

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY



OCTOBER MEETING ANNOUNCEMENT

DATE: Wednesday, October 24, 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: David Lawler, Bureau of Land Management, Minerals Division, Sacramento, CA.

Hydraulic Gold Mining's Historical Legacy - Mercury Contamination Issues: Sierra Nevada and Klamath Mountain Regions, California

Mercury, was used extensively in gold processing in the Sierra Nevada and Trinity-Klamath regions of California during the late 19th and early 20th centuries, has contaminated water, sediment, and biota on a watershed scale. Hydraulic mining has severely modified the geomorphology and hydrology of these regions, leading to increased turbidity of the natural waters, siltation of river beds, and contamination of the bottom sediments of reservoirs downstream of the mines. Thousands of pounds of mercury were used at each of many mines to facilitate gold recovery by amalgamation within sluice boxes during hydraulic mining. Visible concentrations of elemental mercury remain in the sediments of some sluices and tunnels that drain abandoned mine pits. The continued interaction between the mercury-laden sediments and flowing water is responsible for ongoing mercury and methylmercury contamination of surface waters.

The Bear River and South Yuba River watersheds of the northern Sierra Nevada are among the most highly impacted areas. During 1999-2000, an interagency team including scientists from the U.S. Geological Survey, the Bureau of Land Management, the U.S. Department of Agriculture's Forest Service, as well as state and local agencies, sampled water, sediment, and biota from several abandoned mine land (AML) sites and from downstream lakes in these watersheds. In 17 of 53 unfiltered water samples, total recoverable mercury (TR-Hg) was above 50 nanograms per liter (ng/L)-USEPA's aquatic life criterion. Water flowing from two tunnels in the Bear River watershed had TR-Hg concentrations greater than 100,000 ng/L, above USEPA's drinking water standard. The Bear River, downstream of the mine sites, had unfiltered concentrations of methylmercury (MeHg, a toxic form that readily bioaccumulates) greater than 0.4 ng/L during July-Aug. 1999 and Jan. 2000. Elevated Hg and MeHg in several taxa of predaceous invertebrates and elevated Hg in amphibians generally occur at, and downstream of, the hydraulic mine sites with the most elevated TR-Hg and MeHg concentrations

Continued on back page of newsletter

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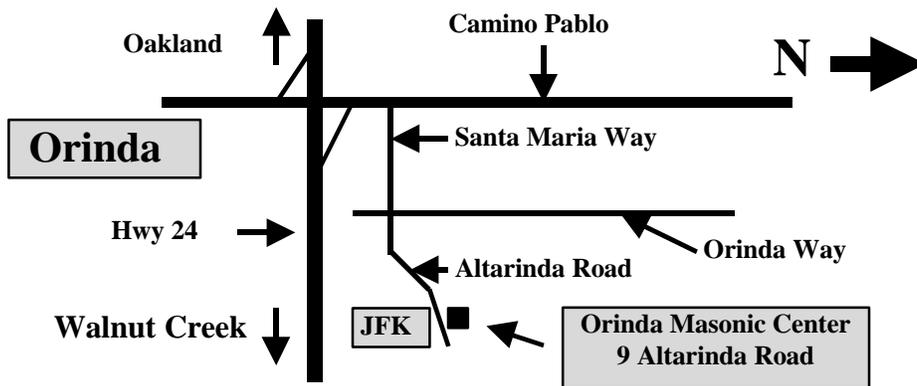
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in water and sediment. Fourteen percent (8 of 57) of bass samples had Hg concentrations (in fillet) greater than or equal to 1 ppm (wet weight), and 29 percent (41 of 141) of all fish analyzed had concentrations of Hg > 0.5 ppm. Bioaccumulation of methylmercury in sport fish downstream of the hydraulic mine sites may be of concern for human health, especially in lakes with shallow, relatively warm-water conditions. Three counties have issued a Public Notification recommending limited fish consumption based on the results of this study, the first such advice from a public agency with regard to lakes and streams in the Sierra Nevada.

