NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

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MEETING ANNOUNCEMENT

DATE: **Wednesday, October 29, 2003** ***It's Family Night!!***

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

TIME: **6:30 p.m. Social; 7:00 p.m. talk (no dinner)**
Cost is $5 per regular member; $1 per student member

RESERVATIONS: Leave your name and phone number at 925-424-3669 or at *danday94@pacbell.net* before the meeting.

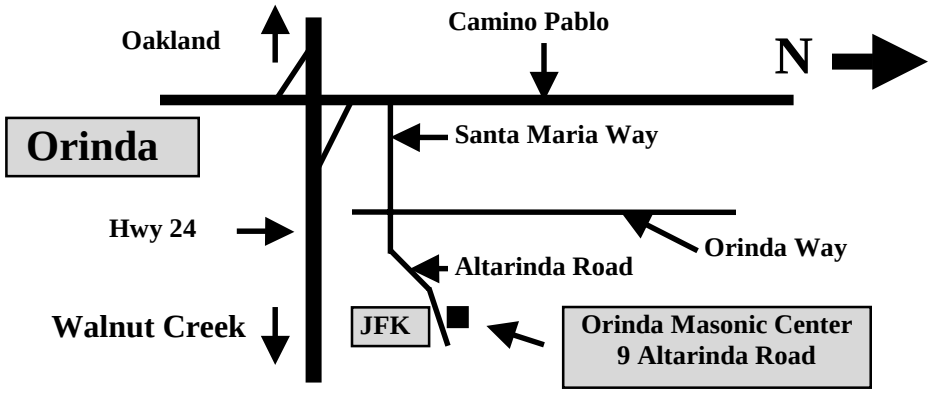
Speaker: **Dr. Stephen Eittreim, Emeritus USGS, Menlo Park**

Revealing the Hidden World Beneath Monterey Bay

The complex geologic setting and rich biologic resources of the Monterey Bay National Marine Sanctuary (MBNMS) form a unique marine environment of national importance. Acoustic swath-mapping of the greater Monterey Bay from Point Año Nuevo to Point Sur reveals complex patterns of rock outcrops, and coarse sand bodies that occur in distinct depressions on the inner and mid-shelves. Most of the rock outcrops are erosional cuestas of dipping Tertiary rocks that make up the bedrock of the surrounding lands. A mid-shelf mud belt of Holocene sediment buries the Tertiary rocks in a continuous, 6-km-wide zone on the northern Monterey Bay shelf. Rock exposures occur on the inner-shelf, near tectonically uplifting highlands, and on the outer shelf, beyond the reach of the mud depositing on the mid-shelf since the Holocene sea-level rise. The detailed mapping carried out by the US Geological Survey has revealed numerous new features including drowned rock pinnacles; active earthquake faults that slice through the seafloor sediments, and highly detailed views of the tortuous Monterey Canyon. Former seacliffs have been discovered that are now buried under water and sediments at depths of 40 meters below sea level. Modern muds, from Monterey Bay rivers in flood stage are being transported northward toward San Francisco, opposite to the direction of surface flow.

By better understanding the links between these seafloor geologic features and the ecosystems of the MBMS we hopefully will be in a better position to protect these valuable resources for our grandchildren.

Meeting Location



Dr. Stephen Eittreim is an Emeritus Researcher with the Pacific Marine Branch of the U.S.G.S., based in Menlo Park, California. He received a PhD. from the Lamont-Doherty Geological Observatory, Columbia University, in 1970. Between 1986 and 1989 he was the Associate Branch Chief of Pacific Marine. He continues to publish very actively. He has specialized in marine seismic reflection, acoustic seafloor mapping through multichannel and multibeam data processing, oceanic suspended particulate matter analysis, seismic stratigraphy, ocean bottom photography, seafloor tectonics and crustal studies, sediment transport, as well as cruise planning and operation.

He has most recently participated in the Monterey Bay Marine Sanctuary Project and the Stratigraphy of the Antarctic Margin Project.

Bring the Family!

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

Would you like to receive the NCGS newsletter by e-mail? If you are not already doing so, and would like to, please contact **Dan Day** at danday94@pacbell.net to sign up for this service.

