# NORTHERN CALIFORNIA GEOLOGICAL SOCIETY


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## APRIL MEETING ANNOUNCEMENT

**DATE:** **Wednesday, April 24, 2002**

**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 925-424-3669 or at *danday94@pacbell.net* before the meeting.**

**SPEAKER:** **John Gabelman, Gabelman Associates**

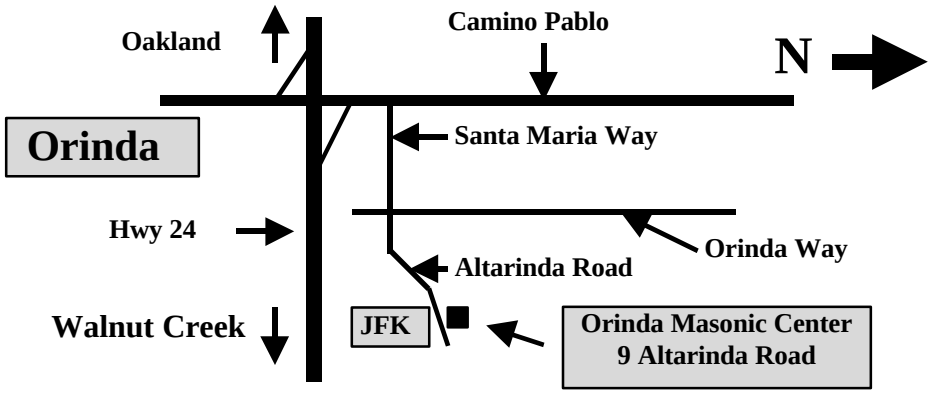
### *Hydrous Carbonatitic(?) Volcanism in Central Wyoming*

Long argumentative, carbonatite now is accepted as magmatically derived limestone. Occurrences are rare. Most are hypabyssal, Precambrian, closely associated with alkaline suites, and occur in ring complexes, pipes, and dikes. Extrusives are more rare, popularly (though incompletely) represented by Oldionyo Lengai, The Baking Soda Volcano, in Tanganyika. The frequency of occurrence seems to have decreased with time. Tectonically carbonatites prefer (need?) tensional (rifts, wrench zones) or passive (shields, platforms) regimes. They tend to avoid compressional belts, and thus are rare in Rocky Mountain systems. The few known in the Rocky Mts. belong to stable platforms beneath the mountains, or to marginal or intersecting tensional/wrench regimes. Known carbonatites associated with Tertiary alkaline hypabyssal centers closest to central Wyoming, are insignificant occurrences in the Bear Lodge Mts. of NE Wyoming,, and in the Bear Paw Mts. of NE Montana. Small dikes/lenses in elevated Precambrian near Lemhi Pass in SW Montana are believed associated with the unexposed tips of alkaline intrusives.

The Sweetwater collapsed basin (superimposed on the Laramide Granite Mts. uplift) in central Wyoming is here interpreted as a wrench-related tensional rift. Twenty-nine separate occurrences of Pliocene or younger carbonate are scattered throughout the rift, associated with wrench or tensional faults, apparent ring structures, and soda lakes. No occurrence is closely related to the Rattlesnake Hills alkaline hypabyssal/volcanic field, the only known Tertiary igneous center in the region. However, two carbonate occurrences contain hybrid quartz porphyry. Carbonate occurs as small pipes cutting rocks of Archean, Paleozoic, and Tertiary age, and as layers (beds? or flows?) capping small mesas in Miocene/Pliocene formations. Small calcite veins/pipes are apparent beneath some mesa caps. The rock has no sedimentary bedding or fossils, but is structurally and texturally quite irregular. Irregular layering illustrates small circular collapse basins in mesa caps. Internally the rock illustrates mega-/macro-flow structure and healed brecciation and veining of five or more generations.

