

# GSA TODAY

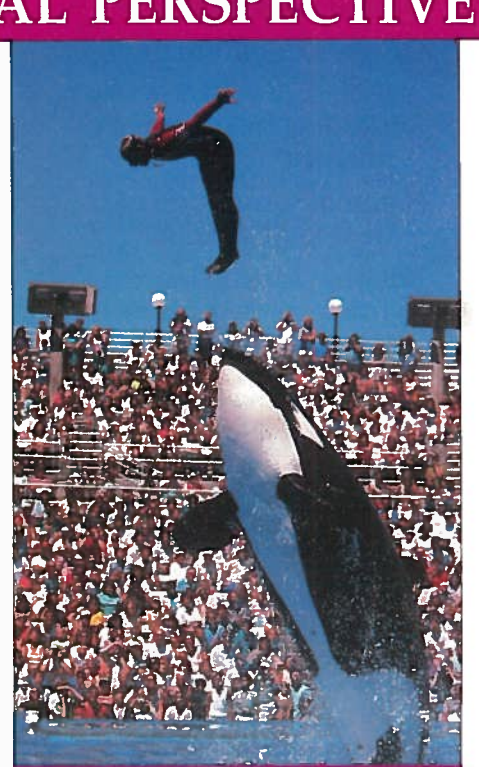
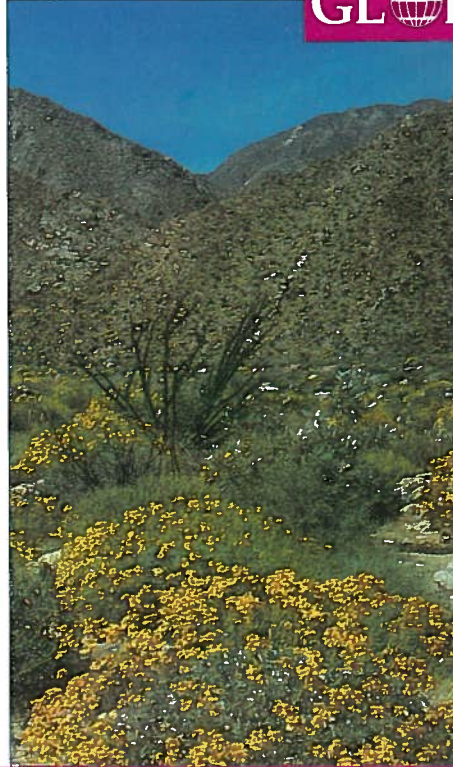
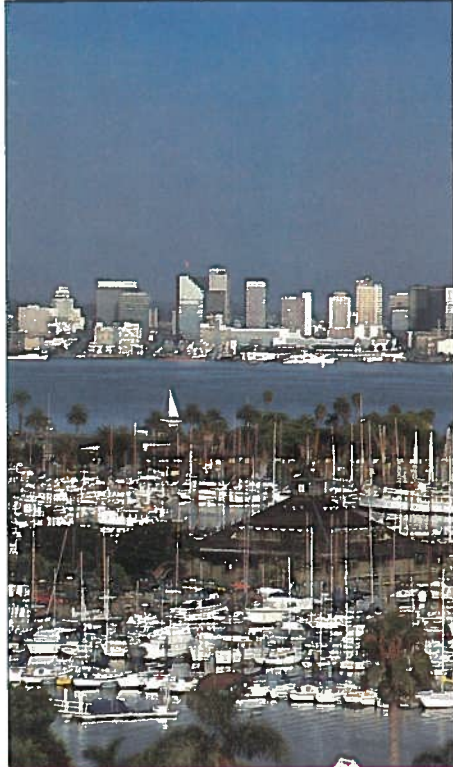
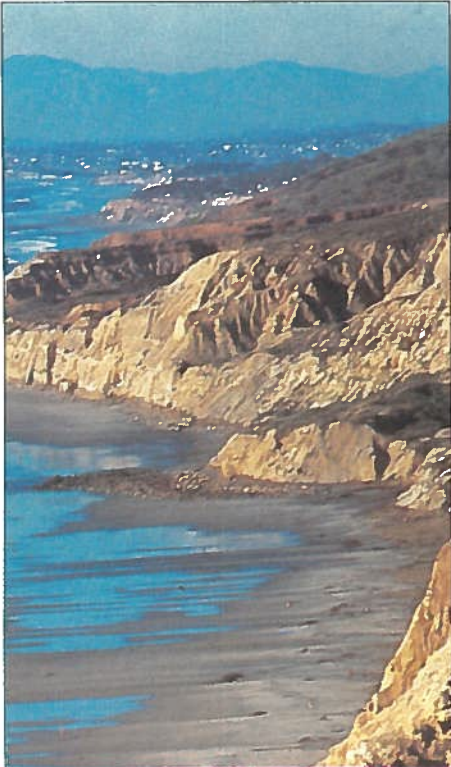
A Publication of the Geological Society of America

## 1991 ANNUAL MEETING

San Diego, California • October 21–24, 1991

Marriott Hotel & Marina • San Diego Convention Center

PREREGISTRATION DUE  
SEPTEMBER 20, 1991



San Diego Convention & Visitor's Bureau (SDCVB)

### THE GLOBAL CHALLENGE

Invitation from R. Gordon Gastil, General Chairman

The Annual Meeting of the Geological Society of America will be held October 21–24, 1991, in San Diego's spectacular new convention center. You must come, and we'll tell you why. First, we are planning one of the finest combinations of technical sessions and field trips ever offered at a GSA meeting—reason enough.

Of even greater importance, the habitat of humankind is in danger, and it's

time that earth scientists step forward boldly to be heard. A special keynote session, "The Global Challenge," will lead off this theme on Monday morning. This special session will be followed during the week by theme sessions on global change, natural disasters, and the limits of natural resources. Following the keynote symposium, there will be an open roundup discussion early Monday evening. On Thursday afternoon a concluding rapporteur session will take place, summarizing the events of the week and challenging us to take the next steps in meeting our global obligations.

It is our vision that GSA will expand its academic membership base to make this a gathering of all who have devoted themselves to the study of Earth. In 1991 we call out not only to those who traditionally attend, but also to the young carrying infants, to financially strapped students arriving in vans, to our international colleagues—especially those in Mexico and Canada, to teachers in community colleges and high schools, and to all of those working for energy and engineering firms across the continent.

We should meet not just to exchange data, but to

interpret our science to everyone. We should let the world know what we have learned, and how it applies to us all. We want you to come to San Diego to help us focus on Earth as a whole, and to be part of the solutions to our major environmental problems.

Consistent with our Global Perspective theme, San Diego welcomes you in varied languages and humankind. Ours is a profession whose members routinely travel to the difficult corners of Earth. In our travel across national boundaries, we have heard or read the languages in which we greet you. WELCOME TO SAN DIEGO!

WELKOM NA SAN DIEGO • DIGEMER MAD E SAN-DIEGO! • VAN HARTE WELKOM IN SAN DIEGO • TERE TULEMAST SAN DIEGOSEE • *शान डेआणे सॅं डायका स्वागत* • BIENVENUE À SAN DIEGO • HERZICH WILKOMMEN IN SAN DIEGO • VILKOMMEN IN SAN DIEGO • ΚΑΛΩΣ ΩΡΙΣΑΤΕ ΣΤΟ ΣΑΝ ΝΤΙΕΓΚΟ • ISTEN HOZTA SAN DIEGO-BA • SELAMAT DATANG DI SANDIEGO • BENVENUTU A SANDIEGO • SVAIDĪSANAT NO SAN DIEGO • SALVE A SANCTO *ሲቲ ድህረ ስጋ ድህረ ስጋ* • DIDACO • CHALUPA NOKE • HAERE MAI SAN DIEGO • VELKOMMEN TIL SAN DIEGO • WITAMY A SAN DIEGO • BIENVENIDOS A SAN *ሲቲ ድህረ ስጋ ድህረ ስጋ* • DIEGO • VÄLKOMMEN TILL SAN DIEGO • MALIGAYANG PAGDATING *வர வேற்கிறீர்கள்* SA SAN DIEGO • *ਸੇਨ ਡੀਏਗੋ ਵਿਚ ਹੁਗਤਾ ਸਵਾਗਤ* • BUTAEMO B CAH AIEGO • CHÀO MỪNG THĂM VIỆTNG SAN DIEGO • CROESO IR SAN DIEGO! • DOBRO DOŠLI U SAN DIEGO • (Ó)-SI-YÓ • HOKAHE KI SAN DIEGO • KARIBUNI SAN DIEGO • DUMELLA SAN DIEGO • KU *سان ڈیوگوهی* SOO DHAWAW SAN DIEGO • *خوش آمدید* ALLA KI NA GNA SAN DIEGO

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 Society of Economic Geologists\*  
 Society of Vertebrate Paleontologists

\*Representatives serve on the 1991 Joint Technical Program Committee

All photos are courtesy of R. Gordon Gastil unless otherwise noted.

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## BACK TO THE FUTURE

More than one hundred volunteers have been involved in the planning and development of the 1991 Annual

Meeting. Most of these are associated with San Diego State University, and even several chairmen from the 1979 San Diego meeting are back again. Geologists giving personal and professional time to such a major undertaking are always appreciated at GSA, but on top of this, our 1991 hosts have

initiated environmentally focused programs and other fresh, new events that call for participation, scientific creativity, and imagination. All of us owe the SDSU faculty, students, and San Diego-based alumni special thanks and recognition.



Eastern escarpment of the Sierra San Pedro Martir, Baja California Norte.

## TECHNICAL PROGRAM


Technical sessions consist of both invited and volunteered papers organized in one of three presentation formats: symposia, theme sessions, and discipline sessions. Abstracts were due on July 3 and selected and organized into sessions on August 2 and 3 by the Joint Technical Program Committee (JTPC). The JTPC consists of 30 geoscientists representing those associated societies and GSA divisions participating in the technical program. The JTPC chairmen, nominated by the Annual Meeting Committee and approved by the GSA Council, also serve a four-year term on GSA's ongoing Program Committee, which oversees all technical program activities.

Abstract notices mailed  
August 14  
Speaker information mailed  
August 24  
Technical Program Schedule  
(GSA Today) September 5

*1991 Technical Program Chairmen*  
Richard W. Berry and Gary H. Girty  
San Diego State University  
(619) 594-5586

### GLOBAL PERSPECTIVE THEME

Geologists have long approached their science with a global perspective, a recognition recently reaffirmed by plate tectonics. Our meeting theme not only reminds us of the global character of earth processes and natural phenomena, but calls attention to the global extent of environmental deterioration, the global dependence of our natural resource inventory, and the need for scientists, especially earth scientists, to address these concerns from a global perspective.

Within this theme several programs have been initiated by the San Diego Annual Meeting Committee. These are called **Global Challenge sessions**, identified by the symbol . There will be four Global Challenge theme sessions, a Monday evening open forum, and a Thursday afternoon wrap-up session. The meeting schedule lists a number of other sessions initiated by other organizations which address closely related topics.

Leading off the Global Perspective theme on Monday morning will be a special **Keynote Symposium**, organized by Patrick L. Abbott and R. Gordon Gastil, San Diego State University.

### The Global Challenge: Our Environment, Our Resources, Our Responsibilities

Monday, October 21, 8:45 a.m. to 12:00 noon  
San Diego Convention Center, Room 6A

1991 Annual Meeting Honorary Chairman, Roger R. Revelle, University of San Diego  
"The Global Challenge"

Digby J. McLaren, Royal Society of Canada  
"Events and Their Causes—Uncertainty in the Ecosphere?"

Frank Press, National Academy of Sciences  
"Natural Hazards: Science Instead of Fatalism"

Lynn Margulis, University of Massachusetts  
"Gaia for Geologists: Darwinian Time and Vernadskian Space"

Michael B. McElroy, Harvard University  
"Change in Global Environment: Perspectives on Human Influence"

Brian J. Skinner, Yale University  
"A Kilometer and Deeper: Will Geologists Be Ready for the Tough Prospecting Challenges Ahead?"

M. Gordon Wolman, Johns Hopkins University  
"Water Quantity and Quality: Changes in the Hydrologic Cycle"

### Global Challenge Roundup

Monday, October 21, 5:00 to 6:45 p.m.  
San Diego Convention Center

Focusing on the Global Challenge, U.S. Congressman George E. Brown, Jr., Chairman of the House Sub-Committee on Science, Space and Technology, will address the audience from 5:00 to 5:30 p.m. This will be followed by a panel discussion with the morning's keynote speakers and several international guests.

### Global Perspective Rapporteur Session

Thursday, October 24, 1:30 to 3:30 p.m.  
San Diego Convention Center

Rapporteurs for the Global Challenge theme sessions will summarize and discuss the evidence and ideas presented earlier in the respective sessions. (See Theme List: T1-T4.) This will be followed by a prominent speaker who will bring together the various threads of the global theme and provide a focus for the conclusion of our meeting.

### INVITED PAPERS (SYMPOSIA)

This format includes only abstracts that have been invited by the convener of a symposium. The dates indicated are tentative and may be changed by the JTPC. Full descriptions appeared in the June issue of *GSA Today*.

- S1. **Archaeological Geology of the Archaic Period (8–3 ka) in North America.** *Archaeological Geology Division.* E. Arthur Bettis III, Iowa Dept. of Natural Resources, Iowa City. Tuesday, October 22, afternoon.
- S2. **Coalbed Methane: Geology, Recovery Technology, and Resources.** *Coal Geology Division.* Walter B. Ayers, Jr., Taurus Exploration USA, Inc., Birmingham, Alabama; Jeffrey R. Levine, University of Alabama. Monday, October 21, morning.
- S3. **GeoRisk Assessment.** *Engineering Geology Division.* Charles Welby, North Carolina State University; Rhea Lydia Graham, Science Applications International Corp., Albuquerque, New Mexico. Tuesday, October 22, morning.
- S4. **Depositional Environments and the Development of Aquifers.** *Hydrogeology Division.* Robert L. Laney, U.S. Geological Survey, Reston, Virginia. Wednesday, October 23, morning.
- S5. **Geology of the Pacific Rim.** *International Division.* Tadashi Sato, Hyogo University, Hyogo, Japan; Bruce Hanshaw, Consulting Geologist, McLean, Virginia. Tuesday, October 22, afternoon.
- S6. **Quaternary Climatic Change in Arid and Semiarid Western North America: Evidence from the Great Basin, Desert Southwest, and Great Plains.** *Quaternary Geology and Geomorphology Division.* Richard F. Madole and Daniel R. Muhs, U.S. Geological Survey, Denver, Colorado. Wednesday, October 23, morning.
- S7. **Fluvial Response to Base-level Changes: Eustatics vs. Tectonics—Part I.** *Sedimentary Geology Division.* Paul L. Heller, University of Wyoming; Christopher Paola, University of Minnesota, Minneapolis; Henry Posamentier, ESSO Resources Canada, Calgary, Alberta. Tuesday, October 22, morning.
- S8. **Strike-Slip Faulting: Geological and Geophysical Perspectives.** *Geophysics and Structural Geology and Tectonics Divisions.* Art Sylvester, University of California, Santa Barbara; Kristian Meisling, ARCO Oil & Gas Co., Plano, Texas; Eugene Humphries, University of Oregon; Matt Golombek, Jet Propulsion Laboratory, Pasadena, California. Wednesday, October 23, all day.
- S9. **The Global Climate Transition from the Late Paleocene to Early Eocene.** *Cushman Foundation.* Kenneth G. Miller, Rutgers University; Lowell Stott, University of Southern California. Tuesday, October 22, morning.
- S10. **MASHing and Smashing: Geochemical Evidence for Long-term Crust-mantle Interaction along a Cra-**

**tonic Margin, Northwest U.S.** *Geochemical Society*. Paul A. Mueller, University of Florida; Joseph L. Wooden, U.S. Geological Survey, Menlo Park, California. Tuesday, October 22, afternoon.

**S11. International Initiatives in Geoscience Information—A Global Perspective.**

*Geoscience Information Society*. Dena Fracolli, Information Consultant, Fort Worth, Texas. Monday, October 21, morning.

**S12. Contact Metamorphism.**

*Mineralogical Society of America*. Maria Luisa Crawford, Bryn Mawr College; Robert J. Tracy, Virginia Polytechnic Institute and State University; Derrill M. Kerrick, Pennsylvania State University, University Park. Monday, October 21, morning.

**S13. New Approaches to Introductory Geology Courses.**

*National Association of Geology Teachers*. Noel Potter, Jr., Dickinson College, Carlisle, Pennsylvania. Monday, October 21, afternoon.

**S14. Biotic Turnover Examined in a Phylogenetic Context.**

*Paleontological Society and Society of Vertebrate Paleontologists*. J. David Archibald, San Diego State University; Sandra J. Carlson, University of California, Davis. Wednesday, October 23, morning.

**S15. Applications of Micro-analytical Techniques to Economic Geology.**

*Society of Economic Geologists*. C. Stewart Eldridge, Australian National University, Canberra. Monday, October 21, afternoon.

**S16. Crustal-scale Controls on Ore Deposits.**

*Society of Economic Geologists*. Robert J. Bodnar, Virginia Polytechnic Institute and State University. Sunday, October 20, all day.

**S17. Survivability of Organic Matter at High Temperature: Implications for Life.**

*Organic Geochemistry Division of the Geochemical Society*. Stephen A. Macko, University of Virginia; Everett L. Shock, Washington University; Michael H. Engel, University of Oklahoma. Sunday, October 20, all day.

**S19. Continental Drift, Plate Tectonics, and Biogeography: The History of a Synthesis of Two Cultures.**

*History of Geology Division*. Alan E. Leviton, California Academy of Sciences, San Francisco; Michele L. Aldrich, American Association for the Advancement of Science, Washington, D.C. Monday, October 21, morning.

**S20. Venus and Earth: Tectonic and Volcanic Evolution.**

*Planetary Geology Division*. Baerbel K. Lucchitta, U.S. Geological Survey, Flagstaff, Arizona. Tuesday, October 22, morning.

**S21. Geophysics of the Southwestern Cordillera—USA and Mexico.**

George R. Jiracek, San Diego State University; Mario Martinez, Centro de Investigación Científica y de

Educación Superior de Enseñanza, Baja California, Mexico. Sunday, October 20, afternoon.


**S22. PANGEA: Ice-house Processes, Climates, and Events on a Supercontinent.**

*Sedimentary Geology Division and Global Sedimentary Geology Program*. George deV. Klein, University of Illinois, Urbana. Sunday, October 20, afternoon.

(S18. Withdrawn)

Hodges, U.S. Geological Survey, Menlo Park, California. Environmental Geology, Global Geoscience, Quaternary Geology, Economic Geology, Petroleum Geology.

**T3. Global Climate Changes—I: The Geologic Record of Climate Dynamics.**

 Tim Herbert, Scripps Institution of Oceanography; Jeff Park,



Sea lions near Asención just off coast of Vizcaino Peninsula.

**VOLUNTEERED PAPERS**

This format includes all abstracts that are not specifically invited for a symposium. Two types of sessions are available:


**1. Discipline sessions**

The JTTC selects and organizes papers in sessions that focus on one scientific discipline, e.g., hydrogeology or structural geology. Each paper receives three reviews. The papers are organized with topical coherence whenever possible, and sessions may be given an appropriate title by the JTTC representative.

**2. Theme sessions**


Papers are submitted to a specific, preannounced topic and to one scientific category. Theme sessions are interdisciplinary; each theme may have as many as three disciplines (categories) associated with it. Each theme has one or more advocates who proposed the idea as well as encouraged submission of papers. The advocates, however, are not able to guarantee acceptance of papers, since this is the responsibility of the reviewers and the JTTC representatives. Full theme descriptions appeared in the April issue of *GSA Today*.

**T1/2. The Global Challenge: Using Planetary Resources and Modeling the Future**

 William S. Fyfe, University of Western Ontario; Digby J. McLaren, Royal Society of Canada; Brian J. Skinner, Yale University; Carroll Ann

Yale University. Marine Geology, Paleoceanography/Paleoclimatology, Paleontology/Paleobotany.

**T4. Global Climate Changes—II: The Past, a Key to the Future.**

 Keith Kvenvolden, U.S. Geological Survey, Menlo Park, California. Geochemistry, Global Geoscience, Paleoceanography/Paleoclimatology.

**T5. Global Warming and Geologic Evidence of Aridification During Late Quaternary Time.**

*Quaternary Geology and Geomorphology Division*. Dale F. Ritter and Nicholas Lancaster, Desert Research Institute, Reno, Nevada. Geomorphology, Hydrogeology, Quaternary Geology.

**T6. Fluvial Response to Base-level Changes: Eustatics vs. Tectonics—Part II.**

*Sedimentary Geology Division*. Paul L. Heller, University of Wyoming. Geomorphology, Sedimentology, Stratigraphy.

**T7. Processes Controlling the Composition of Siliciclastic Sediments.**

Mark J. Johnsson, U.S. Geological Survey, Menlo Park, California; Abhijit Basu, Indiana University. Sedimentary Petrology, Sedimentology.

**T8. Global Sedimentary Geology of the Phanerozoic: A Theme Session in Honor of A. B. Ronov.**

William W. Hay, University of Colorado; Bruce Wilkinson, University of Michigan. Geochemistry, Global Geoscience, Sedimentology.

**T9. Approaches to Sequence Stratigraphic Analysis—Examples from the Tertiary.**

Janet Coleman, Kansas Geological Survey. Global Geoscience, Sedimentology, Stratigraphy.

**T10. The K-T Boundary—I: Late Cretaceous Extinctions: Catastrophes or Not?**

Robert M. Sullivan, San Diego Natural History Museum; Spencer G. Lucas, New Mexico Museum of Natural History. Paleontology/Paleobotany, Stratigraphy.

**T11. The K-T Boundary—II: Nonmarine Fossil Record at the Cretaceous-Tertiary Boundary.**

*Paleontological Society*. R. Farley Fleming, University of Colorado at Denver; William A. Clemens, University of California, Berkeley. Paleontology/Paleobotany, Stratigraphy.

**T12. Actinide-series Disequilibria in Igneous and Geothermal Processes.**

Neil Sturchio, Argonne National Laboratory, Illinois; Michael Murrell, Los Alamos National Laboratory, New Mexico. Aqueous Geochemistry, Igneous Petrology, Volcanology.

**T13. Solution Mass Transfer and Volume Strain in Crustal Rocks.**

Mark Brandon and Jay J. Ague, Yale University. Hydrogeology, Metamorphic Petrology, Structural Geology.

**T14. Site Characterization Studies Related to Ground-Water and Surface-Water Contamination at Sites Operated by the U.S. Department of Energy.**

Stephen H. Stow and C. Stephen Haase, Oak Ridge National Laboratory, Tennessee. Engineering Geology, Environmental Geology, Hydrogeology.

**T15. Geology, Hydrogeology, and Tectonics of Southern Nevada in Relation to the Potential Storage of High-Level Nuclear Waste.**

Steven R. Mattson, Science Applications International Corp., Las Vegas, Nevada. Hydrogeology, Tectonics, Volcanology.

**T16. Characterization and Monitoring of Ground-Water Contamination at Hazardous Waste Sites: Research and Case Histories.**

*Hydrogeology Division*. Claudia Stone, S.S. Papadopoulos & Associates, Inc., Rockville, Maryland. Engineering Geology, Environmental Geology, Hydrogeology.

**T17/18. Urban Geologic Hazards: Recognition and Remediation.**

*Engineering Geology Division*. Daryl Streiff, Consulting Engineering Geologist, San Diego, California; Lyne Perry, Leighton and Associates, San Diego, California. Engineering Geology, Environmental Geology, Hydrogeology.

**T21. Geophysical Exploration for Ground Water in Arid and Semi-Arid Regions.**

*Hydrogeology Division*. William F.