During 2000, the interagency AML team also focused its efforts on mercury from sites in both the Bear-Yuba and the Trinity River watersheds. Concentration data for water, sediment, and biota (invertebrates, amphibians, and fish) in both watersheds will be used to prioritize sites for eventual remediation. Monitoring of key sites before and after hydraulic mine remediation will allow documentation of the benefits in terms of reduced mercury bioaccumulation and mercury loading to downstream waterbodies.

David A. Lawler is a Geologist/Mining Engineer with the U.S. Bureau of Land Management, California State Office, located in Sacramento, California. He received a Masters Degree in Paleontology/Geology in 1978 from the University of California at Berkeley. He has gained over 20 years of domestic and international professional experience in alluvial placer deposits and associated mercury use. Recent investigations and studies have focused on the mercury fate and transport in selected California watersheds as part of the interagency Abandoned Mine Lands Program, including the Bear and Yuba River Watersheds.

Northern California Geological Society
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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

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

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 Research 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

Chalk Bluff Preserve Tour

David Lawler of the U.S. Bureau of Land Management, Minerals Division, California State Office, is leading a tour of the **Chalk Bluff Preserve** near Nevada City, California, on **Saturday, October 20, 2001**. David is acting as a representative of the **Far West Geoscience Foundation**, and has led other groups to the preserve, which features Eocene leaf fossils and other flora preserved in fine-grained lacustrine muds of volcanic ash fall origin. These flora are associated with the Eocene auriferous gravel deposits of the ancient Yuba River watershed. This is a benefit event for the Nevada County Land Trust. Interested members should make reservations through the Land Trust Office at **530-272-5994**.

September NCGS Meeting Addresses the Origin and Evolution of a Mesozoic Ophiolite, Arc, and Subduction Complex in Western Baja California

An enthusiastic, animated talk on the origin and tectonic history of various ophiolitic, forearc basin, and subduction zone terranes in western Baja California was presented at the September 26, 2001, NCGS meeting by **Dr. Richard Sedlock** of San Jose State University. *Blueschists and Ophiolites in Baja: Coast Range Geology, But With Outcrops* took the audience through a casual tour of the geographical terrane and geological history of well-exposed rock units on the Vizcaino Peninsula along the western coast of Baja California.

Dr. Sedlock has spent over 15 years unraveling the complex stratigraphy and tectonic history of this barren peninsula, the Isla Cedros, and other small islands off the northwest tip of Vizcaino. The area is quite remote and logistically difficult to work on. The only sizeable community in the region is a small village on Isla Cedros that supports a fish cannery. Fishermen would ferry Richard to nearby uninhabited islands to map the rocks, but he would have to bring his own drinking water. Driving down Baja to the Vizcaino Peninsula is also treacherous because the roads are one lane, unpaved, and have no shoulders. One has to be on the lookout for approaching vehicles to avoid head-on collisions. The outcrops are so well exposed that Dr. Sedlock has conducted San Jose State Geology Department summer field camps in the area. A local peasant tapped into a mountain spring and uses the water to irrigate a small farm he established on an alluvial fan in the valley below. The farmer allows Richard to set up a base camp for the students on his secluded plot.

The regional geology is similar to the Peninsular Ranges in southern California, with lower and middle Mesozoic rocks overlying mid-Cretaceous granitoid intrusives. Oceanic igneous and sedimentary rocks comprise the overlying Mesozoic sequence in Vizcaino. The section consists of Great Valley Sequence-type forearc basin turbidites, island arc volcanics, and ophiolite separated from a subduction zone complex by a 5 to 500-meter wide serpentine matrix melange fault zone. The blueschist grade rocks lie in the footwall of a shallowly-dipping fault zone with higher level crustal rocks exposed in the hanging wall above. Detailed $\text{Ar}^{40}/\text{Ar}^{39}$ age dating indicates the protolith was subducted, metamorphosed, and deformed between 105 and 115 m.y. ago, then exhumed in late Cretaceous to Paleogene times. The thrust ophiolite suite overlying the high grade metamorphic rocks can be indirectly dated by radiolarians found in a 40-meter thick ribbon chert section deposited on top of pillow basalts. The dated chert horizons yield a linear deposition rate that can be extrapolated to an age of ~225 m.y. (upper Triassic) at the chert-basalt contact. The cherts are in turn overlain by turbidites, signaling the approach of continental sediment sources.

