

# Christopher Zahm

## Professional Summary

February 1, 2011

Business address: The University of Texas at Austin  
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### Academic Background

B.Sc. Geology and Geophysics, University of Wisconsin, 1993  
M.S. Geology, The University of Texas at Austin, 1998  
Ph.D. Geology, Colorado School of Mines, 2002

### Areas of Expertise

- A. Fractured reservoir characterization.
- B. Discrete fracture network modeling and flow characterization.
- C. Seismic interpretation of complex structural styles.
- D. Fault-related fracture development modeling.
- E. Mechanical stratigraphy framework characterization.
- F. Integrated reservoir characterization and modeling.
- G. Fault seal characterization and analysis.

### Professional Work Experience

- A. Present Position: Adjunct Professor, The University of Texas at Austin (January 2009 - Present).

Teaching of Petroleum Basin Evaluation, which highlights the fundamentals of developing exploration prospects from tectonics to economics.

- A. Present Position: Research Associate, Bureau of Economic Geology, The University of Texas at Austin (January 2007 - Present).

Characterization of fracture and other discrete features (e.g., karst or nonmatrix pores) in analog systems and working to understand how these features influence fluid flow in the subsurface; responsible for conducting innovative research while presenting and publishing results within RCRL consortia and at international forums. Co-Principal Investigator, 2008, CGM Research: Multi-scale flow and transport modeling of large-vug Cretaceous carbonates..

- B. Geologic Advisor, Exploration Decision Board, ConocoPhillips Exploration & Business Development, Houston, Texas (2006 - 2006).

My role in this position was to review reservoir characterization efforts in support of large capital expenditure projects (greater than \$25 million) within the ConocoPhillips Exploration & Business Development portfolio. My role was to ensure proper characterization had been performed and provide technical feedback to senior management. In this role, I received training to use two proprietary internal decision and risk analysis software and was a reviewer for play analysis characterization.

C. Senior Geologist, ConocoPhillips Subsurface Technology, Houston, Texas (2002 - 2006).

- Providing technical support in structural geology characterization and fractured reservoir characterization to the ConocoPhillips business affiliates. I worked a diverse portfolio across the globe including South Sumatra, Northwest Shelf Australia, Mackenzie Delta, Alaska North Slope, Norwegian North Sea, West Shetlands, Nigeria, North Africa and the Middle East.
- Principal Investigator and Manager of the Fractured Reservoir Flow Characterization Technology Development Program. My role involved identifying critical technology gaps within industry and ConocoPhillips to prescribe a yearly path forward direction to address these gaps. As the PI for this effort I monitored several industry and academic consortia, maintained software development related to fracture reservoir modeling and managed a yearly budget.
- Instructor on several corporate trainings that focused on structural interpretation and modeling of faulted and fractured reservoirs.

D. Geoscientist, iReservoir.com, Greenwood Village, Colorado (2000 - 2003).

Use of integrated data including 3D seismic, petrophysics, reservoir engineering and geologic characterization of outcrop and core to build 3D reservoir models for characterization and simulation. My responsibilities included fracture core and outcrop characterization along with limited structural attribute modeling using gOCad.

E. Adjunct Professor, Colorado School of Mines, Golden, Colorado (2001 - 2001).

Responsible for course development, including both lecture and laboratory portions of the undergraduate course, 'Structural Geology and Tectonics.' I also supervised the teaching assistant for the course and I developed a two-day fieldtrip with exercises to central Wyoming and northern Colorado.

F. Structure Geology Consultant, YPF Maxux, SE Asia Division, Golden, Colorado (2000 - 2000).

Used earth stress data, 2D and 3D seismic interpretation, sedimentary channel patterns, fault traces, and regional tectonics to restore fields within the Asri and Sunda basins to an undeformed geometry during time of deposition. This allowed for better understanding of basin history, including fluid migration timing and trap development.

G. Teaching Assistant, Colorado School of Mines, Golden, Colorado (1998 - 2000).

Responsible for the development and instruction of the laboratory portion of two undergraduate course, 'Structural Geology and Tectonics' and 'Applied Structural Geology'.

H. Geologist Intern, Mobil Technology Company, Dallas, Texas.

Developed a correlation between fracture core observations, structural geometry and reservoir injection data within a field located in the overthrust belt of southwest Utah.