NCGS 2003-2004 Calendar

Wednesday October 29, 2003, ***Family Night!!***
Steve Eittreim, Emeritus, U.S. Geological Survey
Revealing the Hidden World Beneath Monterey Bay
7:00 PM at Orinda Masonic Center

Wednesday November 19, 2003
(Please note that this talk is one week early)
Dr. John Williams, San Jose State University
Engineering Geology Provides Clues to Living Safely in the Geologically Dynamic San Francisco Bay Area
7:00 PM at Orinda Masonic Center

Upcoming Field Trips…

November 2003	***Mt. Burdell*** *(with a hike to the top!)*	**Rick Ford**, SFSU Graduate Thesis
Summer 2004 (TBA)	***Northern California Gold Belt, Quincy*** *(BLM has put all travel on hold)*	**Gregg Wilkerson**, BLM

Announcement!!
Student Meeting Cost Reduced

The Northern California Geological Society is pleased to announce a change in the monthly meeting admittance cost for students. Beginning this month student members of the NCGS will find the cost of admittance to the meetings reduced from $5 to $1. This will afford student members munchies before the meeting, as well as one liquid refreshment from our beverage cache. Should additional beverages be required, the price will increase accordingly. We hope that this will make attendance at the meetings a more affordable experience for these members.

We look forward to seeing you at the meetings!!

Don't Forget to Renew Your Membership!

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

National Earth Science Day
Black Diamond Mines Regional Preserve
Educator's Day
Saturday, October 25, 2003

To help celebrate National Earth Science week, the East Bay Regional Park District and the Northern California Geological Society are hosting on Saturday October 25, 2003 a very special field trip for Bay Area teachers at Black Diamond Mines Regional Preserve, Antioch. The setting for the field trip is the coal mines and historic cemetery located in the foothills of Mount Diablo. The area played an important part in the early history of San Francisco Bay Area as it provided much of the coal needed for the emerging industries. A total of over 4 million tons of coal were mined between 1860 and 1904. The Mount Diablo Coalfield became the major population center in Contra Costa County during the 19th century and five mining towns were established in the coalfield. The coal mines finally closed about the time of the 1906 earthquake and the towns were abandoned leaving behind the many miles of underground coal workings and Rose Hill Cemetery. These unique facilities are maintained by the East Bay Regional Park District and are an ideal location for school field trips.

The field trip will be led by professional geologists from the Northern California Geological Society and naturalists from the Park District. The size of the group is limited to 30 teachers. The morning will be spent underground exploring the mines workings. Hard hats and flash lights will be provided. After the mine tour, a barbecue lunch will be served in the Picnic ground that will be followed by a leisurely walk through the old town site of Somersville and Rose Hill Cemetery. At the cemetery, the families of the mining communities are buried and we will learn about their way of life using records and the inscriptions preserved on the headstones.

A fee of about $25 will be charged to cover the costs of an extensive set of handouts and other resources that will be provided to the teachers on the geology, mining and history of the Mount Diablo Coalfield. 1 unit of academic credit is also available for this class on application through the EBRP Academy and California State University, Hayward.

For further information please contact Ray Sullivan at 415-338-7730 or sullivan@sfsu.edu

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

Miocene Volcanic Rocks at Burdell Mountain and Implications for Slip along the East Bay Fault System

Saturday, November 22, 2003

Trip Leader:

Eric Ford, SFSU Master's Student

Burdell Mountain, located 50 km north of San Francisco, California, consists of Cretaceous and Jurassic Franciscan Complex and Great Valley Sequence rocks overlain by 65 m of Tertiary marine sandstone, and 200 m of Miocene volcanic rocks. The Burdell Mountain volcanics (BMV) are approximately 200 m thick and consist dominantly of flow-banded, porphyritic andesite, and lesser amounts of volcanic breccia, volcaniclastic mudflow deposits, and minor flow-banded rhyolite. The BMV together with the underlying Tertiary marine strata generally form a moderately, northeast-dipping (~30˚) homocline that is truncated by the Burdell Mountain fault zone (BMFZ) to the east.