The high grade subduction zone metamorphic rocks are unique in that they do not show the typical high temperature overprint commonly seen in plots of the metamorphic trajectory on P-T (pressure-temperature) diagrams. The absence of this high temperature overprint suggests to Dr. Sedlock that the rocks were exhumed *during* subduction before the equilibrium temperature gradient could be established. The compressive deformation features preserved in these rocks are cut by extensional normal faults. The late extensional event poses a problem until one examines the mechanics of subduction closely. The accretionary sediment prism that fills the gap between the subducting oceanic plate and the overriding plate can grow by two processes: obduction (repetitive overthrusting) and underplating. Richard hypothesizes that enough underplating occurred in the Vizcaino area to uplift the accreting sediments and tilt the prism block 3 or 4 degrees trenchward. This would be enough to trigger gravitational sliding and the extensional regime necessary to create the late normal faults. He likens this to gravitational sliding associated with metamorphic core complexes. The intervening serpentine matrix melange that forms a thin shear zone separating the higher crustal level forearc basin sediments, arc volcanics, and ophiolitic suite from the subducted metamorphics is a near vertical early Cretaceous left-lateral strike-slip fault. It removes 25 km. of stratigraphic column across the fault plane.

The complete sequence of events identified by Dr. Sedlock's field research includes the genesis of a Triassic-Jurassic island arc/ophiolite complex, late Jurassic-early Cretaceous accretion to North America, mid-Cretaceous overlap of flysch/turbidite deposits onto the arc/ophiolite terrane, and late Cretaceous-Paleogene crustal extension. Similarly, he identified a structural sequence beginning with Triassic normal faulting associated with ocean ridge spreading, Jurassic thrust faults and folding accompanying ophiolite emplacement and continental accretion, early Cretaceous left-lateral San Andreas-style strike-slip faulting (serpentine matrix melange shear zone), and late Cretaceous-Paleogene normal faulting caused by gravity sliding. His research continues with further refinement of field relationships in the Vizcaino Peninsula and his tectonic model of syn-subduction exhumation of blueschist facies metamorphic complexes.

The NCGS wishes to thank Dr. Richard Sedlock for a very congenial synopsis of his on-going field work in Baja California. His enthusiasm and engaging style enhanced audience appreciation of the work he and his students have been doing in this remote but well-exposed field area. Richard is also instrumental in compiling data on the geology and tectonics of Mexico. His efforts are detailed in GSA Special Paper 278, "Tectonostratigraphic Terranes and Tectonic Evolution of Mexico." He collaborates with Mexican geologists and plans someday to revise Special Paper 278 to reflect the results of recent research there.

2001-2002 AAPG-SEG Joint Distinguished Lecture

Sponsored by the Bay Area Geophysical Society (BAGS)

Thursday, October 25, 2001

ChevronTexaco Overseas Petroleum, 6001 Bollinger Canyon Rd., San Ramon, CA

12:30 pm in Room D-2193, Chevron Park

Kurt W. Rudolph, ExxonMobil Exploration Company, Houston, TX

“DHI/AVO Analysis Best Practices: A Worldwide Analysis”

Industry increasingly relies on DHI and AVO technology to identify and risk prospects in many key exploration areas, including West Africa, the Gulf of Mexico, and the North Sea. As a measure of the impact of this technology, success rates are higher in plays where DHI technology can be applied (+20% for ExxonMobile wildcats). A calibrated DHI rating system, using both DHI and data quality characteristics, provides a structured approach to evaluate DHI quality on a risk analysis basis. Based on analysis of over 100 anomalies drilled with pre-drill DHI ratings, there is an excellent correlation between predicted and actual anomaly success rate within DHI-dependent plays.

