NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

MEETING ANNOUNCEMENT

DATE: **May 27, 2009** **DINNER MEETING!**

Special Note: We Cannot Accommodate Walk-ins

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

TIME: **6:00 p.m. social; 7:00 p.m. dinner; 8:00 p.m. talk; Cost: $20 per member; sorry no discounts for this deal of a meal!**

SPEAKER: **Dr. W. Gary Ernst**,
Stanford University, Palo Alto, CA

For this special event, NCGS has arranged for a **Back Forty Texas BBQ dinner consisting of Pork Ribs and BBQ Chicken, Tossed Green Salad, BBQ Beans, and Fresh Corn Cobettes. For vegetarians a deluxe veggie burger will replace the BBQ meal. Dessert includes assorted cookies and brownies. Wine (90^+ pts.) will be served.**

Mesozoic Transpression, Transtension, Subduction, and Metallogenesis in Northern and Central California

This presentation will describe Middle Paleozoic to Middle Jurassic mafic-ultramafic (seafloor) accreted terranes in the Klamath Mountains and the Sierra Foothills, and associated fine-grained terrigenous strata derived from accreted continental-margin belts. Oceanic terranes sutured the continental margin reflect 230 m.y. of margin-parallel slip involving strike-slip oblique tension and compression. Quartzofeldspathic sediments and high grade metamorphics are rare. Magmas liberated few volatiles, hence coeval hydrothermal ore deposits and granites are also rare. In contrast, nearly head-on Cretaceous subduction of the Farallon Plate generated the massive Klamath-Sierra Nevada volcanic-plutonic arc, driven by dewatering of eastward descending oceanic crust. Immature Great Valley forearc sediments and Franciscan trench deposits eroded from the arc record 70 m.y. of rapid crustal growth. Gold-bearing solutions rising from subduction-driven magma genesis zones, cooling plutons, and heated wall rocks were mobilized during arc growth. Gold-bearing quartz veins precipitated where hydrous CO_2-bearing fluids encountered major geochemical discontinuities in the wall rocks. Intense redistribution of oceanic and continental allochthons occurred during the Middle Paleozoic-

Continued on the back…

NCGS 2009 Calendar

Wednesday May 27, 2009 **Dinner Meeting!!**
See Attached Reservation Form
Mesozoic Transpression, Transtension, Subduction, and Metallogenesis in Northern and Central California; **Dr. W. Gary Ernst**, Emeritus Professor at Stanford University, Palo Alto, California
6:00 pm at Orinda Masonic Center
NOTE THE TIME!! SORRY NO WALK INS!!

Wednesday June 24, 2009
Cleanup on Aisle 9 - The Long-Lasting Legacy of Nuclear Waste; **Dr. Dave Stonestrom**, U.S. Geological Survey Research Hydrologist, Menlo Park, California,
7:00 pm at Orinda Masonic Center

As Usual – Our Summer Break!

Wednesday September 30, 2009
Bay Area Geoscapes: Geology of the San Francisco Bay Region – Photos That Didn't Make it Into the Book**; Dr. John Karachewski,** Dept. Toxic Substances Control
7:00 pm at Orinda Masonic Center

Wednesday October 28, 2009
The Loma Prieta Earthquake Turns 20; What we Have Learned From Seismology, Engineering & Politics; **Dr. Jack Boatwright, U.S.G.S, Menlo Park**
7:00 pm at Orinda Masonic Lodge

Wednesday November 18, 2009
EARLY DATE!!
Massive Ionization at the Air-to-Ground Interface as Possible Pre-Earthquake Indicator – **Dr. Friedmann Freund**, NASA Ames Research Center, Moffett Field, CA

December 2009 - As usual no meeting!

Wednesday January 27, 2010
The Earthquake of 1868 and the Birth of Seismically Resistant Architecture in California
Dr. Stephen Tobriner, Professor Emeritus of Architecture, UC-Berkeley

Upcoming NCGS Field Trips

Do you have a place you've wanted to visit for the geology? Let us know. We're definitely interested in ideas. For those suggestions, or for questions regarding, field trips, please contact Rob Nelson at **jmc62@sbcglobal.net** or John Christian at: **jmc62@sbcglobal.net**. In the mean while there is one upcoming field trip!

June 13 & 14, 2009	***Gold Country Field Trip***; Ross Smith, Member and Precious Metals Consulting Geologist

Peninsula Geologic Society
Upcoming meetings

For an updated list of meetings, abstracts, and field trips go to http://www.diggles.com/pgs/. The PGS has also posted guidebooks for downloading, as well as photographs from recent field trips at this web address. Please check the website for current details.

