NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

SEPTEMBER MEETING ANNOUNCEMENT

DATE: **Wednesday, September 26, 2001**

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

TIME: **6:30 p.m. Social; 7:00 p.m. talk (no dinner)**
Cost is $5.00 per person

RESERVATIONS: Leave your name and phone number at 925-736-6039 or at *danday94@pacbell.net* before the meeting.

SPEAKER: **Dr. Richard Sedlock**, Associate Professor, Department of Geology, San Jose State University

Blueschists and Ophiolites in Baja: Coast Range Geology, But With Outcrops

Regionally metamorphosed, structurally coherent Cretaceous blueschists in western Baja California, México form the footwalls of major shallowly-dipping normal fault systems. The hanging walls of these major normal faults consist of Mesozoic arc, ophiolite, and forearc basin rocks that formed part of the Cretaceous forearc above an active subduction zone. All Mesozoic rocks underwent extensional strain of probable Late Cretaceous to Paleogene age. Exhumation of the blueschists from depths of 15-30+ km is interpreted to have occurred during syn-subduction extension of the North American forearc between >95 Ma and about 40-30 Ma, and thus is unrelated to Basin and Range extension or the opening of the Gulf of California. The structural style of extension is similar in many ways to that of metamorphic core complexes.

This exhumation event is the youngest of four deformation events that affected a Triassic ophiolite in the hanging wall. Normal faults due to the syn-subduction extension (youngest event) truncate a subvertical, 500 meter-wide fault zone that may be an Early Cretaceous left-lateral strike-slip fault zone. This fault zone cuts spectacular folded thrust faults that placed gabbros atop sheeted dikes and metavolcanic rocks. The thrusts and folds probably formed during Late Jurassic to Early Cretaceous accretion of the ophiolite to western North America. The thrusts and folds truncate older faults that thin the ophiolite stratigraphy. I interpret these older faults as normal faults that formed at or near the Triassic spreading center that generated the ophiolites of the Vizcaíno Peninsula.

Dr. Richard Sedlock is an Associate Professor in the Department of Geology at San Jose State University. A native of Cleveland, Ohio, he received his B.A. in Geology from Northwestern University (1980), his

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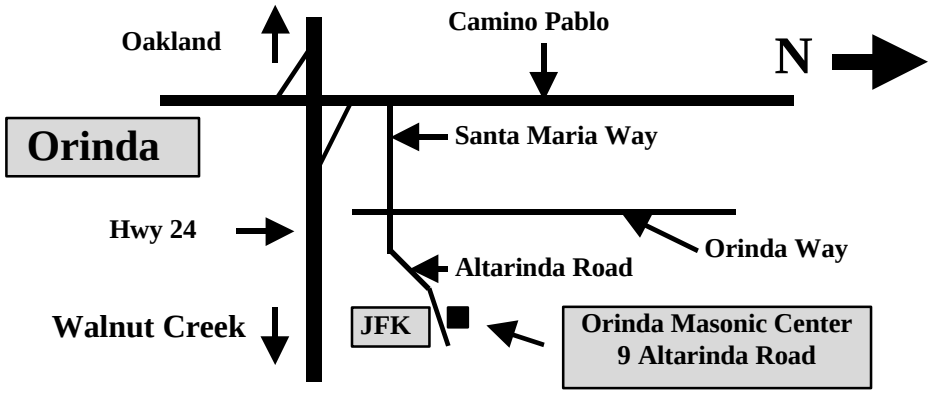

M.A. in Geology from U.C. Santa Barbara (1982), and his Ph.D. in Geology from Stanford University in 1988. His teaching interests include field courses, structural geology, and earthquakes. His research efforts involve the Mesozoic geology of Baja California and Bay Area faulting. Additional activities include K-12 teacher enhancement and participation in a South Bay disaster mitigation collaborative.

Important Note to NCGS Members

I have been writing many of the articles in NCGS newsletters for several years now. However, this is ***your*** newsletter, not mine, so please feel free to approach me with any articles or points of interest that you would like to share with your fellow NCGS members. Recently, member Liz Gordon prepared an excellent write-up of John Wakabayashi's May 19-20th Blueschist and Brew Pub field trip. Articles like this are an excellent way to hone technical writing skills and exhibit them to your peers. Good written communication skills are required for most professional careers in the geosciences. Our only criteria are that the items we publish be tastefully written and on topics of professional or academic interest to earth scientists. Contact me at ***danday94@pacbell.net*** if you have an article or an announcement to contribute to the NCGS newsletter.

