

Dr. Thomas A. Hauge
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Structural Geologist – Geophysicist
Hydrocarbon Exploration, Development, and Production

EXPERIENCE

October 2016 – December 2017

On contract with Numeric Solutions, Ventura CA, interpreting well data and surface geology to create a 3D structural model of a Southern California oil field.

Jan 2015 - August 2016

On contract with Aera Energy, Bakersfield CA, performing interpretation, integration, and structural analysis of surface geology, 3D seismic data, and well data from the Temblor Range and adjacent San Joaquin Basin, in support of exploration efforts.

March - April 2014

On contract with Pacific Rubiales USA. Restored cross-sections across salt-tectonic minibasins and diapirs.

Nov 2008 - Feb 2009; Jan 2012; May 2013-April 2014

On contract with Aera Energy, Bakersfield CA, performing 2D and 3D structural analysis and 2D palinspastic restoration of a complexly folded and thrust oil field, based on dense array of production wells.

Oct 2009 – July 2010; Nov 2010; Jan-Mar 2011; Oct 2011-January 2014

On contract with Maersk Oil Houston, interpreting 3D seismic data from offshore Angola for development-scale 3D structural modeling. Presented “state of the art” techniques for interpretation and 3D modeling of 3D seismic data at Maersk internal meeting of structural geologists.

September 2012

Taught field-based course on extensional structural geology and tectonics for ExxonMobil Upstream Research Co., in conjunction with ExxonMobil staff.

May-June 2011

On contract with Orchard Petroleum, Ventura CA, analysis of prospect-scale complex structure.

Dec 2010

On contract with ExxonMobil Exploration Company, preparing instruction materials for field-based course in hydrocarbon systems analysis.

April 2010

On contract with ExxonMobil Exploration Company, teaching field-based course on introductory analysis of hydrocarbon systems.

Feb-July 2009

On contract with Maersk Oil Houston, interpreting seismic data for offshore Brazil and compiling regional structural analysis.

Aug 2008

On contract with ExxonMobil Exploration Company, teaching field-based course in advanced structural analysis of contractional structures, Wyoming and Utah.

Oct 2007 – Feb 2008

On contract with ExxonMobil Exploration Company, working Wyoming fold-thrust belt. Defined structural geometry of complexly linked thrust faults and multiple reservoir and source horizons, based on 2D seismic, 3D seismic, and data from numerous wells. Analysis included cross-section construction and restoration in Lithotect, and construction of 3D faulted-framework models at multiple scales in Gocad.

Sept 2007

On contract with ExxonMobil Exploration Company, preparing teaching materials and conducting a field-based course in advanced structural analysis and hydrocarbon systems of basement-involved and basement-detached contractional basins.

May-July 2007

On contract with Maersk Oil and Gas, Copenhagen, Denmark, working offshore Angola for hydrocarbon systems analysis and trap definition. Interpreted 3D and 2D seismic data, made sequential restorations of 2D cross-sections and maps to define halokinetic history.

2004-April 2007

Geologic Advisor, ExxonMobil Production Company, Houston, Texas, assigned to U.S. Production Company as mentor and expert in structural and seismic interpretation.

- Providing interpretation assistance and mentoring in 3D seismic interpretation and 3D visualization of data sets from Wyoming, West Texas, onshore Texas and Louisiana, the Gulf of Mexico, offshore California, and Abu Dhabi, including a broad range of structural styles.
- Primary responsibility for ensuring that complex Wyoming fold-thrust interpretations are structurally sound (balanced and admissible in 2D and 3D).
- Mentored 30+ staff members in production and exploration companies.
- Additional responsibilities for developing and teaching field-based structure schools and hydrocarbon systems seminars for recruiting and continuing education of ExxonMobil staff in exploration, development, and production.

1985-2004

Senior Research Associate (as of 2004), ExxonMobil Upstream Research Company

(formerly Exxon Production Research Company), Houston, Texas, specializing in structural and tectonic interpretation, and analysis and modeling of geological and geophysical data, from plate-scale to production-scale.

