painful lesson oft repeated around the world
- interpretation of the pre-and co-seismic deformation patterns led Henry Reid to propose the elastic rebound hypothesis--that earthquakes represent sudden release of elastic energy along a fault resulting from a cycle of slow strain accumulation produced by relative displacements of neighboring portions of the crust. It is still accepted today with minor modifications, even though the basis for large-scale horizontal displacements wasn't established until the plate tectonic revolution five decades later.

Dr. Mary Lou Zoback Dinner March 29, 2006

As earthquake science evolves, reanalysis of the 1906 earthquake data continues to yield new insights about that event and the behavior of large strike-slip faults in general. A ~60 yr period of seismic quiescence in N. California after 1906 remains the best example of a regional "stress shadow" resulting from reduction of stress on adjacent subparallel faults by slip in a major earthquake. Looking to the future, a dense array of continuous GPS recorders in N. California, part of EarthScope's Plate Boundary Observatory, can search for fault interactions and determine if an acceleration of strain rate precedes the next big earthquake as it may have prior to 1906.

Biography:
Dr. Zoback is a Research Geophysicist at the U. S. Geological Survey, Menlo Park, CA. She received her B.S. in 1974, an M.S. in 1975, and Ph.D., 1978. All degrees are in Geophysics and all were received from Stanford University. She held a National Research Council Post-Doctorate in 1978-1979 with the USGS Heat Flow Studies group, and has been a research scientist in the Earthquake Studies office at the USGS since 1979, and is currently in the Seismology Branch.

Her major area of interest is active tectonics, with emphasis on the relationship of the in-situ tectonic stress field to earthquake deformation. Regions of interest range from the Basin and Range province, the San Andreas fault system, and intraplate regions. She was Leader of the World Stress Map Project of the International Lithosphere Program (1986-1992). This project involved more than 40 scientists from over 30 different countries with the objective of compiling and interpreting geologic and geophysical data on the present day tectonic stress field to infer the relative magnitudes of the different forces acting on the lithosphere. She was also the Lead to a special issue of JGR in July 1992.

She is a past member of U. S. Geodynamics Committee (National Research Council); Editorial Board, GEOLOGY; NSF review panel for the Continental Dynamics program; and National Research Council Panel on Coupled Hydrologic/Tectonic/Hydrothermal Systems at Yucca Mountain. She is also a past member of Geological Society of America Council and Executive Board; past-President, GSA Cordilleran Section; past-Chair, GSA Geophysics Division. Her honors include: AGU Macelwane Award (1987), Elected National Academy of Sciences (1995), USGS Gilbert Fellowship Award for a one year sabbatical in Karlsruhe, Germany (1990-1991), Fellow, GSA (1984), Fellow, AGU (1987).

********** **Dinner Logistics** **********

Meeting Details: Social Hour: 6:00 – 7:00 pm Dinner: 7:00 – 8:00 pm Presentation: 8:00 – open

Time: March 29, 2006, 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA.

Cost: **$20/person**

**********REGISTRATION FORM (Dr. Mary Lou Zoback Dinner) **********

Name:_____ E-mail:_____

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

Dinner: 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: tridibguha@sbcglobal.net Phone: (925) 370-0685 (evening - PREFERRED) (925) 363-1999 (day – emergency)

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

2005-2006 Renewal Form

Please fill out this form and attach your check made out to NCGS. (Due September 2005)

Mail to:

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

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

Please provide the following information:

Name: _____

e-mail: _____

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

I can help with:

Programs_____ Field Trips_____ Newsletter_____ Web Site_____

K-12 Programs_____ Scholarships_____ AAPG Delegate_____ Membership_____

Please complete the following *only* if there are changes since last year:

Address _____

City, State, Zip _____

Phone: Home (____)_____Work (____)_____Fax (____)_____

Employer _____**Job Title**_____