Dan Day, NCGS Newsletter editor

Northern California Geological Society
c/o Judy Hayes
453 Scotts Mill Rd.
Danville, CA. 94526-4234

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 2001-2002 Calendar

Wednesday, September 26, 2001
Richard Sedlock, San Jose State University
Blueschists and Ophiolites in Baja: Coast Range Geology, But With Outcrops
Orinda Masonic Center

Friday, October 12, 2001 AAPG Distinguished Lecture
Carlos Bruhn, Petrobras E & P, Rio de Janeiro, Brazil
Contrasting Styles of Oligocene/Miocene, Giant Turbidite Reservoirs from Deepwater Campos Basin, Brazil
Chevron Park, San Ramon

Wednesday, October 24, 2001
David Lawler, Far West Geoscience Foundation, Berkeley (Tentative)
Hydraulic Gold Mining's Historical Legacy - Mercury Contamination Issues: Sierra Nevada and Klamath Mountain Regions, California
Orinda Masonic Center

Wednesday November 28, 2001
David Des Marais, NASA Ames Reseach Center, Moffett Field
The Biogeochemical Carbon Cycle and the Coevolution of Early Earth and Biosphere
Orinda Masonic Center

Wednesday January 30, 2002
Roger Ashley, USGS Menlo Park
Lode Gold Deposits of the Sierra Nevada and Their Environmental Impacts
Orinda Masonic Center

Monday, January 14, 2002 AAPG Distinguished Lecture
William Zempolich, ExxonMobil, The Hague, Netherlands
The Kashagan Discovery: An Example of the Successful Use of a Multidisciplined Approach in Reducing Geologic Risk
Chevron Park, San Ramon

Wednesday, May 15, 2002 AAPG Distinguished Lecture
James Harrell
Archaeological Geology in Egypt: Ancient Oil Wells and Mummy Bitumen, Earliest Geological Map, First Paved Road, Pyramid Temple Pavements, and the Sphinx Age Controversy
Orinda Masonic Center

TEACHER'S DAY AT BLACK DIAMOND MINES
SATURDAY, OCTOBER 13, 2001

Northern California Geological Society, East Bay Regional Park District and Pacific Bell are hosting a very special day at Black Diamond Mines Regional Park for Bay Area Teachers as part of the National Earth Science Week program. This unique park is located is located near Antioch in the historical Mount Diablo Coalfield. Among the scheduled activities are lecture and tour of the underground mines followed by a walk through the site of the old mining town site of Somersville and a visit to the Rose Hill cemetery. Participants should wear warm and comfortable clothing and shoes because temperatures are cool in the mines. In contrast, temperatures can be high for the afternoon walk up the hill to the cemetery. In addition to the park naturalists, professional geologists from NCGS will be on hand to explain the mining history and answer questions.

The program is scheduled from 9AM to 4 PM on Saturday October 13. Hard hats and flash lights will be provided for the underground walk. A barbecue lunch will be served in the picnic area of the park. Teachers will receive an extensive packet of information and other resources to encourage them to bring their classes to the Park. The class may be taken for credit through the Educators Academy of the East Bay Regional Park District. This is a very popular program and space is limited. For additional information please call Traci Parent at Black Diamond (**925-757-2620** or **dvisit@ebparks.org**) or Ray Sullivan at San Francisco State University (**415-338-7730** or **sullivan@sfsu.edu**).

June NCGS Meeting Discusses Mercury Distribution in North Bay Sediments

A look at mercury-contaminated sediments in the San Pablo-Suisun Bay portion of the greater San Francisco Bay system was presented at the June 27th NCGS Meeting by **Dr. Bruce E. Jaffe** of the U.S. Geological Survey's Pacific Science Center at U.C. Santa Cruz. His talk entitled ***Mercury-Contaminated Sediments in the North Bay—A Legacy of the Gold Rush*** explored the work he and his colleagues have been doing to model the current distribution of hydraulic mining sediments deposited in the Bay during the last half of the 19th Century.

The key points that Dr. Jaffe addressed were: 1) How much hydraulic mining debris entered the North Bay during the late 1800's; 2) How much mercury entered with the sediments; and 3) Where is the debris now? To answer these questions, one must discuss gold mining in California during the Gold Rush era, determine how much mercury is in the Bay sediments, define sedimentation patterns over the last 150 years, and apply computerized models to track the details of mercury-contaminated sediment burial or exposure since hydraulic mining activity in the Sierras ceased.