Several examples from around the world illustrate both successes and pitfalls in DHI/AVO analysis. Key points include:

- Preservation of seismic amplitude and phase is critical. Standard industry acquisition and processing can create false anomalies and errors in quantitative predictions as proven by subsequent drilling.
- Non-unique seismic response remains a fundamental limitation on our ability to predict reservoir thickness and fluid type (e.g., oil versus gas).
- 3D AVO and visualization are powerful techniques for recognizing subtle fluid anomalies, which would otherwise be difficult to recognize.

Experience indicates that the best practice application of DHI technology is dependent on both optimal technologies and work processes, including:

- Calibration using physical property and modeling analysis
- Improved seismic data quality, including pre-stack attributes
- Integration of DHI analysis with other technologies.
- Development and application of new and emerging technologies

Kurt W. Rudolph received his B.S. in Geology from Rensselaer Polytechnic Institute and his M.A. in Geology from the University of Texas. From 1978-1981 he was an Exploration Geologist for Unocal, Jackson, Mississippi. He joined Exxon Production Research Company in 1981 and was a Research Geologist from 1981-1990. He went to Kuala Lumpur, Malaysia, from 1990-1995 as Chief Interpreter, Exxon Production Malaysia, Inc., and was Technology Advisor for Africa/Middle East for Exxon Exploration Company, Houston from 1995-1999. Since 1999 Kurt has been Hydrocarbon Systems Resource Manager for Exxon Exploration, Houston. He has published papers and abstracts on seismic interpretation, stratigraphy, and basin analysis which have discussed carbonate platform evolution, seismic modeling of reefs, DHI analysis, outcrop-based seismic modeling, structural inversion, and tectonic effects on sequence stratigraphy. Kurt was the 1992 recipient of the Wallace Pratt Award for the Best Paper, AAPG Bulletin.

For more information, please contact **E. Fred Herkenhoff** at ChevronTexaco by e-mail at efhe@chevron.com

PLEASE NOTE: Non-ChevronTexaco employees will need visitor badges to get past security to the lecture room. If you are not a ChevronTexaco employee, please e-mail Mr. Herkenhoff with your name so he can have a badge prepared for you. He will also tell you where to meet to get the badge and proceed to room D-2193.

For directions to Chevron Park in San Ramon, call **Dan Day** at 925-736-6039 or e-mail him at danday94@pacbell.net

Groundwater Resources Association of California, Sacramento Chapter

Aerial Photography Interpretation Workshop

Saturday, November 10, 2001 at the Red Lion Hotel in Sacramento

The GRA Sacramento Chapter will hold an Aerial Photography Interpretation Workshop Saturday, November 10, 2001 from 8:30 a.m. to 3:30 p.m. at the Red Lion Hotel in Sacramento. Red Lion Hotel is located at 1401 Arden Way next to the Arden Fair Mall. For directions, go to www.redlion.com. Brian Hausback, the chair of the CSUS Geology Department, will be the lead instructor. Cartwright Aerial Surveys, Inc. will provide the aerial photos and will demonstrate the use of digital aerial photos. Lunch will be provided.