- McCaffrey, U.S. Geological Survey, Sacramento, California. Engineering Geology, Geophysics, Hydrogeology.
- T22. **Multivariate Statistical Methods in the Geosciences.** *Hydrogeology Division.* Charles Brown, U.S. Geological Survey, Reston, Virginia. Computers, Global Geoscience, Hydrogeology.
- T23. **Failure Mechanisms of Megaslides.** *Engineering Geology Division.* Martin Stout, California State University, Los Angeles; Michael Hart, Geocon, Inc., San Diego, California. Engineering Geology, Quaternary Geology, Structural Geology.
- T24. **Active Margin of Antarctica—Proterozoic to Holocene.** David Kimbrough, San Diego State University; Bruce Luyendyk, University of California, Santa Barbara. Igneous Petrology, Structural Geology, Tectonics.
- T25. **Cenozoic Extension in the Cordillera: Geometry, Timing, Mechanisms, and Regional Controls.** William

- Dickinson and Jon Spencer, University of Arizona. Geophysics/Tectonogeophysics, Structural Geology, Tectonics.
- T26. **Mesozoic Stratigraphic and Structural Evolution of Northwestern Mexico.** Claudio Bartolini, Gold Fields Mining Corp., Yuma, Arizona; Mariano Morales M., Universidad de Sonora, Mexico. Stratigraphy, Structural Geology, Tectonics.
- T27. **Jurassic Magmatism and Tectonics of the North American Cordillera.** *Dedicated to Richard L. Armstrong.* David Miller, U.S. Geological Survey, Menlo Park, California; Cathy Busby-Spera, University of California, Santa Barbara; Steven Reynolds, Arizona Geological Survey; James Wright, Rice University. Igneous Petrology, Stratigraphy, Tectonics.
- T28. **Tectonics of Modern and Ancient Accretionary Prisms.** J. Casey Moore, University of California, Santa Cruz; Darrel Cowan, University of Washington; Daniel Karig,

- Cornell University; Michael B. Underwood, University of Missouri, Columbia. Marine Geology, Metamorphic Petrology, Tectonics.
- T29. **Landscapes of Tectonically Active Strike-Slip, Normal and Reverse Faults.** William Bull, University of Arizona; Thomas Rockwell, San Diego State University. Geomorphology, Quaternary Geology, Tectonics.
- T30. **New Views of the Moon: The Lunar Frontier Revisited.** Donald A. Morrison, Johnson Space Center, Houston, Texas. Geochemistry, Geophysics, Planetary Geology.
- T31. **Southern California Areal Mapping Project—Accomplishments, Work-in-Progress, Goals (POSTER SESSION).** Vickie Todd, University of California, Riverside. Igneous Petrology, Stratigraphy, Tectonics.
- T32. **Baja California: Geologic History of the Peninsula and Gulf of California.**

- Judy Terry Smith, Consulting Geologist, Palo Alto, California; Jose Luis Ferman and Jorge Ledesma, Universidad Autónoma de Baja California, Ensenada, Baja California, Mexico. Paleontology/Paleobotany, Stratigraphy, Structural Geology.
- T33. **Geology of the Future—Now (POSTER SESSION).** *Sigma Gamma Epsilon.* Daniel F. Merriam, Wichita State University; Charles J. Mankin, University of Oklahoma. Environmental Geology, Stratigraphy, Other.
- T34. **Earth Scientists and Science Educators: Common Ground.** *National Earth Science Teachers Association.* Leslie C. Gordon, U.S. Geological Survey, Menlo Park, California. Geology Education.
- (T19.Withdrawn)  
(T20.Withdrawn)

## PROFESSIONAL HORIZONS

### GSA-SPONSORED SHORT COURSES

Would you like to learn something new, brush-up on the latest, or refresh the basics? GSA short courses will be held immediately before and after the Annual Meeting in San Diego and are open to members and nonmembers. Registration for the meeting is not required. Preregistration is recommended; on-site is \$25 additional. You may register for GSA courses on the Annual Meeting Preregistration Form. Registration substitutions may be made at any time.

PREREGISTRATION  
DEADLINE: SEPTEMBER 20

Cancellation Deadline: September 27

FOR MORE INFORMATION  
CONTACT GSA COURSE REGISTRAR

#### 1. Concepts, Strategy, and Software for Practical Three-Dimensional Contaminant Transport Modeling

Friday, October 18, 8:00 a.m. to 5:00 p.m., Saturday, October 19, 8:00 a.m. to 5:00 p.m., Sunday, October 20, 8:00 a.m. to 12:00 noon; San Diego Convention Center. Cosponsored by the *Hydrogeology Division*.

ATTENTION STUDENTS: The Hydrogeology Division will SUBSIDIZE THE FIRST STUDENT WHO IS A VALID DIVISION MEMBER. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Division.

This *advanced* course is designed for the hydrogeologist familiar with flow modeling, but who has had limited experience in transport modeling, and for the hydrogeologist with



Pooh discusses plutonic emplacement with Pogo.

some experience in transport modeling, who is interested in alternative software tools and approaches. The objectives of this short course are:

- to familiarize participants with fundamental concepts and mathematical methods underlying contaminant transport simulation. Emphasis will be placed on the implications of these concepts and methods for solution of practical field problems;
- to develop the ability of participants to formulate effective modeling strategies, considering project goals, available data, and field conditions. Discussions will center on when and how one can benefit most from the use of transport simulation and what components of the transport process (advection, dispersion, and chemical reactions) should be included;
- to provide an introduction to software for particle tracking and contaminant transport simulation which is compatible with the U.S. Geological Survey modular flow model (MODFLOW) and can be applied to transient or steady-state

situations in two or three dimensions. Participants will have the opportunity to work with the relevant software during the class.

Faculty: Chunmiao Zheng, Charles B. Andrews, and Gordon D. Bennett, S. S. Papadopoulos & Associates, Rockville, Maryland.

Limit: 30. Fee: \$295 (includes course manual and lunch both days).

#### 2. Description and Analysis of Fluid-Mineral Equilibria Using the SUPCRT91 Software Package

Friday, October 18, 8:00 a.m. to 5:00 p.m., Saturday, October 19, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center.

The SUPCRT91 software package, developed by the faculty listed below, in collaboration with H. C. Helgeson, facilitates the practical use of recent theories, equations, and data that permit quantitative description of chemical equilibrium among minerals, gases, and aqueous species from 1 to 5000 bars and 0 to 1000 °C. The objectives of this course are to review these recent advances, provide

hands-on instruction in the use of SUPCRT91, and emphasize its practical application to define equilibrium constraints on geochemical processes in diverse geologic systems. Specific applications will be presented that demonstrate the effective use of SUPCRT91 in geochemical studies of the ground-water environment, diagenetic systems, hydrothermal ore deposits, and metamorphic terranes. Although a background in theoretical geochemistry and experience using interactive software is helpful, the course is recommended for any advanced graduate student or professional who wishes to apply thermodynamic calculations and computer technology to solve geochemical problems. Each participant will receive a notebook of course materials: a user's manual for the SUPCRT91 package, lecture notes, reprints of relevant publications, and diskettes containing the SUPCRT91 source codes and database. Topics covered include:

- equations used to present the thermodynamic and electrostatic properties of H<sub>2</sub>O,
- the revised Helgeson-Kirkham-Flowers equation of state for aqueous species,
- correlation algorithms for estimating the thermodynamic properties of aqueous species,
- equations used to describe the thermodynamic properties of minerals and gases,
- hands-on use of SUPCRT91: class and self-paced tutorials on the Mac II,
- geochemical information that can be obtained from SUPCRT91 calculations,
- practical application of SUPCRT91 to diverse geologic systems.

Faculty: James W. Johnson, Lawrence Livermore National Laboratory; Eric H. Oelkers, University of California, Berkeley; Everett L. Shock, Washington University.

Limit: 60. Fee: \$295 (includes course manual, computer diskettes, and lunch both days).



Recent maar and obsidian domes, Isla de Encantada, Baja California Norte.

### 3. Deformation and Kinematics of High Strain Zones

Saturday, October 19, 8:00 a.m. to 5:00 p.m., Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego State University. Cosponsored by the *Structural Geology and Tectonics Division*.

Designed for professionals and graduate students, this course will introduce participants to the techniques used in the determination of finite strain state and kinematic history of ductile sheared rocks. The course will provide hands-on exercises in the analysis of rock deformation and preserved microstructures using petrographic microscopes and Macintosh computers. Only limited computer experience is required, and no previous knowledge of microstructural analysis is necessary. Throughout the course, emphasis will be on the recognition of diagnostic criteria for general shear and its partitioning into pure shear and simple shear components. Topics covered:

- basic theory of purely simple shear and simply pure shear strain,
- deformation mechanism theory and kinematic analysis and their application to preserved microstructures,
- homogeneous and heterogeneous strain analysis using simple graphical methods,
- using Macintosh computer programs to teach the concepts of strain and kinematic theory,
- theoretical and kinematic basis for the analysis of general shear zones, i.e., those in which both pure shear and simple shear operate.

Faculty: Carol Simpson and Declan De Paor, Johns Hopkins University.

Limit: 50. Fee: \$175 (includes course manual, computer disks, ground transportation to and from San Diego State University both days, and lunch both days).

### 4. Fractals and Their Use in Earth Sciences

Saturday, October 19, 8:00 a.m. to 5:00 p.m., Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center.

Fractal geometry provides a means of mathematically describing and modeling some of the complex patterns that earth scientists map, measure, and describe in ever-increasing detail. Fractal geometry is a branch of mathematics for quantifying how the geometry of patterns changes from one scale to another. It

provides a powerful tool for analyzing the roughness, size distribution, and density or frequency of objects over a range of scales in time or space. Appropriate for government, academic, and industry earth scientists, including graduate students, this course is an introduction to the concepts of fractal geometry, and will include:

- the concepts of self-similarity and self-affinity,
- stochastic fractals,
- generation of synthetic fractals,
- methods for measuring the fractal dimension of earth science data sets,
- fractals and probability.

The purpose of the course is to enable participants to comprehend the fractal literature and to measure the fractal properties of their own data sets.

Faculty: Christopher C. Barton, U.S. Geological Survey, Denver, Colorado; Paul R. LaPointe, ARCO Oil & Gas Co., Plano, Texas; Alberto Malinverno, Lamont-Doherty Geological Observatory of Columbia University.

Limit: 60. Fee: \$255 (includes course manual, *Fractals* by Jens Feder, and lunch both days).

### 5. Quantitative Sedimentary Basin Modeling

Saturday, October 19, 8:00 a.m. to 5:00 p.m., Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center. Cosponsored by the *Sedimentary Geology Division*.

ATTENTION STUDENTS: The Sedimentary Geology Division will SUBSIDIZE ALL STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Division. To be reimbursed, students must apply in writing to: Mary J. Kraus, Dept. of Geology, University of Colorado, Boulder, CO 80309.

This course is aimed at those with a background in sedimentary geology, but with little experience in modeling. A basic undergraduate level background in mathematics is assumed. Divided into two parts, this course will first introduce researchers to the concepts and methods of constructing and modeling basin subsidence histories in various tectonic settings, and second, deal with how basin subsidence interacts with other primary factors, such as sediment supply and sea level, in the development of basin-filling stratigraphy. Both parts of the course show the essential math involved in basin

modeling and provide an overview of much of the recent literature on quantitative basin analysis. Covered in the course will be:

- why basins form and subside—an overview,
- how to analyze basin subsidence histories, including: geohistory analysis, compaction corrections, and backstripping,
- thermal mechanisms affecting basin subsidence, including: thermal isostasy, and uniform and nonuniform stretching models,
- lithospheric loading and basin flexure, including: thrust belts and foreland basins, and intraplate stress,
- summary of basin subsidence mechanisms in various tectonic settings,
- modeling the development of basin filling sequences generated by the interaction of subsidence, sediment supply, and sea-level changes.

Faculty: Charles L. Angevine and Paul L. Heller, University of Wyoming; Chris Paola, University of Minnesota, Minneapolis.

Limit: 100. Fee: \$165 (includes course manual and lunch both days).

### 6. Thermochronology: Applications to Tectonics, Petrology, and Stratigraphy

Saturday, October 19, 8:00 a.m. to 5:00 p.m., Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center.

Aimed at the *non-isotope* geologist, this course uses actual case studies to illustrate how mineral geochronologic data can be applied to problems in tectonics, petrology, and stratigraphy. Participants will first be brought to a similar level of understanding of the isotope systematics for the U-Pb, Rb-Sr,  $^{40}\text{Ar}/^{39}\text{Ar}$ , and fission track dating techniques that are the common systems used in thermochronologic studies. The remainder of the course will be spent presenting and discussing how these techniques have been applied to solving the following problems:

- chronology of faulting and sequence of tectonic development,
- timing of peak metamorphisms and chronology of prograde and retrograde metamorphic processes,
- development of regional chronostratigraphic relationships,
- definition of denudation, uplift, and burial histories,
- chronology and rate of the mineralization process.

The various isotopic systems and minerals to be discussed will include:

- U-Pb; zircon, monazite, titanite (sphene), apatite, baddeleyite,
- Rb-Sr; hornblende, muscovite, biotite,
- $^{40}\text{Ar}/^{39}\text{Ar}$ ; hornblende, muscovite, biotite, K-feldspar, plagioclase,
- fission track; apatite, zircon, sphene.

Faculty: John F. Sutter, U.S. Geological Survey, Reston, Virginia; Peter K. Zeitler, Lehigh University; Robert D. Tucker, Royal Ontario Museum, Toronto.

Limit: 40. Fee: \$215 (includes course manual and lunch both days).

### 7. Assessing the Mobility of Chemicals in the Vadose Zone

Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention

Center. Cosponsored by the *Engineering Geology Division*.

ATTENTION STUDENTS: The Engineering Geology Division will SUBSIDIZE THE FIRST FIVE STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Division.

This course is targeted at practicing geologists with a limited background in environmental chemistry. The objective of the course is to provide some of the basic techniques necessary to evaluate the mobility of chemicals in both the vapor and aqueous phases of the soil. This type of evaluation is critical in selecting appropriate treatment alternatives and in assessing the hazards involved with leaving contamination in place. Topics covered:

- establishing site-specific concentration limits for soil contamination,
- identification of soil parameters that are critical in evaluating chemical mobility (e.g., moisture content, organic carbon content, porosity),
- identification of physical properties that are critical in evaluating chemical mobility (e.g., solubility, vapor pressure, partitioning coefficients),
- design of subsurface investigations to produce the type of data required to evaluate the mobility of chemicals,
- review of assumptions that are routinely employed to assess the mobility and persistence of vadose zone contaminants,
- equilibrium and kinetic factors involved in phase partitioning,
- vapor phase migration by diffusion and advection,
- aqueous phase migration via infiltrating water,
- review of available models to predict contaminant mobility,
- justification and verification of mobility predictions.

Faculty: Donn L. Marrin, Inter-Phase, San Diego, California.

Limit: 50. Fee: \$105 (includes course manual and lunch).

### 8. Computer-aided Illustration in Geology

Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center. Cosponsored by the *National Association of Geology Teachers*.

This course provides an introduction to computer-aided illustrating in the geological sciences. The course focuses on hands-on training to construct geological illustrations such as index and geologic maps, stratigraphic columns, graphs, and other diagrams on a Macintosh computer using a graphic illustrator's program, Adobe Illustrator 3.0. (Illustrator is available in DOS, Mac, and NeXT versions.) Of interest to any geologist who needs to make attractive and accurate illustrations for publication or teaching purposes, this course will be particularly useful for graduate students preparing thesis illustrations. *Each registrant will be provided with a computer.* Some prior computing experience is necessary, especially basic keyboarding skills, familiarity with mouse techniques, and a working knowledge of a graphical user interface such as Windows 3, the Macintosh GUI, or NeXTstep.

Numerous simple techniques and topics will be presented, including:

- drawing straight lines, curves, ovals, and polygons,
- using auto-tracing,
- applying transformations such as scaling, shearing, rotating, and reflecting,
- handling text (fonts and wrapping),
- using geologic symbol and pattern libraries,
- designing patterns,
- using fill and stroke for text and lines,
- using masks,
- blending objects for shading,
- scanner and laser printer tips.

Faculty: Gary A. Novak, California State University, Los Angeles.

Limit: 20. Fee: \$295 (includes course manual, disks containing course-related files, and lunch).

### 9. Earthquakes and Earthquake Preparedness

Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center. Cosponsored by the *Geophysics Division* and *National Association of Geology Teachers*.

- suddenly last summer—perceived effects of earthquakes,
- rock around the clock—basic principles of seismology,
- a crack in the earth—the revolution in plate tectonics,
- dancing in the dark—the art of lecturing with slides,
- it wasn't my fault—faults and fault hazards in the United States,
- shake, rattle, and roll—seismic hazards off the fault,
- don't build your house of bricks—earthquake engineering made simple,
- an ounce of prevention—earthquake preparedness for you and your home,
- my cat warned me—fact and fiction about forecasting and prediction,
- one step ahead—coping with large classes.

Faculty: Kenneth L. Verosub, University of California, Davis.

Limit: 100. Fee: \$105 (includes course manual, set of thirty 35-mm color slides, and lunch). *Note: Due to the popularity of this topic, preregistration is strongly recommended.*

which isotopic systems are most appropriately used in a given situation.

Faculty: Richard W. Hurst, California State University, Los Angeles.

Limit: 50. Fee: \$120 (includes course manual and lunch).

### 11. Applications of Radar Remote Sensing: Terrestrial and Planetary

Friday, October 25, 8:00 a.m. to 5:00 p.m.; Marriott Hotel. Cosponsored by the *Planetary Geology Division*.

ATTENTION STUDENTS: The Planetary Geology Division will SUBSIDIZE THE FIRST TWO STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$100 after the GSA meeting by the Division.

In August 1990, NASA's Magellan spacecraft began systematic mapping of Venus using side-looking synthetic aperture radar (SAR) to penetrate the dense clouds surrounding the volcanically and tectonically complex planet. The quality of the radar image data being returned from Magellan has been outstanding. The use of SAR in geologic investigations is not limited to Venus, however, but is becoming one of the new breed of remote sensing tools for studying Earth. This sophisticated technology has been applied to Earth from aircraft, the Space Shuttle, and unmanned spacecraft to detect geologic features, structural relations, and other surface (and subsurface) phenomena not visible or so well enhanced by conventional sensors. This course is designed for students and educators in the geosciences who desire to learn about or be brought up to date on the latest applications of radar imaging in remote sensing exploration of Earth and other planetary bodies. Topics covered:

- basics of radar frequency sensors, including how images are obtained and processed; and how they differ from conventional visible-wavelength images,
- surface properties (terrestrial and extraterrestrial) that can be determined using radar systems of different wavelength and polarization options,
- an overview of the use of SAR for geologic applications,
- case studies, including the use of SAR data from the Shuttle Imaging Radar Experiments, the NASA aircraft (AIRSAR) program, and the current Magellan radar mapping mission to Venus.

Faculty: Gerald G. Schaber, U.S. Geological Survey, Flagstaff, Arizona; Tom G. Farr, Jet Propulsion Laboratory, Pasadena, California.

Limit: 50. Fee: \$135 (includes course manual, precourse reception on Thursday evening, and lunch on Friday).

### 12. Contaminant Hydrogeology: Practical Monitoring, Protection, and Cleanup

Friday, October 25, 8:00 a.m. to 5:00 p.m., Saturday, October 26, 8:00 a.m. to 5:00 p.m.; Marriott Hotel. Cosponsored by the *Hydrogeology Division*.

ATTENTION STUDENTS: The Hydrogeology Division will SUBSIDIZE THE FIRST STUDENT WHO

IS A VALID DIVISION MEMBER. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Division.

This course is for newcomers and entry-level professionals who are interested in practical contaminant hydrogeology as it is applied daily to soil and ground-water contamination problems. The course emphasizes the consultant working approach to solving hydrogeologic problems of data collection, interpretation, and remediation as required by government regulation. This course will *not* include rigorous mathematical ground-water contamination modeling. Topics covered:

- theoretical and practical elements of geologic and hydrogeologic investigations,
- subsurface drilling procedures and sampling,
- monitoring well construction,
- water-sampling techniques,
- contaminant transport and fate—general concepts,
- data interpretation,
- aquifer analysis—general concepts,
- criteria for selecting monitoring and remediation procedures,
- site cleanup,
- regulations,
- client and budgetary considerations.

Case histories explore the application of investigation techniques for UST, CERCLA, and RCRA projects, hazardous waste landfill siting, leaking underground tanks, and contaminated properties in several states.

Faculty: Christopher M. Palmer, Exceltech, Inc., Fremont, California; Jeffrey L. Peterson, GeoStrategies, Inc., Hayward, California.

Limit: 40. Fee: \$195 (includes course manual and lunch both days).

### 13. Sedimentary Basin Systems

Friday, October 25, 8:00 a.m. to 5:00 p.m., Saturday, October 26, 8:00 a.m. to 5:00 p.m.; Marriott Hotel. Cosponsored by the *Sedimentary Geology Division*.

ATTENTION STUDENTS: The Sedimentary Geology Division will SUBSIDIZE ALL STUDENTS WHO ARE VALID DIVISION MEMBERS. The student MUST PAY THE FULL COURSE FEE when registering, but will be reimbursed \$50 after the GSA meeting by the Division. To be reimbursed, students must apply in writing to: Mary J. Kraus, Dept. of Geology, University of Colorado, Boulder, CO 80309.

This course is designed for faculty in four-year colleges and M.S. degree programs, M.S. and Ph.D. graduate students, practitioners in oil and mining companies, hydrologists/engineering geologists, managers in oil, mining, or engineering firms, and professional earth scientists in state and federal agencies. Devoted to providing a systematic overview of basin analysis and sedimentary geology, this course stresses the interdisciplinary aspects of basin analysis, focusing on how geodynamic processes of basin formation influence both the nature of sediment fills and the maturation of the sediment through diagenesis, fluid



View toward the Gulf of California; flat-lying Miocene volcanic strata cap granitic basement.

The October 1989 Loma Prieta earthquake and the recent prediction of a large earthquake in Missouri have significantly raised public awareness about the need for earthquake preparedness, in both California and other states. This new awareness provides an excellent opportunity for geology departments to broaden their course offerings and increase their enrollments by offering a course on Earthquakes and Earthquake Preparedness. This outstanding course is designed for faculty from universities, four-year colleges, and junior colleges who would like to teach a lower division course in earthquakes but either lack the background they feel they need or lack the confidence to organize what they do know into a coherent course. Special attention will be given to the mechanics of organizing and teaching an introductory level course on earthquakes and earthquake preparedness. Other nonspecialists interested in the topic are also welcome to attend. Topics covered:

- once around the world—important recent and not-so-recent earthquakes,

### 10. Hydrogeologic and Environmental Applications of Stable Isotopic Systems

Sunday, October 20, 8:00 a.m. to 5:00 p.m.; San Diego Convention Center.

This course is designed to address the theory and applications of stable isotopes to hydrogeology and environmental geology. Background information will be provided for each isotopic system discussed so that the course will be appropriate for upper division undergraduates, graduate students, faculty members, and geoscientists in the commercial sector. Each application or case study will focus on a specific isotopic system, its utility, and potential limitations. For example, topics which will be used to introduce Sr, Pb, and light stable isotopic systems will include:

- fate and transport of fossil fuel waste (hydrocarbons, coal),
- source apportionment of heavy metals at Superfund sites,
- tracking of organics by stable and Pb isotopic systems.

Integrated isotopic studies will be presented in order to evaluate

circulation, and thermal history. Additional topics covered:

- basin classification,
- paleogeography,
- sedimentary facies,
- black shales,
- cratonic sequences,
- sea-level history—sequence and seismic stratigraphy,
- pelagic cycles,
- clastic diagenesis,
- fluid migration through sedimentary basins.