The California Gold Rush and subsequent mining activity is a key part of the State's historical legacy. Hydraulic mining began in 1852 with the advent of Antoine Cabot's water cannon system for removing material from auriferous sediments exposed in the northern Sierra Nevada Range. The gold-bearing gravels are part of extensive fluvial deposits laid down in the Eocene by braided streams eroding the now exposed plutons intruded during the Cretaceous Nevadan Orogeny (~150 m.y. ago). These lower Tertiary placer gravels were subsequently capped by Oligocene and Miocene volcanic debris and exposed by Plio-Pleistocene erosion associated with either post-Miocene Sierran uplift or extensive glacial outwash, depending on which theory of Sierra Nevada batholith evolution one endorses. In either case, the gently dipping gravels were exposed at several localities scattered throughout the northern Sierras, and were exploited by miners anxious to recover gold from the easily eroded cliffs. The result was the removal and processing of millions of tons of sediment, and the estimated loss of 10,000 tons of mercury metal used to amalgamate the gold in sluices. Not all of this mercury was washed away with the sedimentary debris; much was boiled off or evaporated to reclaim the gold. The effects of the hydraulic mining, however, were devastating to the river systems feeding the Sacramento River, as evidenced in slides Bruce projected showing sediment-choked river channels in the Sierran foothills. In response to this massive influx of sediment into the northern Sierran river system and its effects on river transportion channels downstream, the California Supreme Court passed a law in 1884 called the Sawyer Decision, which prohibited the dumping of mine tailings into the State's rivers. This law in effect closed down major hydraulic mining practices in California. Dr. Jaffe added that the aftermath of a major hydraulic mining complex can be seen at Malakoff Diggins State Historic Park in Nevada County 26 miles from Nevada City.

That mercury has been introduced into North Bay sediments via the deposition of Sierran placer mining tailings was confirmed by a 1999 study that showed 44 of 84 samples exceeded the EPA's human health screening value. The hydraulic mining debris sediments were identified by geochemical techniques, including their neodymium (Nd) isotope signatures (a sophisticated technique which uses the rare earth element neodymium to determine sediment source regions). The San Pablo Bay hydraulic mining debris has 5 to 10 times the pre-mining background mercury values and are significantly higher than time-equivalent Tomales Bay sediments used as a control. These high mercury concentrations are also reflected in the biosystem. Bruce displayed charts of North Bay marine life mercury contents in parts per million and noted that toxicities increased up the food chain, particularly in the larger fish species. The incorporation of mercury into the food chain begins with sulfur-reducing bacteria that initiate biochemical processing of inorganic mercury compounds into the lipid soluble toxic methyl mercury that resides in animal tissue. The exposure of hydraulic mining debris to the sediment-water interface is therefore the principal mercury release mechanism and the motivating factor for locating the tailings in the North Bay.

Sedimentation associated with hydraulic mining was well documented by G.K. Gilbert in his 1917 treatise on mining debris in the Sierra Nevadas. It is estimated that nearly 1.7 billion cubic yards of sediment was washed out of the Sierras by hydraulic mining efforts. Between 1852 and 1915 the Sacramento River and its tributaries were choked with mining debris. By 1899 the Yuba River itself had up to 85 feet of debris in its channel. These sediments are also sources of mercury contamination, and have been addressed by other studies.

The bulk of Dr. Jaffe's work focuses on modeling the sedimentation process in the North Bay over the last 150 years, and using this as a tool to guide wetland reclamation and identify toxic contaminant sources. Crucial information was provided by the U.S. Coast and Geodetic Survey, which carefully conducted periodic bathymetric surveys in the greater San Francisco Bay for commercial purposes. This database allowed Bruce and his colleagues to generate animated computer models of North Bay sedimentation processes since the 1850's. The bathymetric surveys were conducted in 1856, 1887, 1898, 1922, 1951, and 1983. The 1856 to 1887 data showed an average of 3 meters deposition in San Pablo Bay due to the hydraulic mining operations. From 1951 to 1983, the trend was reversed and erosion occurred ostensibly because of reduced sediment load due to California's massive water

redistribution, flood control, and irrigation projects. Currently the average deposition rate is 3 cm. per year, but rates tend to vary from place to place and with major climate fluctuations. The deposition and erosion rates extrapolated from bathymetric data agree with results obtained from short-lived radioactive isotope studies (Lead-210 and Cesium-137) of sediment cores. The results indicate a period of major sediment deposition in the North Bay from 1856 to 1887, and net erosion from 1898 to the present, with the latter most prevalent during the post-1951 period. The studies also suggests that the slower tidal current and wind wave erosional processes have more influence on sediment distribution than episodic events, and that sedimentation mimics the sediment input by major rivers feeding the Bay. Right now the North Bay is in an erosional cycle.

Dr. Jaffe projected a time-lapse sequence of San Pablo Bay bathymetric changes from 1856 to the present based on linear interpolation of the Geodetic Survey data. It clearly showed the transition from a depositional regime before 1887 to gradual erosion afterwards, particularly after 1951. Next he showed another time-lapse sequence demonstrating the distribution of exposed hydraulic mining debris over the last 150 years. The present day map is a compilation based on bathymetric data taken from the five geodetic surveys conducted between 1887 and 1983. The 1887 map shows 75% of the mercury-contaminated tailings are near the sediment surface, but by 1998 this has been reduced to about 30% exposure. This map project will help scientists pinpoint areas where mining tailings would likely be releasing mercury and other contaminants into the ecosystem. Much of the original tailings has been removed by erosion, but researchers estimate there are still about 300 million cubic meters of mining debris in the North Bay (San Pablo and Suisun), with about 250 million of this in San Pablo Bay. Future efforts by Dr. Jaffe's research team will focus on verifying the computer model by isotopic geochemical techniques, examining the bioavailability of mercury in the North Bay sediments, and ultimately expanding their work to the entire San Francisco Bay and Sacramento Delta areas.