I. Contributing Editor, U.S. Geological Survey, Bureau of Indian Affairs, Denver, Colorado (1998 - 1998).

Updated oil and gas reserves assessments for the Pueblo Indian Reservation of New Mexico. This atlas focused on hydrocarbon potential of the Albuquerque & Raton basins.

J. Geologist Intern, Texaco EP Technology Development, Houston, Colorado (1998 - 1998).

Developed a worldwide database of seals and traps, which was used by the Risk Assessment team to determine relative risk associated with different trap and seal types. Lithology, thickness, and age were used to categorize the seals.

K. Teaching Assistant, The University of Texas at Austin (1996 - 1997).

Assisted in the teaching of Advanced Hydrology Field Methods for 20 graduate students. This course teaches graduate students how to conduct field-based studies in hydrology, hydrogeology and geochemistry assessment skills. I also taught introductory geology labs for engineering students.

L. Geologist, RMT, Corrective Action Group, Austin, Texas (1994 - 1997).

Activities within this firm included the characterization of geology and hydrogeology at locations throughout Texas. My responsibilities included field characterization and mapping, modeling of the hydrogeology, supervisor for field operations, report generation, and client interaction based on the needs of our clients.

### Professional Societies

American Association of Petroleum Geologists  
Society of Petroleum Engineers

### Awards and Honorary Societies

Phillips Petroleum Fellowship, 2001  
Paul S. Puestmueller Fellowship, Colorado School of Mines, 2001  
BP-Amoco Field Geologist Fellowship, 2001  
Gordon I Atwater Fellowship, AAPG Grants-in-Aid, 2000  
Student Research Grant, American Association of Petroleum Geologists, 2000  
Best Teaching Assistant Award, AEG Student Chapter, 2000  
Union Pacific Resources Field Geologist Fellowship, 2000  
AAPG Student Chapter President, Colorado School of Mines, 1998 - 2000  
Outstanding Research Grant, Rocky Mountain Association of Geologists, 2000  
J.D. Love Field Research Grant, Wyoming Geological Association, 1999  
Outstanding Student Research Award, GSA, Structural Geology & Tectonics, 1999  
Duncan A. McNaughton Fellowship, AAPG Grants-in-Aid, 1999  
Research Grant, Society of Independent Professional Earth Scientists, 1999  
Best Teaching Assistant Award, AEG Student Chapter, 1999  
Student Research Grant, American Association of Petroleum Geologists, 1999  
Student Research Grant, Geological Society of America Research Grants, 1999  
Harry C. Kent Petroleum Scholarship, Colorado School of Mines, 1999  
Richard T. Bell-Marathon Oil Company Fellowship, UT-Austin, 1998  
Research Grant, Gulf Coast Association of Geological Societies, 1997  
Student Research Grant, Geological Society of America Research Grants, 1997

### Committee Responsibilities and Professional Activities

Co-Chair, Reservoir Deformation Research Group, American Association of Petroleum Geologists, 2009 - 2010

Co-Chair, 2010 American Association of Petroleum Geologists Convention, Denver, Colorado, 2009

Co-Chair, Session, Role of Mechanical Stratigraphy in Reservoir Development, 2009 Annual American Association of Petroleum Geologists Convention, Denver, Colorado, 2009

Member, Theme Hire Search Committee, Energy Theme, Jackson School of Geosciences, 2009

Co-Chair, Session, 2008 American Association of Petroleum Geologists Annual Convention, San Antonio, 2008

Co-Convenor, Geologic Occurrence and Hydraulic Significance of Fractures in Reservoirs, 2008 AAPG-SPE-SEG Hedberg Research Conference, 2008

Reviewing Editor, American Association of Petroleum Geologists, 2000 - present

## Publications

### Guidebooks

Janson, Xavier, Kerans, Charles, Bellian, J. A., and Zahm, C., 2009, Linking depositional, diagenetic facies, stratal geometries, and cycle architecture: examples from Paleozoic carbonate systems of West Texas and southern New Mexico: The University of Texas at Austin, Bureau of Economic Geology RCRL Laboratory Field Course Guidebook, 148 p.

Zahm, C., Phelps, R., Garcia-Fresca, B., Bellian, J. A., Kerans, C., El Azzi, J. A., and Janson, X., 2008, Cretaceous, Ordovician, and Permian reservoir heterogeneities: The University of Texas at Austin, Bureau of Economic Geology RCRL Field Trip Guidebook, 74 p.

Zahm, C., 2008, Influence of mechanical stratigraphy on fault-related fracture development, Cretaceous carbonates, central Texas: The University of Texas at Austin, Bureau of Economic Geology RCRL Field Trip Guidebook, 48 p.