Association of Engineering Geologists San Francisco Section
Upcoming meetings

Meeting locations rotate between San Francisco, the East Bay, and the South Bay. Please check the website for current details:

- For further meeting details go to: http://www.aegsf.org/

USGS Open House!!

It's Finally Here!

Exhibits, Live Music, Video Theater

May 16 – 17, 2009

10 a.m. – 4 p.m.

It's time for the ***9th triennial U.S.G.S. Open House***. This year the theme is ***2009 – Year of Science.*** The USGS Campus is located at 345 Middlefield Road, Menlo Park.

For information call (650) 329-4390 or better yet go to: http://openhouse.wr.usgs.gov/. A detailed list of events can be found at: http://openhouse.wr.usgs.gov/exhibits.html. The list is printable (seven pages) and is organized according to event location, and kid friendly events are labeled as such; there are many. And there are many for the more "advanced user". You can download a map of the USGS Campus at: http://openhouse.wr.usgs.gov/map.html or

obtain driving directions. The USGS does encourage visitors to consider using Caltrain for further fun or adventure. Information on speakers and movies at Presentation Theater can be found at:
http://openhouse.wr.usgs.gov/presentations.html
Information on touring the gardens at the USGS campus can be found at:
http://openhouse.wr.usgs.gov/gardens.html.

Go Out and Enjoy!!

AAPG Annual Convention
June 9 – 10, 2009; Denver, Colorado

Don't forget about this opportunity as well! Many details are available, but more will come. Go to http://www.aapg.org/denver/index.cfm for details!

U.C. Berkeley Campus Seismic Retrofit, Seismological Laboratory Tour, and Hayward Fault Field Trip

Highlights Life Along An Active Fault Line

Submitted by Dan Day!

Over thirty NCGS members and their friends attended the November 15, 2008 **U.C. Berkeley Campus Retrofit and Hayward Fault Field Trip** featuring a tour of the UCB Seismological Laboratory. Trip Leaders **Peggy Hellweg** of the UCB Seismological Laboratory staff, U.C. Berkeley Professor Emeritus **Dr. Doris Sloan**, and University Administrator C**hristine Shaff** prepared a beautiful guidebook featuring a tour of campus facilities and surrounding neighborhoods. They were assisted by contributing authors **Donald Wells**, Project Manager with AMEC-Geomatrix and **Patrick Williams** of San Diego State University. Under sunny, clear blue skies, the group trekked across the Campus to view seismic retrofits, and through nearby neighborhoods to examine the Hayward Fault trace. The University is concerned about seismic risk because experts believe the next significant Bay Area earthquake has a high probability of occurring along the northern segment of the Hayward Fault.

Participants met at McCone Hall on the U.C. Berkeley campus, and then marched off to examine signs of the Hayward Fault reflected by the local geomorphology and damaged man-made structures.

Figure 1 Field trip group assembled at Mc Cone Hall, U.C. Berkeley.

Stop 1 was at Founders Rock, a silica-carbonate outcrop of highly altered serpentine, where a plaque commemorates the founders of the University of California, Berkeley. Peggy noted that a reliable water source prompted the founding body to select Strawberry Canyon as the University site. Large acreage was subsequently purchased by the University in this area. Founders Rock displays abundant slickensides on its exposed surfaces, subtly acknowledging its complex tectonic history.

Figure 2 Trip leader Peggy Hellweg of the U.C. Berkeley Seismological Laboratory at Founders Rock.

A short walk south along College Avenue took the group to the Foothill Housing Commons. This building was earthquake retrofitted. The second stop was at a nearby bus station where a stream channel exits the East Bay Hills. The channel has been "beheaded" or cut off from its drainage source by right lateral motion along the Louderback Fault, a strike-slip offshoot of the Hayward Fault. Chert debris found in the channel bottom indicates it was originally fed by Strawberry Canyon, which has chert-bearing horizons in its drainage basin. Strawberry Creek has been offset about 1,100 feet north on the west side of the Hayward Fault.

Discussions of relative plate movement and displacement rates were held at this stop, by the Foothill Housing Commons. Regional GPS measurements indicate there is about 5 cm per year right lateral movement between the Reno, Nevada, baseline station and its sister station on the Farallon Islands. Gradually partitioning this motion along Bay Area strike slip faults yields a 1 cm/yr. creep rate on the northern segment of the Hayward Fault. Trenched C^{14} dates of exposed fault features in displaced stream channels feeding Strawberry Canyon east of the Hayward Fault give offset dates at 35,000 yrs. B.P., 45,000 yrs. B.P., and 60,000 yrs. B.P. These dates represent the times when these channels were "beheaded" by right lateral motion along the fault. Active tectonic creep along the Hayward Fault continues today.