The NCGS and its members sincerely thank Dr. Bruce Jaffe of the USGS for an informative talk on the distribution of mercury-laden Gold Rush era sediments in San Pablo Bay. His lecture is the first in a three-part series of talks on gold-mining related contamination in California. The other talks are **David Lawler's** (Far West Geoscience Foundation) ***"Hydraulic Gold Mining's Historical Legacy–Mercury Contamination Issues: Sierra Nevada and Klamath Mountain Regions, California"*** on October 24, 2001, and **Roger Ashley's** (USGS Menlo Park) ***"Lode Gold Deposits of the Sierra Nevada and Their Environmental Impacts"*** scheduled for January 30, 2002. Both lectures will be held at the Orinda Masonic Center.

Enchanted Rock and Texas Hill Country

My wife and I made a short trip to San Antonio, Texas, in late June, and I was miraculously able to persuade her to accompany me on a short jaunt to the Precambrian Llana Uplift. The directions to this area and the geological history of Texas Hill Country are very well described in Darwin Spearing's ***Roadside Geology of Texas*** paperback book published by Mountain Press Publishing Company, Missoula, Montana. For those readers who might find themselves traveling in the San Antonio-Austin vicinity, this short but interesting geological side-trip might be worth taking.

Although we stayed in San Antonio, our flight was out of Austin, which allowed us to make a clockwise sweep of the Texas Hill Country before departing. So we took I-10 northwest from San Antonio past Boerne, then headed north on Highway 87 to Fredericksburg. This was our first trip to Texas, and we learned that there is a strong German influence in this part of the state. In fact, German settlers fought and gave their lives at the Alamo. Fredericksburg is a German settlement in central Texas Hill Country, elevated about 2,000 feet above sea level. Central Texas ranges from Austin-San Antonio on the east to Del Rio and Langtry on the Rio Grande, the Pecos River on the west, and San Angelo to the north. The northeastern corner of this provenance is occupied by the Llano Uplift, a circular exposure of Paleozoic and Precambrian igneous and metamorphic rocks about 85 miles across, surrounded by Cretaceous sedimentary rocks of the Edwards Plateau. The timing and mechanism of the Edwards uplift is debated, but happened in early Tertiary to Miocene time, and lifted the region undeformed to its current 2,000 elevation. The edge of the uplift, and beginning of the Gulf of Mexico coastal plane follows a curved boundary southwestward from Austin through New Braunfels to San Antonio. The erosional dissection of the Balcones fault escarpment forms Texas Hill Country, an extensive area dotted with flat-topped mesas and oak grassland reminiscent of California's central Coast Range. The Llano Uplift is a structurally high but topographically low exhumed 1.35 billion year old Precambrian mountain range unconformably overlain by Paleozoic sediments capped by flat-lying Cretaceous sandstones, carbonates, and shales. The carbonates are riddled with caverns, a major tourist draw to this area; the sandstones and carbonates are extensively quarried for building stone, as are the Precambrian crystalline rocks. The granites and schists of the Llano Uplift begin a few miles north of Fredericksburg.

Highway 87 intersects east-west 290 in the center of Fredericksburg. A few miles west of this intersection on Highway 290 we turned north on county road 965 towards Enchanted Rock State Park about 15 miles north of Fredericksburg. The domed granite that forms Enchanted Rock is Precambrian in age and intrudes the surrounding metamorphic schists as part of the larger Town mountain batholith. It has been unconformably overlain by

Cretaceous limestone, then exposed by erosion. The summit of Enchanted Rock lies at an elevation of 1875 feet, 445 feet above Sandy Creek and campgrounds below. The 360-degree vista atop the Rock is breath-taking. Four smaller domes flanking Enchanted Rock itself are the product of erosion along major fracture systems that follow joint planes in the rock. Joint fractures also control spheroidal weathering patterns. The domed morphology of the granite is due to exfoliation of the surface in sheets a few feet thick. The exfoliation fractures form in response to pressure release as overburden is removed from the granite. Enchanted Rock is the second largest exfoliation dome in America, the largest being Stone Mountain, Georgia. The pinkish microcline granite porphyry is crosscut by aplite and pegmatite dikes, the former protruding slightly above the granite, and the latter weathering more deeply to form shallow furrows in the country rock. Flow structures delineated by phenocryst alignment can also be seen in the granite. Enjoy the geology, but remember that defacing or removing rock from the park carries with it a stiff $1000 fine!