The liquid, which produced these deposits, must have been very fluid to enter small feeding channels, yet viscous enough to maintain suspension and isolation of xenoliths and xenocrysts. The deposits have features of both viscous flows and hot spring tufas, with flow structures in early invasive pulses suggesting a very fluid magma. Penetration in thinnest veins and crystallization of cavity linings during latest pulses suggest evolution to a hydrothermal solution. The

**Continued on back page of newsletter**




carbonate-silica liquid may have been a phase of some underlying rising magma or a derivation of it. The nearly identical petrology and paragenetic history of these deposits requires an equally identical fluid or magma, concluded to be carbonatitic. The region (135km x 46km) throughout which the isolated deposits are scattered, essentially coincides with the Sweetwater Rift, implying tensional tectonic control. Geochemical, mineralogical, textural, and structural evidence for an igneous origin of these carbonates will be presented.

**John W. Gabelman** received Geological Engineer (1943), Master of Geological Engineering (1948), and D.Sc. (1949) degrees from the Colorado School of Mines, and spent his career in world-wide mineral exploration and mining. He worked for New Jersey Zinc Company, Colorado Fuel & Iron Corp., American Smelting & Refining Company, The U.S. Atomic Energy Commission (25 years), and Utah International Company (finally Broken Hill Proprietary). Emphasis at different times was on lead/zinc, ferrous and related industrial minerals, fluorspar, uranium, copper, gold, silver and geothermal fluids. He retired from company work in 1981, incorporated Gabelman Associates, and has since been continually active as consultant and independent, emphasizing metallic and industrial minerals, oil/gas, and geothermal energy. For the past five years he has explored for minerals and oil in central Wyoming. He has authored over 200 technical articles and one short book (on uranium). His expertise emphasizes mineralization processes, structure, tectonics, and petrography. John is a fellow in the GSA and Society of Economic Geologists, emeritus in the AAPG, and member of the Society of Mining Engineers, AGU, and AIPG. He is a registered geologist in California and Wyoming, and registered professional engineer in Colorado.

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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 2002 Calendar

**Wednesday, April 24, 2002**
***John Gabelman***, Gabelman Associates
**"Hydrous Carbonatitic(?) Volcanism in Central Wyoming"**
Orinda Masonic Center

**Wednesday, May 15, 2002 AAPG Distinguished Lecture**
**James Harrell,** The University of Toledo, Toledo, Ohio
**"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

**Saturday, May 18, 2002 Field Trip**
***Ron Crane,*** Consultant, and ***Craig Lyon***, retired Chevron
**"Structure and Geology of Mount Diablo"**
See flyer in this newsletter.

### *In the Works…*

The following field trips are being pursued, but have not been finalized! Watch future newsletters for details.

| | | |
|---|---|---|
| **Rogers Creek/Maacama Fault Zones** | Bob McLaughlin, USGS | Fall 2002 |
| **Hayward Fault Trench Field Trip** | Jim Lienkaemper, USGS | October 12, 2002 |
| **Pacheco Pass Field Trip*** | Gary Ernst, Stanford University | Fall 2002 |

*(*tentative* pending results of his knee and hip surgery)

# Bay Area Geophysical Society

**John Etgen** of BP in Houston will talk ***about "High-end Imaging for Exploration and Development."*** Exact title TBA. The talk will be sometime this Winter or Spring 2002.

**Geoffrey Dorn** of BP Center for Visualization, University of Colorado will present the SEG 2002 Spring Distinguished Lecture, titled: ***"The Role of Visualization in Resource Exploration and Development."*** The talk will is set for **Tuesday, May 7, 2002**

This talk will be held at Chevron Park, tentatively in Room D-2193. Check website later for room location!

Because this talk is at ChevronTexaco, non-ChevronTexaco employees must make sure they RSVP via email to **wfki@chevrontexaco.com** or call Warren King (925) 842-9964 before Monday. This must be done to insure that you get visitor's passes.

Tables will be reserved for BAGS attendees at the ChevronTexaco Cafeteria from 11:30 to 12:30 before the talk. After checking in at the front desk, come to the Cafeteria and join us at the tables. The talk is tentatively scheduled to be held in Building D, room D-2193 at 12:30.

**Jon Claerbout** of Stanford University is tentatively scheduled to speak this Winter 2002. The talk will most likely be at the Chevron Visualization Center in San Ramon. Please check back later for more details.