- Technical efforts include research (creation of new interpretation tools, concepts, and techniques) and analysis of data for exploration and production applications.
- Project areas include: Europe, Middle East, Africa, South America, Caribbean, Southeast Asia, Asia, North America (details below).
- Technical efforts typically include interpretation of 2-D and 3-D seismic reflection data, seismic modeling, 2-D and 3-D geometric and kinematic structural modeling, analysis of potential field data, geodynamic modeling, mapping and interpretation of surface geology, and regional tectonic syntheses. Most work performed on UNIX workstations, PCs.
- Other duties include project initiation, planning, and coordination; oral and written presentation of results; developing and teaching classroom and field schools in geology and geophysics (details below); mentoring junior staff; personnel recruiting.

1982-1985

Postdoctoral Associate, Institute for the Study of the Continents, Cornell University, Ithaca, New York. Research included planning and supervising collection of deep seismic reflection data for COCORP surveys; processing and interpreting the data; and preparing papers for publication of the results of the surveys.

1980-1982

Staff Geologist, Slosson & Associates, Van Nuys, California. Projects included: structural and tectonic study of Transverse Ranges, California, for seismic risk assessment; petroleum potential study, Powder River Basin, Wyoming; Field mapping and landslide risk assessment, southern California, for hillside development.

1980

Instructor, University of Southern California, Los Angeles: Structural Geology.

1979-1980

Consultant, Rand Corporation, Santa Monica, California: Planetary Mapping Project.

1977-1978

Instructor, Santa Monica City College and Oxnard College, California: Physical and Historical Geology.

1976-1979

Teaching Assistant, University of Southern California, Los Angeles: various geology and geophysics courses.

1972-1975

Manager, small retail shops, Chicago, Illinois

EDUCATION

1976-1982

Ph.D., Geological Sciences, University of Southern California, Los Angeles.

Dissertation: Geometry and kinematics of the Heart Mountain detachment, northwestern Wyoming and Montana. The Heart Mountain detachment is a geometric and kinematic analog to salt-basin “raft tectonics.”

1971-1972

M. S., Earth and Space Sciences, State University of New York, Stony Brook.

1965-1971

B. A., English Literature, Northwestern University, Evanston, Illinois; graduate studies in geology.

BASIN EXPERIENCE

Extensional and Salt Basins

- North Sea: Statfjord field, Brent field, Naglfar Dome structural analyses
- Arctic Canada: Parsons Lake structural analysis
- Gulf of Suez: East Zeit field structural analysis
- South Atlantic:
 - regional structural and tectonic analysis, African and American margins
 - detailed structural analyses: Angola deep water, Pelotas basin Brazil, Erha field Nigeria, Rosa field Angola
- Yemen: Marib Al-Jawf basin framework study, Alif field structural analyses
- Gippsland, Australia: West Tuna field structural analysis
- Gulf of Mexico: numerous detailed structural analyses, onshore South Texas, East Texas, and Louisiana and offshore (shallow and deep water) Texas and Louisiana

Contractional and Foreland Basins

- San Joaquin Basin, California
- Ventura Basin, California
- Trinidad fold-thrust structural and tectonic analyses
- Papua New Guinea fold-thrust structural analysis
- French Pyrenees
- Tarim and Junggar Basins, China
- Colombia, Llanos basin fold-thrust structural analysis
- Permian/Delaware basins, tectonic and structural analyses
- Oman foreland basin, Abu Dhabi and Oman: foreland basin structural and tectonic analyses; fold-thrust structural analysis
- Wyoming fold-thrust belt, tectonic and structural analyses
- Wyoming Laramide foreland, tectonic and structural analyses

Strike-Slip and Hybrid Basins

- Santa Barbara Channel: Santa Ynez unit tectonic and structural analyses
- Ventura Basin, California: production-scale structural analysis

Miscellaneous

- Many short structural consulting efforts: Barents Sea, Chukchi Sea, Azerbaijan, Madagascar, Kazakhstan, Peru, Russia (esp. Sakhalin), Venezuela, Viet Nam, Bangladesh, Chad, and other areas mentioned above

COURSES DEVELOPED AND TAUGHT

1985-2006; 2007-2010 on contract

Instructor and School Coordinator, Exxonmobil Upstream Research Company (formerly Exxon Production Research Company). Recognized for excellence in teaching and mentoring 1989, 1991, 1992, 2006. Courses developed and taught:

- Advanced Structural Analysis: Extensional Tectonics (field-based) (~15)
 - Colorado River Trough (metamorphic-core-complex structure)
 - Death Valley (superposed structures, highly extended terrane)
 - Southern San Andreas fault (strike-slip and extension)
- Advanced Structural Analysis: Contractional Tectonics (field-based) (~15)
 - Bighorn Basin, Wyoming (basement-involved contraction)
 - Alberta basin foothills, Canada (basement-detached contraction)
- Contractional Structure and Sedimentation (field-based) (2)
 - Bighorn Basin, Wyoming
 - Cordilleran fold-thrust belt, Utah and Wyoming
- Hydrocarbon Systems Analysis, Bighorn Basin, WY (4)
- Fundamentals of Structural Analysis (~10)
- Applied Seismic Interpretation (~20)
- Quantitative Structural Analysis: Contractional Structures (~3)
- Quantitative Structural Analysis: Extensional Structures (~3)
- Quantitative Structural Analysis: Strike-slip and Hybrid Structures (~2)

1980

Instructor, University of Southern California, Los Angeles: Structural Geology.

1977-1978

Instructor, Santa Monica City College and Oxnard College, California: Physical and Historical Geology.

1976-1979

Teaching Assistant, University of Southern California, Los Angeles: various geology and geophysics courses.

SOFTWARE EMPLOYED (UNIX, PC, MAC)

Seismic Interpretation

Voxelgeo (preferred)
Geoframe
Landmark

3D Geometric Modeling

Gocad (preferred)
Framework3D
Petrel (trained, but limited experience)

Cross-section Balancing and Restoration

MVE Move
Lithotect
Geosec

ARTICLES PUBLISHED

Swanson, Erika, Wernicke, Brian P., and Thomas A. Hauge, 2016, Episodic dissolution, precipitation, and slip along the Heart Mountain detachment, Wyoming: *The Journal of Geology*, v. 124, p. 75-97.

Hauge, T. A., 2013, South Fork Fault as a Gravity slide: its break-away, timing, and emplacement, northwestern Wyoming, U.S.A: *COMMENT: Rocky Mountain Geology*, v. 48, No. 1, p. 63-65.

Hauge, T. A., 2011, Heart Mountain and South Fork fault systems: Architecture and evolution of the collapse of an Eocene volcanic system, northwest Wyoming: *REPLY: Rocky Mountain Geology*, v. 46, No. 1, p. 77-84.

Beutner, E. C., and Hauge, T. A., 2009, Heart Mountain and South Fork fault systems: Architecture and evolution of the collapse of an Eocene volcanic system, northwest Wyoming: *Rocky Mountain Geology*, v. 44, No. 2, p. 147-164.

Johnson, C. A, Hauge, T., Al-Menhali, S., Bin Sumaidaa, S., Sabin, B., and West, B., 2005, Structural Styles and Tectonic Evolution of Onshore and Offshore Abu Dhabi, UAE: *International Petroleum Technology Conference*, Doha, Qatar, November, 2005, Paper 10646-MS.

Malone, D. H., Hauge, T. A., and Beutner, E. C., 1999, Field guide for the Heart Mountain detachment and associated structures, in: Lageson, D. R., Lester, A. P., and Trudgill, B. D., eds, *Colorado and Adjacent Areas: Geological Society of America Field Guide 1*, 1999, p. 177-201.

Hauge, T..A., and Gray, G. G., 1996, A critique of techniques for modelling normal-fault and rollover geometries, in: Buchanan, P. G., and Nieuwland, D. A., eds., *Modern developments in structural interpretation, validation and modelling: Geological Society of London Special Publication 99*; Pages 89-97.

Kim, Y. C., Samuelsen, C. M., and Hauge, T. A., 1996, Efficient velocity model building for prestack depth migration: *Leading Edge (Society of Exploration Geophysicists ,Tulsa, OK)*, v. 15, pp. 751-753.

Hauge, T. A., 1993, The Heart Mountain detachment: 100 years of controversy, in: Snoke, A. W., ed., *The Geology of Wyoming*, University of Wyoming and Wyoming Geological Survey *Memoir 5*, p. 530-571.