A short distance northward Road 965 meets Highway 16, which we followed northward several miles to Llano, Texas, after which the Precambrian uplift was named. Llano is a neat, quite country town with an impressive new high school built of reddish sandstone and buff-colored limestone quarried from local rock. About 9 miles north of town on route 16 one passes Baby Head cemetery, and proceeds down a shallow dip in the road which rises to a low ridge marking an east-west trending igneous dike. The latter is a unique granitic rock aptly named "llanite." It contains pinkish-red potash feldspar phenocrysts and striking bluish quartz crystals in a darker fine-crystalline groundmass. The rock is hard, and the boulders next to the roadcut are scarred by hammer blows that failed to fracture them. Those who overshoot the outcrop can turn around at a small roadside picnic area a few hundred feet past the roadcut.

Having seen my geology for the day, we ate a tasty lunch at a country café in Llano, then took Highway 71 through Llano east towards Austin to complete our journey. Igneous and sedimentary geologists will enjoy this half-day jaunt, and in good weather the scenery is quite enjoyable for the geologist and layman alike.

The Tragic Life of William Smith

A recent article in the San Francisco Chronicle describes the geologic contributions of an unsung 19th Century Englishman named William Smith. His saga merits repeating here.

In the late 1700's, the science of geology had become a gentleman's pursuit. At this opportune time one William Smith was born to a village blacksmith. At an early age he developed a passion for rocks. He was fascinated by the marine fossils he found in the local fields, and wondered how these deceased sea creatures ended up so far inland. Smith was fortunate enough to finish his schooling when coal exploration and constructing canals were important to the British economy. Landowners with coal seams on their property or whose estates lay in the path of the growing canal systems became quite wealthy. This situation created a need for good surveyors. Coincidentally, Smith had apprenticed himself to a master surveyor to satisfy his enthusiasm for geology. By the age of 25, he was a well-paid surveyor working on the largest canal project in Somerset. While witnessing the canal excavations he noticed that the rock layers were always in the same sequence and that the fossils varied between the different units. Smith deduced that any rock layer containing the same fossil assemblage would be the same age as the one in Somerset. He applied the term "strata" to the sedimentary layers, and his discovery is now known as the Principle of Faunal Succession. This is one of the basic concepts of Stratigraphy.

Enthused by his observations, Smith resolved to make a geologic map of Britain. He began with a small-scale geologic map centered around the town of Bath, and satisfied with his accomplishment, embarked on his more challenging goal. One of his most formidable obstacles, however, was funding. He accepted engineering jobs all over the country, and although he attracted investors, the money trickled in slowly. Worse yet, Smith was not a good businessman. He covered 10,000 miles of Britain surveying and noting the local geology for his map, but the cost of this scheme was weighing heavily on his pocketbook. In desperation, he approached the newly formed Geographical Society for help. This decision proved to be his undoing. The society not only scorned Smith, but its president George Greenough persuaded one of Smith's ex-pupils to hand over all of his mentor's maps. Using Smith's techniques and data, Greenough set out to produce his own geologic map of Britain, while utilizing his position in the Geographical Society to undermine Smith's own efforts. Greenough's financial position was much sounder than Smith's, which he used to his advantage. By 1819, Smith was in financial ruin and spent three months in debtors' prison. His wife ultimately went insane, his property and possessions were confiscated by the government, and his professional reputation had been devastated.

But Smith's personal agony was not in vein. Today his impressive 8 foot-by-6 foot color geologic map of Britain hangs in the Royal Academy of London's Burlington House, a tribute to his painstaking workmanship, perseverance, and single-minded determination. The saga of William Smith is told in Simon Winchester's recent biography ***The Map That Changed The World*** (Harper Collins, 329 pages, $26). It relates another intriguing chapter in the history of Geology.
(This article is based on a book review by San Francisco Chronicle writer Amanda Foreman*).*

Tenure Track Position In Engineering / Environmental Geology at SFSU

The Department of Geosciences at San Francisco State University invites applications for a tenure-track faculty position at the assistant professor level in engineering/environmental geology, beginning August 2002. The position requires a Ph.D. in geology and a strong commitment to excellence in teaching at the graduate and undergraduate levels. We seek someone to teach advanced-level engineering geology courses and general education courses in natural hazards or earth systems. We also seek someone with training in surficial processes or geophysics who can contribute to courses and advising in one of these areas. The successful applicant will be expected to maintain an active research program that involves graduate and undergraduate students. Preference will be given to those who have applied experience with a geotechnical or environmental firm, strong quantitative skills, teaching experience, and interdisciplinary interests that include other geoscience fields.

The Department of Geosciences includes geology, meteorology, and oceanography and consists of 13 faculty members from these fields. The department offers B.S. and B.A. degrees in Geology, a B.A. degree in Meteorology, and an M.S. degree in Applied Geosciences.

San Francisco State University, a member of the California State University system, serves a multi-cultural, ethnically diverse student body of 27,000 students, offering bachelor's degrees in 117 academic areas and master's degrees in 95 fields of study. Excellence in teaching is the University's primary mission, although SFSU faculty are expected to demonstrate continued professional achievement and growth through research, publications, and community involvement.

