



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 9, 1999

MEMORANDUM TO: C. William Reamer, Chief
HLWB/DWM/NMSS

FROM: Jeffrey Ciocco, Hydrogeologist *Jeffrey Ciocco*
Philip Justus, Senior Geologist *Philip Justus*
Geosciences Section
HLWB/DWM/NMSS

SUBJECT: DEATH VALLEY WORKSHOP, CONFERENCE ON STATUS OF
GEOLOGIC RESEARCH AND MAPPING IN DEATH VALLEY
NATIONAL PARK, LAS VEGAS, NV (APRIL 9-11)

The conference sponsors included the United States Geological Survey (USGS), U. S. Department of Energy, National Park Service, and Death Valley Natural History Association. The purpose was to foster communication and increase awareness among parties conducting a broad range of geologic research in and around the Death Valley National Park. The program is attached, and the conference proceedings are published in the USGS Open File Report 99-153 (Slate, 1999).

Yucca Mountain is a hydrologic subsystem of the larger Death Valley ground-water flow system. Death Valley serves as the ultimate terminus of the flow system. The conference demonstrated the hydrologic, geomorphologic, hydrogeologic, paleoclimatologic, and structural importance of this region. Sessions of the conference included: (1) regional structure, tectonics, and bedrock geology; (2) Neogene basin stratigraphy, geophysics, and hydrology; (3) posters on mapping in the Death Valley region and topical ones on Death Valley National Park; (4) imagery, Quaternary stratigraphy and geomorphology, and Quaternary geochronology; and (5) paleoclimate and active tectonics.

A 1-day field trip was conducted on April 10 to Death Valley. The selection of stops was determined by the logistics of moving a large group through the Death Valley National Park and the opportunity to present participants with summaries of recent and ongoing research activities encompassing a broad range of topics. Stops included Mormon Point, Badwater, Zabriskie Point, Texas Springs-Echo Canyon, and Cow Creek. Significant hydrogeological features observed were: (1) the eroded tufa shorelines of the late Pleistocene Lake Manley, which was at least 150 meter deep in the past; (2) the bottom of the basin, thousands of feet thick salt pan, which provides a long, though discontinuous, record of the region's Quaternary paleoclimate; and (3) the discharge springs at Cow Creek and Furnace Creek Ranch.

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Selected results of Quaternary tectonic studies discussed on the field trip are of interest to the Yucca Mountain Project because the Death Valley-Furnace Creek fault system is one of the principal sources of earthquakes that contributes to the seismic hazard at Yucca Mountain.

Mormon Point stop: studies of the Willow Creek scarp on the Death Valley fault indicate a vertical slip rate of about 1-3 millimeters/year, and a return period of ground-rupturing earthquakes of 1000-2000 years. This is a new data point to be considered in the Structural Deformation and Seismicity Issue Resolution Status Report. **Zabriske Point Stop:** Geophysical evidence of unusually deep voids (steep-sided sub-basins) in Death Valley, now filled with sediments, was presented by R. Blakely, USGS. He speculated that these are local, disconnected pull-apart basins. The significance of these newly described features is not known. **B. Wernicke, California Institute of Technology (CIT),** suggested that preliminary Global Positioning Satellite (GPS) data indicate that Death Valley is closing (getting narrower) under compression, and GPS in the next few years will be exciting because the data collected in that short timeframe could confirm or refute various concepts of crustal motion in the region. **Texas Springs-Echo Canyon Stop:** evidence presented of compressional, extensional and strike-slip features in this area elicited comments about the concept that the region may be subdivided into structural domains wherein a particular strain-type dominates compared to adjacent domains. This concept of domains in the Death Valley area may be related to the concept of structural domains that has been applied by USGS to the vicinity of Yucca Mountain. **Cow Creek Stop:** some observers pointed out that mappers have emphasized the vertical component of net slip when describing fault slip rate (in part because vertically offset topography is more readily observed and measured than horizontally offset features). However, observations of the fault scarp in this area between the Furnace Creek and Death Valley Faults indicated the possibility of about equal amounts of horizontal slip (strike-slip) and vertical slip (normal). The point is that hazard analysts need to be sure to document and distinguish among the net slip or its components when analysing slip rates. Seek the net slip because it is the greater of its components.

