Robert T. Langan
5 Burriana
San Clemente, CA 92672
www.meqgeo.com
bob@meqgeo.com
blangan1@yahoo.com
+1 714 315-0763 (Mobile)

EDUCATION

1977-1980	Ph.D.	Geological Sciences (Geophysics)	Northwestern University
1979-1980		Geophysics (Research Associate)	Stanford University
1977-1979	M.S.	Civil Engineering (Geotechnical)	Northwestern University
1971-1974	M.S.	Geological Sciences	Northwestern University
1971		Geological Sciences	University of Wyoming
1966-1971	B.S.	Electrical Engineering	Northwestern University

THESES

PhD	"Kinematic Thermal Models of the Earth's Mantle"	(Advisor: N. H. Sleep)
MSCE	"The Use of a SDF System as a Dynamic Model for Low-Rise Residential Structures Subjected to Blast Vibrations"	(Advisor: C. H. Dowding)
MSGeol	"Structural Analysis of NE Illinois Using Geophysical Methods"	(Advisor: R.C. Speed)

WORK HIGHLIGHTS

- Geophysical, Geological, & Soils Engineering Site Investigations for foundation design on small to major projects, 5 years. (Registered Professional Engineer, Illinois, as Civil Engr. (1979-2002)
- As graduate student and post-doctoral fellow of Professor Chuck Dowding, made key contributions to the effects of blasting vibrations and associated air blasts on residential structures that led to revised safety standards in the U.S.A.
- Field mapping experience in complex geological terranes in Nevada (Toiyabe and Clan Alpine Mountains) and U.S. Virgin Islands.
- Member of 9-person geophysical team credited with inventing Seismic Reflection Tomography, including creating a ray tracing algorithm that is widely used in industry.
- Initiated a major project in processing COCORP crustal seismic line applying state-of-the-art industry algorithms to a Laramide overthrust (Wind River Mountains, Wyoming; “thick-skinned” tectonics), whose publication led to changes in how academia processed and interpreted crustal seismic lines. Involved in similar proprietary effort on nearby Big Horn Mountains overthrust.
- Industry expert in Crosswell Seismic Profiling (XSP) & Vertical Seismic Profiles (VSP)
- Visiting Scholar and Consulting Associate Professor, Department of Geophysics, Stanford University (2 years).
- Initiated research and technical services programs at Chevron in Microseismics, Shale Gas Geophysics, and Induced Seismicity.
- Helped drive development of Crosswell, VSP, and Microseismic technologies through leveraged external collaboration with industry partners, including universities.

WORK EXPERIENCE

2013- ***Geophysical Consultant***, *MEQ Geo, Inc., San Clemente, CA and Denver, CO USA*

- Management of projects involving induced seismicity, crosswell seismic imaging, microseismic monitoring, VSP's, & prototype borehole instrumentation, all phases: marketing, planning, field execution, data processing, and interpretation. Clients include Oil & Gas producers, Salt Mining companies, Venture Capital Companies, and Geotechnical Consultants.

2002-2013 ***Geophysical Consultant (2007-2013), Sr. Staff Geophysicist (2002-7),*** *Chevron Energy Technology Company, San Ramon, CA*

- Corporate advisor on Induced Seismicity. Advisor to industry trade groups on Induced Seismicity. Coordinator of Geophysical R&D for Gas Shale (2010-12). Founded Microseismic Surveillance R&D and Services Program (2002), Project Leader (2002-5, 2009-12). Corporate advisor on borehole seismic methods (3D VSP, Microseismics, Crosswell). Projects involved steam injection, waterflood, sour gas injection, waste disposal, CO_2 sequestration, high volume production, salt cavern collapse (Bayou Corne Sinkhole), geothermal and fracture stimulation monitoring.
- Recruiting Coordinator, Earth Sciences R&D (2005-8). Personally conducted R&D recruiting at numerous universities (*e.g.,* MIT, Harvard, Columbia, Cornell, Princeton, Caltech, UCLA, USC, Delft). Recruited 30% geophysical R&D staff as of 2013.
- Technical Advisor, High Performance Computing (2003-2008). Use of Beowulf clusters with graphics processing units (GPU's) and Field Programmable Gate Arrays (FPGA's) as math co-processors.
- Coordinator, Continuous Seismic Monitoring, *i-field* Program (Instrumented Oil Field), *e.g.,* microseismic monitoring & permanent seismic cables (2002-5).