The age and petrology of the volcanics and stratigraphic relations of the Burdell Mountain area are important to ongoing studies of long-term right-lateral displacement along the East Bay portion of the San Andreas Fault system. McLaughlin et al. (1996) estimated a maximum offset of 175 km along the East Bay fault system (EBFS) based, in part, on a correlation between the BMV and similar rocks of the Quien Sabe volcanic field (QSV) in central California. However, previous radiometric ages (K/Ar and Ar/Ar) for the Burdell Mountain volcanics (11.8-13.6 ma) do not match those for the QSV (7.4-11.6 Ma). Three new Ar/Ar ages for the BMV cluster around 11.1 Ma establishing an age correlation to the QSV. The age and lithology of the rhyolite of the BMV are also similar to the Northbrae rhyolite in the Berkeley Hills suggesting a minimum right-lateral offset of 30 km between these two regions. We will test further the BMV-QSV correlation by focusing on petrographic and stratigraphic comparisons of the two regions.

Few studies have focused on the BMFZ, a complex, northwest-striking, 500 m-wide, subvertical, shear zone characterized by local hydrothermal alteration and silicification. Map relations suggest that the fault zone exhibits up to 10 km of right-lateral offset of the distinctive Cretaceous Novato Conglomerate of the Great Valley Sequence, implying that the BMFZ is an important component of the EBFS. Youthful tectonic geomorphic features along the (unzoned) fault suggest late Holocene movement. Future efforts will focus on locating a trench site suitable for providing information on the age of faulting.

Abstract written by Eric W. Ford, S. John Caskey, David L.Wagner, and Robert J. Fleck

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

Time: **Saturday, November 22, 2003; leave Ferry Terminal @ 8:30 am** (8:00 am coffee, pastries)

Departure: We will meet at Larkspur Ferry Terminal (no charge for parking), closest parking area to Sir Francis Drake Blvd.; and carpool from there to different stops showing along the Burdell Mountain fault. Most of this trip will be on the east side of Mt Burdell.

Cost: **$30;** $12 for adolescents; discount for students. Cost includes transportation, refreshments, lunch, and field guide.

********** **REGISTRATION FORM --- PLEASE RSVP by November 18** **********

Name _____ **E-mail or Fax No.** _____

Address (Street/City/Zip) _____

Phone (day) _____ **Phone (evening)** _____ Indicate if you are a nonmember (cost is $35) _____

Regular Lunch _____ Vegetarian Lunch _____ **(Please check one)**

Please mail form and a check made out to NCGS to: **Jean Moran, P.O. Box 1861, Sausalito, CA. 94966**
If you have any questions or need additional information, e-mail Jean at jeanm@stetsonengineers.com, or call 415-331-6806 (evening)

NCGS Field Trip – Geology of the Point Reyes Area, California

Reported by Richard Cardwell

There aren't many places in the world where you can examine an accretionary complex of a subduction zone, straddle a transform plate boundary, view the surface rupture zone of a major earthquake, examine the granitic basement of a continental magmatic arc, and investigate the petroleum exploration potential of a major basin all in a single day. However, the Point Reyes area of northern California is one place where it can be done easily and in a setting of great natural beauty.

On Saturday, September 27, NCGS members and friends joined field trip leaders Tom MacKinnon and Rusty Gilbert for a day of field work. Tom worked for ChevronTexaco for 21 years and is now a consultant for them on a part-time basis. He has spent several years working on the geology of the Monterey Formation in California. Rusty has worked for ChevronTexaco for 23 years and is currently Team Leader for the Stratigraphy and Geostatistics Team with ChevronTexaco's Energy Technology Team. He has spent several years working on various California offshore lease sales during the 1980s.

Our day began on at the Larkspur Ferry Terminal. Over coffee and donuts (unfortunately not Krispy Kreme) supplied by Phil Reed, we had a brief overview of the day's activities. The first three stops would be in the Franciscan Complex on the North American plate, the fourth stop would be on the San Andreas plate boundary, and the last three stops would be on the Salinian Block on the Pacific plate.