Five geological maps presented at poster sessions interpret site-scale features significant to Yucca Mountain and include: (1) regional geologic maps of the Nevada Test Site and Death Valley ground-water flow systems - the starting points for ground-water studies; (2) regional hydrogeological features from a new geologic map of the Yucca Mountain region; (3) preliminary surficial geologic map of the Beatty 30 x 60 minute quadrangle, Nevada-California; (4) geologic map of the Yucca Mountain region 1:50,000 by Potter, et al.; and (5) tectonic-geologic map of the Death Valley region, including Yucca Mountain by L.A. Wright et al. The maps are expected to be published later this year.

Frank D'Agnese, USGS was a keynote speaker on the Death Valley hydrology. He presented the conceptual model for the Death Valley regional ground-water flow system. The fluxes from the regional model are used for the Yucca Mountain site-scale flow model. Several other important posters were presented that helped characterize the large Death Valley ground-water flow system.

Keynote speaker, Brian Wernicke, CIT, presented a new grand reconstruction of deformation of the southern Basin and Range over the last 36 million years (Snow and Wernicke, American Journal of Science, in press, V.298). He emphasized that in the past, crustal thinning of the Basin and Range accommodated most of the extension (stretching) of the crust. He restated his hypothesis that the current regional strains are dominated by regional right lateral shear, as

evidenced by GPS measurements. He also discussed evidence of about 100 kilometers of N67W translation along the Death Valley-Furnace Creek Fault Zone over the last 12 million years between the Cottonwood Mountains and Resting Spring Range. The Death Valley area continues to be an active seismogenic source region.

Paleoclimate posters included a new study conducted by Tim Lowenstein (Lowenstein et al., 1999), which supports the paleoclimate model for the YM project.

References:

Lowenstein, T.K., J. Li, C.B. Brown, S.M. Roberts, T.-L. Ku, S. Luo, and W. Yang, 200 k.y. paleoclimate record from Death Valley salt core, *Geology*, v. 27, 3-6, 1999.

Slate, L.S., Proceedings of Conference on Status of Geologic Research and Mapping, Death Valley National Park, *U.S. Geological Survey Open-File Report 99-153*, 1999.