Hennings, P. H., Zahm, C., Olson, J., and Ersley, E. A., 2008, Geologic occurrence and hydraulic significance of fractures in reservoirs: AAPG-SPE-SEG Hedberg Research Conference Field Trip Guidebook, 38 p.

Zahm, C., Ferril, D. A., Morris, A., Sims, D. W., and Waiting, D. J., 2008, Fault zone deformation controlled by mechanical stratigraphy in Cretaceous carbonates of central Texas: AAPG Field Trip Guidebook, 46 p.

Kerans, Charles, Bellian, J. A., Phelps, R. M., and Zahm, C., 2007, Cretaceous reservoir heterogeneity styles: facies to fractures: The University of Texas at Austin, Bureau of Economic Geology RCRL Field Trip Guidebook, 135 p.

Kerans, Charles, Phelps, R., Zahm, C., Bellian, J. A., Janson, Xavier, and El Azzi, J. A., 2007, Cretaceous, Ordovician, and Permian reservoir heterogeneities: The University of Texas at Austin, Bureau of Economic Geology RCRL Laboratory Field Trip Guidebook,, 90 p.

Hennings, P. H., Zahm, C., Krantz, B., and D'Onfro, P., 2006, Reservoir structural heterogeneities of Wyoming and Utah: ConocoPhillips Field Seminar, 112 p.

Hennings, P. H., and Zahm, C., 2006, Reservoirs and structures of the Laramide Rockies petroleum system: ConocoPhillips Field Seminar, 55 p.

Zahm, C., Hennings, P. H., Ersley, E. A., and Hurley, N. F., 2001, Beyond the cross-section: 3D deformation of classic foreland structures, Wyoming, *in* AAPG 2001 Annual Meeting: American Association of Petroleum Geologists Field Trip Guidebook, 146 p.

## Articles

### Peer Reviewed

- Zahm, C., Zahm, L., and Bellian, J. A., 2010, Integrated fracture prediction using sequence stratigraphy within a carbonate fault damage zone, Texas, USA, *Journal of Structural Geology*, v. 32, p. 1363–1374. doi:10.1016/j.jsg.2009.05.012.
- Zahm, C. K., and Hennings, P. H., 2009, Complex fracture development related to stratigraphic architecture: challenges for structural deformation prediction, Tensleep Sandstone at the Alcova anticline, Wyoming: *AAPG Bulletin*, v. 93, no. 11, p. 1427–1446.
- Kurtzman, Daniel, El-Azzi, J. A., Lucia, F. J., Bellian, J. A., Zahm, C., and Janson, Xavier, 2009, Improving fractured carbonate-reservoir characterization with remote sensing of beds, fractures, and vugs: *Geosphere*, v. 5, no. 2, p. 126–139.

#### Non-Peer-Reviewed

- Zahm, C. K., and Enderlin, M., 2010, Characterization of rock strength in Cretaceous strata along the Stuart City Trend, Texas: *Gulf Coast Association of Geological Societies Transactions*, v. 60, p. 693–702.
- Zahm, C., and Reed, R. M., 2009, Folds and fractures, Dinosaur Monument, Utah, *in* Laubach, S. E., and Tinker, S. W., eds., 2009, *Earth's art: celebrating the Centennial of the Bureau of Economic Geology, 1909–2009: The University of Texas at Austin, Bureau of Economic Geology*, p. 26–27.
- Zahm, C. K., Marrett, R., and Sharp, J. M., Jr., 1998, Prediction of regional groundwater flow and permeability anisotropy using fractured outcrop exposures, Edwards aquifer, central Texas, *in*: Brahana, J. V., Eckstein Y., Ongley L. K., Schneider, R., Moore J. E., eds., *Proceedings, Joint meeting of the XXVIII Congress of the International Association of Hydrogeologists and the Annual Meeting of the American Institute of Hydrologists*, v. 28, p. 697-705.