To apply, send a curriculum vitae, a statement of teaching and research interests, and names and addresses of three references to: **Lisa White, Dept. of Geosciences, San Francisco State University, San Francisco, CA 94132**. ***Applications should be received before*** **January 15, 2002**. San Francisco State University is an Equal Opportunity / Affirmative Action employer.

Group photo of participants from May 19-20, 2001, NCGS ***Blueschist and Brew Pub Field Trip*** led by Dr. John Wakabayashi. Photograph is courtesy of Dr. Terry Kato, Department of Geology, California State University, Chico.

Arsenic Symposium

October 3, 2001
Radisson Hotel, Sacramento California

The Groundwater Resources Association will be hosting the third symposium in The Series on Groundwater Contaminants: Arsenic. Cooperating organizations include the International Association of Hydrogeologists (IAH), Water Education Foundation (WEF), California Groundwater Association (CGA), National Ground Water Association (NGWA), American Ground Water Trust (AGWT), The Professional Environmental Marketing Association (PEMA), Association of California Water Agencies (ACWA), and The Natural Resources Section of the California State Bar.

Program Agenda - Wednesday, October 3, 2001

8:00-8:45 am	Registration and Pastries
8:45-9:15 am	Welcome and Overview of the Problem and Day
9:15-10:00 am	Session One: Arsenic Characteristics, Geochemistry and Distribution
10:15-10:30 am	Break
10:30-12:00 pm	Session Two: Risk/Toxicology and Regulations
12:00-1:30 pm	Lunch: Keynote Presentation, TBA
1:45-3:00 pm	Session Three: Treatment & Remediation
3:00-3:15 pm	Break
3:15-4:45 pm	Session Four: Social and Political Impacts, and Legal Issues
4:45-5:00 pm	Conclusion
5:00-6:00 pm	Reception

Exhibitor/Sponsorship Opportunities

Exhibit and sponsorship opportunities are available for the Symposium -- click here for a detailed description and order form contact GRA Executive Director Kathy Snelson by phone (916)446-3626 or e-mail execdir@grac.org.

MCLE Credits

An application is pending for approval of this program for minimum continuing legal education credits by the State Bar of California.

Symposium Site & Accommodations

Radisson Hotel Sacramento - 500 Leisure Lane, Sacramento, CA 95815 Tel: (916) 922-2020. A block of sleeping rooms is available for Symposium participants on a first come, first served basis at the rate of $109 single/double plus tax and $139 for a Lakeside Room, single/double plus tax. Make your reservations by calling the Radisson at (916) 922-2020 or (800) 333-3333 and identify yourself as a GRA Symposium participant. The above rates will be available through September 11, 2001.

Registration / More Information

To register for this event or for more information go to **http://www.grac.org/Arsenic_Symposium.html** or contact GRA Executive Director Kathy Snelson by phone **(916) 446-3626** or e-mail **execdir@grac.org.**

AAPG Allan P. Bennison Distinguished Lecture

Dr. Carlos H. L. Bruhn, Petrobras E&P, Rio de Janeiro, Brazil

Sponsored by Chevron Overseas Petroleum, Inc. and NCGS

Friday, October 12, 2001

12:00 Noon in Bldg. A, Room A-1036 at COPI Chevron Park, 6001 Bollinger Canyon Rd., San Ramon

"Contrasting Types of Oligocene/Miocene Giant Turbidite Reservoirs From The Deep Water Campos Basin, Brazil"

The most prolific Brazilian turbidite hydrocarbon reservoirs occur in the Upper Oligocene-Lower Miocene section from present day deep water (400 to 2500 meters) Campos Basin. They contain a total oil-in-place volume of about 20 billion bbl and total oil reserves of 5 billion bbl, mostly concentrated in seven oil fields. Oligocene/Miocene turbidites form part of the middle Eocene to Recent regressive succession which typically displays a progradational pattern along the eastern Brazilian margin.

The first discoveries of giant Oligocene/Miocene oil fields in the deep water Campos Basin date from the mid-1980's. Initially recognized as homogeneous, widespread turbidite fans, massive data collected from over 300 wells and extensive 3-D seismic surveys changed this view. More recent studies found the Oligocene/Miocene Campos Basin turbidite reservoirs can be complex and heterogeneous. This presentation is focused on the stratigraphic framework, sandbody geometry, and reservoir heterogeneities of the most important, contrasting types of Oligocene/Miocene reservoirs which include: 1) trough-confined gravel/sand-rich channel complexes, 2) unconfined, sand-rich lobes heavily dissected by younger, mud-filled channels, 3) unconfined, sand-rich lobes, 4) trough-confined, sand-rich lobes, and 5) sand/mud-rich channel fills and splays. These reservoir types will be illustrated with examples from the Albacora, Barracuda, Marlim, and Marlim Sul fields.