Attachment: As stated

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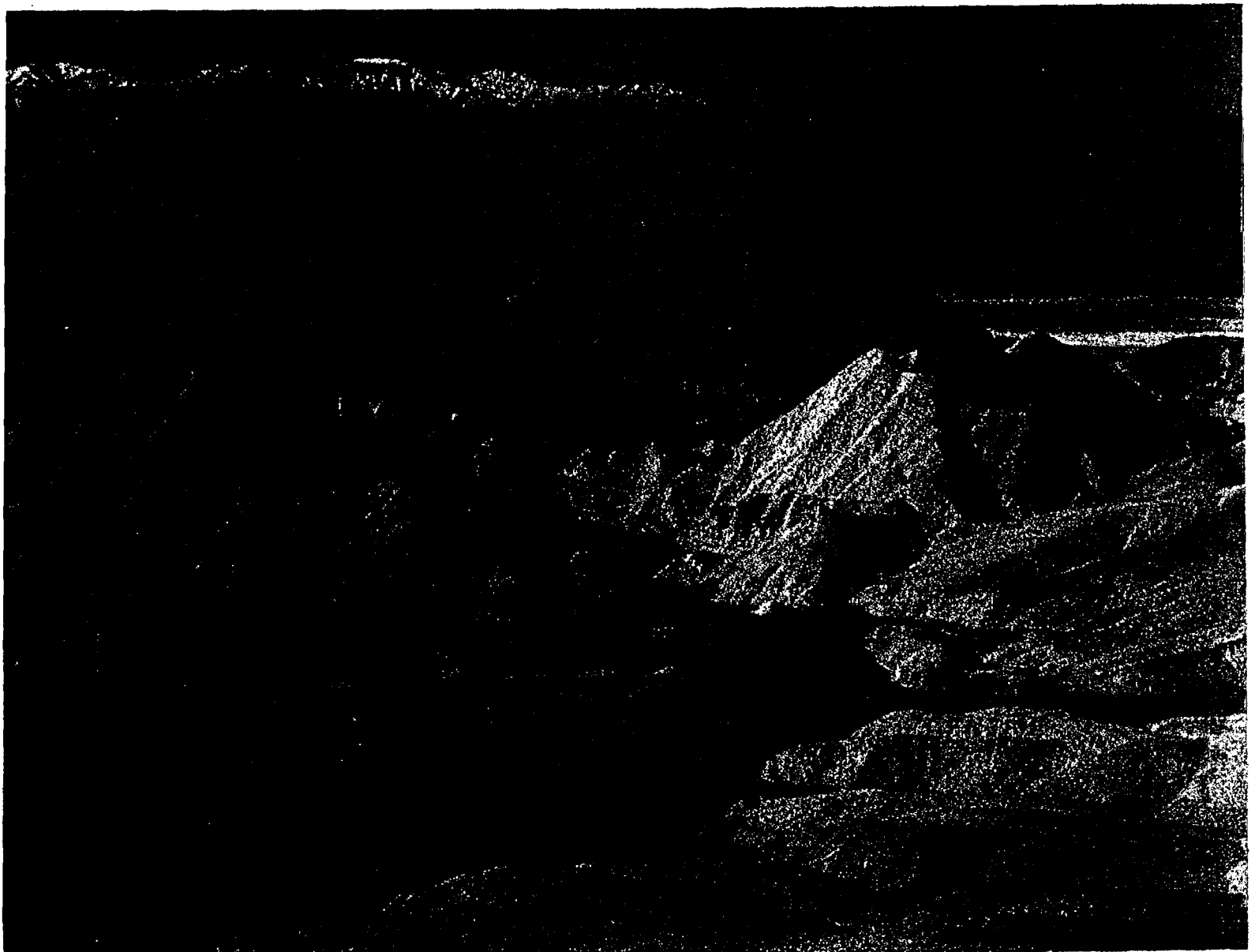
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**Status of Geologic Research & Mapping
in Death Valley National Park
Las Vegas, Nevada
April 9-11, 1999**

Program

**Sponsored by the U.S. Geological Survey, Department of Energy, National Park Service,
and Death Valley Natural History Association**



Death Valley National Park

Posters (up throughout meeting):

Geologic Highlights of Death Valley National Park

Michael N. Machette, Ren A. Thompson, and Mel Essington

Status of Geologic Mapping in Death Valley National Park—A Database

Angela S. Jayko, M. Essington, Bruce Heise, H.E. Johnson, P.W. McGrath, D.W. Prichett, G. Saucedo,
R. Thompson, and D. Wagner

How to Get a Research Permit from Death Valley National Park

Richard L. Anderson

National Park Service Geologic Resources Inventory

Joe Gregson and Bruce Heise

Inventorizing Paleontological Resources at Death Valley National Park

Torrey G. Nyborg and Vincent L. Santucci

**Accessing Death Valley National Park's Museum Collection for Geological and Paleontological
Research**

Blair Davenport

Special thanks to Lee-Ann Bradley and Chris Menges for help with meeting logistics.

Friday, April 9, 1999

✓ **Introduction** – Ren A. Thompson, Dick Martin, and Bruce Heise 8:00 – 8:15

Regional Structure, Tectonics, and Bedrock Geology (8:15 – 12:00)

Keynote speakers:

- ✓ **Tectonic Evolution of the Death Valley Region**
Brian P. Wernicke 8:15 – 8:50
- ✓ **Tectonics of the Southwestern Death Valley Region—A Progress Report**
Terry L. Pavlis and Laura Serpa 8:50 – 9:25
- Architecture and Miocene Evolution of the Northeastern Death Valley Detachment Fault System,
Nevada and California**
- ✓ Chris Fridrich 9:25 – 10:00

Posters:

- ✓ **Temporal, Spatial, and Compositional Constraints on Extension-Related Volcanism in Central Death Valley, California**
R.A. Thompson, L.A. Wright, C.M. Johnson, and R.J. Fleck
- ✓ **Fluid Flow during Metamorphism and Deformation in the Panamint Mountains**
Theodore C. Labotka
- ✓ **Preliminary Results of Detailed Structural Investigation and Large-Scale Mapping in the Southern Panamint Range, California**
Joseph E. Andrew
- ✓ **Magnitude and Timing of Extreme Continental Extension, Central Death Valley Region, California**
N.A. Niemi, B.P. Wernicke, R.J. Brady, J.B. Saleeby, and G.C. Dunne
- ✓ **Field and Laboratory Studies of Fault Rocks from Detachment Faults, Western Black Mountains, Death Valley**
Darrel Cowan, Trenton Cladouhos, Nicholas Hayman, Julia Morgan, and Peter Vrolijk
- ✓ **Evidence for Pre-55 Ma Phanerozoic Fabrics in the Black Mountains, Death Valley, California**
Martin G. Miller, Henry Turner, and Richard M. Friedman
- ✓ **Structural Features of the Amargosa Fault near Virgin Spring Canyon**
Charles Rogers and Martin G. Miller
- ✓ **Paleomagnetism of the Bare Mountain-Yucca Mountain Region and Implications for Vertical-Axis Rotations related to the Walker Lane (no abstract in Proceedings volume)**
John Stamatakos and David Ferrill

Neogene Basin Stratigraphy, Geophysics, and Hydrology (1:30 – 5:15)

Keynote speakers:

- ✓ **Cenozoic Basins of the Central Death Valley Region, Eastern California**
Lauren A. Wright 1:30 – 2:05
- ✓ **Looking Beneath the Surface, a Three-Dimensional Geophysical View of the Death Valley Region, California and Nevada**
Richard J. Blakely, Robert L. Morin, and Claudia C. Faunt 2:05 – 2:40
- The Death Valley Regional Ground-Water Flow System (DVRFS) Model: Calibration Versus Hydrogeologic Conceptual Model Testing**
Frank A. D'Agness and Claudia C. Faunt 2:40 – 3:15

Posters:

Stratigraphy:

- Preliminary Description of the Subsurface Geologic Units in the Amargosa Desert**
Emily M. Taylor, Christopher M. Menges, and Carma San Juan
- Tectonostratigraphic Relationship between the Cenozoic Sedimentary Successions of the Southern Funeral Mountains, Furnace Creek Basin, Eagle Mountain, and the Northern End of the Resting Spring Range**
Ibrahim Cemen

Geophysics:

Three-Dimensional Model of Pre-Cenozoic Basement beneath Amargosa Desert and Pahrump Valley, California and Nevada—Implications for Tectonic Evolution and Water Resources
Robert L. Morin, Richard J. Blakely, E.H. McKee, Kevin M. Schmidt, Victoria E. Langenheim, and Gary L. Dixon

Buried Structures in the Amargosa Desert Revealed by Detailed Gravity and Ground Magnetic Surveys (no abstract in Proceedings volume)
John Stamatakos and others

Hydrology:

Using Geologic Data for a Three-Dimensional Hydrogeologic Framework Model for the Death Valley Region

Claudia C. Faunt, Wayne R. Belcher, and Frank A. D'Agnese

Regional Geologic Maps of the Nevada Test Site and Death Valley Ground-Water Flow System—The Starting Points for Ground-Water Studies

Peter D. Rowley, Jeremiah B. Workman, Gary L. Dixon, Janet L. Slate, Karen S. Morgan, E.B. Ekren, David A. Ponce, William R. Page, Mel A. Kuntz, and Douglas A. Trudeau

Ground-Water Flow Model of Amargosa Valley and Yucca Mountain Site Revisited

Parviz Montazer and Nick Stellavato

Development of a Hydrologic Database and Data Analysis Tool for the Death Valley Regional Ground-Water Flow Model