1999-2002 **Sr. Staff Geophysicist**, Chevron Energy Technology Company, New Orleans, LA

- Member of 4-person R&D troubleshooting team assisting with exploration in Deepwater Gulf of Mexico. Identify and solve problems associated with building accurate velocity models, coherent noise removal, seismic imaging below salt, and turn-around time for intensive geophysical computing.

1995-1999 **Staff Geophysicist,** Chevron Petroleum Technology Company, La Habra, CA

- Project Initiator & Leader of 75-profile crosswell seismic program leveraged through collaboration with universities and service companies. Met objectives of characterizing reservoir at a new scale using reflection imaging, building reservoir models for flow simulations using geostatistical methods, and time-lapse monitoring of fluids. Conducted field projects in California and West Texas.
- Technical Advisor: Industry-first, time-lapse 3-D VSP in Lost Hills (1998-2001), massive 3D VSP in North Texas (2001-3).
- Continuing role with K.P. Bube as Co-Principal Investigator (PI) of the limitations of seismic reflection tomography, including stability and resolution issues.

1993-1995 ***Visiting Scholar*** *and* ***Consulting Associate Professor****, Department of Geophysics, Stanford University, Stanford, California, and*
Senior Research Geophysicist, *Chevron Petroleum Technology Company, Stanford, California*

- Co-PI (with Prof. J. Harris) of McElroy Reservoir Geosciences Project.
- PI of crosswell projects in Westbrook (TX) and Pakenham (TX).
- Co-author and Technical Coordinator for geophysical portion of DOE Class III Reservoirs Research Grant in Buena Vista Hills (CA).
- Co-PI on fundamental analysis (with K.P. Bube) of surface seismic reflection tomography for isotropic media.
- Co-created and co-taught (with Prof. J. M. Harris) graduate-level course in crosswell seismic imaging.
- Acting Director of Prof. J. M. Harris' Seismic Tomography Project and mentor to 5 graduate students and a postdoctoral fellow (1994-5).

1985-1992 ***Senior Research Geophysicist****, Chevron Oil Field Research Company, La Habra, California*

- Co-PI on crosswell field projects in the San Joaquin Valley and Alberta.
- Initiated crosswell seismic R&D program based upon low-cost acquisition.
- PI on development of a tomographic inversion algorithm for traveltime data obtained from crosswell seismic surveys.
- Co-PI (with K. P. Bube) on an L^1-L^2 hybrid data-fitting criterion.
- Co-PI (with K. P. Bube) on methodology for joint inversion of crosswell seismic transmission and reflection traveltimes.

1981-1985 ***Research Geophysicist**, Gulf Research and Development Company, and **Co-Chief Scientist** of Geophysical Analysis Group (October 1984 to June 1985)*

- Member of core team that developed original reflection traveltime tomography for surface seismic data, a method now ubiquitous in industry.
- Developed ray-tracing algorithm for gridded models that is used extensively in both industry and academia.
- Initiator and Co-PI on reprocessing of COCORP Wind River 2-D Seismic Line.

1980-1981 ***Postdoctoral Fellow (NSF)**, Department of Civil Engineering, Northwestern University, Evanston, Illinois*

- Simulated numerically the dynamic stability of large openings in jointed rocks.