These topics will be used to illustrate the role of interpreting sediments as a barometer of basin tectonic processes, and extrinsic basinal processes during basin evolution. Analyses from the Arkoma and Illinois basins, the North Sea, and Pacific Ocean back-arc basins, illustrating the interdisciplinary approaches, will be discussed. This course is a revised version of a comparable one-day course presented at the 1987 GSA Annual Meeting in Phoenix and a comparable two-day course presented at the 1989 GSA Annual Meeting in St. Louis.

Faculty: George deV. Klein, University of Illinois at Urbana-Champaign.

Limit: 100. Fee: \$145 (includes course manual and lunch both days).

## OPEN FORUMS

### Congressional Field Hearing on Earthquake Hazards

Monday, October 21, 1:00 to 4:00 p.m.  
San Diego Convention Center

The national House Committee on Science, Space, and Technology will be holding a field hearing on earthquake hazards in San Diego during the GSA meeting. Some of GSA's members will be expert witnesses. Everyone is invited to drop in to view the government's decision-making process in action.

### Geology and Public Policy Forum

#### Geologic Information Needs of Local Governments: Emergency Response Planning and Earthquake Planning Scenarios

Tuesday, October 22, 12:00 noon to 1:30 p.m.  
San Diego Convention Center

The GSA Geology and Public Policy Committee will sponsor a forum on the needs of local governments for geologic information. The focus will be emergency response planning and the role that earth scientists can and should have in providing basic and interpreted scientific information to emergency response planners for the purpose of improving response plans, conducting exercises, and improving the public's general knowledge of local and regional geologic hazards.

Discussion will center on the Planning Scenario for a Major Earthquake, San Diego-Tijuana Metropolitan Area, recently released by the California Department of Conservation, Division of Mines and Geology.

The earthquake planning scenario will provide the foundation for discussions by local, state, and federal planners on how the scenario

information is used and in what forms geologic information is most useful to government officials who do not necessarily have in-house scientific expertise. A panel discussion will focus on how geologic hazards information can be presented so as to be most useful.

This forum will be the seventeenth in a series and will be open to everyone, including guests and the general public; no cost or registration.

### Venus: A Global Perspective from the Magellan Mission

Tuesday, October 22, 12:15 to 1:15 p.m.  
San Diego Convention Center

During the 243-day primary mission, which ended May 15, 1991, Magellan's radar mapped 84% of the surface of Venus. With these data scientists have begun to address what processes have shaped this Earth-like planet. The first global look reveals that tectonism and volcanism have been the dominant processes on Venus. R. Stephen Saunders, Magellan Project Scientist, will talk about these findings as well as goals for extended mission cycles.

## OTHER SHORT COURSES/WORKSHOPS/FORUMS

### MSA-Sponsored Course

#### Contact Metamorphism Short Course

Friday, October 18 through Sunday, October 20

Pala Mesa Resort, San Diego, California

Class will be held in the morning and early evening, leaving afternoons free for recreation. A welcoming reception will be held Thursday evening, October 17, as well as a summary round-table discussion on Sunday morning, October 20.

This course, convened by Derrill M. Kerrick, Pennsylvania State University, will use theoretical, experimental, and field information to elucidate the processes and controls of contact metamorphism. Speakers will review current knowledge and will explore avenues for future research. Particular emphasis is given to multidisciplinary analysis of contact metamorphism (igneous and metamorphic petrology, geochemistry, thermal modeling, structural geology).

Preregistration required. Limit: 125. Fee: MSA member—\$530 (double room), \$680 (single room); MSA student member—\$340. Nonmembers—\$570 (double room), \$720 (single room); student non-member—\$360. Fee includes accompanying volume of *Reviews in Mineralogy*, lodging Thursday, Friday, and Saturday nights, and all meals beginning with the reception and light buffet dinner on Thursday through lunch on Sunday. There are a limited number of student scholarships available to support students actively involved in thesis research on or related to contact metamorphism. For information and registration: MSA Business Office, 1130 17th Street, N.W., Suite 330, Washington, DC 20036, (202) 775-4344, fax 202-775-0018.

## SEPM and PS-Sponsored Course

### Sequence Stratigraphy and Biostratigraphic Patterns: An Integrated Approach to Defining Basin History

Saturday, October 19, 8:00 a.m. to 5:00 p.m.

Holiday Inn on the Bay

This hands-on course consists of a series of exercises in integration of seismic record sections, wireline logs, and biostratigraphic data. Each participant receives a complete set of short course notes and exercise materials. The study area is offshore Texas where the Pliocene-Pleistocene stratigraphy is dominated by progradational cycles across a tectonic framework of basin-margin subsidence and salt withdrawal. The course is organized for geologists and geophysicists with introductory knowledge of stratigraphy and sedimentation. The sequence of exercises will expose the participants to (1) depositional systems, (2) facies analysis, (3) chronostratigraphic framework, (4) integration of multiple data sets, (5) comparison of local to global depositional patterns, and (6) application of the integrated approach to stratigraphic problems. (Credit: 0.7 C.E.U.)

Faculty: John M. Armentrout, Mobil Research & Development Corp., Dallas, Texas.

Preregistration required. Limit: 30. Fee: SEPM and PS members—\$185, nonmembers—\$200 (includes course notes). For information and registration: SEPM Business Office, P.O. Box 4756, Tulsa, OK 74159, (918) 743-9765, fax 918-743-2498.

## PS-Sponsored Workshop and Course

### Paleoecology Workshop

Saturday, October 19, 8:00 a.m. to 5:00 p.m.

Pala Mesa Resort, San Diego, California

This workshop will consist of a full day of short presentations by the faculty and extensive discussion with the participants centered around three themes that represent areas of future growth in paleoecology. These themes are (1) geochemistry, (2) sequence and event stratigraphy, and (3) the role of uniformitarianism in paleoecology.

Faculty: Brian Rosen, Peter Sheehan, Carl Brett, Keith Meldahl, Arnie Miller, Doug Jones, and Brad Sageman.

Preregistration required. Limit: 50. Fee: \$110 (double room), \$155 (single room). Fee includes shuttle service from the San Diego Airport to the Pala Mesa Resort until 10:00 p.m. on Friday evening, Friday evening welcoming reception, Friday night lodging, all Saturday meals, course handouts, and transportation to downtown San Diego hotels after dinner on Saturday. For information and registration: Mary Droser, Dept. of Earth Sciences, University of California, Riverside, CA 92521, (714) 787-3797, or David Bottjer, Dept. of Geological Sciences, University of Southern California, Los Angeles, CA 90089, (213) 740-6100.

## Analytical Paleontology Short Course

Sunday, October 20, 8:00 a.m. to 5:00 p.m.  
Marriott Hotel

This course will focus on new applications of analytical methodologies to the fossil record. A series of speakers will address a wide range of application of analytical methodologies, ranging from biostratigraphic to sampling problems, from constructional morphology to diversity patterns. The emphasis of the course is on providing tools for research and teaching. Interested geoscientists are welcome to attend all or part of the course.

Faculty: Philip W. Signor, Carl Koch, Mike Foote, George McGhee, Daniel C. Fisher, Lucy Edwards, Rebecca Z. German, Charles Marshall, J. John Sepkoski, Jr., David M. Raup, and Norman L. Gilinsky.

No fee or registration. Course notes will be available on-site for approximately \$10. For information: Norman L. Gilinsky, Dept. of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, (703) 231-5951, fax 703-231-3386, or Philip W. Signor, Dept. of Geology, University of California, Davis, CA 95616, (916) 752-0846, fax 916-752-0951.

## Annenberg/CPB Project Workshop for College Teachers

### Teaching Introductory Geology with Video as a Partner

Sunday, October 20. Two separate sessions: 8:30 a.m. to 12:00 noon or 1:00 to 4:30 p.m.  
San Diego Convention Center

Sponsored by *The Annenberg/CPB Project* in conjunction with the *National Association for Geology Teachers* and the *Southern California Consortium*.

Explore how to use video models to prompt students to interact with geology concepts, with examples drawn from the new PBS 26-part series, "EARTH REVEALED: Introductory Geology." Emphasis will be on the capability of the video to:

- show role models of geologists and scientific research in action,
- provide visual imagery of dynamic processes important to geology, such as landslides, earthquakes, and sediment transport,
- offer vivid examples with lasting impact of strong links between the study of geology and the needs of human society.

The two separate workshops will include working within small groups organizing inventive approaches to a lesson on volcanism or mass wasting, for example. Workshops will be led by Richard W. Hazlett, Pomona College, together with geology advisors from the "EARTH REVEALED" academic development team and the producer of the video series from the Southern California Consortium.

Limit: 60 persons per half-day session. No fee. Preregistration required. For information and registration: Janice Ford, Annenberg/CPB Project, 901 E Street N.W., Washington, DC 20004; (202) 879-9655.



## GIS, AGI, and GeoRef-Sponsored Workshops and Forum

### GIS on CD-ROM Workshop

Sunday, October 20, 1:30 to 4:30 p.m.  
Marriott Hotel

Sponsored by the *Geoscience Information Society*.

This workshop will provide an in-depth look at the contents and searching capabilities of several databases on CD-ROM that cover the geoscience literature. The databases featured include GeoRef, GeoIndex, and Selected Water Resources Abstracts. Find out how these tools can help you be more comprehensive in your searches and help you locate references to a topic quickly. The workshop is designed for information specialists and geoscientists. Hands-on practice time is included in the workshop.

Limit: 30. No fee. Preregistration required by September 15. For information and registration: Barbara DeFelice, Kresge Physical Sciences Library, Dartmouth College, Hanover, NH 03755, (603) 646-3845.

### GIS Database Forum

Monday, October 21, 1:30 to 3:30 p.m.  
Marriott Hotel

Sponsored by the *Geoscience Information Society*.

This forum will focus on databases in a variety of formats (including CD-ROM, on-line, and floppy disks) useful to earth scientists and earth science librarians. Representatives of several databases will review the contents and search systems of their databases. In addition, they will describe access for users. Individuals in most disciplines in the geosciences will find at least one of the databases to be of interest. Producers of databases in these formats interested in participating should contact the organizer.

No fee or registration. For information: Charlotte Derksen, Stanford University, Branner Earth Sciences Library, Mitchell Building, Stanford, CA 94305, (415) 723-1093, fax 415-725-6566.

### GeoRef Workshop

Wednesday, October 23, 8:00 to 10:00 a.m.

Marriott Hotel

Sponsored by the *Geoscience Information Society* and *American Geological Institute*.

Learn how to search AGI's GeoRef on-line database of over a million references to the geological literature from 1785 to the present. The workshop will teach searchers about (1) the GeoRef database and its subject coverage, (2) Boolean logic used for combining search terms, (3) on-line search commands, and (4) designing effective search strategies. Sample searches will be used to illustrate the points, and the GeoRef Thesaurus and other on-line searching tools will be described. General discussion and questions from the attendees will follow.

No fee. Preregistration required by September 15. Limit: 50. For information and registration: Barbara DeFelice, Kresge Physical Sciences Library, Dartmouth College, Hanover, NH 03755, (603) 646-3845.

## SPECIAL EVENTS

### San Diego Welcoming Reception

Sunday, October 20, 6:00 to 9:00 p.m.  
San Diego Convention Center,  
Outdoor Terrace

Ocean sunset, and later, night lights along the shoreline; salt-laden sea breeze; halyards clanging against masts; Latin jazz to fit the mood. Welcome to San Diego! This is the time and place to be with friends and colleagues. You're on your own for drinks and your choices of pizza, tacos, and fajitas made available for everyone, including those late arrivals from field trips. The Latin-Caribbean-African band promises welcome sounds with a global perspective.

For your convenience, registration will be open until 7:00 p.m. Shuttle buses will be servicing the GSA hotels from the Convention Center until 9:30 p.m. If you plan to go out for dinner, we suggest you make reservations. A dining guide will be available with registration, or ask your hotel concierge.

### Exhibitors' Global Welcome Reception

Monday, October 21, 4:30 to 6:00 p.m.  
San Diego Convention Center,  
Exhibit Hall

After a full day in technical sessions, relax and tour the exhibit hall. Exhibitors will be hosting this event by providing finger foods from their booths or designated food areas. Beer and wine will be available to quench your thirst.

### Alumni Night

Monday, October 21, 7:00 to 9:30 p.m.  
Marriott Hotel, Marriott Ballroom

Everyone knows someone at the popular Alumni Receptions. It's a haven for geologists who thrive on college connections. Over 70 schools will be represented. If you would like your university to hold a reception, check with your department chairman, then call Vanessa George, GSA headquarters.

### GSA Presidential Tribute and Awards Ceremony

Tuesday, October 22, 5:45 to 7:00 p.m.  
San Diego Convention Center

The San Diego Meeting is dedicated to the memory of our friend and leader, Doris M. Curtis, who died on May 26. During the ceremonies, we will celebrate the life of this exceptional person. (Although E-an Zen has assumed the duties of President, there will not be a Presidential Address this year.)

Following the Tribute, 1991 medalists and awardees will be honored:

#### Penrose Medal

William R. Dickinson

#### Day Medal

Ian S. E. Carmichael

#### Young Scientist Award (Donath Medal)

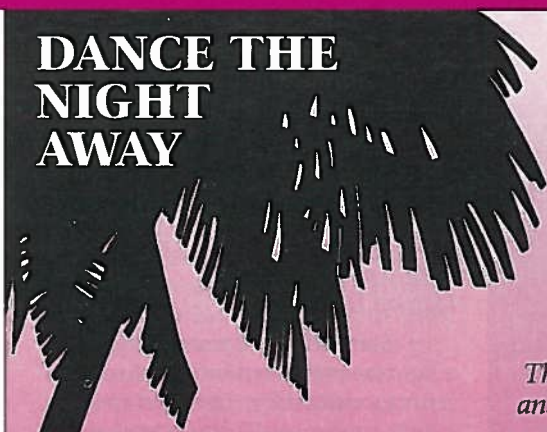
Brian P. Wernicke

#### GSA Distinguished Service Award

Dorothy M. Palmer

Recognition will also be given to newly elected Honorary Fellows Dr. Valdar Jaanusson, Dr. Hans Laubscher, and Dr. Richard L. Stanton.

## DANCE THE NIGHT AWAY



Who sang these unforgettable words?

RAMA-LAMA-DING-DONG

The fabulous rock oldies of the 50s and 60s live again with San Diego's TOP nostalgia band.

### THE MAR DELS

opened for the Beach Boys, Johnny Rivers, Frankie Avalon, the Platters, the Association, the Righteous Brothers.

## BEACH PARTY—HOT! HOT! HOT!

Tuesday, October 22, 7:30 to 10:30 p.m.

Outside Under the Sails—San Diego Convention Center  
(Warning: For those who like to dance and love loud-music.)

Free cold beer all night long—Wine and soft drinks in between and around the dancing. Wear your shaggy cutoffs, sneakers, Blues Brothers sunglasses or day-glo shields. Black tie prohibited!

**Fabulous Fee: \$17**



Marriott Hotel & Marina sdcvb

## BAY LIGHTS DINNER CRUISE

Tuesday, October 22, 7:30 to 10:00 p.m.  
2½ hour get-away cruise on San Diego Bay

Ours exclusively—the top deck of the super yacht, *Spirit of San Diego*

### TRIO SPERANZA

(Superb Quiet Classical Chamber Jazz)

Completely hosted wine, beer, cocktails, and soft drinks throughout the evening.

Two-entree, seated dinner including:

Tenderloin Beef Tips  
in a Cream Madeira Sauce over Flaky Pastry Shell

Stuffed Chicken Breast à La Reine  
with Apple Almond Dressing

Fresh Vegetables/Parsley New Potatoes/Caesar Salad  
Choice of Carrot, Cheese, or Chocolate Mousse Cake

Think cool sea breezes. Bring a jacket. Seating for dinner is inside, so the boat goes—rain or shine.

Transportation to and from the dock included.

**Fee: \$38**



## ¡Vamos a Mexico!

Wednesday, October 23  
6:00 to 11:00 p.m.  
Tijuana, Mexico



¡Andale, amigos y amigas! You can't be this close to Mexico and not visit! Venture by bus across the border to Tijuana for a trip into colorful Old Mexico. First take advantage of a brief shopping spree that will yield all kinds of south-of-the-border finds at duty-free shops or, if you aren't a shopper, stop at one of the many outdoor cafes for a beverage and interesting people-watching. Then enjoy a delicious Mexican dinner at the well-known La Escondida Restaurant, beginning with a refreshing margarita. For added atmosphere, experience the traditional strolling mariachis, as Mexican artisans demonstrate piñata, flower, and tortilla making. Don your sombrero and end the week right. ¡Vamos!

Persons who are not U.S. or Canadian citizens must have a passport to enter Mexico and return.

Fee: \$37 (includes transportation, dinner, and guides).

### Awards Luncheons and Other Ticketed Meal Functions

Associated societies and GSA divisions invite their members and other interested guests to join them for their annual meal functions, special addresses, and awards ceremonies. You do not need to be registered for the meeting; everyone is welcome. Please check the Registration Form for event dates and to order tickets. Location and times will appear on the ticket.

Please note: The newly established GSA Geoscience Education Division will hold its first luncheon meeting on Wednesday, October 23, 12:15 to 2:30 p.m. Luncheon tickets can be ordered on the Registration Form. This Division's inaugural meeting will be on Tuesday, October 22, 4:30 to 5:30 p.m. at the Marriott.

The Association for Women Geoscientists is sponsoring two ticketed meal functions. The traditional breakfast and awards will be Tuesday, October 22. A special premeeting luncheon will be held on Sunday, October 20. Both events are open to everyone.

**T.A.C. (Thursday Afternoon Club)**  
Thursday, October 24, 3:30 to 5:00 p.m.  
San Diego Convention Center,  
Poster Area, Hall B

By popular demand, the T.A.C. that was started at last year's meeting is being brought back for San Diego. T.A.C., featuring free beer, is held in the Poster Session heartland, and immediately follows the Global Challenge Rapporteur Session. It's a great, informal way to close the meeting.

## SPORTS EVENTS

### Tennis Tournament

Sunday, October 20, 9:00 a.m. to 1:00 p.m.  
Marriott Hotel

Start off Sunday morning with a light-hearted round-robin doubles tennis tournament. This year the courts are conveniently located at the Marriott next to the fitness center on the fourth floor in the South Tower. Follow the signs to the rooftop courts. The tournament will be run by Marriott tennis pro Dave Bacon. San Diego lays claim to last year's GSA tennis winner, who will stand all challengers! Entry will be limited to the first 30 registrants. This event is by preregistration only. Awards will be given to the top three players, plus one consolation prize. If you have any questions on Sunday morning, call or visit the GSA Annual Meeting office at either the Marriott or the Convention Center.

Fee: \$22 (includes court fees, balls, and refreshments).

### San Diego Chargers Football

Sunday, October 20, 1:00 to 4:30 p.m.  
San Diego Jack Murphy Stadium

If you have free time on Sunday and enjoy football, watch the San Diego Chargers take on the Cleveland Browns. For tickets, either call (619) 563-8281 for a Single Game Order Form, or call 1-800-876-SEAT and order your tickets by phone. Base ticket prices are \$15, \$21, or \$23, and then add \$4 per Single Game Order Form, or \$2 per ticket for phone orders. You will need to provide your own transportation. Soak up the San Diego sunshine in this outdoor stadium.

### Volleyball Tournament

Monday, October 21, 4:00 to 7:00 p.m.,  
Tuesday, October 22, 12:00 noon to 2:00 p.m., and Wednesday, October 23,  
4:00 to 7:00 p.m.  
Embarcadero Marina Park South

Be a part of history and enter GSA's first, almost-beach Volleyball Tournament. This for-fun event is enthusiastically promoted by Patrick Abbott and San Diego State's Department of Geological Sciences. The games will be played in the Embarcadero Marina Park South, located between the San Diego Convention Center and San Diego Bay. Let us

know if you want to field a 4- or 6-person team. Ringers accepted—if they are working geologists or geology students.

FREE. No limit, but sign up required. If you would like to play or enter a team, write to: 1991 Volleyball, c/o GSA, P.O. Box 9140, Boulder, CO 80301, or call GSA at 1-800-472-1988. On-site, stop by the Sports Desk at the Convention Center for information and a map.

### Sunrise Run (5K)

Wednesday, October 23, 7:00 to 9:00 a.m.  
Marriott Hotel

A salty breeze, the clang of a mooring bell, and the squawking of seagulls will welcome this year's 5K runners. The race will start and end at the harbor-side entrance to the Marriott and proceed along San Diego's beautiful downtown harbor. October weather should be great, but it could be brisk and breezy by the bay, so bring your windbreaker.

The GSA shuttle buses will start at 6:30 a.m. transporting runners from other downtown hotels to the Marriott. The race will be professionally directed and timed by Breaking Forty Race Consultants. Water will be provided on the course, with

refreshments and prizes at the finish. GSA will provide race shirts, so be sure to indicate your shirt size on the registration form. Shirts and maps may be picked up at the Sports Desk in the Convention Center.

Fee: \$18 (includes shirt, refreshments).

### Health/Fitness

You are in the sports-and-fitness capital of the U.S., so take advantage of all there is to do. Supplement your workout with a walk or jog along San Diego Bay boardwalk. Rental equipment for all sports is readily available by checking with your hotel concierge. Many of the downtown GSA hotels offer complete health centers for their guests. Please refer to the hotel descriptions on page 180 for what your hotel features. For people not staying at one of these hotels, downtown San Diego offers a complete fitness center at the YMCA, 500 West Broadway, (619) 232-7451. Offering state-of-the-art equipment, programs, and facilities, the Y is conveniently located just ten blocks from the Convention Center. Guest passes are \$7 per visit and \$3.50 for members of another city's YMCA. Hours are 8:00 a.m. to 4:30 p.m. weekends, and 6:00 a.m. to 9:00 p.m. weekdays.



## SCIENCE THEATER

Monday, October 21, through  
Thursday, October 24  
San Diego Convention Center

Science Theater 1991 will feature a host of new video programs, as well as repeating the best of those you were sorry to have missed last year. In addition to the broad range of usual geologic topics, there will be programs on acid rain, tidal bores, vortexes, and vineyards, and you can travel with us from Hell's Canyon to the Holy Land. Even harried geo-

holics who have no time for movies will want to see some of the technical programs, such as the computer animations of Loma Prieta aftershocks, fault model sandbox experiment, or Emiliano Mutti's provocative turbidite lecture.

Video aficionados, on the other hand, will be interested in many of the informative and colorful programs on volcanoes, dinosaurs, earthquakes, mountain building, and other topics of broader geological interest. We will also be previewing a new 26-part geology course and public television series, "EARTH REVEALED," and we hope as well to

stage Science Theater demonstrations of two emerging video technologies. One of these is interactive teaching techniques using CD technology; the second is scientific visualization using desktop mini-supercomputers and application visualization software. Science Theater has something for everyone.

For your convenience, viewing of the most popular videos will occur in the Video Lounge in the Exhibit Hall as well as in the Science Theater during its regular programming.

Support for the Science Theater has come through a partnership gift from the Annenberg/CPB Project.

## GUEST PROGRAM

San Diego is a special city offering a wonderful array of attractions in a beautiful setting. The Guest Committee cordially welcomes you to San Diego and wants to make your visit a memorable one. All guest registrants are invited to visit the Hospitality Room, located in the Manchester Room of the San Diego Marriott Hotel & Marina. Join us there to greet old friends, meet new friends, and learn about the interesting tours and seminars we have planned for you. We will be serving a tempting array of light refreshments throughout the day, and our hostesses will be happy to answer your questions. *Please remember to wear your GSA badge and to bring your gift certificate so you can receive your registration gift.*

### Sunday

9:00 a.m. to 4:30 p.m.

### Monday-Thursday

8:00 a.m. to 4:30 p.m.

## GUEST SEMINARS

No registration or cost. All seminars will be in the Marriott Hotel.

### Welcome to San Diego

Monday, October 21, 8:00 to 8:30 a.m.