Grady M. O'Brien, Matthew L. Jones, and Claudia C. Faunt

Correlations of Lithostratigraphic Features with Hydrogeologic Properties, a Facies-Based Approach to Model Development in Volcanic Rocks at Yucca Mountain, Nevada

David C. Buesch and Richard W. Spengler

Using Multivariate Statistical Analysis of Ground-Water Major Cation and Trace-Element Concentrations to Evaluate Ground-Water Flow in South-Central Nevada

Irene M. Farnham, Kevin H. Johannesson, Ashok K. Singh, Klaus J. Stetzenbach, and Xiaoping Zhou

Rare Earth Elements in Ground Water and Aquifer Materials from Southern Nevada and Eastern California

Xiaoping Zhou, Kevin H. Johannesson, Klaus J. Stetzenbach, Caixia Guo, and Irene M. Farnham

Estimating Evapotranspiration Rates in Death Valley, California

Guy A. DeMeo, Randell J. Lacznik, and Walter E. Nylund

Ostracodes as Indicators of Present and Past Hydrology in Death Valley

Richard M. Forester

Mapping in the Death Valley Region (Hawthorn Suites 7:00 – 9:00 p.m.)

Posters:

Regional Geologic Maps of the Nevada Test Site and Death Valley Ground-Water Flow System—The Starting Points for Ground-Water Studies

Peter D. Rowley, Jeremiah B. Workman, Gary L. Dixon, Janet L. Slate, Karen S. Morgan, E.B. Ekren, David A. Ponce, William R. Page, Mel A. Kuntz, and Douglas A. Trudeau

Geologic Map of the Trona-Kingman 1:250,000 Quadrangle, Southeastern California

Eugene Y. Hsu and David L. Wagner

Tectonic-Geologic Map of the Death Valley Region, California and Nevada

L.A. Wright, R.A. Thompson, and J.B. Workman

Regional Hydrogeologic Features from a New Geologic Map of the Yucca Mountain Region

C.J. Potter and D.S. Sweetkind

Preliminary Surficial Geologic Map of the Beatty 30 x 60-minute Quadrangle, Nevada-California

Janet L. Slate and Margaret E. Berry

Strategy for Mapping Quaternary Surficial Deposits in Support of the Death Valley Regional Flow Model in California and Nevada

Christopher M. Menges, Emily M. Taylor, Janet L. Slate, and John C. Dohrenwend

Geology of the Saddle Peak Hills 7.5-minute Quadrangle, Southernmost Death Valley, California

Bennie W. Troxel

Saturday, April 10, 1999 (Depart Hawthorn Suites 7:30 a.m., return ~9:00 p.m.)

Field Trip Guide

Stop 1: Mormon Point/Willow Creek Fault Scarp

Terry L. Pavlis
Jeffrey R. Knott
Ralph E. Klinger and Lucille A. Piety

Stop 2: Badwater

Martin G. Miller
Tim Lowenstein
Diana E. Anderson

Stop 3: Zabriskie Point

Lauren A. Wright
Richard J. Blakely

Stop 4: Texas Spring Syncline/Echo Canyon Thrust

Ralph E. Klinger and Lucille A. Piety

Stop 5: Cow Creek Administrative Area

Michael N. Machette

Sunday, April 11, 1999

Imagery, Quaternary Stratigraphy and Geomorphology, and Quaternary Geochronology (8:15 – 12:00)

Keynote speakers:

Thirty Years of Remote Sensing in Death Valley: What Have We Learned?

Alan Gillespie..... 8:15 – 8:50

Quaternary Stratigraphy and Geomorphology of Death Valley

J.R. Knott..... 8:50 – 9:25

Quaternary Dating Methods—Applications to Death Valley Studies

Marith C. Reheis..... 9:25 – 10:00

Posters:

Imagery:

Imaging Radar Applications in the Death Valley Region

Tom G. Farr

Regional 1:100,000 Mapping of Quaternary Units from SPOT Images and 30-m DEMs

A.S. Jayko and D.W. Prichett

Differential GPS/GIS Analysis of the Sliding Rock Phenomenon of Racetrack Playa, Death Valley National Park

Paula Messina and Phil Stoffer

Quaternary Stratigraphy and Geomorphology:

Quaternary Geologic Mapping and Geochronology of the Las Vegas 1:100,000 Sheet and Yucca Mountain Area—Geomorphic and Hydrologic Response to Climate Change near Death Valley

S.C. Lundstrom, J.B. Paces, S.A. Mahan, W.R. Page, and J.B. Workman

A Soil Survey of Death Valley National Park—New Techniques in Standard Soil Survey

Douglas J. Merkler, Leon Lato, and Peter Scull

Surficial Geology and Geomorphic Process Studies in Support of Multidisciplinary Ecosystem Investigations—Examples from Parts of Greenwater and Valjean Valleys, Mojave Desert Ecosystem

David M. Miller and James C. Yount

Quaternary Geochronology:

Late Cenozoic Tephrochronology of Death Valley: New Insights into Stratigraphy, Paleogeography, and Tectonics

J.R. Knott, Andrei M. Sarna-Wojcicki, Ralph E. Klinger, John C. Tinsley, III, and Bennie W. Troxel

Quaternary Geochronology (continued):

Chlorine-36 Ages of Pluvial Shoreline Features in the Death Valley/Panamint Valley Area

Fred M. Phillips and Marek G. Zreda

Geochemistry of Archaeological Obsidian Sources in the Saline Range, Death Valley National Park, California

Lynn Johnson, David L. Wagner and Craig E. Skinner

Paleoclimate—only one in morning session because author must leave early:

Lake Manly(?) Shorelines in the Eastern Mojave Desert, California

Roger LeB. Hooke

Paleoclimate and Active Tectonics (1:30 – 5:15)

Keynote speakers:

Middle to Late Quaternary Environmental Changes in Death Valley and Vicinity

W. Geoffrey Spaulding..... 1:30 – 2:05

Latest Quaternary (<30 ka) Lake High-Stand Fluctuations and the Evolving Paleohydrology of Death Valley

Diana Anderson..... 2:05 – 2:40

Tectonic Geomorphology along the Death Valley Fault System: Evidence for Recurrent Late Quaternary Activity in Death Valley National Park

Ralph E. Klinger..... 2:40 – 3:15

Posters:

Paleoclimate:

200-ky. Paleoclimate Record from Core DV 93-1, Badwater Basin, Death Valley, California

Tim Lowenstein

Using Event-Based Simulation of Water Budgets to Study the Hydroclimatology of Lakes in Death Valley, California

Larry Mayer

Eolian Processes and Deposits in the Mojave Desert—Integrated Studies to Evaluate Impacts from Climate Variability and Land Use

U.S. Geological Survey and Desert Research Institute

Active Tectonics:

Scenario Earthquakes along the Death Valley Fault System

Craig M. dePolo and Ron H. Hess

GPS-Determined Constraints on Interseismic Deformation along Active Fault Zones within the Death Valley Region, Southeastern California

Todd B. Williams, Daniel J. Johnson, M. Meghan Miller, and Timothy H. Dixon

Seismic Potential of the Fish Lake Valley Fault Zone, Nevada and California

Thomas L. Sawyer and Marith C. Reheis

Quaternary Strike-Slip Components of the Death Valley Fault between the Furnace Creek and Southern Death Valley Fault Zones

D. Burton Slemmons and George E. Brogan

Using Geomorphic Features to constrain Tectonic Activity near Pahrump Valley, Nevada and California

K.M. Schmidt and J.G. Davidson

USGS Geologic and Seismic-Hazard Investigations of the Cow Creek Area, Death Valley National Park

Michael N. Machette, Anthony J. Crone, Kathleen M. Haller, Lee-Ann Bradley, Carlos Ninci Martinez, and Giuliana D'Addezio

Late Quaternary Flexural-Slip Folding and Faulting in the Texas Spring Syncline, Death Valley National Park

Ralph E. Klinger and Lucille A. Piety

Geology of the Stump Spring Quadrangle—Evidence of Late Quaternary Transpression on the Southern Segment of the Pahrump Valley Fault Zone, Nevada and California

Mathew R. McMackin