1977-1981 ***Consultant** in Engineering Geophysics, Langan Associates, Evanston, Illinois*

- Monitored subsidence above coal mines using time domain reflectometry.
- Investigated the effect of blasting vibrations on "hoodoos" in Bryce Canyon National Park. Developed computer programs for the U. S. Bureau of Mines to model the response of residential structures to blasting vibrations.

1974-1976 ***Senior Engineering Geophysicist**, Soil Testing Services (STS Geotechnical Consultants) Northbrook, Illinois*

- Project Engineer/Project Geophysicist on geotechnical site investigations. Specialist in unconventional field instrumentation. Geophysical methodologies employed included micro-gravimetry, seismic refraction profiling, crosswell seismic profiling, and DC electrical resistivity.
- Developed geotechnical data base for the Naval Facilities Engineering Command.

PhD DEFENSE COMMITTEES

PhD defense of Mark Van Schaack, Stanford, 1997 (non-signing member)
PhD defense of Jie Zhang, MIT, 1997 (signing member)

RECENT EXTERNAL TECHNICAL PRESENTATIONS (1996-2014)

ASEG-PESA (Melbourne, 2013): Keynote Address - Invited
Northwestern University Seminar Series on Shale Gas (2013): Opening Address - Invited
Universities: MIT (1996, 1997, 2004, 2006), Princeton (1997), Berkeley (1997), Scripps (1998), Northwestern (1997, 1998, 2013), Utah (1996), LSU (2001), Cornell (2004), Kansas (2005), Columbia (2006, 2007), Caltech (2006), UCLA (2006), Harvard (2006), Memphis (2007), U. of Washington (2008), University of Bristol (2011), Berlin Free University (2012)
SEG Workshop on Gas Shale, Chengdu, China (2011)
SEG International Meeting (1996, 1998, 1999, 2000)
EAGE International Meeting (2001) - Invited
SEG Development and Production Geophysics Forum (1996, 1997, 1998)
Society of Petroleum Engineers (SPE) Archie Conference (1998)
SPE Development and Production Geophysics Forum (1997)
Pacific Coast SEG-AAPG-SEPM Annual Meeting (1997, 2000)

AWARDS AND INVITED PRESENTATIONS

- Invited Paper, Opening Lecture, Northwestern University Seminar Series on Shale Gas (2013): "A Short History of the Shale Gas Phenomenon".
- Invited Paper, 2013 Australian Society of Exploration Geophysicists and Petroleum Engineering Society of Australia Annual Meeting, Keynote Address, "A Brief History of the Shale Gas Phenomenon in North America".
- Outstanding Paper Citation from the Society of Exploration Geophysics for 1985 paper in *Geophysics*: "Tomographic Determination of Velocity and Depth in Lateral Varying Media".
- Outstanding Paper Citation from Society of Exploration Geophysicists for 1995 presentation at International Meeting: "Crosswell Seismic Imaging in the Permian Basin, West Texas".
- Invited Paper, 1999 Society of Exploration Geophysicists International Meeting, *Special Session: Recent Advances and the Road Ahead*, "The instrumented oil field: Implications for borehole geophysics".
- Invited Paper, 2001 European Association of Geoscientists and Engineers Annual Meeting, Amsterdam, "Time-Lapse Reflection and Velocity Imaging in the Lost Hills Steam Pilot using Crosswell Seismology: Successes, Lessons Learned, and Unsolved Problems".
- Invited Paper, 2002 R.J. Krizek Commemorative Symposium, Northwestern University, "Crosswell Imaging in the Oil Patch".
- Sponsored and funded research that led to 1998 *AAPG Bulletin* Best Paper Award, "Geologic Investigation of Crosswell Seismic Response in a Carbonate Reservoir - McElroy Field, West Texas", K.E. Tucker, P. M. Harris, and R. C. Nolen-Hoeksema.