Barbara Johnston, Guest Committee Chairman, and a representative of California Convention Events, Inc., will welcome you to San Diego and give you a preview of what there is to see and do. You'll have difficulty finding time for everything! After this talk, plan to attend the opening session, "The Global Challenge."

### Historical San Diego

Tuesday, October 22, 9:00 to 10:30 a.m.

Two hundred years before the birth of our country, an explorer named Cabrillo rounded Coronado Island and discovered the beautiful bay that is the centerpiece of "America's Finest City." Hear about San Diego's rich history, from the establishment of the Spanish missions in 1769 to the heyday of the Spanish dons, the war with Mexico, the cowboys' cries of "Manifest Destiny" and the turn-of-the-century visionaries. This historical development will be narrated by a prominent member of the San Diego Historical Society.

### Earthquakes: Past and Future

Wednesday, October 23, 9:00 to 10:00 a.m.

Patrick Abbott, professor of geology at San Diego State University, and a regular guest on ABC's daily television news program, "Inside San Diego," will speak on the fascinating subject of earthquakes. Learn the different types of earthquakes in the United States and California, and what determines size, location, and frequency.

### Mexican Cooking

Wednesday, October 23, 3:30 to 4:30 p.m.

What is the basis for good-tasting Mexican-style cooking? Join us for a fun-filled and educational hour of demonstration and tasting. The Marriott chef promises to share his personal tips and recipes.

## Colors

Thursday, October 24, 10:00 to 11:00 a.m.

Everyone gains attractive sparkle, men as well as women, when they're dressed in colors that complement their natural coloring. Join us for this enlightening seminar.

## GUEST TOURS

Since many people will be arriving in San Diego early, we have planned tours beginning on Sunday, October 20. All GSA meeting registrants are welcome to participate. Some of the tours are ideal for children and adults. *Children are welcome to accompany parents on the tours for which child prices are listed.* Child prices are for 3- to 15-year-olds. Very small children (under 24 months) are welcome on all tours at no charge, but they must share the parent's meal and seat on the bus.

Tours will leave the Marriott from the exit on Marriott Hall Drive. Reservations for all tours will be accepted on a first-come, first-served basis, so please register early. Since space is limited, please be sure to pre-register. We hope you will join us.

### Wild Animal Park

Sunday, October 20, 10:00 a.m. to 3:00 p.m.

The San Diego Wild Animal Park is a 1,800-acre wildlife preserve where exotic animals can be seen in their native surroundings. Begin at the Nairobi Village, viewing special exhibits and animal shows, before riding the Wgasa Bush Line Monorail for a five-mile guided tour through the wilds. Later you can walk through a giant aviary housing birds from East Africa, hike the Kilimanjaro Trail, or visit the gorilla grotto, a fascinating lowland gorilla colony. All ages will enjoy the Animal Care Center, where you can observe the baby animals and have a hands-on experience with the park's young inhabitants.

Cost: \$33 adults, \$25 children (includes transportation, admission, and guides).

### Best of San Diego Tour and Harbor Cruise

Sunday, October 20, 12:00 noon to 4:00 p.m.

Begin your tour where the west began—historic Cabrillo Monument at the end of Point Loma. Explore the restored lighthouse with its sweeping view. Motor through Presidio Park and Old Town, seeing lovely old adobe homes and romantic courtyards. A visit to the Bazaar Del Mundo offers a colorful shopping experience. Drive through the Prado in beautiful Balboa Park past classic buildings, gardens, and reflecting ponds. Pass through the Embarcadero on your way to boarding a tour boat for a one-hour cruise of the San Diego Harbor. On this scenic cruise you will pass under the Coronado Bay Bridge, the longest orthotropic span in the world.

Cost: \$23 adults (includes transportation, cruise, and guides).

### Tijuana Shopping and Lunch

Monday, October 21, 11:00 a.m. to 4:00 p.m.

Enjoy a trip into colorful Old Mexico and take back some real

bargains. Begin your excursion with a traditional Mexican lunch at La Escondida, a beautiful Mexican estate overlooking Tijuana. Later, visit the open-air international free-port shops for bargain hunting featuring Mexican folk art, pottery, wood carvings, jewelry, and handcrafted leather. Persons who are *not* U.S. or Canadian citizens must have a passport to enter Mexico and return. A similar trip to Tijuana is also being offered on Wednesday evening, October 23, as a special event. The evening trip is open to all registrants and their friends.

Cost: \$35 adults (includes transportation, lunch, and guides).

### Gaslamp Tour and High Tea

Monday, October 21, 12:00 noon to 4:00 p.m.

On this walking tour, a costumed guide will take you back into the Victorian era where horse-drawn carriages, refined taffeta, and architectural ornamentation evolved out of the rugged wild west. Visit the 1850s William Heath Davis House in the Gaslamp Quarter, before taking in two well-known galleries featuring international arts and crafts. Complete your experience with the charm of the Horton Grand Hotel. Originally built in 1886, the Horton Grand has been authentically restored to its original grandeur. We will visit the gracious tearoom for high tea, with traditional finger sandwiches, scones, small pastries, and English breakfast tea.

Cost: \$20 (includes guides and high tea).

### Zoo Behind-the-Scenes Tour

Tuesday, October 22, 11:00 a.m. to 4:00 p.m.

One of San Diego's most popular attractions. Enjoy a VIP private bus tour through the zoo's sprawling canyons and mesas. As a VIP, you will enjoy a behind-the-scenes look at one of the world's rarest collections of animals. Later, visit the petting zoo, the extensive African birds exhibit, Tiger River, Sun Bear Forest, or

Gorilla Tropics. So much to see, so little time. In between, stop at the gift shop for a perfect souvenir or a light refreshment.

Cost: \$35 adults, \$25 children (includes transportation, guides, and admission).

### La Jolla Lunch and Shopping

Tuesday, October 22, 1:00 to 5:00 p.m.

Discover the charm of La Jolla, the Mediterranean-like village on the cliffs of the Pacific with special shops, magnificent homes, and fine art galleries. View the magnificent coast while eating a delicious California lunch at the "El Crab Catcher," complete with a slice of Naughty Hula Pie for dessert. You will have time to shop in the many unique shops and boutiques. You may want to stop by The Collector, a wonderful gem shop featuring fine jewelry.

Cost: \$37 (includes transportation, guides, and lunch).

### Presidio Park and Old Town Lunch

Wednesday, October 23, 10:00 a.m. to 3:00 p.m.

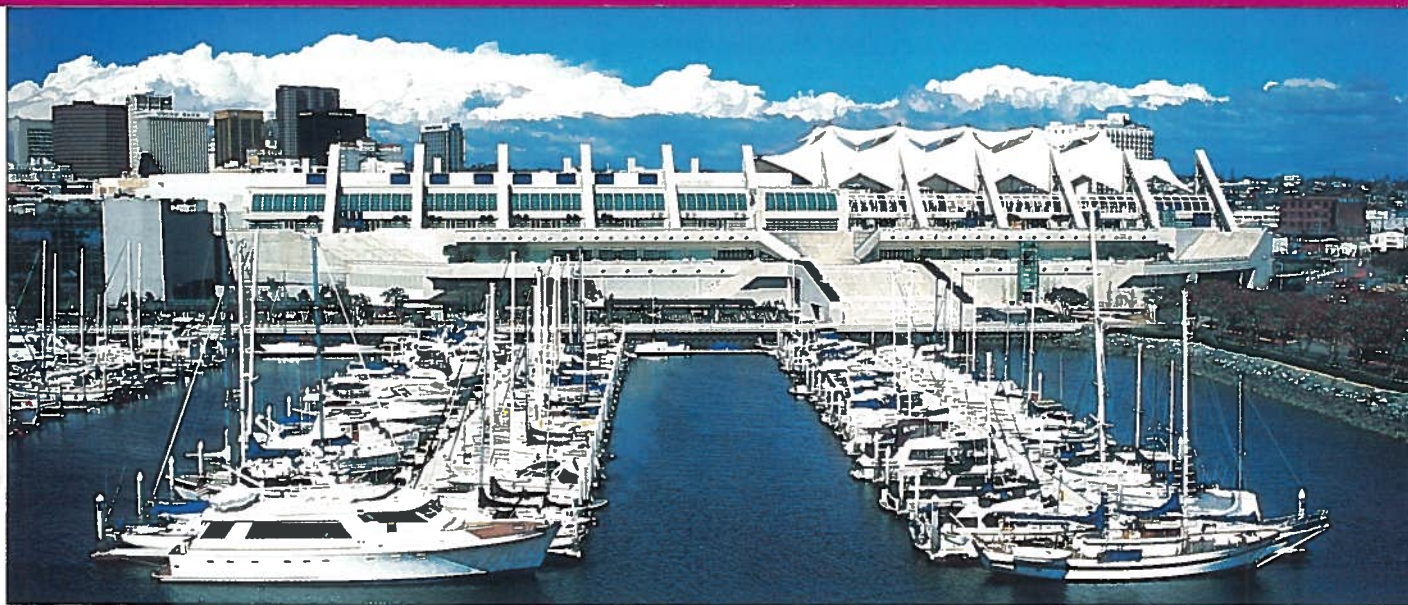
Learn of San Diego's historical Spanish influence as you tour Presidio Park. Begin with the Junipero Serra Museum, with exhibits showing the pre-American era when Mexican explorers settled on San Diego's coast. Next you'll visit the archaeological excavations within the Presidio. After the Presidio, you will descend into Old Town for a walking tour of the original buildings, which reflect the history and romance of colonial Mexico. After lunch at a local favorite, "Hamburguesa Restaurant and Cantina," you will have time to shop at Bazaar Del Mundo, a collection of stores offering goods from around the world.

Cost: \$34 adults, \$29 children (includes transportation, admission, and lunch).



**INTRODUCING  
THE 1991  
EXHIBITORS:  
TECHNOLOGIES  
TO MEET THE  
GLOBAL  
CHALLENGE**

**San Diego  
Convention Center,  
Hall C**



*San Diego Convention Center*

Daily food and beverage service during exhibit hours

**Monday, October 21  
9:00 a.m. to 6:00 p.m.\*\*\***

**Tuesday, October 22  
9:00 a.m. to 5:30 p.m.**

**Wednesday, October 23  
8:00 a.m. to 5:30 p.m.**

**Thursday, October 24  
Not open**

**\*\*\*EXHIBITORS' GLOBAL WELCOMING RECEPTION!**

*Monday, 4:30 to 6:00 p.m.*

Exhibitors will be hosting finger foods from their booths, and beer and wine will be available to quench your thirst after a full day of sessions.

**THE 1991 SAN DIEGO EXHIBITORS**

*(at press time)*

Academic Press, Inc.  
Activation Laboratories Limited  
Alaska Oil and Gas Association  
Alberta Geological Survey  
American Association of Petroleum Geologists Bookstore  
American Association of Petroleum Geologists Visiting Petroleum Geologists' Program  
American Geological Institute  
American Geophysical Union  
American Institute of Professional Geologists  
American Journal of Science  
Arizona Geological Society  
ASC Scientific  
Association of American State Geologists  
Australian National University  
Ben Meadows Company  
Blackwell Scientific Publications  
Blake Industries, Inc.  
Buehler Limited  
Bureau of Economic Geology  
California Division of Mines & Geology  
California Well Sample Repository  
Cambridge University Press  
Cameca Instruments, Inc.  
Canadian Society of Petroleum Geologists  
Carl Zeiss, Inc.  
ChemPet Research-CPR  
CJS Sciences Limited  
Colorado School of Mines  
Columbia University Press  
Contempo Lapidary Equipment Manufacturing  
Cushman Foundation  
Dapple Systems  
Desert Research Institute  
Dibblee Geological Foundation  
Donald K. Olson Minerals

Economic Geology Publishing Company  
Editions Française  
Eichrom Industries, Inc.  
Elsevier Science Publishing Company  
Encyclopaedia Britannica  
Europa Scientific Limited  
Finnigan MAT  
Fisons Instrument Corporation  
Friendship Publications  
General Supply Corporation  
Geo-Tech Imagery  
Geological Association of Canada  
Geological Society of America  
1992 Annual Meeting, Cincinnati Bookstore  
Combined Publishers Display Foundation  
Geology & Public Policy Committee Membership  
Planetary Geology Division  
SAGE Program  
Geological Survey of Canada  
Geology Stuff  
Geoscience Information Society  
Geotech Computer Systems  
GEOTEMPS, Inc.  
Heldref Publications  
Howard Minerals  
Hunter Textbooks, Inc.  
IKON Mining & Exploration  
Indus International, Inc.  
Interactive Concepts  
International Geologic Correlation Program  
International Union of Geological Sciences (EPISODES)  
J C P D S  
J. L. Darling Corporation  
Jena/Distr. Seiler Instruments

Jet Propulsion Laboratory  
Joint Oceanographic Institute  
Kendall/Hunt Publishing Company  
Kevex Corporation  
Kluwer Academic Publishers  
Komodo Dragon Treasures  
Krueger Enterprises, Inc.  
Louisiana State University  
Lubrecht and Cramer Limited  
Macmillan Publishing Company  
Magellan Systems Corporation  
Mineralogical Society of America  
Mountain Press Publishing Company  
National Association of Geology Teachers  
National Earth Science Teachers Association  
National Science Foundation  
Nature's Own  
Nevada Bureau of Mines & Geology  
Nikon Inc., Instrument Group  
Ohio State University  
Oklahoma Geological Survey  
Oxford University Press  
Pacific Section—SEPM  
Paleontological Society  
Pergamon Press, Inc.  
Philips Electronic Instruments, Inc.  
Plenum Publishing Corporation  
Prentice-Hall, Inc.  
Reflex Measurement Limited  
Rigaku, USA  
Rocklabs  
Rocky Mountain Association of Geologists  
SEPM  
San Diego Association of Geologists  
San Diego State University  
Saunders College Publishing  
Schonstedt Instrument Company  
Scintag, Inc.

Siemens Analytical X-Ray Instruments  
Sigma Gamma Epsilon  
Society of Economic Geologists  
Spectrex Corporation  
Spex Industries, Inc.  
Springer-Verlag New York, Inc.  
STN International  
THE Company  
The McCrone Group  
Ulrich's Fossil Fish Gallery  
University of California, Los Angeles  
University of California, Riverside  
University of Chicago Press  
University of Idaho  
University of Kentucky  
University of Nevada, Las Vegas  
University of Nevada, Reno  
University of Oklahoma  
University of Ottawa  
University of Wyoming  
U.S. Bureau of Mines  
U.S. Department of Energy/Yucca Mountain  
U.S. Department of Energy/ER & WM  
U.S. Department of Energy/OCRWM  
U.S. Geological Survey  
Utah Geological & Mineral Survey  
Van Nostrand Reinhold  
VG Instruments, Inc.  
W. H. Freeman & Company  
Washington State University  
West Publishing Company  
John Wiley & Sons, Inc.  
William C. Brown Publishers  
Williams & Heintz Map Corporation  
Wright State University  
X-Ray Assay Laboratories Ltd.  
Yellow Springs Instruments

## FIELD TRIPS

San Diego is a hub from which the diverse geologic environments of California, the American southwest, Mexico, and the offshore islands of the continental borderland can be easily reached. A spectacular array of field trips has been planned for the 1991 Annual Meeting in San Diego that will take advantage of this location and thus appeal to a broad spectrum of geoscientists. We hope that you will choose to participate in one or more of these excursions.

All trips begin and end in San Diego unless otherwise noted. Participants must provide their own transportation to the starting point and from the termination point for those trips not originating or terminating in San Diego. Trips are technical in nature and can be physically rigorous. Please check with the trip leader if you have any questions.

Trip costs include transportation for the trip, guidebook, and other services as noted by the following symbols: B—breakfast, L—lunch, D—dinner, and ON—overnight lodging. For some trips, group-rate airfares have been arranged to get participants to San Diego at the termination of a field trip or to another city for the start of a postmeeting trip. If you do not wish to take advantage of this air travel, please register using the fee without airfare for that trip.

Preregistration for a field trip is recommended because of participant limitations. All participants are accepted on a first-come, first-served basis through GSA headquarters. **PREREGISTRATION DEADLINE: Must be RECEIVED at GSA headquarters no later than September 20.**

The registration form and procedures are provided in this announcement. Registration for field trips after the deadline may be possible if trip logistics and space permit; contact the GSA Registration Coordinator. Meeting registration fees are not required for those participating only in field trips. Although preregistration is advised, on-site registration for mini-trips and postmeeting trips MAY be possible during the meeting in the Registration Area, San Diego Convention Center.

**CANCELLATION DEADLINE IS SEPTEMBER 27.** No refunds will be given after this date. If GSA must cancel a field trip because of logistics or registration requirements, a full refund will be issued after the meeting. Also, please be aware of cancellation deadlines and penalties imposed by the airlines. You may wish to cancel your flight arrangements if a trip you have registered for is canceled. It is a good idea to plan alternatives ahead of time.

GUIDEBOOKS may be purchased at the Field Trip Guidebook Desk during the meeting. After the meeting, write 1991 Guidebook, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182.

For further information, contact the 1991 Field Trip Chairman, Michael J. Walawender, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-6543, or the Registration Coordinator, GSA headquarters.

## PREMEETING

### 1. Mesozoic and Cenozoic Geologic Evolution of the Mojave Desert Block and Environs

Wednesday, October 16 through Sunday, October 20. Roy Dokka, Dept. of Geology and Geophysics, Louisiana State University, Baton Rouge, LA 70803, (504) 388-2975; Darrell J. Henry and Timothy Ross, Louisiana State University; Christopher J. Travis, BP Exploration, Inc., Houston, Texas; Michael McCurry, Idaho State University; Carl Jacobsen, Iowa State University; Michael O. Woodburne, University of California, Riverside. Cost: \$260 (4 ON, 4 L). Limit: 33.

This trip will emphasize the tectonic, metamorphic, magmatic, and basin evolution of the Mojave region from structural, thermal, petrologic, sedimentary, and timing perspectives. Special attention will be paid to (1) the evidence for a major Mesozoic crustal thickening event that resulted in regional granulite-facies metamorphism, (2) a subsequent crustal thinning event that was related to Mesozoic extension, (3) the Pelona Schist controversy, (4) development of the regional early Miocene Mojave Extensional Belt, and (5) structures related to the Eastern California shear zone, a newly recognized network of faults that has accommodated a major part of Pacific-North America transform shear during the late Neogene.

### 2. High-Resolution Sequence Stratigraphy of Coal-Bearing Delta Complexes, Ferron Sandstone (Cretaceous), Western Interior, and Optional Geological Overflight Over the Southwestern United States

Wednesday, October 16 through Saturday, October 19. Michael H. Gardner, University of Texas, Bureau of Economic Geology, Austin, TX 78712, (512) 471-0328; Timothy A. Cross, Colorado School of Mines, Golden; John H. Shelton, La Jolla, California. Cost: \$290 (3 ON, 3 L, 3 D). Limit: 30.

Trip begins and ends in Salt Lake City. Optional overflight begins in Price, Utah, Sunday, October 20. Additional cost for overflight: \$750. Limit: 13.

This field trip will focus on a variety of stratigraphic responses to changes in sediment accommodation space and base level, including occurrences of thick, extensive coals, laterally amalgamated fluvial sandstones, and lithologically homogeneous and heterogeneous shorefacies at reservoir scales. By walking a time-significant surface, we will demonstrate the basis for high-resolution correlation from marine through nonmarine facies, using facies successions and architecture, and changes in symmetries and sediment volumes as preserved in base-level transit cycles. The optional geological overflight will view spectacular geologic features of the southwestern United States, starting with the Ferron cuestas. It will proceed over the San Rafael Swell, the Henry Mountains laccolith, the Waterpocket fold, Bryce and Zion National Parks, the Hurricane fault, and the Virgin anticline to the Keystone thrust, the Kelso sand dunes, the San Andreas fault, the Salton Trough, and the Peninsular Ranges.

Early registration is suggested. Note: If the overflight trip is less than 13 participants, we will either cancel the flight and refund or if we are under by one or two participants, we will ask registrants if they wish to continue the trip by sharing the additional cost. Also, if the weather is bad, we will make the decision to cancel up to the last minute with a full refund.

### 3. Miocene to Holocene Extensional Tectonics and Volcanic Stratigraphy, Northeast Baja California, Mexico

Friday, October 18 through Sunday, October 20. Joann M. Stock, Dept. of Earth and Planetary Sciences, Harvard University, 20 Oxford St., Cambridge, MA 02138, (617) 495-8033; Arturo Martin Barajas and Francisco Suarez Vidal, CICESE, Ensenada, Mexico. Cost: \$190 (2 ON, 3 B, 3 L, 3 D). Limit: 23.

This trip will examine the structure and stratigraphy of the Gulf of California extensional province at the latitude of San Felipe-Puertecitos. Day one will cover the fault systems of the main gulf escarpment, including the San Pedro Martir fault and related structures to the south, and structural variations along the strike of the escarpment. A west-to-east transect across the extensional terrane at the northern boundary of the Puertecitos volcanic province on day two will highlight north-south structural variations across accommodation zones, and the temporal and spatial variation in extension within the province. Day three will focus on the structure and stratigraphy along the eastern edge of the Puertecitos volcanic province and the temporal relations among volcanism, extensional faulting, and marine sedimentation. Both overnights will involve camping. Participants should bring their own sleeping gear.

### 4. Plate Tectonic History of the Central California Margin

Friday, October 18 through Sunday, October 20. Mark Cloos, Dept. of Geological Sciences, University of Texas, Austin, TX 78713-7909, (512) 471-4170; Eric James, Bureau of Economic Geology, Austin, Texas; Michael J. Apted, Intera Sciences, Inc., Denver, Colorado. Cost: \$255 (2 ON, 3 L). Limit: 42. Trip begins in San Francisco.

This trip will focus on the subduction and transform tectonics of coastal central California. Day one begins in the Diablo Range and will concentrate on the blueschist facies metasedimentary rocks of the Franciscan Complex and Cretaceous Great Valley Group forearc basin deposits. Stops will also be made in Hollister to see the effects of active faulting along the Calaveras fault and Tertiary transform margin sediments exposed near the Vergeles fault. Day two starts in Monterey and will include stops at



Vizcaino Peninsula elephant trees in bloom.

metamorphic and granitic rocks of the Salinian block and sheeted dikes and layered gabbros of the San Simeon ophiolite. Day three will start in San Simeon and include stops to examine deformational features including boudinaged blueschist blocks in Franciscan melange and Cambria Slab trench-slope basin deposits. Stops are planned for the Miocene Morro Rock intrusion, rodingite dikes in serpentinites of the Cuesta Ridge ophiolite, and pillow basalts and flows at Avila Beach.

#### 5. Upper Cretaceous Submarine-Fan Deposits, San Diego

Saturday, October 19. Patrick L. Abbott, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-5591; Tor Nilsen, San Carlos, California; John Warne, Colorado School of Mines, Golden. Cost: \$45 (1 L). Limit: 44.

Sea-cliff exposures west of the Rose Canyon fault display the facies of a submarine-fan complete with "textbook" example sedimentary structures and trace fossils. The upper Campanian-lower Maastrichtian section begins with shallow-water marine beds overlain by bathyal-depth strata apparently deposited as a borderland-sized submarine fan prograded into a fault-created basin. Exposed are slope/basin plain, mid-fan channel, mid-fan overbank, and inner-fan facies. The top of the section is marked by Maastrichtian retrogradation.

#### 6. Geologic Hazards in San Diego

Sunday, October 20. Patrick L. Abbott, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-5591; William J. Elliott, Solana Beach, California. Cost: \$60 (1 B, 1 L). Limit: 45.