Tom began by giving us an overview of the Franciscan Complex. The Franciscan Complex is a package of rocks formed in an eastward-dipping subduction zone. Ages range from Late Jurassic through Miocene. During that time period the Farallon plate was being subducted beneath the overriding North American plate. Rock units consist of sediments deposited in an accretionary prism (imbricated ocean trench deposits) as well as the sections of the underlying oceanic crust and mantle. The sediments of the accretionary prism are medium- to fine-grained detrital rocks (graywackes, micrograywackes, and dark mudstones) sourced mainly from the Sierran magmatic arc, and deposited into the trench as turbidites. In the subduction process they have been metamorphosed into metagraywackes and shales. The ocean floor rocks are radiolarian chert, pillow basalts and pillow breccia, and peridotite (oceanic mantle). These have been metamorphosed into metachert, greenstone, and serpentine, respectively.

Broadly speaking, the Franciscan complex is about 100 km wide and can be subdivided into three belts from west to east: the Coastal Belt, the Central or Mélange Belt, and the Metamorphic or Yolla Bolly Belt. The ages of the belts decrease from east to west reflecting the accretion of successively younger material to the North American plate. The metamorphic grade within each belt also decreases from east to west ranging from blueschist facies in the Metamorphic Belt to zeolite facies in the Coastal Belt. On a previous trip in the spring with Gary Ernst we examined the eastern Metamorphic Belt.

On this field trip we would spend the morning in the Central Belt. Much of the Central Belt is primarily sheared mudstone matrix (argillite), within which are mixed large blocks of lithic sandstone (greywacke and metagraywacke); smaller blocks of chert, greenstone, and serpentinite; and with lesser amounts of limestone, amphibolite, blueschist, and eclogite.

Recent work by Blake and others of the USGS has subdivided the Franciscan of the Central Belt in the Marin County area into eight discrete tectonostratigraphic terranes. This approach to mapping in the Franciscan was discussed at Stop 3

Stop 1 was at the Novato quarry on Ignacio Boulevard to see a unit called the Novato Quarry terrane. Here we saw several packets of well-bedded sandstone and shale that had been sheared and folded such that each had a slightly different strike and dip. This is a structural style called "broken formation," and it is characteristic of the Franciscan. In each packet the sands are mainly thin-bedded turbidites deposited in deep water. Nearby we saw an isolated block of red chert surrounded by sheared mudstone.

Stop 2 was along Novato Road to see the distinct topography typically associated with Franciscan mélange. Isolated blocks of resistant Franciscan rocks of various types (known as knockers) were mixed into a sheared mudstone matrix.

Ron Crane led a discussion about whether much of the mixing was done tectonically (and therefore these units would be called mélanges), or whether the mixing was done by soft sediment slumping such as would occur in submarine landslides (and therefore the units would be called olistostromes). Both processes undoubtedly operated.

Stop 3 was on Petaluma Road to see a unit called the Nicasio Reservoir terrane. This unit is also called the Black Mountain volcanics. This is one of the best exposures of pillow basalts anywhere in the Franciscan and possible anywhere in California. Here the tube-shape nature of the pillows can be seen in three dimensions. The total thickness of the volcanic pile is 1-2 km. This unit may have originated as a seamount that was scraped off the descending plates and incorporated into the trench accretionary material.

At Stop 3 we had a discussion of the terrane concept as it applied to mapping stratigraphic units within the Central Belt. Some authors such as Dickinson have argued that the Franciscan is a relatively straightforward subduction complex, and that most of the accreted material in the Franciscan was locally derived from the continental magmatic arc. Other authors such as Blake and Jones have argued that much of the Franciscan originated as unique tectonostratigraphic terranes located far to the south. These terranes were then carried long distances northward by strike-slip faulting before being emplaced in the accretionary wedge. In the absence of unequivocal evidence for a unique stratigraphy and long distance transport for most of the material, it may be simplest to consider the terranes to be only convenient mapping units.

Stop 4 was at the Point Reyes Visitor Center where we were joined by a troop of Boy Scouts working on their geology merit badges. The San Andreas Fault comes ashore to the southeast in Bolinas Lagoon, passes near the Visitor Center, and exits to the northwest in Tomales Bay. By hiking the Earthquake Trail it is possible to walk along the trace of the San Andreas Fault, to straddle the boundary between the present day North American and Pacific lithospheric plates, and to see some of the effects of the 1906 earthquake.