PROFESSIONAL SOCIETIES AND ASSOCIATED ACTIVITIES

Society of Exploration Geophysics (1974-)
- **Associate Ed.,** *Geophysics* Special Issue, "Migration Velocity Analysis & Tomography" (2008)
- Member of the SEG Scientific Delegation to the People's Republic of China (1988)
- Chair, Vertical Seismic Profile (VSP) session, 2014 and 2015 SEG International Meetings
- Organizer, Vertical Seismic Profile Sessions (2) at 2018 SEG International Meeting
- Chair, Tomography/Inversion/Borehole Geophysics/Microseismic Monitoring Sessions at SEG International Meetings (1985, 1987, 1990, 1992, 1994, 1996, 2010, 2016, 2019)
- Technical Program Chairman, Poster Sessions, 1988 SEG International Meeting
- Co-organizer, original Borehole Geophysics Forum (1987-1992)
- Member of Salt-Flank Imaging Consortium (SIC-Not officially part of SEG), (1994-1999)

European Association of Geoscientists and Engineers (2001-)
- **Associate Ed.**, *Geophysical Prospecting* Special Section on "3D VSP" (2013)
- Member of Organizing Committee for 2011 Borehole Geophysics Workshop I: 3D VSP
- Member of Organizing Committee for 2013 Borehole Geophysics Workshop II: 3D VSP

Society of Petroleum Engineers
- Member of Steering Committee, 1998 Society of Petroleum Engineers (SPE) Archie Conference
- Technical Editor, *SPE Journal* (2000-2008)

Environmental and Engineering Geophysical Society (2003-8)
American Geophysical Union (1972-2013)

OTHER INDUSTRY ACTIVITIES

Member, Proposal Review Panel, National Science Foundation (2016, 2018)
Assisted with One-Day Microseismic Workshop for ASEG-PESA Conference (Melbourne, 8/2013)
Co-chair/Organizer of AGU Special Session on Industrial Microseismics, December 2011
Member, Monitoring Technical Panel for San Andreas Fault Observatory at Depth (EarthScope)
Nominated and sponsored 2000 SEG Clarence Karcher Award Winner Tamas Nemeth
Nominated and sponsored 2004 SEG Virgil Kauffman Medal Award Winner Ross Hill
Co-Nominated 2010 SEG Virgil Kauffman Medal Award Winner Jerry Schuster
Co-Sponsored 2002 SEG Clarence Karcher Award Winner Oleg Mikhailov

OTHER ACTIVITIES

Chair of Safety & Rules Committee of USA Triathlon national governing body (1990-2007)

JOURNAL PUBLICATIONS AND REFEREED CONFERENCE PROCEEDINGS

1. "Simultaneous Air Blast and Ground-Motion Response", C. H. Dowding, C. S. Fulthorpe, and R. T. Langan, *Proceedings of the American Society of Civil Engineers, Journal of the Structural Division, STII*, 2363 (1981).

2. "A Kinematic Thermal History of the Earth's Mantle", R. T. Langan, and N. H. Sleep, *Journal of Geophysical Research*, **87**, 9225 (1982).

3. "Seismic Tomography: The Accurate and Efficient Tracing of Rays Through Heterogeneous Media", R. T. Langan, I. Lerche, R. T. Cutler, T. N. Bishop, and N. J. Spera, *Expanded Abstracts of the 1984 SEG International Meeting* (1984).

4. "Tomographic Determination of Velocity and Depth in Laterally Varying Media", T. N. Bishop, K. P. Bube, R. T. Cutler, R. T. Langan, P. L. Love, J. R. Resnick., R. T. Shuey, D. A. Spindler, and H. W. Wyld, *Geophysics*, **50**, 903-923 (1985).

5. "Tracing of Rays Through Heterogeneous Media: An Accurate and Efficient Procedure", R. T. Langan, I. Lerche, and R. T. Cutler, *Geophysics*, **50**, 1456-1465 (1985).

6. "The Tracing of Rays Through Heterogeneous Media", R. T. Langan, I. Lerche, R. T. Cutler, *The Proceedings of the Offshore Technology Conference*, 497-504 (1985).