The Oligocene/Miocene architectural types of turbidite reservoirs typically comprise the lowstand system tracts of distinct third and fourth-order sequences, which can be bounded in the deep water portion of the Campos Basin by unconformities and/or collective non-erosive surfaces. Some sequence boundaries can be correlated with Haq et. al.'s (1988) eustatic, third order sea level falls at 30 m.y., 28.4 m.y., 26.3 m.y., and 25.5 m.y., with sequence boundaries at 25 m.y. and 24.5 m.y., and with two other undated boundaries between the 25.5 and 26.3 m.y. boundaries. The transgressive and highstand systems tracts mapped in the oil fields are composed of cyclically interbedded marls and mudstones containing benthic foraminifera that represent upper to lower bathyal conditions.

Regional stratigraphic correlations suggest that the Albacora Field gravel/sand-rich channel complexes can be time-equivalent along basin strike to lobe successions in the Barracuda, Marlim, and Marlim Sul fields. The development of the various turbidite types seems to be related to tectonically-controlled basin/gradient confinement and sediment supply. These different sedimentary regimes are in response to the upward movement or withdrawal of underlying Aptian evaporites. The latter gave rise to progradational, offlapping successions and more proximal, unconfined sand-rich lobes which were heavily dissected by low-sinuosity, mud-filled channels during a relative sea level fall. The trough-confined sand-rich lobe reservoirs filled fault-bounded, strike-oriented depressions located farther into the basin. The type 2, 3, and 4 reservoirs are overlain by a marl-rich red bed marker horizon that can be widely correlated throughout the Campos Basin. After another relative sea level fall, the 125-meter thick sand-rich succession of the Marlim Field occurred, north of the Barracuda and Marlim Sul fields. Sand/mud-rich channel fills and splays (type 5) filled a depression between two type 3 depocenters at the Marlim Sul Field following a sea level rise that ended turbidite sedimentation in the Oligocene/Miocene Campos Basin.

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Carlos H. L. Bruhn received his B.Sc. in Geology from Bahia Federal University, Brazil (1980), his M.Sc. in Geology from Ouro Preta Federal University, Brazil (1985), and his Ph.D. from McMaster University, Canada, in 1993. From 1981-1986 he worked in Exploration, Production, and the Sedimetology Laboratory of Petrobras E&P in Salvador, Brazil. Dr. Bruhn was part of the Reservoir Characterization Group, Petrobras E&P, Rio de Janeiro, from 1986-2000. His responsibilities included intergrating multidisciplinary teams responsible for reservoir characterization studies and management of the oil fields from the Campos Basin, and doing consulting work for Petrobras E&P offices across Brazil. From 1994-1999 he was visiting professor to the M.Sc. program on Reservoir Characterization and Engineering at the University of Campinas, Brazil. Since 2000 he has been Corporate Manager for Reservoir Characterization at Petrobras E&P. In 1991 Dr. Bruhn received the J.A. Downing Memorial Award from the Canadian Society of Petroleum Geologists for the best paper presented at the Central Canadian Geological Conference in Hamilton, Ontario. He was the 1993 recipient of the Canadian Society of Petroleum Geologists' Graduate Students Award for the Ph.D. Thesis considered the most significant contribution to Canadian sedimentary geology. His major research interests include deep water sedimentation processes, sequence stratigraphy, and hydrocarbon reservoir characterization. He has co-authored seven professional articles for conferences and journals, and is a member of the American Association of Petroleum Geologists, the Brazilian Association of Petroleum Geologists, the International Association of Sedimentologists, and the Society for Sedimentary Geology.

***For directions to Chevron Park, San Ramon, and Building A, Room A-1036, phone* Dan Day *at* 925-736-6039 *or e-mail him at* danday94@pacbell.net**

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY and
AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

K-12 EARTH SCIENCE TEACHER OF THE YEAR AWARD

$500 Northern California Geological Society (2002)
$500 Pacific Section AAPG (2002)
$5,000 National AAPG (2003)

Call for Nominations for the Year 2002 NCGS Competition

The Northern California Geological Society (NCGS) is pleased to announce that it will accept applications from candidates in the Northern California region for the Year 2002 competition, for the Earth Science Teacher of the Year Award. The $500 NCGS award is intended to recognize pre-college earth science programs already in place, and to encourage their organization in districts where they have not been fully developed. Nominations of qualified K-12 teacher candidates are solicited from teachers, school administrators, teacher outreach programs, and other interested parties.

NCGS has joined with the American Association of Petroleum Geologists (AAPG) Foundation in presenting a $5,000 national award, to be given to a K-12 teacher for *Excellence in the Teaching of Natural Resources in the Earth Sciences.* The award recognizes balanced incorporation of natural resource extraction and environmental sustainability concepts in pre-college earth science curricula. It includes $2,500 to the teacher's school for the winning teacher's use, and $2,500 for the teacher's personal use. The award will be given at the 2003 AAPG Annual Meeting in Salt Lake City, Utah.