Hauge, Thomas A., 1992, Field guide; Heart Mountain detachment, northwestern Wyoming; in: Elliott, James E., ed., *Guidebook for the Red Lodge-Beartooth Mountains-Stillwater area; Northwest Geology (University of Montana, Department of Geology, Missoula, MT.) 20-21*, p. 21-45.

Hauge, Thomas A., 1991, Kinematic model of a continuous Heart Mountain Allochthon: Reply: Geological Society of America Bulletin, v. 103, p. 719-722.

Hauge, T. A., 1990, Kinematic model of a continuous Heart Mountain allochthon: Geological Society of America Bulletin, v. 102, p. 1174-1188.

Hauge, Thomas A., 1990, The case for a continuous Heart Mountain Allochthon, in: Specht, Ralph W. (ed), Wyoming sedimentation and tectonics, Wyoming Geological Association Guidebook, v. 41, p. 183-185. 1990.

Hauser, E. C., Potter, C., Hauge, T. A., Burgess, S., Burtch, S., Mutchler, J., Allmendinger, R. W., Brown, L., Kaufman, S., and Oliver, J., 1987, Crustal structure of eastern Nevada from COCORP deep seismic reflection data: Geological Society of America Bulletin, v. 99, p. 833-844.

Knuepfer, P. L. K., Lemiszki, P. J., Hauge, T. A., Brown, L., Kaufman, S., and Oliver, J. E., 1987, Crustal structure of the Basin and Range - Sierra Nevada transition from COCORP seismic reflection profiling: Geological Society of America Bulletin, v. 98, p. 488-496.

Potter, C. J., Liu, C.-S., Huang, J., Zheng, L., Hauge, T. A., Hauser, E. C., Allmendinger, R. W., Oliver, J. E., Kaufman, S., and Brown, L., 1987, Crustal structure of north-central Nevada: results from COCORP deep seismic profiling: Geological Society of America Bulletin, v. 98, p. 330-337.

Hauge, T. A., Allmendinger, R. W., Caruso, C., Hauser, E. C., Klemperer, S. L., Opdyke, S., Potter, C. J., Sanford, W., Brown, L., Kaufman, S., and Oliver, J., 1987, Crustal structure of western Nevada from COCORP deep seismic reflection data: Geological Society of America Bulletin, v. 98, p. 320-329.

Allmendinger, R. W., Hauge, T. A., Hauser, E. C., Potter, C. J., Klemperer, S. L., Nelson, K. D., Knuepfer, and Oliver, J., 1987, Overview of the COCORP 40o N transect, western United States: the fabric of an orogenic belt: Geological Society of America Bulletin, v. 98, p. 308- 319.

Klemperer, S. K., Hauge, T. A., Hauser, E. C., Oliver, J. E., and Potter, C. J., 1986, The Moho in the northern Basin and Range Province, Nevada, along the COCORP 40o seismic-reflection transect: Geological Society of America Bulletin, v. 97, p. 603-618.

Allmendinger, R. W., Hauge, T. A., Hauser, E. C., Potter, C. J., and Oliver, J. E., 1986, Tectonic heredity and the layered lower crust in the Basin and Range province, western United States, in: J. F. Dewey, M. P. Coward, and P. L. Hancock, eds., Continental Extensional Tectonics: Geological Society of London Special Publication No. 28, p. 223-246.

Hauge, T. A., 1985, Gravity-spreading origin of the Heart Mountain alochthon, northwestern Wyoming and Montana: Geological Society of America Bulletin, v. 96, p. 1440-1456.

Hauge, T. A., 1983, Geometry and kinematics of the Heart Mountain detachment fault, northwestern Wyoming and Montana [Ph.D thesis]: Los Angeles, California, University of Southern California, 265 p.

Hauge, T. A., 1982, The Heart Mountain detachment fault, northwestern Wyoming: involvement of Absaroka volcanic rock: Wyoming Geological Association Guidebook, 33rd Ann. Field Conf., p. 175-179.

Davies, M. E., Hauge, T. A., Katayama, F. K., and Roth, J. A., 1979, Control networks for the Galilean satellites: Rand Corporation Report R-2532-JPL/NASA, 61 p.