This trip will provide graphic views and good understanding of geologic hazards in the city of San Diego. We will see (1) the Rose Canyon fault that slashes through the urban area and a view of the city from the fault-created topography of Point Loma (from Cabrillo National Monument) and Mount Soledad, (2) three different approaches to flood control in the San Diego River, (3) slump landslides in Eocene strata that have destroyed homes in Fletcher Hills, and (4) sea-cave formation and sea-cliff retreat at Sunset Cliffs, along with engineering attempts to thwart erosion. Discussed also will be the public-policy decisions regarding each site.

#### 7. Igneous and Metamorphic Features of the Smartville Complex, Northern California

Friday, October 18 (evening) through Sunday, October 20. Howard Day, Dept. of Geology, University of California, Davis, CA 95616, (916) 752-2882; Raymond Beiersdorfer and Eldridge M. Moores, University of California, Davis; James S. Beard, Virginia Museum of Natural History, Martinsville. Cost: \$195 (2 ON, 2 B, 2 L, 1 D). (With optional airfare from Sacramento to San Diego, \$358.) Limit: 30. Trip begins and ends in Sacramento.

This field trip will highlight



Mouth of Colorado River, head of Gulf of California. Sierra Las Pintas upper left.

the metamorphic and igneous features of the Smartville Complex, a Late Jurassic rifted volcanic arc located in the northern Sierra Nevada foothills. The metamorphic part will focus on (1) low-grade (prehnite-pumpellyite to greenschist facies) metamorphism in pillowed and massive basalt flows and volcanoclastic rocks, and (2) contact aureoles around plutons. The igneous part will highlight the intrusive relations of massive diabase, sheeted dikes, and plutons ranging in composition from gabbro to tonalite. It will include a transect of the Pilot Peak pluton, which is zoned from an olivine gabbro core to a quartz diorite margin.

#### 8. Tectonic and Magmatic Evolution of the Central Death Valley Region

Friday, October 18 through Sunday, October 20. Lauren Wright, Dept. of Geosciences, Pennsylvania State University, University Park, PA 16802, (814) 238-2603; Ed DeWitt, Jim Otton, and Ren Thompson, U.S. Geological Survey, Denver, Colorado; Michael A. Ellis, Earthquake Research Center, Memphis, Tennessee; Bennie Troxel, Napa, California; Terry Pavlis, University of New Orleans. Cost: \$240 (2 ON, 2 B, 3 L, 2 D). Limit: 30. Trip begins and ends in Las Vegas.

Participants will visit localities in the Black Mountains and Greenwater Range to observe features critical in the reconstruction of the interrelated tectonic and igneous events that have shaped the central Death Valley plutonic-volcanic field. Presentations will include summaries of (1) the vol-

canic stratigraphy, (2) the chronology of the volcanic and plutonic bodies, (3) major and trace element geochemistry of the plutons and volcanic units, (4) the history of kinematics of the Furnace Creek and Sheephead fault zones, which bound the field, and (5) deformational features ascribed to the Amargosa Chaos. The leaders will evaluate the proposed extensional models based on observations made during the trip.

#### 9. Gem-bearing Pegmatites of San Diego County

Friday, October 18 through Sunday, October 20. Eugene E. Foord, U.S. Geological Survey, MS 905, Federal Center, Denver, CO 80225-0046, (303) 236-4755; Anthony R. Kampf, Natural History Museum, Los Angeles, California; David London, University of Oklahoma; James E. Shigley, Gemological Institute of America, Santa Monica, California. Cost: \$225 (2 ON, 3 L). Limit: 30.

This trip will explore the mineralogy and geology of the famous gem-bearing granitic pegmatites of San Diego County, California. Around the turn of the century, this area supplied most of the world's pegmatite gemstones. The pegmatites continue to yield a wealth of commercial and scientific information. Five pegmatites will be visited: the Little Three mine, in the Ramona district, and the White Queen, Pala Chief, Elizabeth R, and Stewart mines, in the Pala district. Participants will have the opportunity to view dramatic exposures both on the surface and underground. These will be discussed in terms of the history,

geology, mineralogy, geochemistry, and genesis of the deposits.

#### 10. Lower Cambrian Depositional and Sequence Stratigraphic Framework of the Death Valley and Eastern Mojave Desert Regions

Thursday, October 17, 1:00 p.m. through Sunday, October 20, 1:00 p.m. Anthony R. Prave, Dept. of Earth and Planetary Sciences, City College of New York, New York, NY 10031, (212) 650-6471; Christopher M. Fedo, Virginia Polytechnic Institute and State University; John D. Cooper, California State University, Fullerton. Cost: \$260 (3 ON, 2 B, 3 L, 3 D). (With optional airfare to San Diego, \$309.) Limit: 30. Trip begins and ends in Las Vegas.

The Lower Cambrian Wood Canyon Formation and Zabriskie Quartzite form part of the north-westward-thickening craton-margin to miogeoclinal sedimentary wedge associated with the early development of the Cordilleran passive margin. Our detailed stratigraphic and sedimentological work suggests that these siliciclastic units, long considered to be shallow-marine transgressive deposits, represent a more complex amalgam of shallow-marine, braid-delta, and continental braid-plain paleo environments. We also recognize several correlatable surfaces and use them to construct a sequence stratigraphic framework of genetically related depositional units that do not necessarily coincide with those defined by existing lithostratigraphic nomenclature. The two main themes of this field trip are (1) to describe and interpret the facies associations, with emphasis on the importance of fluvial sedimentation and criteria for its recognition, and (2) to consider this depositional framework in a sequence stratigraphic context, with emphasis on correlation of surfaces that reflect significant changes in relative sea level. Participants will discuss the implications such correlations suggest for the Early Cambrian paleogeography of this region. A light sleeping bag or other bedding will be needed for the second night.

#### 11. Modern Eolian Processes of the Algodones Dune Field, California

Friday, October 18 and Saturday, October 19. Michael Sweet, BP-Exploration, 5151 San Felipe, Houston, TX 77210, (713) 552-8604; Gary Kocurek and Karen Havholm, University of Texas, Austin. Cost: \$250 (1 ON, 2 L). Limit: 19.

The Algodones dune field of southeastern California provides a unique setting to examine modern eolian processes and to see, in a relatively small and accessible area, a dune field that is composed of a variety of different dune types, including small barchan dunes (2-3-m-tall), 5-20-m-tall linear dunes, and 60-80-m-tall complex-crescent dunes. Along the margins of the dune field, eolian-fluvial interactions can be observed. Outcrops of fluvial and eolian deposits within the dune field provide clues to its Quaternary evolution. We will use dune buggies to traverse the dune field, examining dunes and eolian depositional processes and describing the results of our studies of airflow and dune migration.

**12. Active Folding and Reverse Faulting in the Western Transverse Ranges, Southern California**

Friday, October 18 through Sunday, October 20. Edward Keller, Dept. of Geological Sciences, University of California, Santa Barbara, CA 93106, (805) 893-3471; Robert Yeats and Gary Huftile, Oregon State University; Tom Rockwell, San Diego State University; Scott Lindvall, Lindvall Richter Associates, Los Angeles, California; John Powell and Craig Prentice, Staal, Gardner, & Dunne, Inc., Ventura, California; Robert West, Ricardo Zepeda, and Xiaolin Zhao, University of California, Santa Barbara. Cost: \$245 (2 ON, 3 L). Limit: 39.

The purpose of this trip is to investigate active folding and reverse faulting in the western Transverse Ranges. In particular, we will focus on the earthquake hazards associated with buried reverse faults that underlie active folds. Several stops will be made on the southern flank of the ranges in the vicinity of Ventura, California. These include South Mountain and the active Oak Ridge fault with a slip rate of 6–12 mm/yr; the Ventura Avenue anticline, an active fold with a Pleistocene uplift rate of about 14 mm/yr; flexural-slip faults associated with folding that displaces terraces of the Ventura River near Ojai, California; and the San Cayetano fault, an active reverse fault with a slip rate of several mm/yr. In the highlands of the Transverse Ranges, we will visit Frazier Mountain, and will examine the evidence for the hypothesis that the central part of the range is being uplifted as a block and responding by rapid erosion. We also plan a stop on the San Andreas fault to examine late Holocene activity. On the northern flank of the ranges, we will visit Wheeler Ridge, which is an active fold with an uplift rate of about 3 mm/yr. A stop is planned at a gravel pit in Wheeler Ridge where we believe a trace of the Wheeler Ridge fault is exposed.

**13. Mesozoic Evolution of Basement Terranes in the San Gabriel Mountains, Southern California**

Saturday, October 19 and Sunday, October 20. Andrew Barth, Dept. of Geology, Indiana/Purdue University, Indianapolis, IN 46202, (317) 274-1243; Daniel May, Bowling Green State University; Carl Jacobsen, Iowa State University. Cost: \$150 (1 ON, 2 L). Limit: 30.

This field trip will focus on the structure and petrology of Mesozoic igneous and metamorphic rocks of the San Gabriel Mountains. We will examine rocks characteristic of four tectonostratigraphic terranes (San Gabriel, San Antonio, Cucamonga, and Pelona Schist) that represent different structural levels within the crust. We will discuss geochemical, geochronologic, and thermobarometric data bearing on their separate Mesozoic histories and will examine ductile shear zones developed during subsequent Late Cretaceous–Early Tertiary juxtaposition along the southwestern margin of the U.S. Cordillera.

**14. Quaternary Geomorphology and Geochronology of Owens Valley, California**

Thursday, October 17 (evening) through Sunday, October 20. Alan Gillespie, Dept. of Geology, University of Washington, Seattle, WA 98195, (206) 543-2079; Paul Bierman, Doug Clark, and Kelin Whipple, University of Washington. Cost: \$255 (3 ON, 3 B, 3 L, 2 D). Limit: 28. Trip begins in Reno.

Owens Valley has a rich and varied geologic history...glaciation, tectonism, volcanism, alluviation, and now-diminished pluvial lakes. This trip will examine the diverse Quaternary geology of Owens Valley and consider both the timing and processes of landscape development. We will visit classic and not-so-classic locales, both reviewing the work of the past century and presenting new research such as measurement of surface-exposure ages, and modeling of debris-flow generation and alluvial-fan aggradation. We will hike to the crest of the Tioga and Tahoe moraines, walk on 0.25 Ma fan surfaces, climb the 0.3 Ma Fish Springs cinder cone, excavate debris-flow deposits, observe the effects of recent range fires, and examine the results of the great 1872 earthquake on the Owens Valley fault zone.

**15. Active Faulting and Volcanism in the Trans-Mexican Volcanic Belt**

Wednesday, October 16 (evening) through Sunday, October 20 (morning). Max Suter, Institute of Geology, National University of Mexico, Apartado 70-296, Mexico DF 094510, (905) 548-87-47; Gerardo J. Aguirre, University of Texas, Austin; Claus Siebe, Arizona State University. Cost: \$265 (4 ON, 4 B, 3 L, 4 D). (With optional airfare from Mexico City to San Diego, \$447.) Trip begins and ends in Mexico City. Limit 24.

The central part of the Trans-Mexican volcanic belt is the most seismically active intraplate region of Mexico. The area is being deformed by numerous normal faults that strike parallel to the axis of the volcanic arc and that cause pronounced scarps

with topographic relief up to 300 m. This trip will examine the structural surface expression of several active faults in the states of Michoacan and Mexico as well as transfer zones between faults. We will discuss the deformation history of some faults, their historic and instrumental seismic record, a proposed regional segmentation based on structural and seismic along-strike discontinuities, as well as regional stress data based on fault striations, focal mechanisms, and alignment of Quaternary cinder cones. We will visit the well-preserved Amealco volcanic center with its 11-km-diameter caldera. The most important product from this caldera is a trachyandesitic to trachydacitic pyroclastic sequence (Amealco Tuff). Stops are planned at rim lava domes, proximal and distal facies of the Amealco Tuff, and at cinder cones that occur adjacent to the caldera. The Jocotitlan composite volcano, which recently has been shown to have been active in historic time, will also be visited.

**16. Ground-Water Basins Along the Eastern Sierra Nevada: Tectonics, Water, and Politics**

Thursday, October 17 through Sunday, October 20. Wesley R. Danskin, U.S. Geological Survey, WRD, 5735 Kearny Villa Road, Suite O, San Diego, CA 92123, (619) 557-6700; Christopher D. Farrar, U.S. Geological Survey, Santa Rosa, California; Shirley J. Dreiss, University of California, Santa Cruz. Cost: \$280 (3 ON, 3 L). Trip begins in Reno. Limit 44.

Mono Basin, Long Valley, and Owens Valley, ground-water basins along the eastern edge of the Sierra Nevada, are typified by active tectonism, recent volcanism (<600 yr B.P.), extensive use of water resources, and continuing political debate. Stops on this three-day field trip include Mono Lake and related tufa formations; Holocene basalt flows, an airfall pumice deposit, and a massive rhyolitic tuff formed by nuees ardentes; a geothermal power plant and thermal springs in Long Valley; juxtaposed glacial and tungsten deposits in the Sierra Nevada; batholithic granite



View to the southwest across the flat-lying Miocene volcanic strata resting with high-relief unconformity on Mesozoic volcanic strata.

and metavolcanic rocks; effects of a magnitude-8 earthquake including a 40-mile-long, 20-foot-high normal-fault scarp; and extensive water-management facilities designed to export water and protect native vegetation in Owens Valley. Discussion will focus on the structure and development of closed-basin depositional systems, the effect of tectonism and volcanism on ground-water resources, and the scientific investigations and political controversies surrounding geologic hazards and water export.

**17. Archaeological Geology of the Point Conception–Vandenberg Areas, California**

Friday, October 18 (evening) through Sunday, October 20. Donald Johnson, Geography Dept., University of Illinois, Urbana, IL 61801, (217) 333-0589; Michael Glassow, University of California, Santa Barbara; Kari Graettinger, Gurnee, Illinois. Sponsored by the *Archaeological Geology Division*. Cost: \$160 (2 ON). Trip begins in Santa Barbara. Limit 45.

In addition to evening wine tasting, this trip covers an array of geologic, soil-geomorphologic, and archaeological problems. Geologic highlights include: uplifted marine terraces; Quaternary coastal dune systems; coastal alluvium–intercalated paleosol sequences that contain Santa Rosa Island-type “fire areas”; and dramatically folded and faulted mid-Tertiary diatomaceous rocks (Monterey and Sisquoc Formations). Soil highlights include: both strongly developed and strongly regressed profiles evolved in 10,000-year-old sands; ironstone concretionary pisolitic soils formed in sand with “dispersed” argillic Bt horizons and siliceous rhizocretions in growth positions; C-14 dated ironstone pisoliths and paleosols; and argillibolls with stone-line and artifact-bearing E horizons evolved in terrestrial marine terrace covers. Archaeological highlights include: some of the oldest C-14 dated shell middens in North America; biogenically induced vertical and lateral artifact soil rearrangements; soils with artifact-bearing stone-lines; and examples of rates of pedogenesis constrained by archaeological contexts. The trip covers pristine and beautiful coastal scenery. Time permitting, a one-hour stop will be made at the Santa Barbara Mission enroute to San Diego.

**HALF-DAY MINI TRIPS**  
(held during the meeting)

**18. Geology of San Diego**

Tuesday, October 22 or Wednesday, October 23. Morning or afternoon, both days. Faculty and staff, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-6543. Cost: \$10. Limit: 30 for each trip.

The diverse geologic environments of the greater San Diego area will be viewed from two overlooks. Participants will also have an opportunity to examine outcrops of the Cretaceous Peninsular Ranges batholith and beach exposures of the Eocene and Cretaceous sedimentary sequence.

### 19. **The Downtown San Diego Blob**

Wednesday, October 23 (morning). David Huntley, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-5483; Robert Hawk, City of San Diego; Gary Pischke and Barry Pulver, Groundwater Technology, San Diego, California. Cost: \$5. Limit: 40.

A nine-square-block region of downtown San Diego is underlain by a free-product hydrocarbon plume with up to three feet of apparent thickness. A walking field trip will originate at the San Diego Convention Center and will include the dewatering system of the convention center, a traverse across the plume and the ongoing recovery systems within the plume.

## POSTMEETING

### 20. **Remote Sensing and Planetology at JPL**

Friday, October 25. Ronald G. Blom, Radar Sciences Group, Jet Propulsion Laboratory, MS 300-233, 4800 Oak Grove Dr., Pasadena, CA 91109, (818) 354-4681. Cost: \$25. Limit: 45.

This trip will visit the Jet Propulsion Laboratory, where spacecraft for planetary exploration (including Earth) are designed, built, and operated. In addition to an overview of the laboratory facilities and its history, this trip will emphasize items of interest to geologists, including the Magellan mission and resultant images of Venus, advanced airborne scanners for geologic applications, image processing, and other advanced data-analysis methods.

### 21. **The Catalina Schist: Metamorphic and Fluid-flow Processes in a Paleo-Subduction Zone**

Friday, October 25 through Sunday, October 27. Sorena S. Sorensen, Dept. of Mineral Sciences, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, (202) 357-4010; Gray E. Bebout, Geophysical Laboratory, Washington, D.C.; Mark D. Barton, University of Arizona. Cost: \$325 (2 ON, 2 B, 3 L, 2 D). Limit: 28.

The Catalina Schist provides a view of deep-seated metamorphic and metasomatic processes in a paleo-subduction zone. It consists of an inverted metamorphic sequence: a nappe of blueschist facies rocks overlain by high-pressure greenschist facies assemblages and structurally highest amphibolite facies rocks. Petrologic, structural, and geochronologic studies suggest that the Catalina Schist represents mafic, sedimentary, and ultramafic rocks that were underplated during the initiation of an Early Cretaceous subduction zone and metamorphosed at 15 to 45 km depth. The diverse rocks of all three units are well exposed in the canyons and sea cliffs of picturesque Catalina Island, the type area for the Catalina Schist. This trip will emphasize the subduction-related processes recorded in the Catalina Schist. Outcrops in the blueschist and greenschist units that display complex veining relations, metasomatic alteration, and metamorphic overprinting will be visited. In the amphibolite unit, evidence for migmatization, formation of an ultra-

mafic melange matrix, and high-temperature metasomatism will be examined.

### 22. **A Petrologic and Structural Transect Across the Peninsular Ranges Batholith, Southern California**

Friday, October 25 through Sunday, October 27. Michael J. Walawender, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-6543; Gary H. Girty and Marc Lombardi, San Diego State University. Cost: \$260 (2 ON, 2 B, 3 L, 2 D). Limit: 30.

The Peninsular Ranges batholith of southern and Baja California averages about 100 km in width and exhibits a structural and lithologic asymmetry that can be traced along its strike length of approximately 1000 km. This field trip will cut across the structural grain of the batholith at the latitude of San Diego and examine its lithologic, structural, isotopic, geochronologic, and geochemical variations. Recent studies and as yet unpublished data

### 23. **Zoned Plutons of the Eastern Peninsular Ranges, Baja California Norte**

Friday, October 25 and Saturday, October 26 or Friday, October 25 through Tuesday, October 29. R. Gordon Gastil, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-6211; Joan Kimbrough, San Diego State University; Susan Gunn, U.S. Geological Survey, Menlo Park, California. Cost: \$145 (2 days only: 1 ON, 1 B, 2 L, 1 D) or \$360 (all 5 days: 4 ON, 4 B, 5 L, 4 D). Limit: 21 (2 days) or 14 (5 days).

This field trip will examine the large, zoned plutons of the eastern Peninsular Ranges. Participants will have a choice of a two-day or a five-day excursion. The first two days will focus on the reversely zoned El Topo pluton (hornblende-biotite tonalite core to garnetiferous, two-mica monzogranite rim) and the normally zoned Laguna Juarez pluton (hornblende-biotite tonalite rim to two-mica monzogranite core). Additional stops in older and younger peraluminous granitic rocks, synplutonic dikes,

Busby-Spera and Douglas Smith, University of California, Santa Barbara; Richard Sedlock, Northwestern University, Evanston, Illinois. Cost: \$510 (3 ON, 3 B, 4 L, 3 D, airfare, boat transportation). Limit: 25.

Mesozoic ophiolite, volcanic arc, and subduction complex terranes are superbly exposed on Cedros Island in the Pacific borderland region of Baja California. Trip participants to this rugged, remote desert-island setting will see a broad array of features related to Mesozoic convergence along the western Cordilleran margin. Middle Jurassic ophiolite and volcanic-arc basement substrates are depositionally overlain by weakly metamorphosed, structurally intact stratigraphic sequences that provide an unusually clear record of arc magmatism, tectonics, and sedimentation. Rocks that correlate with parts of the Franciscan Complex of California include spectacular melanges and coarsely crystalline blueschist-facies metamorphic rocks. Structural relations between Franciscan and volcanic arc assemblages will also be



*Red barrel cactus.*

will be integrated into a coherent picture of the origin and evolution of this calcic batholith. Day one will focus on the older (130–104 Ma) tonalite, granodiorite, and gabbro plutons in the western zone and will include one moderate hike through a gabbroic complex. On day two, we will examine the older (165 Ma), strongly deformed rocks of the Cuyamaca–Laguna Mountain shear zone and cross into the eastern zone to examine the western half of the undeformed 94 Ma La Posta pluton. A moderate hike through a sillimanite-grade metasedimentary screen and a visit to a working pegmatite mine are also planned. Day three will cover the eastern side of the La Posta pluton and the 89–93 Ma S-type plutons associated with migmatitic pelitic and calc-silicate screens. The field trip will end at coastal outcrops recording the unroofing and deep erosion of the Peninsular Ranges batholith.

and enclave zones are also planned. Participants in the five-day trip will continue south to the Sierra San Pedro Martir pluton (hornblende-biotite tonalite rim to two-mica granodiorite core). Unlike the El Topo and Laguna Juarez plutons, which are magnetite-free, the Sierra San Pedro Martir pluton has both magnetite-free and magnetite-bearing zones. This phenomenon, as well as the origin of magnetite in contact zones, dark enclaves, and synplutonic dikes will be considered. Participants should bring their own sleeping gear and be prepared to camp.

### 24. **Mesozoic Geology of Cedros Island, Baja California, Mexico**

Friday, October 25 through Monday, October 28. David L. Kimbrough, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-1385; Cathy

examined and evidence for extensional faulting reviewed. An evening slide show and discussion for the first night on the island will preview the field plan for the following three days. The trip will involve the use of small boats, moderately strenuous hiking and camping out. Participants should bring their own sleeping gear.

### 25. **Eocene Depositional Systems in San Diego**

Friday, October 25 and Saturday, October 26. Patrick L. Abbott, Dept. of Geological Sciences, San Diego State University, San Diego, CA 92182, (619) 594-5591; Jeff May, Marathon Oil, Littleton, Colorado; John Warne, Colorado School of Mines, Golden; Martin Link, Mobil Research & Development Corp., Dallas, Texas; John Lohmar, Exxon, USA, Thousand Oaks, California; Scott Morgan, Exxon Production and Research, Houston, Texas; Tor Nilsen, San Carlos,



California. Sponsored by the *Sedimentology Division*. Cost: \$140 (1 ON, 2 B, 2 L, 1 D). Limit: 40.

Day one will be a dip-oriented traverse from Eocene fluvial channel deposits incised into Cretaceous strata and the Peninsular Ranges batholith to the apex of the massive alluvial fan down through distal parts to marine facies at Tourmaline Beach. Discussions will concentrate on facies geometry and provenance of the far-traveled exotic rhyolite clasts of the Poway conglomerate and depositional environments. Day one will conclude with Solana Beach cliff exposures of paralic facies that beautifully expose physical and biogenic sedimentary structures. Day two will be a 7 km beach walk devoted to a careful inspection of the world-class outcrop exposed from Torrey Pines State Reserve to the Scripps Institution of Oceanography. This 100-m-high oblique-dip section exhibits lagoonal and tidal deposits that are truncated by erosional unconformities and overlain by an interpreted incised-valley fill and a superbly displayed submarine-canyon system. Discussions will center on the lateral and vertical facies relations and their genetic significance within a sequence-stratigraphic framework.