The SEG will announce a Fall Distinguished Lecture for the Autumn of 2002

*Please check the BAGS website at* **http://sepwww.stanford.edu/bags/** *for meeting updates.*

# *NORTHERN CALIFORNIA GEOLOGICAL SOCIETY*

# *Mount Diablo Field Trip*

## Saturday, May 18, 2002

### Led by Ron Crane, Consultant and Craig Lyon

The field trip will begin in Walnut Creek and proceed east to Lone Pine Way and then back along Marsh Creek Road through the Upper Cretaceous section. The trip will then proceed up North Gate Road to a lunch stop at Rock City. The afternoon will consist of several geological stops up the mountain where the geology will be discussed at each view stop. The trip will conclude at the top. Attendees are encouraged to actively participate in the technical discussions at trip stops.

*The number of participants will be limited to 30 and to NCGS members only.*

**Time:** **Saturday, May 18, 2002**

**Departure:** **Cal State University Hayward Contra Costa Campus, Ygnacio Valley Blvd., Walnut Creek, at 7:30 a.m. *sharp!***

**Directions:** Take Ygnacio Valley Road east through Walnut Creek and continue on it for 2.5 miles east of the Ygnacio Valley Road and Oak Grove intersection in Walnut Creek. The main entrance to Cal State University Hayward is at the intersection of Campus Drive and Ygnacio Valley Road (just past the tall white smokestack on the left). Turn right and follow the signs around to the left to student parking.

**Cost:** **$35 (NCGS members only, please)**. Includes guidebook, transportation, lunch, and beverages.

********** REGISTRATION FORM **********

**Name** _____

**Address (Street/City/Zip)** _____

**Phone (day)** _____ **Phone (evening)** _____

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

**Please indicate (check) if you are a nonmember _____**

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

**I am willing to drive a rental van or my SUV _____** (check if YES) Mileage will be paid by the NCGS.

*Please write a check to the NCGS and mail it with the completed registration form to:*

**Jean Moran, P.O. Box 1861, Sausalito, CA. 94966**.

**RSVP's and trip fees must be in by May 11th.**

**If you have any questions or need additional information or clarification of trip policy**, please e-mail Jean Moran at **jeanm@stetsonengineers.com** or call her at **415-331-6806** (evenings)

## The World's Hydrocarbon Reserves and Energy Future Discussed at March Meeting

Worried about the world's hydrocarbon resources? Are the earth's petroleum and gas supplies dwindling? What might our energy future be? Answers to these questions were provided by **Dr. Donald Gautier** of the U.S. Geological Society, Menlo Park, in his presentation ***"The Ghost of Malthus, the Global Greenhouse, and the Perilous Geography of Petroleum,"*** given at the March 27, 2002, NCGS meeting.

Don has spent most of his 25-year career at the USGS studing energy resource supply, both domestic and international. This issue delicately juggles energy, environmental, and political issues. And its importance to our future is underscored by today's current Middle East unrest. All of this focuses on America's image of its energy needs and our quality of life. Over the last 100 years we have gone from a society that consumed essentially no petroleum products to consuming about 25% of the world's annual demand in 2000. This amounts to approximately 35 quadrillion Btu's of energy per annum! As nonrenewable resources, coal dominates the electrical generation market (~50%), petroleum feeds transportation, and natural gas monopolizes the residential market. The U.S. currently consumes 6.9 billion barrels of oil per year, with Japan a distant second at about 2 billion barrels a year. In terms of production, Saudi Arabia leads the way with 3.34 billion barrels a year; the U.S. produces 2.92 billion barrels a year, and the former Soviet Union adds 2.25 billion barrels a year. The average Saudi oil well pumps about 5,300 barrels of oil a day, the average Norwegian well approximately 4,800 barrels a day, and an American well only 11 barrels a day. We simply have more wells that yield progressively less oil with time.