UNPUBLISHED ARTICLES

Hauge, T. A., and others, 1985-2003: approximately 50 Exxon and ExxonMobil, and other proprietary reports.

ON-LINE PUBLICATIONS

http://www.searchanddiscovery.com/pdfz/documents/2014/20255schwalbach/ndx_schwalbach.pdf.html
Schwalbach, Jon; Hauge, Thomas; Glascock, Michael; Ganev, Plamen; Lucero, Jaron; Coldewey, Ralph,
2014, Using Borehole Image Logs to Characterize a Major Fault in the Ventura Avenue Field:
Search and Discovery Article #20255 (2014)** Posted July 24, 2014

ABSTRACTS

Hauge, Thomas, and eleven others, 2017. submitted, Onshore San Joaquin Basin and Temblor Range, California: Implications of multiple episodes of structural overprinting on subsurface interpretation of undiscovered traps: Annual Meeting Abstracts, American Association of Petroleum Geologists.

Molinaro, Matteo; Hauge, Thomas; O'Connor, S.; Salem, A.; Kostenko, O.; and Naruk, S., 2017, ; Onshore San Joaquin Basin and Temblor Range, California: new insights into the structural framework of a complex and mature fold and thrust belt: Annual Meeting Abstracts, American Association of Petroleum Geologists, 2017.

Hauge, Thomas A., Glascock, Michael, Harris, John, Schwalbach, Jon, 2010, Structural analysis of the Ventura Avenue Anticline, California: reinterpretation of a classic contractional anticline using modern 3D methods: Annual Meeting Abstracts, American Association of Petroleum Geologists, v. 19, p. 103.

Becker, Thomas P., McGroder, Michael, Rudolph, Kurt W., Hauge, Thomas A., Fan, Majie, 2010, Paleogene influence of the Moxa arch on the architecture of the composite Darby-Hogsback-Prospect thrust sheet near Labarge, Wyoming, USA: Annual Meeting Abstracts, American Association of Petroleum Geologists, v. 19, p. 23.

Hauge, T. A., Gray, G. G., and Myers, R., 2005, High-resolution 3D seismic data: insights into the deformation of heterogeneous layered materials: Geol. Soc. America Abstracts with Programs 37:7:313.

Chemale, Farid, Francolin, J. B. L., Hauge, T. A., Pinheiro Machado, M. A., Mahon, K. I., Smith, P. R., and Snow, J. K., 2000, Tectonic denudation in a strike-slip continental suture: the Villa Nova and Tijucas belts, Rio Grande do Sul, Brazil: Transactions, American Geophysical Union, v. 81, p. F1218.

Hauge, T. A., 1998, The Heart Mountain detachment, NW Wyoming: Update on the controversy: Geological Society of America Abstracts with Programs, v. 30, p. xx.

McGroder, M. F., Kim, Y. C., and Hauge, T. A., 1995, Integration of 3D imaging techniques with structural analysis tools for trap definition in offshore California: Annual Meeting Abstracts, American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, v. 4, p. 63.

Hauge, T. A., 1993, A speedometer for the Heart Mountain Allochthon, Wyoming: Geological Society of America Abstracts with Programs, v. 25, p. 49.

Hauge, T. A., 1990, Kinematic model of a continuous Heart Mountain faulting coeval with Eocene volcanism: Geological Society of America Abstracts with Programs, v. 22, p. xx.

Hauge, T. A., 1986, The Absaroka detachment complex, Wyoming: rootless low-angle normal faulting coeval with Eocene volcanism: Geological Society of America Abstracts with Programs, v. 18, p. 114-115.

Knuepfer, P. L. K., Lemiszki, P. J., Hauge, T. A., Brown, L., Kaufman, S., and Oliver, J., 1985, Crustal structure of the northern Walker Lane from COCORP reflection profiling and its relation to seismicity: Transactions, American Geophysical Union, v. 66, p. 974.

Oliver, J., Allmendinger, R., Hauge, T., Hauser, E., Potter, C., Klemperer, S., Nelson, K. D., Knuepfer, P. L. K., 1985, COCORP 40o N transect of the North American Cordillera: Transactions, American Geophysical Union, v. 66, p. 1073.