**26. Landslides in the Peninsular Ranges, Southern California**

Friday, October 25 and Saturday, October 26. Michael W. Hart, Gecon Inc., 6960 Flanders Dr., San Diego, CA 92121, (619) 558-6900. Cost: \$190 (1 ON, 2 L, 1 D). Limit: 20.

This field trip will examine landslides in the crystalline terranes of San Diego and Riverside Counties, California. An opportunity for observing the structure and stratigraphy of large debris flows, rock avalanches, and complex landslides will be provided as we visit four classic landslide locations. On the first day, we will examine a complete section through a Pleistocene long-run-out rock avalanche and a complex landslide in the Anza-Borrego Desert. During the second day, we will examine evidence for another long-run-out landslide on Palomar Mountain and a two-mile-wide series of complex slides near Vail Lake in southern Riverside County. If time permits, we will stop along I-15 to view an ancient wedge-slide in quartz monzonite.

**27. Geologic Structure, Transpression, and Neotectonics of the San Andreas Fault in the Salton Trough, California**

Thursday, October 24 through Saturday, October 26. Arthur Sylvester, Dept. of Geological Sciences, University of California, Santa Barbara, CA 93106, (805) 961-3156; Michael Rymer, U.S. Geological Survey, Menlo Park, California. Cost: \$230 (2 ON, 2 L). Limit: 45.

This popular trip, which is one of the DNAG Cordilleran trips, features the remarkable geologic structure of the Mecca Hills, with their deeply dissected, vegetation-free badlands cut into colorful Proterozoic gneiss and migmatite, Mesozoic schist, and late Tertiary alluvial fan, fluvial, and lacustrine strata. Transpression associated with right slip along the San Andreas fault has produced a long, narrow zone of tight

folde and numerous faults that constitute a tectonic welt and topographic barrier to sediment transport along the northeast edge of the Salton Trough. Offset stream courses, scarps, uplifted fluvial terraces, interpretations of trench exposures, and a few earthquakes attest to the currently active nature of the fault in this area. The first day of the field trip makes two traverses across the hills to become familiar with the stratigraphy, facies changes, and natures of fault exposures in Box Canyon, and then it proceeds into Painted Canyon for a detailed cross-sectional study of the palm-tree structural style of the main deformation zone. The second day focuses on the late Quaternary structural development and constraints on recent displacements along the fault as revealed in Thermal Canyon, where nonmarine strata contain the Bishop Tuff of Quaternary age. This informative trip is a spectacular one intended for students of structural geology, geophysics, tectonic sedimentology, and geomorphology.

**28. Late Cenozoic Sedimentation and Tectonics Along the Western Margin of the Salton Trough, California**

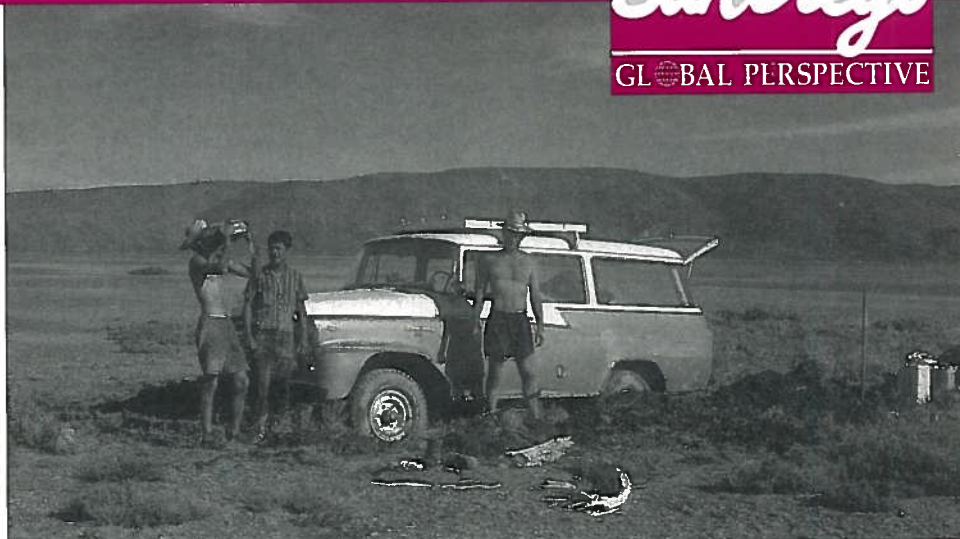
Friday, October 25 through Sunday, October 27. Dennis Kerr, Dept. of Geosciences, University of Tulsa, 600 S. College Ave., Tulsa, OK 74104, (918) 631-2517; Charles Winker, Shell Development Co., Houston, Texas; Susan Kidwell, University of Chicago. Cost: \$275 (2 ON, 2 B, 3 L, 2 D). Limit: 24.

Participants will survey spectacular outcrops in the beautiful, rugged back-country of the Anza-Borrego Desert State Park and environs. Here, late Cenozoic age strata reveal an excellent record of the early history of rift and rift-transform systems. Early to middle Miocene extensional tectonics and late Miocene to Holocene transtensional tectonics are recorded in the distribution of sedimentary facies, paleodispersal patterns, unconformities, and structural configurations. A wide variety of sedimentary facies will be examined, including braided alluvial, alluvial fan, fan delta, nearshore, open-marine, Colorado River delta, and more. Implications for the late Cenozoic geological and paleobiological evolution of the Gulf of California will be discussed throughout the trip. Many stops require hiking over difficult terrain, so that appropriate physical condition, footwear, and field gear are required.

**29. A Hydrogeologic Overview of the Regional Ground-Water Flow System in Relation to Yucca Mountain, Nevada**

Friday, October 25 through Sunday, October 27. Devin Galloway, U.S. Geological Survey, 2800 Cottage Way, Room W-2234 Federal Building, Sacramento, CA 95825, (916) 978-4648; Elisabeth Ervin, Michael Chornack, and Alan Riggs, U.S. Geological Survey, Sacramento, California. Cost: \$180 (3 ON, 3 L, 1 D). (With optional airfare from Las Vegas to San Diego, \$258.) Trip begins and ends in Las Vegas. Limit: 20. *Limited to U.S. citizens.*

This field trip will focus on hydrogeology of the Ash Meadows



*Stuck. Baja California Norte.*

and Alkali Flat-Furnace Creek Ranch ground-water subbasins that compose the major part of the regional ground-water flow system for the Yucca Mountain area. Yucca Mountain, located about 160 km northwest of Las Vegas, Nevada, is being evaluated as a potential site for commercially generated high-level radioactive waste. On the first day we will visit the regional recharge area and stop at Pahute Mesa and the Timber Mountain-Oasis Valley caldera complex. The second day focuses on the hydrogeology of the fractured ash-flow and ash-fall rhyolitic tuffs in the Yucca Mountain area, where stops will identify many of the key stratigraphic and structural features controlling unsaturated and saturated fluid flow. The final day includes stops at regional discharge locations near the Amargosa Desert and Death Valley. Additional stops will be made at Franklin Lake playa, the principal discharge area for ground water flowing beneath Yucca Mountain, and at Furnace Creek Wash, the location of paleo-spring mounds and calcite veins. The final stop will be near Furnace Creek Ranch in Death Valley National Park where springs discharge water several hundred meters above the valley floor.

**30. Low-Angle Detachment Faulting and Rapid Uplift of Mid-Crustal Mylonitic Rocks in the Whipple Mountain Metamorphic Core Complex**

Thursday, October 24 through Sunday, October 27. Gregory A. Davis, Dept. of Geological Sciences, University of Southern California, University Park, CA 90089-0740, (213) 743-6126; Lawford Anderson, University of Southern California. Cost: \$245 (3 ON, 3 B, 3 L). Limit: 35.

The geologically spectacular Whipple Mountain metamorphic core complex is one of the best exposed and most thoroughly studied of the Cordilleran core complexes. Profound Miocene crustal extension in the range is characterized by a regionally extensive, shallow dipping normal (= detachment) fault system with displacements of tens of kilometers, and by highly extended upper-plate rocks. Lower-plate rocks include a several-kilometers-thick, mid-crustal zone of ductile shear (= Tertiary mylonitic gneisses), and a Cretaceous suite of deep, unusually calcic peraluminous plutons. We will study these features and discuss in the field structural and petrologic evidence for rapid uplift of footwall rock assemblages. Participants should be prepared for

moderately long hikes (about 10 km roundtrip) on two successive days.

**SEG-Sponsored Field Trips**

**Final registration deadline for SEG Field Trips is August 20, 1991.** To reserve a place, send a deposit of \$50 per person per trip payable to "Society of Economic Geologists, Inc." Send payment to Michael A. McKibben, SEG Program & Field Trip Chairman, Dept. of Earth Sciences-036, University of California, Riverside, CA 92521-0423, (714) 787-3444, or fax 714-787-4324.

**Industrial Mineral Deposits of the Mojave Desert.** Thursday, October 17 (afternoon) through Saturday, October 19 (evening). Thomas P. Anderson, California Division of Mines and Geology, 3231 Ocean Park Blvd., Suite 204, Santa Monica, CA 90405, (213) 396-8051. Cost: \$225 (2 ON, all meals). Limit: 40.

A 2-1/2 day trip to major industrial mineral deposits of the Mojave Desert, with stops at Searles Lake brine operations (soda ash), Boron mine (borates), Hector mine (lithium smectite), and Gillebrand mine (anorthosite-hosted ilmenite).

**Active and Fossil Rhyolite-hosted Epithermal Systems.**

Thursday, October 17 (noon) through Saturday, October 19 (evening). Alan E. Williams, Dept. of Earth Sciences, University of California, Riverside, CA 92521, (714) 787-4611. Cost: \$225 (2 ON, all meals). Limit: 40.

A 2-1/2 day trip to study the geology of both active and fossil rhyolite-hosted epithermal systems, including stops at Coso Hot Springs (active geothermal system) and Cactus Queen mine (vein and disseminated gold deposit).

**Active and Fossil Hydrothermal Mineralization in the Salton Trough Rift.**

Thursday, October 24 (afternoon) through Saturday, October 26 (evening). Michael McKibben, Dept. of Earth Sciences, University of California, Riverside, CA 92521, (714) 787-3444. Cost: \$225 (2 ON, all meals). Limit: 40.

A two-day trip to examine the geology of active and fossil hydrothermal mineralization in the Salton trough, an active continental rift zone. Included will be stops at Salton Sea geothermal field (active metalliferous hydrothermal system), Modoc deposit (Pleistocene hot springs-type gold deposit with sinters, stockwork veining, and acid alteration), and Mesquite mine (Tertiary disseminated bulk-mineable gold deposit in gneiss).

## LODGING

Tight budget? We're on your side. We've gotten the best possible rates for October including discounts of 30% or more. GSA has blocked rooms at 12 downtown hotels that are offering special convention rates to GSA meeting attendees. These properties include a good cross section of lodging that should appeal to almost everyone's budget and taste. All meet GSA's standards for rate reliability, cleanliness, service, and location. The GSA shuttle will

not be servicing all 12 downtown hotels. Please refer to the shuttle information on page 179 or the individual hotel descriptions.

**The most outstanding property in the resort class is GSA's headquarters, the Marriott Hotel & Marina, which is truly an impressive property. Immediately adjacent to the Convention Center and Seaport Village, it offers first-class services, dining, and a resort atmosphere right on San Diego Bay. A good value.**

Over and above the 1000 rooms at the Marriott, there are 700 single rooms priced between \$70 and \$85, and 425 single rooms between \$50

and \$69. There is an excellent set of options within this group, including four-star properties and basic motels.

**Student Housing.** GSA has also negotiated convention rates with eight downtown and nearby Travelodge properties. These properties offer the least expensive rate in the GSA block. *They will not be serviced by the GSA shuttle service,* although some of these properties are near the GSA shuttle pick-ups or the San Diego trolley. You may need to provide your own transportation, but none of the properties are more than six miles from the convention center.

## TO MAKE YOUR HOTEL RESERVATION

Fill out the Official Housing Request Form and *either* (1) mail it, or (2) fax it to the San Diego Housing Bureau. Please refer to the address and fax number shown on the Housing Request Form. All reservations must be RECEIVED BY FRIDAY, SEPTEMBER 27. *Do NOT send your Housing Form in after you have faxed it.* This will result in a duplicate reservation.

AFTER FRIDAY, SEPTEMBER 27, you should contact the GSA hotel of your choice directly. Note that many hotels will be filled at this time, and hotels will only be able to offer the special GSA rate on an as-available basis. Under no circumstance should they be offering a room at a higher rate. If you are interested in a suite, please call the hotel of your choice *directly*. The San Diego Housing Bureau will NOT be handling suite arrangements.

## ASSIGNMENT

Hotel rooms will be assigned on a first-come, first-served basis as they are received by the Housing Bureau. *Please list your top four choices in priority order.* Remember to include the hotel code on the Housing Form with the hotel name. Once your request is received, the Bureau will send an acknowledgment to both you and to your assigned hotel.

You will then receive a confirmation from the hotel. This is a notice that the hotel received the information from the Bureau and that the reservation has been entered into their system. Please check it carefully.

## ROOM DEPOSITS/GUARANTEES

All GSA hotels require a first night's room deposit. Deposits can be made by (1) providing credit card information on the housing form, or (2) sending payment directly to the hotel once you have received your confirmation. The deposit amount should be the cost of one night's stay plus 9% tax at your assigned hotel. Note that the Housing Bureau will accept ONLY credit cards (American Express, VISA, MasterCard, Carte Blanche, or Diners Club), *not* checks or cash. When making payment directly to the hotel, be sure to give your confirmed reservation number. *Please note that the Marriott requires a credit card guarantee at the time you make your reservation.*

Once the hotel receives your deposit, it automatically guarantees your reservation. The guarantee assures you that no matter what time you arrive on your scheduled arrival day, your room will be held until at least midnight.

## CHANGES AND CANCELLATIONS

Changes and cancellations **BEFORE** the SEPTEMBER 27 deadline should be communicated to the Housing Bureau, either by phone (619) 239-0271, fax 619-595-0216, or mail. Please supply your confirmed hotel reservation number for any change or cancellation. **AFTER** the SEPTEMBER 27 deadline, please contact the hotel directly with any changes.

## GSA OFFICIAL HOUSING REQUEST FORM

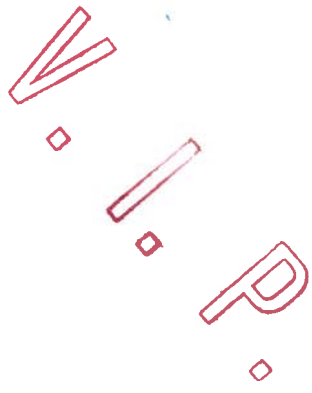
Your Housing Request Form must be received BY FRIDAY, SEPTEMBER 27. Please complete and either:

1) **Mail to:** GSA Convention Housing  
San Diego Convention & Visitors Bureau  
1200 Third Avenue, Suite 824  
San Diego, CA 92101

or

2) **Fax to:** San Diego Convention & Visitors Bureau/GSA Housing  
1-619-595-0216

For changes and information call the San Diego Housing Bureau at (619) 239-0271.



### HOTEL PREFERENCE: (Please print or type all information below)

Hotel Code #	Hotel Name
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

### TYPE OF ACCOMMODATION NEEDED:

<input type="checkbox"/> Single (1 person, 1 bed)	<input type="checkbox"/> 1 additional person	(For suites, call the hotel)
<input type="checkbox"/> Double (2 persons, 1 bed)	<input type="checkbox"/> 2 additional persons	
<input type="checkbox"/> Double/Double (2 persons, 2 beds)	<input type="checkbox"/> Add rollaway	

Rate requested \$ \_\_\_\_\_ (NOTE: All rooms are subject to 9% tax)

ARRIVAL DAY/DATE \_\_\_\_\_ TIME \_\_\_\_\_ a.m./p.m.

DEPARTURE DAY/DATE \_\_\_\_\_ TIME \_\_\_\_\_ a.m./p.m.

### NAMES OF OCCUPANTS:

1. _____	3. _____
2. _____	4. _____

### MAIL CONFIRMATION TO:

Name \_\_\_\_\_ Telephone ( \_\_\_\_\_ ) \_\_\_\_\_  
 Address \_\_\_\_\_ City \_\_\_\_\_  
 State \_\_\_\_\_ ZIP \_\_\_\_\_ Country \_\_\_\_\_

### GUARANTEED ROOM RESERVATION AUTHORIZATION:

All GSA hotels require a first night's deposit to make a reservation. I understand that the hotel may bill me for one night's housing if I fail to properly cancel a guaranteed reservation. Please check one:

- Credit card information is provided below to guarantee my reservation.  
 My guarantee will be made directly to the hotel after I receive my hotel confirmation.  
 (This is *not* an option at the Marriott. The Marriott requires a guarantee when you *make* your reservation.)

Please guarantee my room reservation with the following:

American Express  MasterCard  VISA  Carte Blanche  Diners Club

NAME (as listed on credit card) \_\_\_\_\_

SIGNATURE \_\_\_\_\_

CARD NUMBER \_\_\_\_\_ EXP. DATE \_\_\_\_\_

**\*\*\* PLEASE DO NOT SEND CHECKS OR CASH WITH THIS FORM \*\*\***

Please note that a cancellation notice must be received AT LEAST 48 HOURS in advance to receive a full refund on your first night's room deposit. Please show courtesy as a professional by notifying the hotel if your plans change.

### ALTERNATIVE HOUSING

Beating the high cost of housing is a priority of GSA staff and the 1991 Local Committee. Here are some alternatives:

- Check your library copy of the Hotel and Motel Redbook, which lists metro properties. Because of the hundreds of properties in the area (some good, some bad), GSA does not provide a general list.

- Call 1-800-555-1212 or check the Yellow Pages to learn the 800 number for your favorite hotel chains, such as Motel 8 or Comfort Inns, which have properties outside the downtown area.
- Consider camping or taking the trolley to/from nearby El Cajon. The Annual Meeting Committee has researched low-cost alternatives, including camping or other motels south of San Diego. Tent and RV campgrounds are available near the San Diego County foothills or on Mission Bay. Advance reservations are required, and nightly fees range from \$16 to \$30. For additional information, contact Vanessa George, GSA Meetings Coordinator.

### 1991 GSA HOTEL CONVENTION RATES



HOTEL NAME (HOTEL CODE)	1 person 1 bed	2 people 1 or 2 beds	3 people 2 beds	4 people 2 beds
SAN DIEGO MARRIOTT (117)* (1991 Headquarters)	\$125	\$139	\$159	\$179
RAMADA HOTEL DOWNTOWN (116)	\$ 80	\$ 80	\$ 80	\$ 80
HORTON GRAND HOTEL (108)	\$ 79	\$ 89	\$ 99	\$109
OMNI SAN DIEGO HOTEL (114)	\$ 95	\$115	\$125	\$135
KINGSTON HOTEL (105)	\$ 76	\$ 83	\$ 98	\$113
THE PAN PACIFIC HOTEL (104)	\$ 73	\$ 73	\$ 88	\$103
HOLIDAY INN ON THE BAY (106)*	\$ 85	\$ 95	\$105	\$115
BEST WESTERN BAYSIDE INN (101)	\$ 50	\$ 60	\$ 60	\$ 60
RADISSON HOTEL HARBOR VIEW (119)	\$ 69	\$ 69	\$ 69	\$ 69
HOLIDAY INN HARBOR VIEW (107)	\$ 65	\$ 75	\$ 75	\$ 75
HOWARD JOHNSON HOTEL (111)	\$ 61	\$ 61	\$ 66	\$ 71
COMFORT INN—DOWNTOWN (123)	\$ 50	\$ 50	\$ 55	\$ 60
TRAVELODGE (8 locations)	\$ 45	\$ 45	\$ 45	\$ 45

(\*Additional \$10 for a guaranteed bay view)

### DOWNTOWN SAN DIEGO

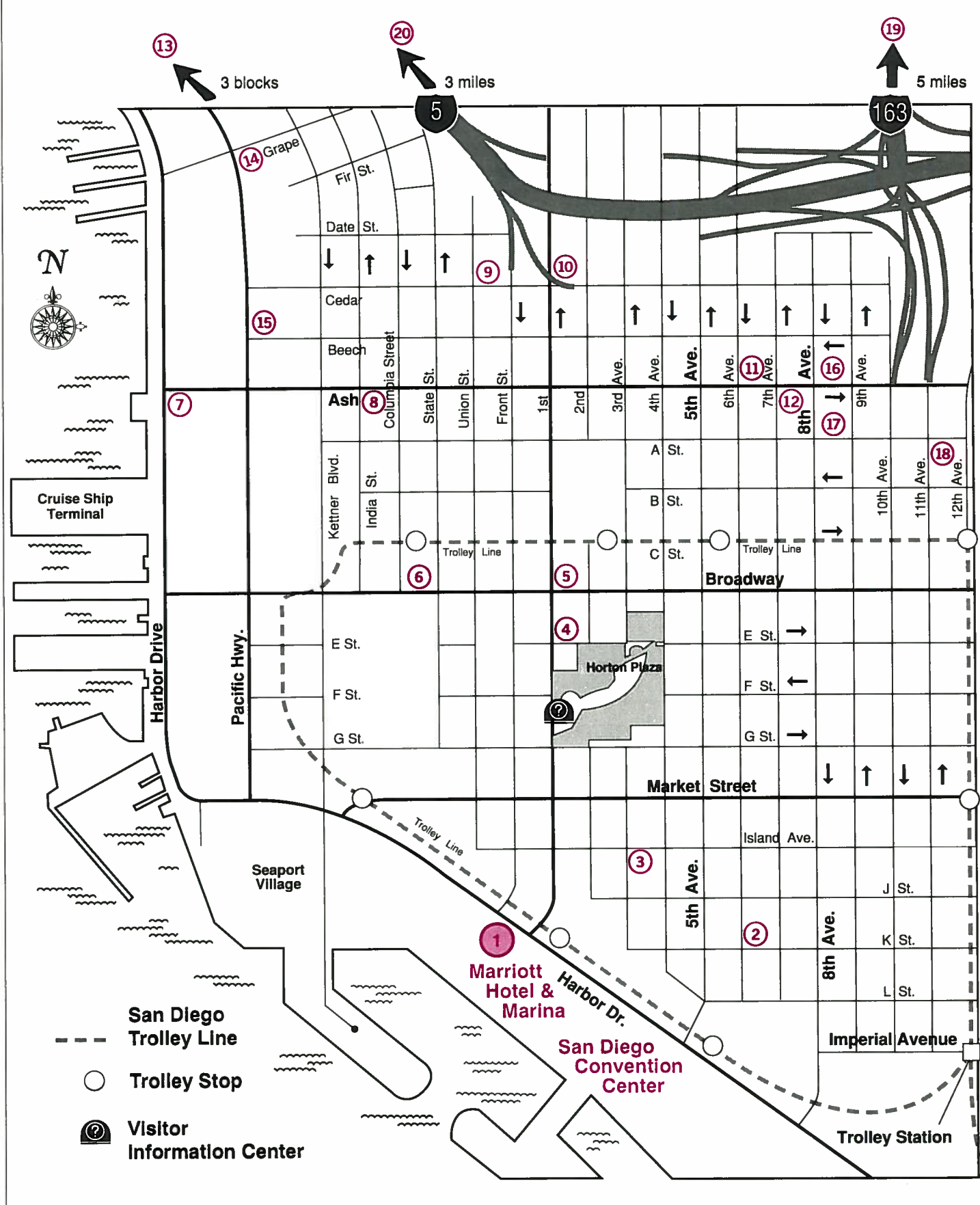
#### HOELS (Hotel Code)

 GSA Shuttle Stop

1. Marriott Hotel & Marina (117)
  2. Ramada Hotel Downtown (116)
  3. Horton Grand Hotel (108)
  4. Omni San Diego Hotel (114) 
  5. Kingston Hotel (105) 
  6. The Pan Pacific Hotel (104) 
  7. Holiday Inn on the Bay (106) 
  8. Best Western Bayside Inn (101) 
  9. Radisson Hotel Harbor View (119) 
  10. Holiday Inn Harbor View (107)
  11. Howard Johnson Hotel—Balboa Park (111) 
  12. Comfort Inn—Downtown (123)
- Travelodges—Student Properties**
13. San Diego Airport Travelodge (124)
  14. San Diego Bayview Travelodge (125)
  15. Civic Center Travelodge (126)
  16. San Diego Balboa Park (127)
  17. San Diego Cabrillo Central (128)
  18. At the Zoo Travelodge (129)
  19. Mission Valley Center (416)
  20. Old Town Travelodge (428)

#### PARKING

Convention Center public parking is available on the Fifth Street side under the Convention Center. A special \$4 rate, with no in and out privileges, will be available during the meeting, Monday through Thursday. Other days the cost will be \$1 per hour. A special exhibitor rate of \$6 per day will allow in and out access during move in, move-out, and show days. Please identify yourself as an exhibitor at the gate to qualify for this rate.