Leader Peggy Hellweg noted that the larger the earthquake magnitude, the greater the relative displacement along the fault. She also pointed out that the Berkeley Hills are an expression of compressive forces acting on land sandwiched between the Hayward Fault and the Calaveras Fault to the east.

The third stop, at the corner of Gayley and Rimway, allowed **Don Wells** of AMEC-Geomatrix to discuss the geotechnical work his firm has accomplished over the years to assess and remediate seismologic structural damage on the campus. Don described the overall project and the details of tectonic activity in the vicinity. Peggy added comments regarding seismic behavior in the Berkeley Hills and its relationship to large scale deformation between the Pacific and North American Plates.

The group reassembled at the fourth stop, a basketball court just south of Bowles Hall, where extensive fault trenching has been done. Don Wells described the trenching activity for the campus housing in this area. Twenty trenches were dug to locate the Hayward Fault trace, which was revealed by ground rupturing and deformation after the 1868 Hayward Earthquake. Recent trenching began in 1992. The east and west fault traces were located but portions were obscured with colluvium and alluvium that had washed down the hillside. Some of this debris may be landslide material. In some cases 1915 aerial photographs were consulted to determine bench locations. Here a sliver of Cretaceous Knoxville Formation is exposed resting on the Coast Range ophiolite. Professor Garniss Curtis of UCB interpreted some of the units in this vicinity as a shale matrix mélange. Don Wells suggested it may be a "flower" structure squeezed up along the Hayward Fault strike-slip zone.

The Hayward Fault trace was located near Bowles Hall, constructed on a hillside fault bench in 1927. The old building has no structural damage, but the Hayward Fault passes beneath its southeast corner. In the interest of seismic safety, Bowles Hall will be structurally decoupled from the fault to allow right lateral ground creep movement beneath it. The group walked south from Bowles Hall to examine nearby street curb creep displacement, and then strolled to Memorial Stadium.

The tour lingered a while at Berkeley Memorial Stadium. Don Wells elaborated on its structural damage and described detailed mapping that AMEC-Geomatrix has done to assess the local geologic structures and stratigraphy. These studies were used to develop a stadium remediation plan to minimize future structural damage. The challenge is to minimize the effects of 4.5 mm per/year shear along the Hayward Fault.

Figure 3 Tension cracks on the side of the Berkeley Memorial Stadium north entrance.

At the north stadium entrance, Peggy Hellweg pointed out a U.C. Berkeley Seismology Laboratory monitoring station. This is the Laboratory's closest station to the Hayward Fault. As the group entered the stadium, Don Wells noted diagonal shear fractures on the stadium wall that are attributed to fault movement. The Memorial Stadium was constructed in 1923 in six separate sections. The builders were cognizant of local fault activity and chose this design to minimize seismic damage to the structure. The stadium was built on fill in Strawberry Canyon, and was buttressed up against a shutter ridge on the southwest side. Some stadium sections have perceptibly rotated with respect to one another.

Figure 4 Large fracture in the wall at the north Berkeley Memorial Stadium entrance below the bleachers.

The stadium shows additional damage at its southwest end. In plan view, the stadium has been constructed adjacent to a shutter ridge which deflects Strawberry Creek northward, forming a natural amphitheater. Excavation into the northern part of the hillside provided fill for the stadium, and the ridge itself supports the southern end. A 36-inch diameter culvert was built under the stadium to handle flow from Strawberry Creek, and when that was found to be inadequate, another was built around it. A deformation zone in the culvert underneath the stadium marks the Hayward Fault crossing. The stadium site was chosen for its view across the San Francisco Bay and because it afforded the least excavation. Shutter ridges play an important geomorphic role along the Hayward Fault. Lake Temescal was formed behind one, and the Claremont Hotel rests on another.

A large gap has opened in the southwestern stadium wall, and is illustrated in Figure 5.