7. "Well Determined and Poorly Determined Features in Seismic Reflection Tomography II", *Expanded Abstracts of the 1985 SEG International Meeting*, K. P. Bube, R. T. Langan, J. R. Resnick, R. T. Shuey, and D. A. Spindler (1985).

8. "Cross-Well Seismology: A New Production Tool", B. N. P. Paulsson and R. T. Langan, *Proceedings of the Seventeenth Annual Convention of the Indonesian Petroleum Association*, October 25-27, Jakarta, 375-386 (1988).

9. "Unique Determination of Reflector Depths in Seismic Reflection Tomography", K. P. Bube, R. T. Langan, and J. R. Resnick, *Expanded Abstracts of the 1989 SEG International Meeting*, 918-921 (1989).

10. "Hybrid L1/L2 Data Fitting with Applications to Tomography", K. B. Bube and R. T. Langan, *Expanded Abstracts of the 1990 SEG International Meeting*, 69-73 (1989).

11. "Shear-Wave Cross-Well Reflection Imaging in West Texas", S. K. Lazaratos, R. T. Langan, J. M. Harris, and B. P. Marion, *Expanded Abstracts of the 1994 SEG International Meeting*, 289-293 (1994).

12. "A Continuation Approach to Regularization for Traveltime Tomography", K. P. Bube and R. T. Langan, *Expanded Abstracts of the 1994 SEG International Meeting*, 980-983 (1994).

13. "Theoretical and Numerical Issues in the Determination of Reflector Depths in Seismic Reflection Tomography", K. P. Bube, R. T. Langan, J. R. Resnick, *Journal of Geophysical Research (Red),* **100**, **B7**, 12449-12458, (1995).

14. "High Resolution Imaging of a West Texas Reservoir: Part I - Project Summary and Interpretation", J. M. Harris, R. C. Nolen-Hoeksema, R. T. Langan, M. Van Schaack, S. K. Lazaratos, and J. M. Rector III, *Geophysics*, **60**, 667-681 (1995).

15. "High Resolution Imaging of a West Texas Reservoir: Part V - Core Analysis", R. C. Nolen-Hoeksema, J. M. Harris, Z. Wang, and R. T. Langan, *Geophysics*, **60**, 712-726, (1995).

16. "Crosswell reflection traveltime tomography: A field data demonstration", M. A. Van Schaack, J. M. Harris, K. P. Bube, and R. T. Langan, *Expanded Abstracts of the 65th SEG International Meeting,* 65-68 (1995).

17. "Resolution of crosswell tomography with transmission and reflection traveltimes", K. P. Bube, and R. T. Langan, *Expanded Abstracts of the 65th SEG International Meeting,* 77-80 (1995).

18. "Crosswell seismic imaging in the Permian Basin, West Texas", R. T. Langan, J. M. Harris, S. K. Lazaratos, T. L. Jensen, and M. A. Van Schaack, *Expanded Abstracts of the 65th SEG International Meeting,* 81-84 (1995).

19. "Processing and migration of a west Texas crosswell data set", T. Nemeth, W. Cai, and R. T. Langan, *Expanded Abstracts of the 65th SEG International Meeting,* 457-460 (1995).

20. "Hybrid *L1/L2* Minimization with Applications to Tomography", K. P. Bube and R. T. Langan, *Geophysics,* **62**, 1183-1195, 1996.

21. "Experimental verification of seismic monitoring of CO_2 injection in carbonate reservoirs, J. M. Harris, R. T. Langan, T. Fasnacht, D. Melton, B. Smith, J. Sinton, and H. Tan, *Expanded Abstracts of the 66th SEG International Meeting*, 1870-1872, 1996.

22. "Seismic monitoring of CO_2 flooding in a carbonate reservoir rock: Rock physics study", Z. Wang, M. E. Cates, and R. T. Langan, *Expanded Abstracts of the 66th SEG International Meeting,* 1886-1889*,* 1996.