#### Abstracts

- Zahm, C., and Kerans, C., 2010, Small faults, big damage zones—an example of fault-related fractures and dissolution collapse in a ramp crest carbonate system, lower Pecos River Canyon, Texas (abs.): *American Association of Petroleum Geologists Annual Convention & Exhibition*, v. 19, p. 284.
- Phelps, R., Kerans, Charles, Waite, L., and Zahm, C., 2010, Stuart City Margin architectural variability and the effect of regional structural heterogeneity (ext. abs.): *Gulf Coast Association of Geological Societies Transactions*, v. 60, p. 759–763.
- Zahm, C., and Tsoflias, G., 2010, Interwell calculation of permeability in vuggy pores using ground-penetrating radar and cross-hole tomography within Albian carbonates reservoir analogs, Pipe Creek, Texas (abs.): *Gulf Coast Association of Geological Societies Transactions*, v. 60, p. 853.
- Enderlin, M., and Zahm, C., 2009, A method to quantifiably relate unconfined compressive strength (UCS) between the surface and the subsurface for mechanical stratigraphic applications (abs.): *American Association of Petroleum Geologists Annual Convention*, v. 18, p. 235.
- Zahm, Chris, Kerans, Charles, and Janson, Xavier, 2009, Integrating fracture systems into a carbonate sequence stratigraphic framework (abs.): *American Association of Petroleum Geologists Annual Convention*, v. 18, p. 235.
- Zahm, Chris, Tsoflias, G. P., Petersen, Kelly, and Janson, Xavier, 2009, Shallow water injection monitoring in vuggy pores using ground-penetrating radar and cross-hole tomography, Pipe Creek, Texas (abs.): *American Association of Petroleum Geologists Annual Convention*, v. 18, p. 235.
- Hennings, P. H., Pujasmadi, H., Alley, H., Zahm, C., Reid, R., and Lozada, T., 2006, Relationship between active deformation, stress heterogeneity, and fracture permeability in the Suban gas field of South Sumatra, Indonesia (abs.), *in* *American Association of Petroleum Geologists International Conference, Perth Australia*.

- Hennings, P. H., Krieger, F. W., Sanner, D., Zahm, C., Reid, R., and Lozada, T., 2006, Bayu-Undan-modeling permeability enhancement in fault damage zones (abs.), *in* American Association of Petroleum Geologists International Conference, Perth Australia.
- Zahm, C., Bellian, J. A., and Hennings, P. H., 2006, Impact of carbonate stratigraphy on fracture development in fault damage zones, central Texas (abs.): American Association of Petroleum Geologists Annual Convention, v. 15, p. 119.
- Zahm, C., Hennings, P. H., and Enderlin, M., 2005, Fracture prediction in fault damage zones using elastic dislocation models: a carbonate outcrop example from central Texas (abs.), *in* International American Association of Petroleum Geologists Meeting, Paris, France.
- Hurley, N. F., Zahm, C., Raba'a, A., and Karadavut, A., 2004, Fractured reservoir modeling in a foreland-basin anticline: From outcrop to flow simulation (abs.), *in* American Association of Petroleum Geologists Hedberg Research Conference— Carbonate Reservoir Characterization and Simulation: From Facies to Flow Units, El Paso, p. 24.
- Meng, H.-Z., Sonnenfeld, M., Uland, M., Canter, K. L., Wingate, T. P., Bush, J., Kosco, K., Simon, M., Pluim, S., Tupman, B., Zahm, L., Zahm, C., and Caldwell, D. H., 2003, Construction and Validation of an Integrated 3D Reservoir Characterization Geomodel for Reservoir Management at Seminole San Andres Unit (abs.), *in* CEED C02 Forum, Midland, Texas.
- Zahm, C., Hennings, P. H., Raba'a, A., Hurley, N. F., and Ersley, E. A., 2003, The use of 3D strain in outcrop to predict subsurface reservoir compartmentalization, southern Bighorn basin, Wyoming (abs.), Annual AAPG-SEPM Meeting, Salt Lake City, p.A187
- Zahm, C., 2001, Deformation in ductile strata: implications for reservoir compartmentalization within foreland structures (ext. abs.), *in* Kluth, C., ed., RMAG-PTTC Structural Traps and Fractured Reservoirs of the Rocky Mountain Region, extended abstracts, p. 38–44.
- Ersley, E. A., Hennings, P. H., and Zahm, C., 2001, Kinematics and structural closure of basement-involved anticlines in the central Rocky Mountains Petroleum Province (abs.), *in* American Association of Petroleum Geologists Annual International Convention, Denver, p. A58
- Gardner, M. H., Sunkanto, J., Zahm, C., Anderson, D., and Borer, J. M., 2001, The beheading of a rift: Stratigraphic and structural evidence for oblique right-lateral offset of the Asri and Sunda Basins, Sunda Shelf, Indonesia (abs.), *in* American Association of Petroleum Geologists Annual International Convention, Denver, p. A70
- Zahm, C., and Hennings, P. H., 2000, Kinematics of tear faulting in structurally attenuated strata, Thermopolis Anticline, Wyoming (abs.), *in* Geological Society of America Abstracts with Programs, Reno, Nevada, p. 415.
- Zahm, C., 2000, Tear faulting as a result of forelimb attenuation, Thermopolis anticline, Wyoming (abs.): American Association of Petroleum Geologists Bulletin, v. 84, no. 11, p.1798.
- Zahm, C., 1999, Mechanics of tear faulting in anticlinal folds, southern Bighorn basin, Wyoming (ext. abs.): American Association of Petroleum Geologists Bulletin, v. 83, no. 11, pg. 1899-1900.
- Halihan, T., Zahm, C. K., Tsoflias, G., Mace, R., and Sharp, J. M., Jr., 1998, Current research at the University of Texas at Austin (abs.), *in* Conference on Hydrogeologic Issues, Adelaide, Australia, p. 17.
- Zahm, C., and Marrett, R., 1998, Regional permeability estimates from fracture apertures in outcrop, Edwards Aquifer, Central Texas (abs.), *in* Muldoon, M. A., and Bradbury, K., eds., SEPM Conference on Fluid Flow in Carbonates, Door County, Wisconsin, p. 36.
- Zahm, C. K., and Sharp, J. M., Jr., 1998, Fracture roughness from stream loss, Edwards aquifer, central Texas (abs.): Geological Society of America Abstracts with Programs, Toronto, Canada, p. 222.