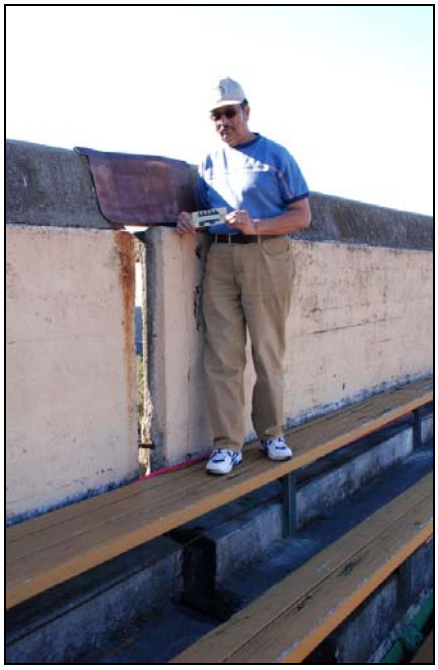


Figure 5 Large gap in the southwest wall of Berkeley Memorial Stadium.

Underneath the stadium bleachers at the south end Don Wells showed the group offset along support pillars where two adjacent stadium sections moved relative to each other (Figure 6). The proposed fault crossing is south-southeast of this point but the deformation has been transferred here. The geologic cross-section across the Hayward Fault at the stadium has a highly sheared zone sandwiched between colluvium and alluvium. This may represent a "flower" type structure along a strike-slip fault where material is squeezed up along a vertical fault plane in response to shearing forces. This feature is common in the California Coast Range.

The clayey fill under the stadium was very well compacted, dense, and not prone to liquefaction. However, NCGS member **Jeffery Shaffer**, a Geology Department faculty member at Napa Community College, presents a convincing argument that the damage is due to settling and not necessarily to fault activity. Regardless, the stadium has clearly suffered significant structural damage.

Figure 6 Offset along pillars underneath Berkeley Memorial Stadium.

Because of these visible flaws, the University of California hired AMEC- Geomatrix to design a seismic retrofit for the stadium. The consultants noted that the north end needs rebuilding, and the south end reinforcement. The master mitigation plan is to drill holes and cast pillars (pilings) underneath the stadium where the Hayward Fault is thought to cross, add a layer of plastic on top, and cap this with a concrete slab that would decouple the stadium from the underlying ground. The pillar system would be free to slide under the stadium. The overlying slab would be constructed of steel-hinged segments that would articulate freely with creep activity along the Hayward Fault.

Carbon-14 (C^{14}) dating of samples taken on a transect beneath the stadium indicate the colluvium layer is over 45,000 years old, and that the top few feet of cover is only a few thousand years old. The Hayward Fault trace lies under the southwest stadium expansion joint, but the creeping fault segment is further southwest. As the group exited the stadium, Don noted that the west stadium end rests on siltstone bedrock.

The group stopped briefly to examine a crack in a large concrete slab on the ground level parking area beneath an apartment complex at Bancroft and Prospect. This building lies immediately south of the stadium, and the crack is interpreted to be evidence of Hayward Fault creep.

A couple blocks further south on Prospect, the group turned east and went up Hillside to follow Hamilton Creek. The gulch it carved is offset right-laterally by the Hayward Fault.

Going south towards Dwight Way, the tour passed the Smythe home. The now deceased Mr. Smythe wrote articles for the local newspaper chronicling the construction of Berkeley Memorial Stadium in the late 1920's. Further south the Hayward Fault was multiply-trenched across a parking lot in 1992, revealing a well-defined fault zone. The parking lot and the adjacent Fernwald Housing complex have been replaced due to seismic risk (the building had been strongly deformed by fault creep). Now a new building and a vegetable garden occupy the site.

The tour emerged on east-west trending Dwight Way, on a steep stretch represent the Hayward Fault scarp. Right-lateral curb deformation is obvious where the street crosses the fault trace (Figure 7).

Don Wells mentioned that although there are many obvious geomorphic and anthropo-morphic expressions of creep deformation along the Hayward Fault, many important natural features have been eradicated by human construction. Hence, consultants like AMEC-Geomatrix have had to consult old aerial photographs for valuable geomorphic information. Don also noted that LIDAR (light detection and ranging) images have been marginally useful to his firm because of the ground disturbances caused by building construction. As the group passed the site of the new U.C. Berkeley Athletic Center, scene of the recent oak tree protests, Peggy Hellweg pointed out an old rhyolite boulder retaining wall that has been in place for decades, and shows no signs of fault displacement.

The field trip returned to the U.C. Berkeley campus and made another stop at Strawberry Creek near Hildebrand Hall. This wooded glen is west of the Hayward Fault. Strawberry Creek flows year round here and has been displaced about 1100 feet northward by right-lateral motion along the Hayward Fault.

Figure 7 Curb offset on Dwight Way looking downhill (west). Red arrow notes general vicinity of creep offset on the Hayward Fault.