## HOTEL LISTING

Please make your reservation with the San Diego Housing Bureau.

All hotel names are followed by a hotel code number. This code is required on the official housing form. Please note that all rooms are subject to 9% occupancy tax, and all hotels require a first night's deposit.



GSA shuttle stop

### 1 SAN DIEGO MARRIOTT HOTEL & MARINA (117) (1991 headquarters)

333 W. Harbor Drive, San Diego, CA 92101  
(619) 234-1500 (1000-room block)  
0 blocks from the Convention Center

Besides being the most convenient hotel to the Convention Center, it is also the finest major hotel in downtown San Diego. Located on the bay, the hotel features four restaurants for casual to elegant dining, two lounges offering cocktails and a beautiful view, and 24-hour room service. Recreational facilities include a serpentine outdoor pool and spa with fountains, rooftop tennis courts, complete fitness center, and more. Concierge, laundry, valet service, and gift shops. Underground, valet and self-parking start at \$4 per day. A guaranteed spectacular bay view is \$10 more; otherwise, your chances are 50/50. For this hotel only, a credit card guarantee is required at the time you send in your housing form.

Check-in: 4 p.m. Check-out: 12 noon  
CC: AX,CB,D,DC,MC,V

### 2 RAMADA HOTEL DOWNTOWN (116)

660 "K" Street, San Diego, CA 92101  
(619) 696-0234 (150-room block)  
3 blocks from the Convention Center

Complimentary shuttle service to and from the airport. Parking for hotel guests is \$4 per day. Enjoy the rooftop fitness center, including a spa overlooking San Diego Bay and the scenic skyline. Dine in the full-service restaurant for breakfast, lunch, and dinner, or enjoy the lobby lounge as you listen to light jazz from the baby grand piano.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,DC,MC,V

### 3 HORTON GRAND HOTEL (108)

311 Island Avenue, San Diego, CA 92101  
(619) 544-1886 (100-room block)  
3 blocks from the Convention Center

A 114-room Victorian hotel, built in 1886 and restored in 1986, set in the heart of San Diego's Gaslamp Quarter. All rooms are individually decorated with antiques including draped, queen-sized beds; hand-carved armoires; lace curtains; and cozy gas fireplaces. English afternoon tea is served daily at 2:30 p.m. in the Palace Bar, award-winning Ida Bailey's serves breakfast and dinner with a sunny New Orleans-style courtyard view, and you can enjoy live jazz on weekends.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,E,MC,V

### 4 OMNI SAN DIEGO HOTEL (114)

910 Broadway Circle, San Diego, CA 92101  
(619) 239-2200 (275-room block)  
5 blocks from the Convention Center

Southwestern stucco, pastel hues, brass, and crystal combine to create a special hotel in the heart of downtown. Enjoy one of two restaurants, a quiet lounge, or nightclub, after using the outdoor pool, tennis, and exercise equipment. Immediately out the hotel door is Horton Plaza, a unique shopping, restaurant, and entertainment complex.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,DC,MC,V

### 5 KINGSTON HOTEL (105)

1055 First Avenue, San Diego, CA 92101  
(619) 232-6141 (50-room block)  
11 blocks from the Convention Center

With European corporate style, this hotel offers complimentary continental breakfast and use of a complete health club facility. The hotel is very proud of its intimate Kingston Playhouse Theater, one of San Diego's finest. Meals are served in Malcolm's, the hotel's restaurant and lounge. Enjoy the character in this graciously renovated property.

Check-in: 2 p.m. Check-out: 12 noon CC: AX,MC,V

### 6 THE PAN PACIFIC HOTEL (104)

400 West Broadway, San Diego, CA 92101  
(619) 239-4500 (100-room block)  
9 blocks from the Convention Center

The newest property in downtown San Diego is a beautiful architectural landmark for the city skyline. All rooms feature marble bathroom, refreshment center, separate sitting area, and three phones for your convenience. Enjoy either of the two restaurants or the atrium lounge for cocktails and live music. Health center, complete with pool, spa, sundeck, sauna, massage, exercise equipment, and organized aerobics programs. Concierge service, same-day valet service, and complimentary airport shuttle.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,DC,D,E,MC,V

### 7 HOLIDAY INN ON THE BAY (106)

1355 North Harbor Drive, San Diego, CA 92101  
(619) 232-3861 (250-room block)  
14 blocks from the Convention Center

This is the only property besides the Marriott that is on San Diego Bay. Enjoy a stroll along the harbor and watch the cruise ships come and go. The hotel offers an outdoor pool and jacuzzi, lobby bakery, and lounge. The Holiday Inn has one restaurant that serves breakfast, lunch, and dinner at reasonable prices. You will enjoy the newly remodeled rooms, each having its own private balcony. A guaranteed bay view is \$10 more; otherwise you have a 50/50 chance.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,MC,V

### 8 BEST WESTERN BAYSIDE INN (101)

555 West Ash Street, San Diego, CA 92101  
(619) 233-7500 (75-room block)  
14 blocks from the Convention Center

This 14-story property has pleasant, comfortable rooms with private balconies to enjoy either a bay or city view. Complimentary features include parking, airport shuttle, local calls, HBO, and continental breakfast. Enjoy the pool and spa, full-service restaurant, cocktail lounge, and room service.

Check-in: 2 p.m. Check-out: 12 noon CC: AX,CB,D,DC,MC,V

### 9 RADISSON HOTEL HARBOR VIEW (119)

1646 Front Street, San Diego, CA 92101  
(619) 239-6800 (150-room block)  
14 blocks from the Convention Center

A new property to grace the San Diego skyline, it offers both harbor and city views to take your breath away. Rooms offer rich wood decor, clock radios, and remote cable TV. Enjoy the hotel restaurant, which serves breakfast, lunch and dinner at reasonable prices, or the cocktail lounge. The hotel offers an outdoor pool, jacuzzi, sauna, health club, and complimentary airport shuttle.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,MC,V

### 10 HOLIDAY INN HARBOR VIEW (107)

1617 First Avenue, San Diego, CA 92101  
(619) 239-6171 (75-room block)

14 blocks from the Convention Center. Pick up GSA shuttle at the Radisson.

Directly off Interstate 5, this 16-floor circular hotel affords stunning views of the San Diego harbor and skyline. Enjoy all meals in the casual rooftop restaurant. For relaxation, visit the quiet lounge or enjoy the outdoor pool. Each room has its own coffee maker. The hotel provides free parking to hotel guests.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,MC,V

### 11 HOWARD JOHNSON HOTEL—BALBOA PARK (111)

1430 Seventh Avenue, San Diego, CA 92101  
(619) 696-0911 (75-room block)  
12 blocks from the Convention Center

Located downtown, this hotel offers complimentary continental breakfast daily and free parking.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,E,MC,V

### 12 COMFORT INN—DOWNTOWN (123)

719 Ash Street, San Diego, CA 92101  
(619) 232-2525 (50-room block)

12 blocks from the Convention Center. Pick up GSA shuttle at Howard Johnson.

Located downtown, this hotel offers complimentary continental breakfast daily and free parking.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,E,MC,V

### 13-20 TRAVELODGE (8 locations)

(300-room block)

0-6 miles from the Convention Center

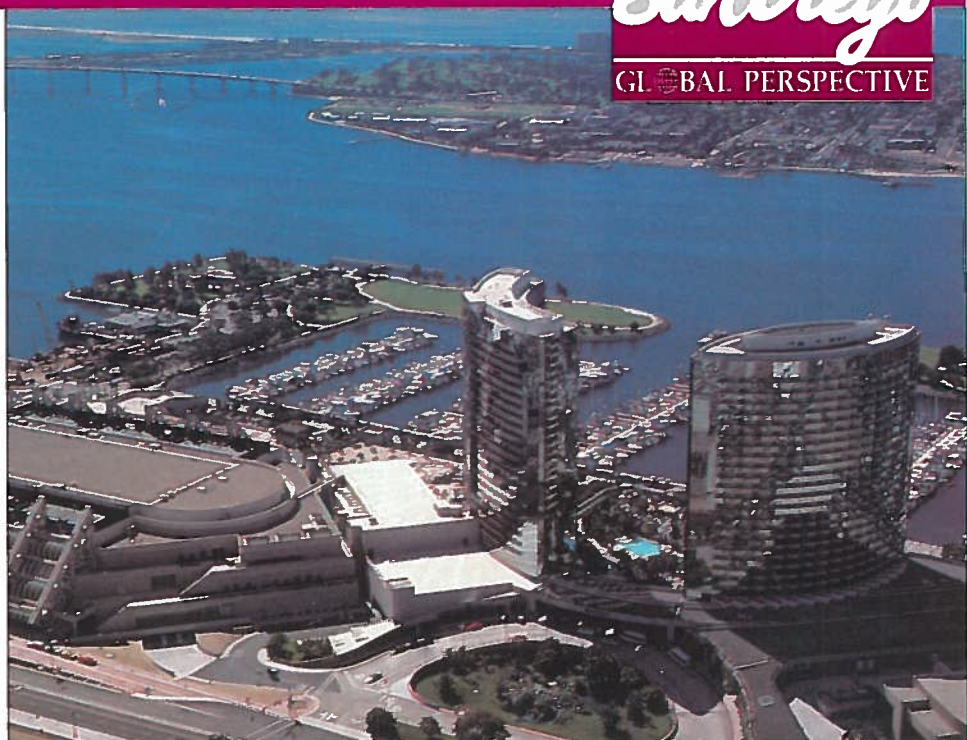
These properties are basic and vary in distance from the Convention Center. If transportation is not a concern, you might choose to enjoy one of the nicer properties indicated by ♦, on page 181. All locations offer complimentary parking, morning coffee, and newspaper in the lobby.

Check-in: 3 p.m. Check-out: 12 noon CC: AX,CB,D,DC,MC,V

Credit Card (CC) Codes: AX—American Express, CB—Carte Blanche, D—Discover, DC—Diners Club, E—Enroute, MC—MasterCard, V—VISA.

Following are the Travelodge properties and their unique characteristics.

- |  |   |
|--|---|
| <p>13. San Diego Airport Travelodge (124)<br/>2353 Pacific Highway<br/>(619) 232-8931<br/>2 miles from Convention Center<br/>60-room block<br/>Notes: free shuttle to airport,<br/>free full continental breakfast</p> <p>14. San Diego Bayview Travelodge (125)<br/>1943 Pacific Highway<br/>(619) 232-7551<br/>1 mile from Convention Center<br/>18-room block</p> <p>15. Civic Center Travelodge (126)<br/>1505 Pacific Highway<br/>(619) 239-9185<br/>1 mile from Convention Center<br/>12-room block</p> <p>16. San Diego Balboa Park (127)<br/>840 Ash Street<br/>(619) 234-8277<br/>1 mile from Convention Center<br/>23-room block</p> | <p>17. San Diego Cabrillo Central (128)<br/>840 A Street<br/>(619) 234-8477<br/>1 mile from Convention Center<br/>22-room block</p> <p>18. At the Zoo Travelodge (129)<br/>1267 Eleventh Avenue<br/>(619) 232-7601<br/>1 mile from Convention Center<br/>20-room block</p> <p>19. Mission Valley Center (416) ♦<br/>1201 Hotel Circle South<br/>(619) 297-2271<br/>6 miles from Convention Center<br/>85-room block. Note: pool</p> <p>20. Old Town Travelodge (428) ♦<br/>2380 Moore Street<br/>(619) 291-9100<br/>4 miles from Convention Center<br/>60-room block<br/>Notes: AAA rated, pool, jacuzzi,<br/>VCR in all rooms, movie rental,<br/>free full continental breakfast</p> |
|--|---|



Marriott Hotel & Marina towers with Convention Center on left.

## TRAVEL

### Getting to San Diego

*By Air.* San Diego International Airport—Lindbergh Field—is one of the few airports to be only 15 convenient minutes from the Convention Center. San Diego is currently served by Aero California, Air Resorts, Alaska Airlines, America West, American, Continental, Delta, Midwest Express, Northwest, Pan American, Sky West, Southwest, States West, Trans World, United, and USAir. Consider staying over Saturday night in San Diego for significant airfare savings.

GSA's official travel agent, Cain Travel Group, has negotiated excellent discounts with the major San Diego carriers. Cain can also assist you with the special discounts and coupon offerings in your area. Call today for the best availability.

To make a reservation, call Cain and identify yourself as a GSA traveler. Tickets can be paid for by check (payable to Cain Travel), by major credit card, or invoiced to your company. Final payment must reach Cain Travel no later than ten days prior to departure to allow for mailing time. All tickets will be mailed via certified mail upon receipt of payment unless requested otherwise. After tickets are issued, you are protected from fare increases; if a fare decreases, call Cain Travel for an adjustment.

As with all airline reservations, please use caution regarding change and cancellation penalties that accompany low-fare tickets. *This especially applies to field trip participants whose trips may be canceled after the September 20 preregistration deadline.* Be sure you understand the restrictions on the type of ticket you purchase.

Cain Travel will have an on-site Customer Service Desk at the San Diego Convention Center.

*By Car.* San Diego is about a 2-1/2-hour drive from downtown Los Angeles via freeway route Interstate 5, which stretches from Canada

to the Mexican border. Interstate 8 serves drivers from Yuma, Arizona, and beyond from the East Coast. Interstate 15 provides access from Nevada, Utah, Idaho, and Montana.

*By Train and Bus.* Amtrak passenger trains provide service to and from Los Angeles. Greyhound and Trailways provide bus service. Call the offices in your area to get the best rates.

### Getting to Your Hotel

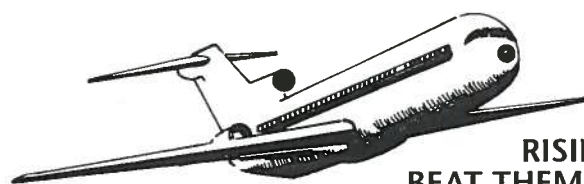
The San Diego International Airport—Lindbergh Field—is four miles from the San Diego Convention Center and the downtown area. Some GSA hotels have free shuttle pick-up, but other transportation options are as follows:

*SuperShuttle.* Operates 24 hours a day, seven days a week. To call SuperShuttle, dial 69 from the Ground Transportation Courtesy Board in the baggage claim area. A reservation agent will then give you instructions on where to board SuperShuttle. Look for the blue and yellow signs and vans. Cost: \$4 to the Marriott, \$6 to other downtown hotels.

From your hotel to the airport, call 24 hours in advance for reservations, (619) 278-8877. For your convenience, SuperShuttle vans are staged at the Marriott Hotel continuously throughout the day. SuperShuttle picks up at all hotels, but a reservation is necessary. Cost: \$4 from the Marriott, \$6 from other downtown hotels.

*Taxis.* Two hundred taxicab companies service the city of San Diego. This adds up to more than 1000 taxis, with the largest fleet belonging to Yellow Cab Company. All vehicles are metered and regulated. Charges are slightly higher from the airport than in the downtown area and range from \$1.20 to \$1.80 for the first mile. Approximate cost from the airport to downtown is \$8.

*Metro Transit System (MTS).* Board the Route 2 bus at the East Terminal of the San Diego Airport, request a transfer from the driver,



RISING AIRFARES?  
BEAT THEM WITH DISCOUNTS!

## Call CAIN TRAVEL GROUP Today

(official travel agency for the San Diego meeting)

Cain offers up to 50% off coach, will meet or beat any fare quote, and will handle at no extra charge the special discount fares advertised in your area.

**1-800-346-4747 toll-free**

(303) 443-2246 collect from outside U.S., 303-443-4485 fax  
8:30 a.m.—5:30 p.m. MDT, Monday–Friday

*You can't lose. Book today. If airfares drop, Cain will automatically reissue your ticket at the lower rate!*

COMPETITIVE RATES, REASONABLE ROUTING  
GREAT SERVICE

and ride to Columbia and Broadway. Disembark and walk across Broadway to the north side of the street and to the bus stop. Here board a Route 7 bus to the Convention Center. In San Diego, call 233-3004 for information. The cost from the airport to downtown is \$1.25.

*Car Rental.* Alamo is the official car rental agency for the meeting. Identify yourself as a GSA delegate by giving Group Identification #85204 and Plan Code G4 to get guaranteed, discounted, daily/weekly rates as follows: economy \$24/\$89; compact \$26/\$109; midsize \$28/\$129; standard \$30/\$149; luxury \$34/\$189. Unlimited mileage. Add \$3 per day for four-door models. Advance reservations are recommended. Call Alamo at 1-800-732-3232.

### Getting Around in San Diego

An excellent freeway system makes travel by car or bus easy throughout the county. San Diego Transit Corporation buses serve the metro area. In San Diego, call the Transit Store, 233-3004, for schedule information.

*San Diego Trolley.* The modern San Diego Trolley provides an excellent, inexpensive service in the downtown area; between downtown and the Mexico border; and to San Diego's East County.

*GSA Shuttle.* GSA will operate a free shuttle service between the downtown GSA hotels and the San Diego Convention Center during meeting hours. (Reminder: the shuttle will not be servicing the student housing motels outside of the downtown area.) Shuttle service will be provided at frequent intervals each day (Sunday, October 20, through Thursday, October 24) beginning at 6:30 a.m. The shuttle will also operate on Sunday, Monday, and Tuesday evenings. Shuttle schedules will be posted in GSA hotel lobbies and in all registration packets.

### FUTURE GSA ANNUAL MEETING SITES

Cincinnati	October 26–29, 1992
Boston	October 25–28, 1993
Seattle	October 24–27, 1994
New Orleans	November 6–9, 1995
Denver	October 28–31, 1996

## EMPLOYMENT SERVICE

Do you need qualified scientists to fill staff needs? Or are you looking for employment in the earth sciences fields? If so, you are invited to participate in the GSA Employment Interview Service that will be conducted in the San Diego Convention Center, Room 1A.

All interested organizations seeking qualified earth scientists to fill staff needs are urged to submit notices of their vacancies and their requests for computer listings of applicants. The minimum fee for a printout of two specialty listings is \$150.

Interview booths may be rented at the meeting for a nominal fee in half-day increments from Monday through Wednesday, October 21 through October 23. GSA staff will handle all interview scheduling with Employment Service applicants.

Many job seekers have found the Employment Interview Service critical to their successful search for positions. The one-year registration fee is \$30 for GSA Members and Student Associates; \$60 for non-members. This applicant fee also includes the interview service at the annual meeting.

Applicants who sign up with the Employment Service by August 15, 1991, will be included in the information that employers receive prior to the meeting. So submit your forms early to receive maximum exposure...and don't forget to indicate on your application form that you would like to interview in October.

Employment Service forms are in the January and July 1991 issues of *GSA Today* or may be obtained by contacting the Membership Services department at GSA headquarters.

### Employment Opportunities in the Geological Sciences Roundtable Discussions

Beginning with the San Diego meeting, the annual forum on employment opportunities in the geosciences is being changed to allow more one-on-one interaction between panel members and individuals or small groups. Each of the experts listed below will conduct his or her own "mini-roundtable discussion" designed to provide a better opportunity to field both general and specific questions on a more personal, individualized basis.

These roundtable discussions will be in the Employment Service area, San Diego Convention Center, Room 1A, on Sunday, October 20, from 12:00 noon to 2:00 p.m. This is during the interview registration time; however, **YOU DO NOT HAVE TO BE SIGNED UP FOR EITHER THE EMPLOYMENT SERVICE OR THE ANNUAL MEETING TO PARTICIPATE IN THESE DISCUSSIONS.** Everyone is encouraged to attend, professionals and students, to talk with as many of the experts as you like and to pick up a free copy of the 1991 booklet on *Future Employment Opportunities in the Geological Sciences*.

Roundtable discussion leaders scheduled are:  
Dick Paull, University of Wisconsin-Madison  
Kathy Duckett, John Mathes & Associates, Columbia, Illinois  
Jon Price, Nevada Bureau of Mines & Geology, Reno  
Bill Greenwood, U.S. Geological Survey, Reston, Virginia  
Norm McIver, Shell Oil Company, Houston, Texas  
Steve Stow, Oak Ridge National Laboratory, Oak Ridge, Tennessee  
For further information contact T. Michael Moreland, Membership Services Manager at GSA headquarters.

## GRADUATE SCHOOL INTERVIEWS

Monday, October 21, through Thursday, October 24  
San Diego Convention Center

Shortcut your search for just the right graduate school program to suit your needs. Come to the San Diego Annual Meeting and meet with your favorite schools without spending the travel time and money to go to each school for interviews. The schools participating are listed below. Schedules will appear in the September issue of *GSA Today* and also the on-site *San Diego Program*.

If you would like to receive a complete list of schools with the contact persons and telephone numbers, so that you can set up an appointment individually or during the scheduled time in San Diego, please write or call Kathy Lynch, GSA Meetings Department.

### Graduate Schools Participating:

Arizona State University  
Brigham Young University  
Brown University  
California State University, Long Beach  
Cornell University  
George Washington University  
Lehigh University  
Louisiana State University  
Miami University  
Northeast Louisiana University  
Northwestern University  
State University New York, Albany  
Teachers College, Columbia University  
Texas A&M University, Dept. of Geology  
Texas A&M University, Dept. of Geophysics  
University of Akron  
University of Alabama  
University of Alaska  
University of Arizona  
University of California, Berkeley  
University of California, Los Angeles  
University of California, Riverside  
University of California, Santa Barbara  
University of Cincinnati  
University of Georgia  
University of Hawaii  
University of Illinois, Urbana-Champaign  
University of Kentucky  
University of Massachusetts  
University of Miami  
University of Missouri, Columbia  
University of Missouri, Kansas City  
University of Nevada, Reno  
University of New Mexico  
University of North Carolina, Chapel Hill  
University of North Carolina, Wilmington  
University of North Dakota  
University of Oklahoma  
University of Ottawa  
University of Pennsylvania  
University of Southern California  
University of South Carolina, Dept. of Geological Sciences

University of South Carolina, Earth Sciences and Resources Institute  
University of Texas, El Paso  
University of Texas, San Antonio  
University of Utah  
University of Vermont  
Utah State University  
Virginia Polytechnic Institute & State University  
Western Washington University

## CONVENIENCE INFORMATION

### INFORMATION/MESSAGES

Friday, October 18, through Thursday, October 24

San Diego Convention Center  
(619) 525-6020  
San Diego Marriott Hotel & Marina  
(619) 234-1500

### NEWS ROOM

Sunday, October 20, through Thursday, October 24  
San Diego Convention Center

The News Room provides information on topics for release to the news media. Please let us know of material that is noteworthy for the science or general press. Also, members of the press may receive complimentary registration with appropriate press credentials. In advance of the meeting, contact Sandra Rush, (303) 443-8489, c/o Communications Dept., GSA headquarters.