Tentative Class Outline:

- 8:00 to 8:30 Registration
- 8:30 to 9:30 Aerial Photography Overview (Brian Hausback, CSUS) - The overview will present examples of what can be learned by proper interpretation of aerial photographs using the various methods available.
- 9:30 to 10:30 Hands-on Workshop - With the assistance of the instructor and trained assistants, small groups will work together using stereo glasses to interpret aerial photographs. The emphasis will be on learning to identify environmental features that might be of significance before future land development is considered. Examples include underground storage tanks, old landfills, air fields, industrial sites, fault lines, drainage areas, etc.
- 10:30 to 10:40 Break (Hot beverages provided)
- 10:40 to 11:40 Continuation of Hands-on Workshop
- 11:40 to Noon Discussion of examples reviewed (Brian Hausback, CSUS)
- Noon to 1:00 Hosted lunch - included in the registration fee
- 1:00 to 2:00 Continuation of Hands-on Workshop
- 2:00 to 2:10 Break (Cold beverages provided)
- 2:10 to 3:00 Demonstration of digital aerial photo interpretation methods (John Burgess, Cartwright Aerial Surveys, Inc.)
- 3:00 to 3:20 Wrap up/questions and answers session (Brian Hausback, CSUS)
- 3:20 to 3:30 Hand out of class completion certificates, class surveys (Roy Kroll, Barbara Heinsch)

Payment - Checks or credit cards only (MasterCard and Visa, not American Express). Registration payments will NOT be accepted at the door. The registration form is available on line at <http://www.grac.org/Sacramento.html>.

Make checks payable to Groundwater Resources Association of California. Mail to: Yolo County Planning and Public Works Dept., Attn: Barbara Heinsch, 292 West Beamer Street, Woodland, CA 95695.

Pre-register by Friday, October 19, 2001 - To qualify for the pre-registration discount, payment must be received by this date.

- Current GRA members - \$90
- Non members - \$100 Join GRA now to receive this discounted price!
Look under "Membership" on the GRA web page www.grac.org
- Registered Students - \$80 (need to show current college reg. card)

After Saturday, October 20, 2001, registration and payment must be received by Monday, November 5, 2001. Note payments will NOT be accepted at the door.

- Current GRA members - \$110
- Non members - \$120 Join GRA now to receive this discounted price!
Look under "Membership" on the GRA web page www.grac.org
- Registered students - \$100 (need to show current college reg. card)

Stereo Glasses are available for purchase for \$35, if ordered by October 20, 2001. If you have your own pair, please bring them to use at the class.

23rd Biennial Groundwater Conference **AND** **10th Annual Meeting,** **Groundwater Resources Association of California**

“Managing California’s Goundwater: The Challenges of Quality and Quantity”

October 30-31, 2001 • Radisson Hotel • Sacramento

For 46 years, the Biennial Groundwater Conference has served as a forum to discuss issues critical to the management of groundwater in California, and to preview emerging challenges. The conference meets jointly with GRA to provide a technical track.

The CONFERENCE WILL OFFER CONCURRENT POLICY AND TECHNICAL SESSIONS WITH 46 INVITED SPEAKERS ADDRESSING A BROAD ARRAY OF ISSUES. THE KEYNOTE SPEAKER WILL BE **CELESTE CANTU**, THE NEWLY APPOINTED EXECUTIVE DIRECTOR OF THE STATE WATER RESOURCES CONTROL BOARD. ALSO FEATURED WILL BE **SUSAN SEACREST**, PRESIDENT OF THE GROUNDWATER FOUNDATION.

SPONSORS

University of California
California Department of Water Resources
California State Water Resources Control Board
Groundwater Resources Association of California
Water Education Foundation
U.S. Geological Survey

COOPERATING ORGANIZATIONS

International Association of Hydrogeologists,
Association of California Water Agencies, California
Ground Water Association, National Ground Water
Association, Natural Resources Section - California
State Bar

POSTERS

Conference participants are encourage to submit applications for poster presentations of relevant published work.

REGISTRATION

Registration fee is \$195; \$250 after September 30. The fee includes lunch both days and a hosted reception with exhibits and poster presentations on October 30.