The trip broke for lunch outside Evans Hall, where U.C. Berkeley administrator **Christine Shaff** detailed the University's efforts to seismically retrofit key campus structures. After the 1989 Loma Prieta earthquake, the U.C. Berkeley admini-stration felt compelled to assess its seismic safety. The University had been aware of Hayward Fault creep in the 1980's, and had done some seismic retrofitting of its infrastructure. The post-Loma Prieta seismic survey ranked 27% of the square footage poor to very poor, using the current U.C. Regents' rating system. Some of the buildings surveyed have to meet higher retrofit standards because they have to be functional in the event of an earthquake. These include the University computer facility, health services buildings, and dining commons (for feeding and sheltering people from the University and surrounding communities).

In 1997, U.C. Berkeley established a 10 point action plan. This plan focused 10% of its budgetary resources on seismic safety. Since 1997, 50% of the targeted campus structures have been retrofitted. The present focus is on the next 25%. There are currently no occupied campus buildings that are rated poorly. The project has allowed the University to design many innovative methods of addressing seismic safety and structural reinforcement, such as shear walls. Now there is plenty of space to house people in the event of an earthquake disaster, based on current USGS predictions of probable earthquake magnitudes. The plan also provides for instruction to continue on the campus while damaged buildings are being repaired. The 10 Point Plan will also review and revise campus disaster preparedness measures.

U.C. Berkeley considers seismic issues a priority and has placed a university Vice Chancellor in charge of implementing the 10 Point Plan. The Vice Chancellor's duties include:

- delivering and streamlining the management of campus capital improvements
- maintaining focus on seismic safety and on disaster preparedness and response

The University has constructed buildings and facilities with shared equipment that will be available to departments in the event that their buildings are rendered unusable. The 2009 California State budget crisis has forced the delay or rescheduling of some retrofitting projects. Damage models have been made based on retrofit structural designs. A key factor in this program, said Christine Shaff, is that U.C. Berkeley is one of the largest employers in the East Bay. The local economy cannot afford to have it closed down.

In addition to items mentioned above, the 10 Point Plan has addressed all non-structural seismic hazards. The retrofitting concept involves protecting laboratory equipment and supplies as well as structures. And the U.C. Berkeley Emergency Awareness Program addresses fire, power outages, hazardous chemical releases, and bomb threats in addition to earthquakes.

After this excellent introduction, the field trip group toured the Hearst Mining Building. This is an older facility built in 1907 and designed by UCB Architecture School professor John Galen Howard under an endowment from Phoebe Hearst. The Hearst Building retrofit is a base

isolation design. This is structurally less intrusive, but expensive to accomplish. The building rests on rubber bumpers or cushions to "isolate" it from the ground beneath. The entire building had to be raised off its foundation to insert the cushions, then lowered onto them. A concrete moat was constructed around the building to contain it and keep the suspended structure from impacting horizontally against the ground. It has been designed for a Magnitude 7.0 earthquake on the Hayward Fault. This design was used for other campus retrofits and has been applied in Japan. The 60 million pound building rests on 134 base isolators fitted with accelerometers (see Figure 8). Other accelerometers and 25 seismometers have been positioned elsewhere in the building. This is the only instrumented base isolated building in the world. Fortuitously, engineering facilities on campus are equipped with large shake tables that can be used to model campus retrofit designs. The utilities in the Hearst Building are designed to move freely in an earthquake. The interior and exterior brickwork was removed, cleaned, and reattached. During this and other retrofits, the occupants were temporarily housed in an "overflow" building on Hearst and Oxford until the retrofit was completed. The tour also stopped at the now closed Lawson Adit, a tunnel used for mining engineer instruction that crosses the Hayward Fault to the east.

Christine Shaff continued to lead the campus building retrofit tour. After leaving the Hearst Mining Building, the group stopped at Latimer and Hildebrand Halls. Hildebrand Hall has inverted "V" beams attached to external concrete structures to anchor and stabilize the building. The Latimer Hall retrofit did not reduce the inner space of the building. It was considered susceptible to earthquake whipping action, so designers constructed an external concrete "shell" fastened to the outer structure to resist flexural forces. Hertz Hall was retrofitted to increase its north-south directional shear strength. Exterior tiles were removed, cleaned, and reattached.

Wurster Hall (College of Environmental Design) is a massive structure. Its external columns were strengthened with fiber wrapping. Barrows Hall was originally constructed with a discontinuous shear wall. The shear walls were made continuous, and concrete "bookends" were added to improve its shear strength. Sather Tower/Camponile is slated for retrofitting to strengthen the upper level viewing platform.