### CHILD CARE

Families should consider bringing their children to San Diego because of the variety of family activities in the area. Call Vanessa George, GSA Meetings Coordinator, if you are interested in the options provided:

- A private organization is interested in providing child care. They require a minimum of 12 children (6 weeks to 12 years old) at all times. Participants need to commit by paying in full in advance, with prices from \$8 to \$11 per hour, per child. Call GSA by September 15.
- GSA coordinates a cooperative service in which parents can share child care responsibilities. UNTIL OCTOBER 4, GSA will accept names, addresses, and phone numbers of interested parents. The information will be mailed to everyone who has responded. Participants should contact one another and make arrangements.
- San Diego has several excellent private child-care agencies. Although GSA cannot endorse any of these agencies, we are happy to give out the names and phone numbers.
- GSA will be providing a quiet room for children and parents to relax together at the Convention Center. Please provide your own stroller or playpen.

### CALIFORNIA/SAN DIEGO INFORMATION

State of California, Visitor Packet  
1-800-862-2543

San Diego Visitor Information Center  
11 Horton Plaza, San Diego,  
CA 92101, (619) 236-1212

## REGISTRATION

### JOIN GSA NOW AND SAVE!

If you're planning to attend this year's Annual Meeting—but are not yet a GSA member—now is the time to join! When you do, the \$40 basic dues you pay will equal the \$40 you'll save on the member registration fee for the meeting. It's like joining GSA for free. Even professional registrants who pay the *nonmember* registration fee and apply for membership by March 31, 1992, can take advantage of this opportunity. Simply attach a copy of your meeting registration form to your membership application and submit it to GSA headquarters.

Likewise, students who pay the basic membership dues of \$15 to become a Student Associate will receive a \$20 discount on their Annual Meeting registration. That's better than becoming a GSA Student Associate for free!

The \$40 registration discount for members applies to professional members of GSA or an Associated Society. The Associated Societies that qualify are on the registration form. Save time by joining *before* the meeting... membership applications are available from GSA headquarters. During the meeting, they can be picked up at the Membership Booth in the registration area of the San Diego Convention Center.

### PREREGISTER TODAY! PREREGISTRATION DEADLINE: SEPTEMBER 20

1. There is a 14% savings in registration fees if you register before the preregistration deadline! Advance registration is suggested for many of the special activities because of participation limits. Use the preregistration form provided in this announcement.
2. Badges must be worn for access to ALL activities and shuttle 10:00 a.m. Sunday through 5:00 p.m. Thursday.
3. Registration discounts are given to GSA or Associated Society members. Associated Societies that qualify for this discount are indicated on the registration form. Please indicate your affiliation(s) and member number and register using the member rates.
4. Full payment MUST accompany registration. Unpaid purchase orders are NOT accepted as valid registration. Charge cards are accepted as indicated on preregistration form. Please recheck the charge card number given—errors will delay your registration. The confirmation card will be your receipt for charge card payments. No other receipt will be sent.
5. Register one professional or student per form. Copy the form for your records.
6. Guest registration is required for guests attending guest activities, technical sessions, or the exhibit hall. Guest registrants MUST be accompanied by either a registered professional or student.

7. CURRENT student ID is required to obtain student rates at both the on-site and preregistration counters. Students not carrying a current student ID when they arrive to pick up registration materials will be required to pay the professional fee.

**CANCELLATIONS, CHANGES, REFUNDS**

All requests for registration additions, changes, and cancellations must be made in writing and received by September 27. NO REFUNDS WILL BE MADE ON CANCELLATION NOTICES RECEIVED AFTER THIS DATE. Refunds will be mailed from GSA after the meeting. Refunds for fees paid by credit card will be credited according to the card number on the preregistration form. NO refunds for on-site registration and ticket sales.

**ON-SITE REGISTRATION SCHEDULE**

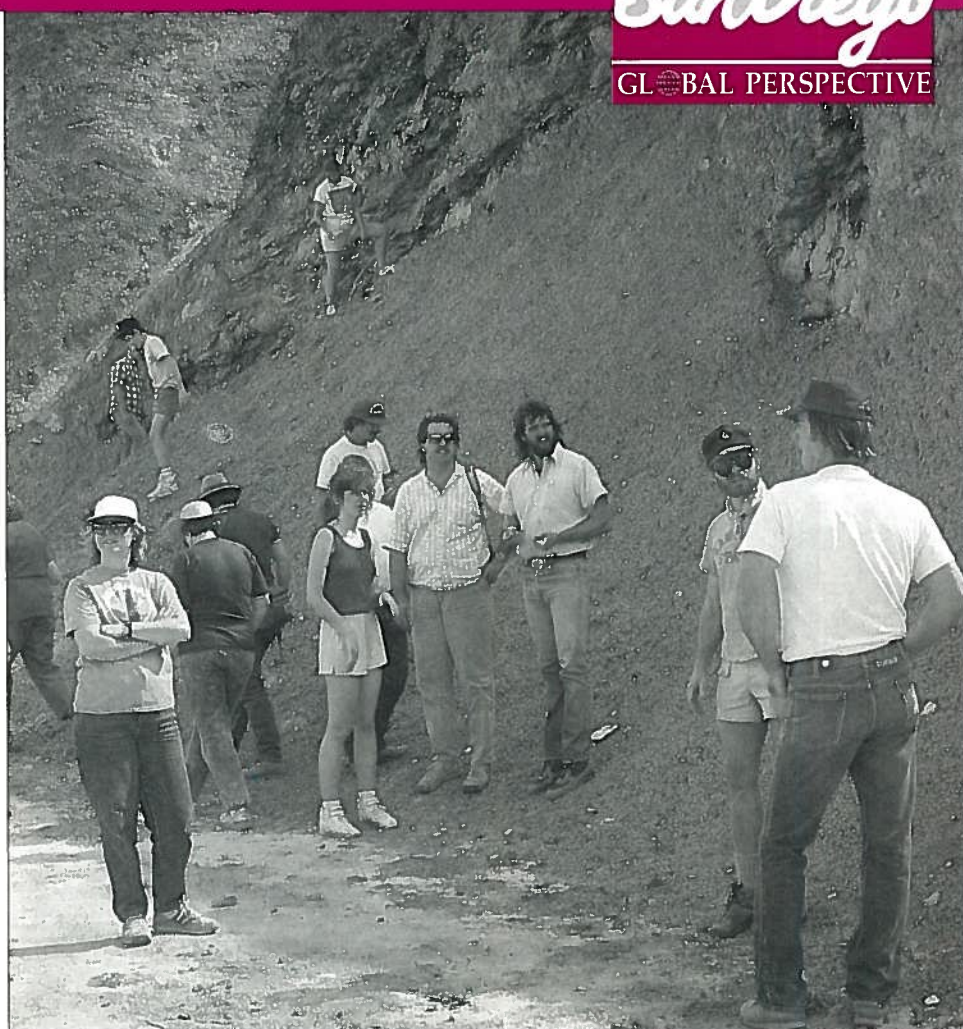
SAN DIEGO CONVENTION CENTER, HALL B

- Friday, October 18  
\* 1:00 p.m. to 5:00 p.m.
- Saturday, October 19  
\* 7:30 a.m. to 2:00 p.m.  
12:00 noon to 2:00 p.m.
- Sunday, October 20  
10:00 a.m. to 7:00 p.m.
- Monday, October 21  
7:30 a.m. to 5:00 p.m.
- Tuesday, October 22  
7:30 a.m. to 4:00 p.m.
- Wednesday, October 23  
7:30 a.m. to 2:00 p.m.
- Thursday, October 24  
7:30 a.m. to 11:30 a.m.

\* PREREGISTRANTS ONLY!

**REGISTRATION FEES**

	Advance (by Sept. 20)	On-Site	One-Day
Professional—Member	\$140	\$160	\$ 80
Professional—Nonmember	\$180	\$200	\$100
Student—Member	\$ 55	\$ 65	\$ 33
Student—Nonmember	\$ 75	\$ 85	\$ 43
Guest	\$ 60	\$ 70	N/A



1990 San Diego State University alumni field trip.

Richard Berry

**PREREGISTRATION FORM** 1991 GSA Annual Meeting  
October 21-24

Please print • Copy for your records • Shaded areas are for your badge.

Name (Last) \_\_\_\_\_ (First) \_\_\_\_\_ Initial \_\_\_\_\_  
 Employer/University/Affiliation (for badge) \_\_\_\_\_  
 Mailing address of affiliation/employer indicated above \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ ZIP code \_\_\_\_\_  
 Country \_\_\_\_\_ Business phone \_\_\_\_\_ Home phone \_\_\_\_\_  
 Guest/Spouse Name (Last) \_\_\_\_\_ (First) \_\_\_\_\_  
 City \_\_\_\_\_ State/Country \_\_\_\_\_

PERSONAL PROFILE (Optional) Please check all that apply:  Male  Female AGE  18-24  25-34  
 EMPLOYED AS  01/Professor/Asst. Professor  02/Teacher/Instructor/TA  35-44  45-54  
 03/Manager/Administrator  04/Government Geologist  55-65  over 65  
 05/Corporate Geologist  06/Other  
 Circle member affiliations: (A) GSA (Member # \_\_\_\_\_) (B) CF (C) GS (D) GIS  
 (E) MSA (F) NAGT (G) PS (H) SEG (I) AWG (J) SGE (K) AGID (L) SVP (M) NESTA

PREREGISTRATION FEES	(Registration required for participation in all exhibits and technical sessions.)		(PLEASE CHECK ONE):		Qty	Column A Amount
	Full 5 Days	or	1 Day			
Professional Member	(1) \$140	<input type="checkbox"/>	(2) \$ 80	<input type="checkbox"/>	1	\$ _____
Professional Nonmember	(3) \$180	<input type="checkbox"/>	(4) \$100	<input type="checkbox"/>	1	\$ _____
Student Member	(5) \$ 55	<input type="checkbox"/>	(6) \$ 33	<input type="checkbox"/>	1	\$ _____
Student Nonmember	(7) \$ 75	<input type="checkbox"/>	(8) \$ 43	<input type="checkbox"/>	1	\$ _____
Guest (fill in name above for badge)	(9) \$ 60	<input type="checkbox"/>	N/A			\$ _____

GUEST ACTIVITIES	Date	Qty	Amount	Total
Wild Animal Park, Adult	Oct. 20	(20)	\$ 33	\$ _____
Wild Animal Park, Child	Oct. 20	(21)	\$ 25	\$ _____
Best of San Diego Tour and Harbor Cruise	Oct. 20	(22)	\$ 23	\$ _____
Tijuana, Mexico Shopping and Lunch	Oct. 21	(23)	\$ 35	\$ _____
Gaslamp Tour and High Tea	Oct. 21	(24)	\$ 20	\$ _____
Zoo Behind-the-Scenes Tour, Adult	Oct. 22	(25)	\$ 35	\$ _____
Zoo Behind-the-Scenes Tour, Child	Oct. 22	(26)	\$ 25	\$ _____
La Jolla Lunch and Shopping	Oct. 22	(27)	\$ 37	\$ _____
Presidio Park and Old Town Lunch, Adult	Oct. 23	(28)	\$ 34	\$ _____
Presidio Park and Old Town Lunch, Child	Oct. 23	(29)	\$ 29	\$ _____

SPECIAL EVENTS*	Date	Qty	Amount	Total
Tennis Tournament	Oct. 20	(40)	\$ 22	\$ _____
Dinner Cruise	Oct. 22	(45)	\$ 38	\$ _____
Beach Party—Dance the Night Away	Oct. 22	(56)	\$ 17	\$ _____
5K Run (check T-Shirt Size <input type="checkbox"/> M <input type="checkbox"/> L <input type="checkbox"/> XL)	Oct. 23	(41)	\$ 18	\$ _____
Mexico Evening	Oct. 23	(46)	\$ 37	\$ _____

TICKETED MEAL FUNCTIONS*	Date	Qty	Amount	Total
Assoc. Women Geoscientists Division Luncheon	Oct. 20	(60)	\$ 19	\$ _____
Engineering Geology Division Luncheon	Oct. 21	(61)	\$ 19	\$ _____
Geochemical Society Luncheon	Oct. 21	(62)	\$ 19	\$ _____
Geoscience Information Society Luncheon	Oct. 21	(63)	\$ 19	\$ _____
Geophysics Division Luncheon	Oct. 22	(64)	\$ 19	\$ _____
History of Geology Division Luncheon	Oct. 22	(65)	\$ 19	\$ _____
Hydrogeology Division Luncheon	Oct. 22	(66)	\$ 19	\$ _____
Mineralogical Society Luncheon	Oct. 22	(67)	\$ 19	\$ _____
National Association Geology Teachers Luncheon	Oct. 22	(68)	\$ 19	\$ _____
Paleontological Society Luncheon	Oct. 22	(69)	\$ 19	\$ _____
Sedimentary Geology Division Continental Breakfast	Oct. 22	(70)	\$ 8	\$ _____
Assoc. Women Geoscientists Annual Breakfast	Oct. 22	(71)	\$ 13	\$ _____
Coal Geology Division Luncheon	Oct. 23	(72)	\$ 19	\$ _____
Geoscience Education Division Luncheon	Oct. 23	(73)	\$ 19	\$ _____
Society of Economic Geologists Luncheon	Oct. 23	(74)	\$ 19	\$ _____

Total Column A \$ \_\_\_\_\_

FIELD TRIPS*	Date	Qty	Column B
1 Mesozoic and Cenozoic Evolution, Mojave	Oct. 16-20	(100) \$260	1 \$ _____
2a Coal-Bearing Delta Complexes, SW US	Oct. 16-19	(101) \$290	1 \$ _____
2b Coal-Bearing, Overflight only	Oct. 20	(102) \$750	1 \$ _____
3 Miocene to Holocene, Recent Ext. Tectonics, Baja	Oct. 18-20	(103) \$190	1 \$ _____
4 Plate Tectonic History, Central California	Oct. 18-20	(104) \$255	1 \$ _____
5 Submarine-Fan Deposits	Oct. 19	(105) \$ 45	1 \$ _____
6 Geologic Hazards	Oct. 20	(106) \$ 60	1 \$ _____
7a Igneous Features, Smartville Complex	Oct. 18-20	(107) \$195	1 \$ _____
7b Igneous Features w/air to San Diego	Oct. 18-20	(108) \$358	1 \$ _____
8 Tectonic Evolution, Central Death Valley	Oct. 18-20	(109) \$240	1 \$ _____
9 Gem-bearing Pegmatites	Oct. 18-20	(110) \$225	1 \$ _____
10a Lower Cambrian Death Valley & Mojave Desert	Oct. 17-20	(111) \$260	1 \$ _____
10b Lower Cambrian Death Valley w/air to San Diego	Oct. 17-20	(112) \$309	1 \$ _____
11 Algodones Dune Field	Oct. 18-19	(113) \$250	1 \$ _____
12 Active Folding and Faulting, Transverse Ranges	Oct. 18-20	(114) \$245	1 \$ _____
13 Mesozoic Evolution, San Gabriel Mountains	Oct. 19-20	(115) \$150	1 \$ _____
14 Quaternary Geomorphology, Owens Valley	Oct. 17-20	(116) \$255	1 \$ _____
15a Active Faulting Volcanism in Trans-Mexican	Oct. 16-20	(117) \$265	1 \$ _____
15b Active Faulting Volcanism w/air to San Diego	Oct. 16-20	(118) \$447	1 \$ _____
16 Tectonics, Water, and Politics	Oct. 17-20	(119) \$280	1 \$ _____
17 Archaeological Geology, Point Conception	Oct. 18-20	(120) \$160	1 \$ _____
18 Geology of San Diego (check day/time below)	Oct. 22 or 23	\$ 10	1 \$ _____
Tues. a.m. <input type="checkbox"/> (121) Tues. p.m. <input type="checkbox"/> (122) Wed. a.m. <input type="checkbox"/> (123) Wed. p.m. <input type="checkbox"/> (124)			
19 Downtown San Diego Blob	Oct. 23	(125) \$ 5	1 \$ _____
20 Remote Sensing Planetology at JPL	Oct. 25	(126) \$ 25	1 \$ _____
21 Catalina Schist	Oct. 25-27	(127) \$325	1 \$ _____
22 Peninsular Ranges Batholith	Oct. 25-27	(128) \$260	1 \$ _____
23a Zoned Plutons, E. Peninsular Ranges, Baja 2 days	Oct. 25-26	(129) \$145	1 \$ _____
23b Zoned Plutons, E. Peninsular Ranges, 5 days	Oct. 25-29	(130) \$360	1 \$ _____
24 Mesozoic Geology, Cedros Island, Baja, Mexico	Oct. 25-28	(131) \$510	1 \$ _____
25 Eocene Depositional Systems	Oct. 25-26	(132) \$140	1 \$ _____
26 Landslides, Peninsular Ranges, S. California	Oct. 25-26	(133) \$190	1 \$ _____
27 Geologic Structure, Salton Trough	Oct. 24-26	(134) \$230	1 \$ _____
28 Late Cenozoic Sedimentation, Salton Trough	Oct. 25-27	(135) \$275	1 \$ _____
29a Hydrogeologic Overview, Yucca Mountain, Nevada	Oct. 25-27	(136) \$180	1 \$ _____
29b Hydrogeologic Overview, Yucca Mountain, w/air to Nev.	Oct. 25-27	(137) \$258	1 \$ _____
30 Detachment Faulting, Whipple Mountains	Oct. 24-27	(138) \$245	1 \$ _____

SHORT COURSES*	Date	Qty	Amount	Total
1 Practical 3-D Contaminant Transport Modeling	Oct. 18-20	(150) \$295	1 \$ _____	
2 SUPCRT91 Software Package	Oct. 18-19	(151) \$295	1 \$ _____	
3 Deformation & Kinematics, High Strain Zones	Oct. 19-20	(152) \$175	1 \$ _____	
4 Fractals and Their Use in Earth Sciences	Oct. 19-20	(153) \$255	1 \$ _____	
5 Quantitative Sedimentary Basin Modeling	Oct. 19-20	(154) \$165	1 \$ _____	
6 Thermochronology: Applications to Tectonics	Oct. 19-20	(155) \$215	1 \$ _____	
7 Assessing Mobility, Chemicals Vadose Zone	Oct. 20	(156) \$105	1 \$ _____	
8 Computer-aided Illustration in Geology	Oct. 20	(157) \$295	1 \$ _____	
9 Earthquakes and Earthquake Preparedness	Oct. 20	(158) \$105	1 \$ _____	
10 Hydrogeologic & Environmental Applications	Oct. 20	(159) \$120	1 \$ _____	
11 Applications, Radar Remote Sensing	Oct. 25	(160) \$135	1 \$ _____	
12 Contaminant Hydrogeology	Oct. 25-26	(161) \$195	1 \$ _____	
13 Sedimentary Basin Systems	Oct. 25-26	(162) \$145	1 \$ _____	

Total Column B \$ \_\_\_\_\_

Total Column A \$ \_\_\_\_\_

\*Meeting registration not required

Columns A & B = Total Remittance (full payment must be enclosed) \$ \_\_\_\_\_

Remit in U.S. funds payable to: 1991 GSA Annual Meeting

Payment by (check one):

Cash/Check  American Express  VISA  \_\_\_\_\_  
 Diners Club/Carte Blanche  MasterCard Expires \_\_\_\_\_

Card Number \_\_\_\_\_

Signature \_\_\_\_\_

Preregistration Deadline: September 20, 1991

MAIL TO: GSA ANNUAL MEETING, P.O. BOX 9140, BOULDER, CO 80301

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 Ref. A/P 2006 \_\_\_\_\_  
 Refund ck# \_\_\_\_\_

# 1991 ABSTRACTS WITH PROGRAMS

## Volume 23, Number 5

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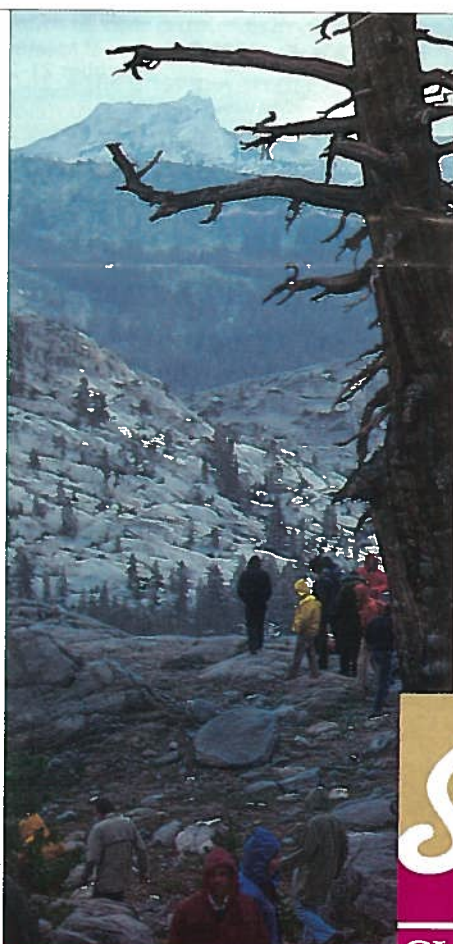
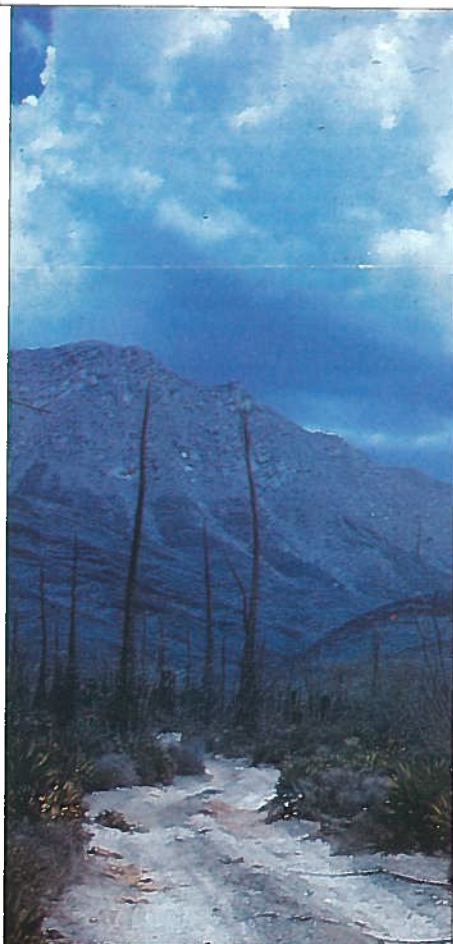
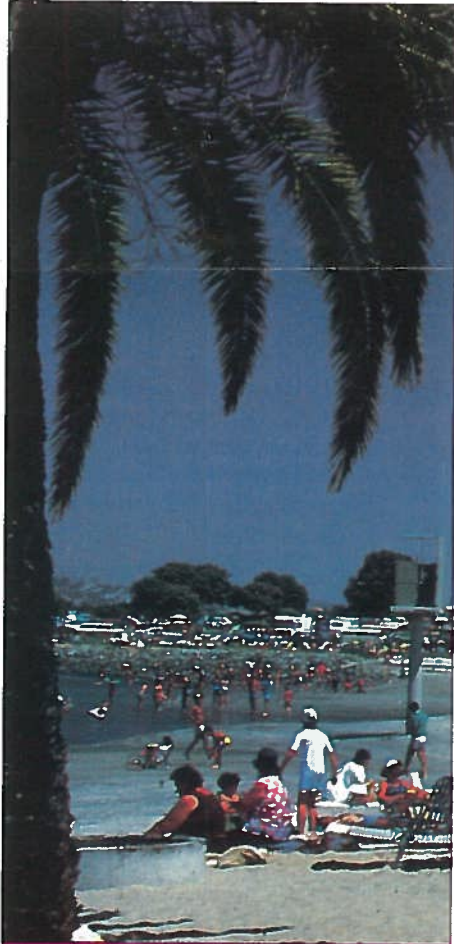
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*San Diego*

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