HOTEL RESERVATIONS

You may contact the Sacramento Radisson Hotel at (800) 333-3333 or (916) 922-2020. **Until September 28, we have secured a special room rate of \$109**, plus tax and surcharges, per night. Mention you are attending the 23rd Biennial Groundwater Conference.

FOR MORE INFORMATION

Contact Cindy DeChaine at the UC Center for Water Resources, (909) 787-4327 or Cindyd@ucr.ac1@ucr.edu

**Watch your mailbox and these web sites,
www.grac.org and www.waterresources.ucr.edu
for a full agenda with speakers.**

PSAAPG / SPE Call for Abstracts and Papers

Pacific Section AAPG and SPE Western Region Joint Meeting

“Energy Frontiers: A 2002 Perspective”

May 18-23, 2002, Anchorage, Alaska

Message from the Technical Program Chairmen:

It is with great pleasure that we announce the joint conference of the Pacific Section of the American Association of Petroleum Geologists (PS-AAPG) and the Western Region of the Society of Petroleum Engineers (SPE) in Anchorage next May 18-23 (Technical Sessions May 20-22): The 2002 Western Regional Meeting SPE and Pacific Section AAPG Convention.

The theme of the meeting "Energy Frontiers: A 2002 Perspective" highlights the challenges, high stakes, and excitement offered through technology to deliver our energy future. With the recent focus and emphasis on the substantial Arctic resource base, this meeting promises to be well attended and very timely. The broad format of this joint conference promotes emphasis on innovation and cross-discipline approaches to oil and gas development. With a wide span of technical presentations, forum topics, short courses, and poster sessions, this meeting is sure to offer something for all professionals in the petroleum industry.

Petroleum engineering technology challenges will cover a range of areas including- 1) Innovative Drilling and Completions, 2) Improved Oil Recovery, 3) Reservoir Management, 3) Low Cost Facilities, and 4) Health, Safety, and Environmental Practices. On the AAPG side, the theme of the meeting will focus on recent advances in knowledge of both regional and local geologic systems in the Arctic and across Alaska.

This joint conference of petroleum engineers and geoscientists should present a stimulating forum for the exchange of ideas and innovations across disciplines. Oral and poster authors are encouraged to submit their work under one of the categories listed below and help us make this meeting a great technical success. We look forward to hearing from you!

Shown below is the reference for submitting an abstract. For more information, contact Gordon

Sincerely,

Gordon Pospisil, BP Exploration, Alaska
Robert Swenson, Phillips Alaska, Inc.

(907) 564-5769
(907) 265-6573

pospisg@bp.com
bkrantz@ppco.com

CALL FOR ABSTRACTS / PAPERS

Papers are invited in both oral and poster format for the theme sessions listed below. The deadline for abstract submittal is **November 15, 2001**. AAPG papers will require an abstract only, while SPE papers will require an abstract, followed by a full-length paper, upon acceptance. AAPG and SPE papers can be submitted for any session theme, with preference for format (oral only, poster only, oral or poster). Authors selected will be notified by December 15, 2001. AAPG oral and poster presentations will be judged.

SUBMITTING AN ABSTRACT

We strongly encourage you to submit your abstracts through the internet at the **Convention website: <http://www.aapg-spe-2002.org>**. Abstracts are limited to 250 words. If you do not have access to the internet, you may send your abstract to PS-AAPG, P.O. Box 101288, Anchorage, AK 99510.

POSTER SESSION INFORMATION

Poster abstracts should be submitted for one of the technical sessions listed below. Final poster sessions will be determined after abstracts are accepted. Posters will be displayed during morning or afternoon sessions. Authors must be present at specific times. Poster space includes 3 panels, each 4'x 8'. Some booths may accommodate tables.

SPE TECHNICAL SESSION THEMES – CONTACT:

SPE Program Coordinator - Gordon Pospisil (907) 564-5769, pospisg@bp.com
Poster Session Coordinator - Robert Krantz (907) 265-6573 bkrantz@ppco.com