The oldest campus building, South Hall, was constructed in 1870 as an earthquake resistant edifice using building failures in the 1865 and 1868 San Francisco earthquakes as guidelines. It is an unreinforced masonry structure dubbed the "Mary Poppins building" for its resemblance to Victorian architecture. Its inner walls were tied together with steel bars and the roof structure was reconstructed to meet current earthquake codes. However, the original design was remarkably earthquake resistant, thus allowing most of the structure to be preserved.

Figure 8 Base isolator cushion and accelerometers underneath the Hearst Mining Building.

The Bancroft Library, adjacent to the Doe Library, was the most recent building to be retrofitted. It houses rare documents, books, and other memorabilia. The previous interior was "like a rabbit warren," with twisting, intricate hallways. The entire interior was gutted and new floors were added to meet seismic requirements. A new heating-ventilating-air conditioning system was installed for climate control. For accessibility needs, Bancroft Hall was attached to the adjacent Doe Library.

The final retrofitting stop was McCone Hall, home of the Earth and Planetary Sciences Department. McCone has also been retrofitted without sacrificing valuable interior space. Exterior walls were added to strength the structure. McCone houses the Berkeley Seismological Laboratory (BSL) on its second floor.

Seismology has a long tradition at U.C. Berkeley. In 1887 seismometers were installed on the

campus near McCone Hall, and at Lick Observatory on Mount Hamilton east of San Jose. From this modest beginning the Berkeley Seismological Laboratory seismic network has grown to nearly 50 sites in California and Southern Oregon. It offers unique seismological research opportunities.

The BSL suite displays a seismometer given to Professor Andrew Lawson in 1913. Lawson did an exhaustive survey of structural damage and geomorphic features associated with the 1906 San Francisco Earthquake. His report on this work is a classic. On display are various research seismometers including a Benioff short period seismometer with a 100 kilogram mass, a Wiechert seismometer with a 160 kilogram inverted pendulum, and several Wood-Anderson seismometers used to establish the Richter magnitude scale in the 1930's. Over the Cold War years, BSL has monitored underground nuclear detonations for compliance with the Nuclear Test Ban Treaty.

Today 30 stations report to the main data center. Analog signals are converted to digital code and are processed. Berkeley enjoys the ability to monitor signals over a wide dynamic range and can therefore analyze a larger spectrum of sources.

In 1966, the USGS established its own seismology laboratory, which eventually grew to over 300 stations in California. With 10 times as many stations, the USGS can more accurately locate epicenters with better precision than BSL. But the USGS has a narrower dynamic range.

The Berkeley system's sensitivity was revealed when its seismographs recorded signals from the December 26, 2006, Sumatran earthquake. This enormous event caused one centimeter of ground displacement in Berkeley and was continuously recorded on UCB seismometers for 5 minutes. Its waveforms made 10 global circum-navigations, and resonant modes were captured up to one month later.

Typically the BSL monitors earthquake in the greater Bay Area. It can provide moment tensors, finite fault inversions, and waveform analyses. These are details that are used for research modeling applications. Relative fault motion and 3-D information can also be generated to characterize motion along the fault rupture, to determine fault rupture mechanics, or to measure ground offset caused by an earthquake. BSL can characterize the structural features, layer velocities, elasticity and other crustal physical properties between the source and the seismic receiver.

Figure 9 Peggy Hellweg in the Berkeley Seismological Laboratory, McCone Hall, U.C. Berkeley

Peggy finished with a discussion of California seismology history. The Southern California Earthquake Center was established at the California Institute of Technology in the 1920's by legendary seismologists Beno Guttenberg and Charles Richter. Monitoring regions between northern and southern California became very territorial. Eventually U.C. Berkeley seismologist Perry Byerly and Beno Guttenberg agreed to demarcate their territories with a line drawn between Morro Bay near San Luis Obispo and Bishop on the east side of the Sierra Nevada.

The USGS began seismic monitoring in the 1960's with their less sensitive but more numerous station system. In 2000 the California Integrated Seismic Network was established to share data between Caltech, the USGS, and the BSL. These institutions are slowly achieving a more cordial state of data sharing.

The Northern California Geological Society extends its sincerest thanks to Peggy Hellweg, Doris Sloan, Christine Shaff, and Don Wells for making this a truly memorable field trip. The hospitality of the University of California, Berkeley is gratefully acknowledged. This multi-faceted look at the Hayward Fault, the U.C. Berkeley seismic retrofitting program, and the University's seismological capabilities was skillfully orchestrated by the trip leaders.