## Thesis

Use of fractures in outcrop to predict regional permeability, Edward aquifer, central Texas.

## Dissertation

3D Deformation in Basement-Involved Anticlinal Folds, Wyoming.

## Lecturing

### Corporate Schools, Research Seminars

Laramide-style folding and associated secondary structures: Wyoming Geologic Association Short Course, Laramie, Wyoming, 2008.

Co-instructor, Structural Interpretation: presented to new hires, ConocoPhillips, Houston, Texas, 2004.

Invited presentation on Fractured Reservoirs: presented to Houston FRESH Group, Houston, Texas, 2004.

Invited corporate presentation: presented at CoP Fractured Reservoir Workshop, Calgary, Canada, 2004.

Co-instructor, Structural Interpretation: presented to new hires, ConocoPhillips, Houston, Texas, 2003.

### Lectures and Addresses

Invited talk presented at Illinois State University, Normal, Illinois, 2007.

Invited presenter: UT-BEG RCRL Consortia Meeting, Austin, Texas, 2006.

Invited talk: presented at RMAG Symposium on Structural Geology of U.S. Rockies, Golden, Colorado, 2001.

## Field Trips

Co-Leader, Field Trip: AAPG Convention, 2008.

Co-Leader, Field Seminar: Hedberg Conference, 2008.

Co-Leader, Petroleum Systems of Laramide Field Seminar: ConocoPhillips, Laramie, Wyoming, 2008.

Co-Leader, Field Seminar, Reservoir Structural Heterogeneities, Wyoming-Utah: sponsored by CoP, , Wyoming, 2006.

Leader, Field Seminar, Facies to Fractures in Carbonates, Central Texas: sponsored by CoP, Austin, Texas, 2005.

Leader, Field Seminar, Facies to Fractures in Carbonates, Central Texas: sponsored by CoP, Austin, Texas, 2005.

Leader, Field Seminar, Facies to Fractures in Carbonates, Central Texas: sponsored by CoP, Austin, Texas, 2004.

Leader, Field Seminar, Facies to Fractures in Carbonates, Central Texas: sponsored by CoP, Austin, Texas, 2003.

Co-Leader, Field trip to Wind River and Bighorn Basins: sponsored by RMAG, , Wyoming, 2001.

## Reviews of Articles, Abstracts, and Research Proposals

Grant-In-Aid, 2009

Grant-In-Aid, 2008

Grant-In-Aid, 2007

Grant-In-Aid, 2006

Grant-In-Aid, 2005

Grant-In-Aid, 2004

Grant-In-Aid, 2003

Grant-In-Aid, 2002

### Graduate Student Committee Participation

Co-Advisor, M.S. Thesis Committee, Nabil Edlam, The University of Texas at Austin, 2009

Co-Advisor, M.S. Thesis Committee, Travis Kloss, The University of Texas at Austin, 2009