Seismologists have used seismic waves recorded at the time to relocate the epicenter of the 1906 earthquake to a position west of the Golden Gate. From there the rupture spread out to the northwest and southeast. However, the maximum fault offset (about 18 feet) was recorded nearby at the head of Tomales Bay.

We walked along the Earthquake Trail to see a portion of the San Andreas Fault that ruptured in the great (magnitude 8.0) earthquake of 1906. The 1906 rupture trace is still visible as a "bench" on the side of a hill, and the famous "offset fence" with its 16 feet of displacement has been reproduced on the Trail. When standing along the fault trace it is difficult to resist imagining what it would be like to be standing there during the next big earthquake, to see the rupture occur, and to see the offset develop. After some discussion about the 1906 earthquake, its effects, and the probabilities for future events, we ate lunch in a grove near the trail.

Stop 5 was at Kehoe Beach at the northern end of Point Reyes peninsula. For the remainder of the afternoon we would be on a section of the Pacific plate known as the Salinian Block.

The Salinian Block has a completely different geology from what we saw in the morning. The basement of the Salinian Block in the Point Reyes area is composed of three different granitic bodies: tonalite of Tomales Point, granodiorite and granite of Inverness Ridge, and porphyritic granodiorite of Point Reyes promontory. The granodiorite is intruded by numerous light- and dark-colored dikes.

The Salinian basement here is all Late Cretaceous age and is considered to be a piece of continental plutonic arc similar to the roots of the Sierra Nevada. This basement is interpreted to have moved to its present position by northwestward motion along the San Andreas Fault starting about 29 m.y. ago (with additional movement prior to the Eocene on a "proto-San Andreas Fault").

The granitic rocks of the Salinian basement are nonconformably overlain here by a sequence of middle to upper Miocene sedimentary rocks. This sequence consists of a transgressive basal sandstone unit, the Laird Sandstone, and an overlying deepwater unit, the Monterey Formation. Here the Monterey Formation consists of mainly siliceous mudstone with some porcelanite and shale.

The Monterey Formation was formed mainly from diatoms, planktonic organisms composed mostly of silica. These diatomaceous sediments were deposited as turbidites derived from slumps on the slope. Porosities of the altered diatomites can be as high as 35%, and a fresh surface on a hand specimen will stick to your tongue! It is used for swimming pool filters and kitty litter.

Prior to about 5.5 m.y. the motion along the San Andreas was slightly extensional as well as strike-slip. This transtensional motion formed deep basins that were filled with thick section of clastics. The total thickness of Monterey on the Point Reyes peninsula is estimated to be about 3500 to 5000 feet.

Rusty gave a summary of the petroleum exploration history in the area. He noted that although onshore oil seeps in the Monterey Formation were observed near Bolinas, it was the offshore basins that were thought to have the greatest potential. The Monterey Formation is both the source rock and the reservoir rock for most of the oil in California. Production is from fracture porosity and permeability.

The first offshore lease in federal waters occurred in 1963. In the Bodega Basin and Outer Santa Cruz Basin twelve wells were drilled. The wells encountered hydrocarbon shows, but no significant oil was discovered. All were plugged and abandoned. Since then no other exploratory drilling has taken place, and since 1990 no future leasing will be allowed in these waters.

Stop 6 was at Drakes Beach on Point Reyes peninsula. Here we saw the diatomaceous mudstones and siltstones of the upper Miocene/Pliocene Purisima Formation. The Purisima was deposited in shallow water and has spheroidal carbonate concretions commonly containing cetacean (whales, dolphins, etc.) bones.

Another interesting sedimentary feature of the Purisima Formation is a beautiful example of a dewatering structure. The rims are distinct from the interiors, and together they form a tile-like mosaic along the bedding plane

Stop 7 was at the lighthouse lying at the tip of Point Reyes peninsula. The peninsula was formed by mass of resistant granodiorite basement and is capped by the Early Eocene Point Reyes Conglomerate. The conglomerates are quite colorful and consist of salt- and pepper-colored granodiorite clasts, purple and black porphyritic volcanic clasts, light-colored quartzite pebbles, red chert, and green volcanic pebbles. This unit consists of both conglomerates and sandstones deposited as turbidites and debris flows in deep water. These beds were deposited in a submarine channel that was cut into the underlying granodiorite.