The energy issue is closely tied to global climate, which is being closely monitored nowadays. The atmospheric carbon dioxide content has risen from 315 ppm in 1960 to 360 ppm recently, as measured on Mauna Loa volcano in Hawaii. Carbon dioxide is a key factor that drives the Greenhouse Effect and Global Warming. Twice as much $CO_2$ is generated per Btu of energy from bituminous coal as from natural gas, with petroleum fuel sources falling in between. The $CO_2$ emissions can be reduced by improving engine efficiencies, sequestering $CO_2$-laden gases by various emerging technologies, and by substituting natural gas for coal in our power-generating facilities. Unfortunately, America's natural gas production peaked in 1970 and began steadily dropping off until it was stabilized in the mid 1980's. Much of the earlier potential gas production was wasted by the practice of burning off the gas to get to the underlying oil reserves. Today, America gets most of its natural gas from Alberta, Canada, but recently the longevity of this source has been questioned. Compliance with the Kyoto Protocol would necessitate that America convert more of its energy consumption to natural gas. This has prompted gas exploration in the Rockies and a focus on gas reserves in the MacKenzie River delta of the Canadian Northwest Territory, and potential sources along the Alaskan Arctic coastline. These developments would also require a way to transport the natural gas south to consumers.

The petroleum picture is more complex. In 1960, world production was 20 million barrels a day. Now it is over 70 million barrels a day. However, oil prices during this period have been volatile, achieving a high of $60 a barrel in the early 1980's. As recent as 1951, the U.S. provided over half the world's oil. Now we contribute less than 9% of the world's oil production and not even half of our own needs. We have now become the world's largest oil importer. The steady increase in the world's energy consumption since the advent of the Industrial Revolution prompted researchers to attempt to predict the long-term availability of these nonrenewable resources. One such individual was M. King Hubbert, a bright graduate of the University of Chicago, who worked for Shell Oil in the early 1950's. Hubbert was a superb mathematician who noted that oil production followed a bell-curve provided the amount left to produce is accurately known. He published his technique in 1956 and predicted the peak in domestic oil production to within a few months of its hiatus in 1970. Once this milestone was passed, Hubbert foresaw a continuous decline in U.S. petroleum production. In the early 1970's Hubbert came to work for the USGS where he continued the studies he began at Shell Oil. The current USGS Director, Vincent McKelvey, however, was following a different philosophy. While Hubbert viewed the petroleum world from the perspective of

a statistician, McKelvey looked at it with the eye of an exploration geologist. He thought that there were numerous undiscovered domestic petroleum reservoirs in yet-to-be explored sedimentary basins. His estimates of domestic reserves were nearly an order of magnitude greater than Hubbert's. Under the national energy policy of the times, and following the 1973 OPEC oil embargo and the rising gasoline prices that accompanied it, government funds were funneled into alternative energy programs. His unpopular stance on the nation's hydrocarbon reserves eventually cost McKelvey his job. A discussion of the global oil shortage and its impact on western society is encapsulated in the article ***"The End of Cheap Oil"*** by Colin Campbell and Jean Laherrère in the March 1998 issue of Scientific American.

In spite of doomsday predictions, the global petroleum life span has gradually been extended. In 1920 George Otis Smith forecasted that the U.S. had less than 20 years of production left. The Club of Rome reported in 1972 that the world would run out of oil in twenty years, and out of gas by 1994. And at the website 2000 energycrisis.com, experts foresaw a world peak in petroleum production in the early 21st Century. Why this trend? It is because Hubbert's predictions require that 1) the system is well defined, 2) the petroleum market is closed to substitutions, and 3) that the ultimate volume of recoverable oil is accurately known. From another perspective, the ultimate recoverability of a resource is based on knowing 1) the cumulative production, 2) the proven reserves, 3) the reserve growth in known fields, and 4) an estimate of future discoveries. Resources versus reserves are key factors in this equation. Reserves represent the predicted amount of economically recoverable oil, and resources are the estimated quantity of discovered petroleum. Characterizing reserves is dependent on the cooperative interaction of three disciplines: geology, engineering, and economics. Modern technological advances have progressively extended reserves by improving recovery in producing oil fields. Thus, between 1981 and 1996, most of the world's oil fields displayed increases in ultimate recovery. In fact, three popular predictive models all underestimated the world petroleum growth rate during this time span.

Currently, the world's five major petroleum provinces produce over 50% of the known volume. Political intrigue in these regions inspires exploration geologists to look elsewhere for new sources. Estimates of undiscovered oil fields are based on sound geological theory gleaned from the detailed examination of established fields. Experts forecast there are about 648 billion barrels of undiscovered oil and an additional 612 billion barrels of recoverable reserves in known fields.