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS FIELD TRIP

Gold Country Field Trip

Saturday June 13 & 14, 2009

Leader: Ross Smith, Precious Metals Consulting Geologist

This will be an easy two-day ramble (mostly driving) along Highway 49 through the historic Gold Country of California from Placerville to Mariposa. The spring is a beautiful time to see this magnificent countryside of our Golden State, replete with green hills, running streams, wildflowers, and superb rock exposures.

Because of the strange social policies of this State, there are no remaining working gold mines. However, there are certain sites where we can view the internal workings of a real gold mine, and these are well documented and generally adequately guided. Some have a modest fee. On day one we will do an underground tour of the Gold Bug mine in Placerville, and a surface tour of the Kennedy Mine in Jackson. As we proceed along Highway 49 we will view the great Melones Fault, also known as the Mother Lode, at a number of locations. We will see numerous gold sites, towns, and historical residues. Just south of Angels Camp we will pull into the Glory Hole Recreation area where we will camp. There is small fee of $18 ($9 for seniors) for use of this California State Recreation Area. Hot showers, fire pits, etc. Quite a pleasant place. The NCGS will put on a barbeque dinner. Bring your own breakfast.

On day two we will start early. We will view the Carson Hill gold mine (now an operating rock quarry—a good story here!); the New Melones reservoir (fault-defined), the Columbia limestone placer deposits near Sonora; the Table Mountain (with numerous drift mines—now abandoned) and (from a distance) the open-pit Harvard Mine near Jamestown; the Moccasin Creek placer tailings (miles of them); an abandoned Mariposite quarry (good collecting point for this California mineral); and the abandoned Virginia Mine (careful-open shafts) near Coulterville. We will continue along Highway 49, looking at various exposures and abandoned mine remains. Time permitting we will walk about ¾ of a mile along an old haul road to view the remains of the Josephine Mine. Around mid-day we arrive at the California State Mineralogy Museum near Mariposa. After lunch in town, we may visit the old Stamp Mill in town. We then go west on Highway 140 to the Dial Rock Shop. Gold panning for those interested, lots of rocks to buy and view, and good exposures along the highway. Then return to Danville (2 hours).

For those who cannot do the two days, or do not wish to camp, they could return to Danville directly from Angels Camp at the end of the first day. For those who hate camping, there are several pleasant motels in Angels Camp—only about 4 miles from our campsite. Our guide is an active commercial gold prospector, a member of the NCGS, and a peripatetic wanderer. He holds a BS in Engineering, with a minor in Geology, and a MS in Geophysics. He spent 30 years in international oil exploration, and for the last 10 years has been a consulting and practicing geologist in precious metals. He will give brief explanations on gold origin, occurrence, and recovery from his modest store of knowledge.

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

THIS FIELD TRIP WILL BE LIMITED TO 30 PEOPLE. **Cost**: **$50/person**

Time & Departure: Depart precisely at 8:00 am from Danville Park and Ride (Sycamore Valley Road at I-680) June 13, 2009. Alternatively, or if late, meet us at the Gold Bug Park (aka Bedford Park) in Placerville at 10:30. Call me on my cell phone at 707-548-3268 if you have any problems.

**********REGISTRATION FORM (Gold Country Field Trip) **********

Name:_____ E-mail:_____

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

Lunch and Dinner: Regular:_____Vegetarian: _____ (Please check one) Check Amount: _____

Please mail a check made out to **NCGS** to: **Rob Nelson, 269 College View Drive, Rohnert Park, CA 94928**

Carpooling is suggested for this fieldtrip. Please let us know if you can provide a van and NCGS can reimburse your gasoline expenses. Questions: e-mail: rlngeology@sbcglobal.net Phone: (707) 795-8090 (evening) (707) 548-3268 (day).

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

NCGS DINNER MEETING

"*Mesozoic Transpression, Transtension, Subduction, and Metallogenesis in Northern and Central California*"

Wednesday May 27, 2009

Speaker: Dr. W. Gary Ernst, Stanford University

6:00 pm at Orinda Masonic Center (please note earlier starting time)

Reservations required by May 21, 2009;

We are sorry but we will not be able to accommodate "walk-ins"

For this special event, the NCGS is planning a **Back Forty Texas BBQ dinner consisting of Pork Ribs and BBQ Chicken, Tossed Green Salad, BBQ Beans, and Fresh Corn Cobettes. For vegetarians a deluxe veggie burger will replace the BBQ meal. Dessert includes assorted cookies and brownies. Wine (90^+ pts.) will be served.**