The outcrop here appears to be the same age and lithology as the Carmelo Formation at Point Lobos (near Monterey). These two units may have once been contiguous, but have now been displaced northward 150 to 185 km by movement along the San Gregorio Fault during the Tertiary.

We ended the day just as the sun began to set. We were fortunate to have good weather throughout the day, and we managed to avoid the fog and cooler temperatures that often occur along this section of the coast.

The NCGS sincerely thanks Tom MacKinnon and Rusty Gilbert for this excellent field trip. Their field guide describes the trip in detail and includes several colored geologic maps and photographs of the area. We thank Jean Moran for another wonderful job in organizing the trip, handling trip registration, arranging transportation and food. Finally, we thank all of the drivers for use of their cars and vans.

FIRST CALL FOR PAPERS
Pacific Sections AAPG/SEPM/SEG
2004 Annual Meeting

Submit your abstract for the
Pacific Section AAPG/SEPM/SEG Convention
May 8-12, 2004 at the Holiday Inn Select Bakersfield, CA.

Technical Program Co-Chairs are:

Don Miller **&** ***Mike Richey***

ddmiller@aeraenergy.com ***michaelrichey@chevrontexaco.com***

Technical Sessions already in place include:

San Joaquin Basin Petroleum Assessment Symposium
Paleogeography of the San Joaquin Basin
Los Angeles and Other Coastal Basins
Turbidites
Great Valley Deep Gas Plays
Advances in Geophysics (SEG)
Paleontology (SEPM)
Environmental Geology
Shale Secrets - Projects in the Monterey Shale
Reservoir Re-Characterization in Mature Fields
Tectonics and Structural Geology (SEPM)
Thermal Projects
Reservoir Modeling
Formation Evaluation and Near Wellbore Environment
Controversial Theories (Sentuer de Boue in the oil patch)

Session Chairs and topics are still being accepted. Please contact Don or Mike to volunteer as a session chairman or to submit an abstract.

www.psaapg.org

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

2003-2004 COLLEGIATE SCHOLARSHIPS PROGRAM

The Northern California Geological Society is pleased to announce the availability of two scholarship awards for the 2003-2004 academic year:

Undergraduate Scholarship Award of $500
For candidates working toward completion of a senior thesis or honors research program
Funding is provided for projects implemented during the 2004 calendar year
Application deadline is November 7, 2003 for a December 7, 2003 award date

Graduate Scholarship Award of $1,000
For candidates working toward the MS or Ph.D degree
Funding is provided for projects implemented during the 2004 calendar year
Application deadline is January 31, 2004 for a March 31, 2004 award date

Applications can be requested from and submitted to:

Randy E. Kirby
Chair, NCGS Scholarship Committee
67 Brookwood Road, Unit 20
Orinda, CA 94563
Voice: (925) 288-2344
Fax: (925) 827-2029
Email: rkirby.geosci@usa.net

Funding priority will be directed to research programs focusing on topics in structural, stratigraphic, economic, engineering, or environmental geology, geophysics, mapping, stratigraphic paleontology, or paleoecology implemented within the State of California or immediately adjacent western states. Candidates will be evaluated based on submission of a cover letter requesting the award, a brief (no more than 2 page) summary of the proposed research topic, and a faculty signature confirming departmental approval of the application. Winners will be invited to speak or otherwise present their research at a regular evening NCGS meeting in Orinda, California.

Issue date: September 5, 2003

NORTHERN CALIFORNIA GEOLOGICAL SOCIETY

2003-2004 Renewal Form

Please fill out this form and attach your check made out to NCGS.

Mail to:

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

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

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K-12 Programs_____ **Scholarships**_____ **AAPG Delegate**_____ **Membership**_____

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

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Phone: Home (____)_____**Work (____)**_____**Fax (____)**_____

Employer _____**Job Title**_____