The deadline for application submittal by candidates for the $500 NCGS award is Friday, February 15, 2002.

The NCGS awardee's application will be submitted to a regional competition sponsored by the AAPG Pacific Section. The Pacific Section winner will receive a $500 award at the Pacific Section regional meeting in Anchorage, Alaska, in May, 2002, plus up to $250 toward meeting expenses and enrollment in the AAPG short course for earth science teachers, *Rocks in Your Head.* The regional winner's project will be submitted to AAPG headquarters for the national contest. The national winner will receive an expense-paid trip to Salt Lake City in 2003 to attend the national meeting and receive the award.

Interested candidates or nominators can request Application Information and an Entrant Application Form, or submit an application, by contacting:

Randy E. Kirby, President
Northern California Geological Society
67 Brookwood Road, Unit 20
Orinda, California 94563
Tel: (925) 254-2990
Fax: (925) 827-2029
E-mail: rkirby.geosci@usa.net

Application Information for
Earth Science Teacher Award

The American Association of Petroleum Geologists (AAPG) Foundation will award $5,000 at the 2003 AAPG Annual Convention in Salt Lake City to an individual teacher ***for excellence in the teaching of natural resources in the earth sciences.*** The award will include $2,500 for use under the teacher's supervision for educational purposes and $2,500 for personal use by the teacher. Also included will be an expense-paid trip to the Salt Lake City convention to receive the award.

Requirements:

1. Minimum of three years full-time teaching experience at any level K-12.

2. Teaching an earth science program including at least one unit per year that deals with natural resources. Natural resources are defined as Earth materials used by civilization past and present such as:

   a. Organic materials found in the Earth such as petroleum, natural gas, coal and oil shale.

   b. Inorganic materials found in the Earth including minerals, ores, building stone, and aggregate.

   c. Geothermal energy and water resources.

3. Teaching should include the scientific study of these resources, their origin, discovery, extraction, and historic and present use. It should also include a balanced presentation of environmental protection, reclamation, and resource conservation issues, and the use of earth science knowledge in decision making.

4. Entries should include the teacher's philosophy of teaching natural resources (both content and pedagogy), a description of the unit and two letters of recommendation. One letter should be from a colleague and one from an administrator.

5. Unit will be evaluated on depth and breadth of concepts (resource origin, discovery, processing, usage and reclamation), creativity of presentation and balanced treatment of information regarding societal need and environmental issues, relative to appropriate grade level. Please include the length of the unit.

Entry Guidelines:

All documents must be provided and signatures are required on the cover sheet. Single or double spaced lines on one side only of typed, ink jet, or laser quality printing required. All decisions of the judging panels are final.

Please note the checklist below:

- Cover sheet with original signatures.
- Teacher's philosophy of the teaching of natural resources, separate from unit description (up to 2 pages).
- Description of unit including unit objectives and relationship to overall science program (2 to 3 pages).

Two letters of recommendation (1 page each).

Do not submit multimedia such as videotapes, computer disks, photos, photo albums, or posters unless requested.

Important Notice:

All entries must be received no later than February 15, 2002. Facsimile and other electric entry forms will not be accepted. Membership in AAPG is not required for entry.

Entrant Information Cover Page

AAPG $5000 Award for Excellence in the Teaching of Natural Resources in the Earth Sciences

Print or type all information:

Name _____ School _____

School Address _____

City _____ State _____ Zip Code _____

Home Address _____

City _____ State _____ Zip Code _____

Telephone Numbers (home) _____ (work) _____ (fax) _____

E-mail _____

Current position and grades taught _____

Number of years in teaching _____ Other subjects taught _____

Degree and year _____ School _____

The above information and information contained in this entry is, to the best of my knowledge, true and correct. I understand that $2,500 of the award will be made to my school for use under my direction only. I also understand that $2,500 of the award will be made directly to me and that I am responsible for all taxes due as a result of this portion of the award. If I am selected as a winner, I hereby give my consent to use my name and photograph for publicity purposes only.

Signature _____ Date _____

The above information and information contained in this entry is, to the best of my knowledge, true and correct and represents the teacher's current assignment. I understand $2,500 of the award will be made to the above named school for use only under the direction of the above named teacher. I also understand that $2,500 of the award will be made directly to the above named teacher and that neither my school nor I is responsible for taxes due as a result of this award. Release time will be given to the above named teacher to attend the award ceremony if selected.

Administrator _____ Position _____ Date _____

Entries must be received by February 15, 2002

Attach this form to the top of your entry. Mail original entry and two copies to:

The Northern California Geological Society
Randy E. Kirby, President, Northern California Geological Society
67 Brookwood Road, Unit 20
Orinda, California 94563