Kaufman, S., Potter, C. J., Hauge, T. A., Hauser, E. C., Allmendinger, R. W., Nelson, K. D., Knuepfer, P. L. K., Farmer, H., and Oliver, J., 1985, The COCORP 40oN transect: deep seismic profiles across the Great Basin: Transactions, American Geophysical Union, v. 66, p. 979.

Lemiszki, P. J., Knuepfer, P. L. K., Hauge, T. A., Brown L. D., Oliver, J., and Kaufman, S., 1985, Crustal structure of the Basin and Range - Sierra Nevada transition from COCORP seismic reflection profiling: Transactions, American Geophysical Union, v. 66, p. 979.

Kaufman, S., Potter, C. J., Hauge, T. A., Hauser, E. C., Allmendinger, R. W., Nelson, K. D., Knuepfer, P. K. L., Farmer, H., and Oliver, J. E., 1985, The COCORP 40 degrees N transect; deep seismic profiles across the Great Basin: Transactions, American Geophysical Union, v. 66, p. 979.

Knuepfer, P. L. K., Lemiszki, P. J., Hauge, T. A., and Oliver, J. E., 1985, Crustal structure of the northern Walker Lane from COCORP reflection profiling and its relation to seismicity: Transactions, American Geophysical Union, v. 66, p. 974.

Hauge, T. A., Allmendinger, R., Burgess, S., Caruso, C., Gibbs, A., Hauser, E., Huang, J., Klemperer, S., Liu, C-S., Nelson, K., Opdyke, S., Potter, C., Sanford, W., Serpa, L., Zheng, L., Zhu, T., Brown, L., Kaufman, L., Zheng, L., Zhu, T., Brown, L., Kaufman, S., and Oliver, J., 1984, The COCORP 40oN transect of the North American Cordillera, Part 1: Geological Society of America Abstracts with Programs, v. 16, p. 532.

Hauser, E., Allmendinger, R., Burgess, S., Caruso, C., Gibbs, A., Hauge, T., Huang, J., Klemperer, S., Liu, C-S., Nelson, K., Opdyke, S., Potter, C., Sanford, W., Serpa, L., Zheng, L., Zhu, T., Brown, L., Kaufman, S., and Oliver, J., 1984, The COCORP 40oN transect of the North American Cordillera, Part 2: Geological Society of America Abstracts with Programs, v. 16, p. 532.

Potter, C., Allmendinger, R., Burgess, S., Caruso, C., Gibbs, A., Hauge, T., Hauser, E., Huang, J., Klemperer, S., Liu, C-S., Nelson, K., Opdyke, S., Potter, C., Sanford, W., Serpa, L., Zheng, L., Zhu, T., Brown, L., Kaufman, S., and Oliver, J., 1984, The COCORP 40oN transect of the North American Cordillera, Part 3: Geological Society of America Abstracts with Programs, v. 16, p. 626.

Hauge, T. A., 1983, The Heart Mountain detachment fault: gravitational spreading from an active volcanic center: Geological Society of America Abstracts with Programs, v. 15, p. 374.

Hauge, Thomas A., 1982, Style and kinematics of extension above detachment faults; the Heart Mountain Fault, Northwest Wyoming: Geological Society of America Abstracts with Programs, v. 14, p. 510.

Hauge, T. A., 1982, The Heart Mountain detachment fault: role of Absaroka volcanic rock: Geological Society of America Abstracts with Programs, v. 14, p. 314.

Hauge, T. A., 1982, Displacement rate and mechanics of low-angle faulting: the Heart Mountain detachment fault: AGU Chapman Conference on Fault Mechanics, Salt Lake City, UT, 1982.

McClay, P. L., Hauge, T. A., Larson, R. A., Slosson, J. E., Yoakum, D. D., and Yelverton, C. A., 1982, Landslides and tract development: case history of a steep, unstable terrain: GSA Abst. Prog., v. 14, p. 213.

Slosson, J. E., Hauge, T. A., and McClay, P. L., 1982, Geologic hazards in hillside properties: in California Continuing Education of the Bar.