The key to accurately forecasting our petroleum future depends on four factors: 1) the size of undiscovered reservoirs, 2) the gradual growth of known reserves as driven by technological advances, 3) the accurate characterization of remaining reserves, and 4) detailed calculation of cumulative production. The first three items account for four times the world cumulative petroleum production. Natural gas is routinely underestimated. These predictions must be soundly based in geological, technological, and economic models. And then one must inject the political factors in key oil-producing regions and how they influence petroleum availability. Today, the Middle East, North African, and fomer Soviet Union countries control much of the world's petroleum supplies in onshore deposits. The fold belts of Saudi Arabia-Iraq-Iran (Persian Gulf) alone supply ~27% of the world's needs. The rest occurs offshore. And natural gas is clearly concentrated in the former Soviet republic of Kazakhstan and in Russia's western Siberian basin. The economical recovery of these immense resources poses an environmental, technological and political juggling act that challenges future generations. Today's Middle East crisis is an example of the complex problems facing our energy future. But it is reasonably certain that the world's oil supplies, both known and yet to be discovered, will exist for several decades, and natural gas reserves for much longer. How we utilize these resources and balance natural gas and alternative energy sources with oil in a politically perilous situation will determine the geopolitical landscape of the 21st Century.

The NCGS offers its thanks to Don Gautier for an intriguing view of the world's energy future, of the science of predicting our hydrocarbon resources, and of how the evolving environmental and political climate will determine the way we utilize these nonrenewable resources. Don and his colleagues continue to plot our course through this treacherous geopolitical scene.

# Tenure Track Position in Engineering Geology or Surficial Processes 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 Geology and/or Surficial Processes, beginning January or August 2003. The position requires a Ph.D. in geology, strong quantitative and field mapping skills, and a commitment to excellence in teaching at graduate (M.S.) and undergraduate levels. We seek someone to teach advanced-level engineering geology and/or surficial processes courses, and general education courses in natural hazards or earth systems. The successful applicant will be expected to maintain an active research program that involves graduate and undergraduate students. Preference will be given to applicants who have applied experience with a geotechnical or environmental firm and experience in teaching and in applying GIS technologies.

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, Department of Geosciences, San Francisco State University, San Francisco, CA 94132***

Applications should be received before September 30, 2002.

San Francisco State University is an Equal Opportunity / Affirmative Action employer.

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# "Statistics for Groundwater Investigations: Touring Data in One to Three Dimensions"

May 7, 2002 (Tuesday) at the Marriott Hotel in Walnut Creek, CA

In Cooperation With: Association of Engineering Geologists (AEG)

Register or Request Updates: **http://www.grac.org/stats.html**

The Groundwater Resources Association of California will conduct a one-day seminar on Statistics for Groundwater Investigations May 7, 2002 (Tuesday) at the Marriott Hotel in Walnut Creek, CA.

Beach, CA. Dennis Helsel, Ph.D., Geologist with the U.S. Geological Survey, will be the seminar leader. Dr. Helsel received his Ph.D. in Environmental Science and Engineering from Virginia Tech and is co-author of the textbook, Statistical Methods in Water Resources (1992). He has designed and taught training courses on environmental statistics since 1986.

Tips for touring environmental data are remarkably similar whether traveling in one dimension (describing data), two dimensions (plots and regression models), or cruising along 3-D surfaces like kreiging. Some roads are smooth, others bumpy. This one-day guided tour stops at some of the best-loved locations, as well as important out of the way spots, to understand the landscape of interpreting environmental data.