Abstract: This presentation will describe Middle Paleozoic to Middle Jurassic mafic-ultramafic (seafloor) accreted terranes in the Klamath Mountains and the Sierra Foothills, and associated fine-grained terrigenous strata derived from accreted continental-margin belts. Oceanic terranes sutured the continental margin reflect 230 m.y. of margin-parallel slip involving strike-slip oblique tension and compression. Quartzofeldspathic sediments and high grade metamorphics are rare. Magmas liberated few volatiles, hence coeval hydrothermal ore deposits and granites are also rare. In contrast, nearly head-on Cretaceous subduction of the Farallon Plate generated the massive Klamath-Sierra Nevada volcanic-plutonic arc, driven by dewatering of eastward descending oceanic crust. Immature Great Valley forearc sediments and Franciscan trench deposits eroded from the arc record 70 m.y. of rapid crustal growth. Gold-bearing solutions rising from subduction-driven magma genesis zones, cooling plutons, and heated wall rocks were mobilized during arc growth. Gold-bearing quartz veins precipitated where hydrous CO_2-bearing fluids encountered major geochemical discontinuities in the wall rocks. Intense redistribution of oceanic and continental allochthons occurred during the Middle Paleozoic-Middle Jurassic suturing events, but involved little net continental growth or metallogenesis. In contrast, voluminous continental crust and ore genesis accompanied the Cretaceous head-on subduction of oceanic lithosphere.

Biography: W. Gary Ernst received his B. A. in Geology from Carleton College (1953), M. S. in Geology from the University of Minnesota (1955), and Ph. D. in Geochemistry from The Johns Hopkins University (1959). After fellowships at the Geophysical Laboratory, he joined the UCLA faculty in 1960. Ernst was Geology chair (1970-74), Earth and Space Sciences chair (1978-82), and director of the UCLA Institute of Geophysics & Planetary Physics (1987-89). He was Dean of the Stanford University School of Earth Sciences from 1989 to 1994 and named the Ben Page Professor in 1999. Ernst went emeritus in 2004. He is a member of the National Academy of Sciences, American Academy of Arts & Sciences, and American Philosophical Society. Ernst served as president of the Mineralogical Society of America (1980-81) and the Geological Society of America (1985-86). He received the MSA Award (1969), the Geological Society of Japan Medal (1998), the Penrose Medal of the GSA (2004), the Roebling Medal of the MSA (2006), and the Legendary Geoscientist Award of the American Geological Institute (2008). He is author of seven books and research memoirs, editor or co-editor of 19 others, and author or co-author of over 270 scientific papers. His interests include physical chemistry of rocks and minerals; Phanerozoic interactions of lithospheric plates and orogenic belts, in central Asia, the Circum-Pacific and the western Alps; early Precambrian petrotectonic evolution; high- and ultrahigh-pressure subduction-zone metamorphism and tectonics; geobotany, remote sensing; and geology and human health.

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

Meeting Agenda: Social Hour: 6:00 pm Dinner: 7:00 pm Presentation: 8:00 **Cost: $20/person**

Time: May 27, 2009, at 6:00 pm, Orinda Masonic Center 9 Altarinda Road, Orinda, CA

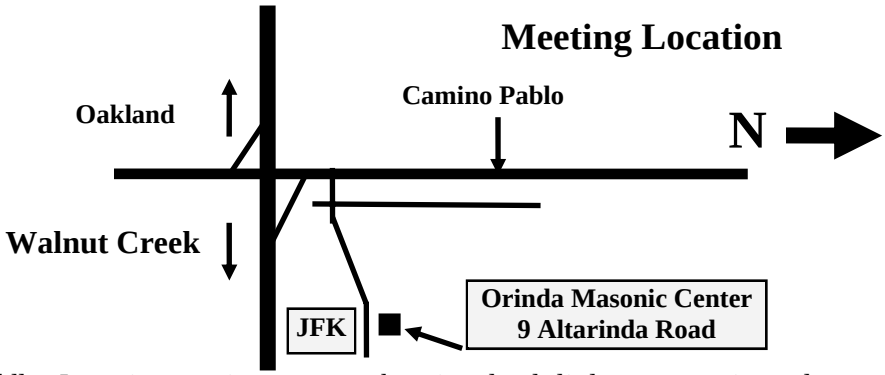
**********REGISTRATION FORM (Dr. W. Gary Ernst Dinner) **********

Name: E-mail:_____ Phone (day): Phone (cell) _____

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) (925) 363-1999 (day)



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Northern California Geological Society
c/o Mark Detterman
3197 Cromwell Place
Hayward, CA 94542-1209

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