Data Touring Topics:

* Know your passengers: data characteristics, including mass versus frequency
* Know your vehicle: hypothesis tests, plots, regression models, and surfaces
* Lurking assumptions: dealing with outliers and skewed distributions
* Decision points: dealing with values below detection limits
* Tools to get you to your destination: principles applicable in 1 and 3-dimensions, including krieging

More details (including complete Course Outline and hotel locations) will be provided in April on the GRA web page (click on the link at the top to be notified when the program is posted). For more information, contact Kathy Snelson at (916) 446-3626 or **executive_director@grac.org.**

# PRINCIPLES OF GROUNDWATER FLOW AND TRANSPORT MODELING

April 16, 17, 18, 2002

University of California, Irvine Learning Center in Orange, CA

Sponsored by the Groundwater Resources Association of California in conjunction with
the University of CA Cooperative Extension Groundwater Hydrology Program and the International Association of HydroGeologists

Web Announcement & Registration Options: **http://www.grac.org/modeling.html**

Course Description

The use of computer modeling tools has become a standard practice in many groundwater investigations. Groundwater resources evaluation, groundwater quality assessment, contamination site assessment and remediation, environmental impact review, and other groundwater related activities increasingly rely on computer models as a means of understanding groundwater flow and the fate of contaminants in the subsurface. This course introduces the conceptual principles and practical aspects of groundwater modeling in an intuitive yet comprehensive manner. The course objective is to demystify the use of groundwater models by providing solid understanding of the principles, methods, assumptions, and limitations of groundwater models, as well as hands-on experience with the planning, preparation, execution, presentation, and review of a modeling project.

Course Topics

* Principles and concepts of groundwater modeling;
* Overview of groundwater modeling software;
* Conceptual model development;
* Data collection and preparation;
* Model grid design;
* Boundary conditions; concepts and application;
* Simulating rivers, lakes, recharge, drainage;
* Modeling multiple aquifer systems;
* Sensitivity analysis;
* Model calibration and verification;
* Contaminant transport modeling;
* Capture zone analysis.

**Who Should Attend**

The short-course is intended for professional consultants, technical personnel in engineering/geology firms and irrigation/water districts, regulatory agency specialists and managers, and those in the legal community specializing in groundwater issues. Participants should have a working knowledge of the principles of groundwater hydrology and be familiar with the PC Windows 95 (or Windows 2000) environment. No formal training in computer programming is necessary.

**Course Instructors**

Graham E. Fogg, Ph.D., is a professor of hydrogeology with the Hydrology Program of the Department of Land, Air, and Water Resources, University of California, Davis. He received a B.S. in hydrology at the University of New Hampshire, a M.S. in hydrology from the University of Arizona, and a Ph.D. in geology from the University of Texas at Austin. He is currently teaching undergraduate and graduate courses in groundwater hydrology and groundwater modeling. His research interests include geologic-geostatistical characterization of subsurface heterogeneity, mass transport in heterogeneous porous media, numerical modeling of ground-water systems, and regional hydrogeology. Fogg has 20 years experience characterizing and analyzing groundwater under a diversity of conditions in the southwest and western United States.

Thomas Harter, Ph.D., received a B.S. in hydrology from the University of Freiburg, Germany and a M.S. in hydrology from the University of Stuttgart, Germany. He received his Ph.D. in hydrology (with emphasis on subsurface hydrology) at the University of Arizona, where he became the 1991 Harshbarger fellow for outstanding research in subsurface flow and transport modeling. In 1995, he joined the faculty at the Department of Land, Air, and Water Resources, University of California, Davis. Harter has been instrumental in developing the University of California Cooperative Extension Groundwater Hydrology Program*. His research focuses on nonpoint-source pollution of groundwater, groundwater resources evaluation under uncertainty, groundwater modeling, andcontaminant transport. Dr. Harter has done extensive modeling of heterogeneous aquifer/vadose zone systems.

**Course Benefits**

* At the end of the Course, participants should have:
* a well-founded knowledge of the principles of groundwater flow and transport modeling
* familiarity with the major elements of groundwater modeling studies
* hands-on experience in designing simple groundwater flow and transport studies with MODFLOW using popular groundwater modeling software
* a fundamental understanding of the capabilities and limitations of groundwater modeling
* an understanding of the appropriate role of groundwater models in groundwater assessment and management

**Course Cost**

GRA Members: $750.00
Government Agencies: $725.00
Registration plus Membership in GRA: $815.00 ($10 savings on membership)
Non-Members: $795.00

Additional Information: Contact Kathy Snelson, GRA Executive Director, at executive_director@grac.org or 916-446-3626.