23. "Crosswell seismic imaging in Buena Vista Hills, San Joaquin Valley: A case history", R. T. Langan, D. R. Julander, M. F. Morea, C. M. Addington, and S. K. Lazaratos, *Expanded Abstracts of the 68th SEG International Meeting*, 353-356, 1998.

24. "Seismic monitoring of a CO_2 flood in a carbonate reservoir: A rock physics study", *Geophysics*, Z. Wang, M. E. Cates, and R. T. Langan, **63**, 1604-1617, 1998.

25. "On a continuation approach to regularization for crosswell tomography", K. P. Bube and R. T. Langan, *Expanded Abstracts of the 69th SEG International Meeting*, 1295-1298, 1999.

26. “Time-lapse imaging of steam and heat movement in the Cymric 36W Cyclic Steam Pilot using crosswell seismology”, J. F. Bair, S. J. Johnson, D. R. Julander, R. T. Langan, J. S. Meyer, and J. K. Washbourne, *Expanded Abstracts of the 69th SEG International Meeting*, 1643-1646, 1999.

27. “The Instrumented Oil Field: The implications for borehole geophysics”, Invited Paper to the Recent Advances and the Road Ahead Special Session, R. T. Langan, K. C. Gester, R. F. Heming, D. O. Johnson, D. R. Julander, *Expanded Abstracts of the 69th SEG International Meeting,* 1990-1994, 1999.

28. “Time-lapse reflection and velocity imaging in the Lost Hills Steam Pilot using crosswell seismology”, R. T. Langan, K. C. Gester, M. A. Jervis, D. R. Julander, J. S. Meyer, M. F. Morea, and T. Nemeth, *Expanded Abstracts of the 70th SEG International Meeting*, 1556-1559, 2000.

29. “3-D VSP migration imaging with constraints in Lost Hills, California”, T. Nemeth, B. E. Cornish, W. C. Kempner, and R. T. Langan, *Expanded Abstracts of the 70th SEG International Meeting*, 1560-1563, 2000.

30. "On the velocity vs. depth ambiguity in limited aperture reflection tomography", K. P. Bube, R. T. Langan, and T. Nemeth, *Expanded Abstracts of the 72nd SEG International Meeting*, *IT1.4*, 4 pp., 2002.

31. "Beam methods for predictive suppression of seismic multiples in deep water", N. R. Hill, R. T. Langan, T. Nemeth, and M. Zhao, *Expanded Abstracts of the 72nd SEG International Meeting*, *SP3.7*, 4 pp., 2002.

32. "An expanding wavefront method for solving the eikonal equations in anisotropic media", Y. Wang, T. Nemeth, and R.T. Langan, *Expanded Abstracts of the 74th SEG International Meeting, AN1.6,* 115-118, 2004.

33. "Analysis of the spectral hole in velocity vs. depth resolution for reflection traveltime tomography with limited aperture", K.P. Bube, R.T. Langan, T. Nemeth, *Geophysics*, **70**, U37-U45, 2005.

34. "An expanding wavefront method for solving the eikonal equations in general anisotropic media", Y. Wang, T. Nemeth, and R.T. Langan, *Geophysics*, **71**, T129-T135, 2006.

35. “Resolution of slowness and reflectors in crosswell tomography with transmission and reflection traveltimes”, K.P. Bube and R. T. Langan, *Geophysics*, **73**, VE321-VE336, 2008.

36. “A continuation approach to regularization of ill-posed problems with application to crosswell-traveltime tomography”, K.P. Bube and R. T. Langan, *Geophysics*, **73**, VE337-VE352, 2008.

37. “Introduction to the supplement on velocity estimation for depth imaging”, W. S. Harlan, R. T. Langan, T. Nemeth, *Geophysics*, 73, VE1-VE3, 2008.

38. “Uncertainty in microseismic event source locations associated with a fracture stimulation in a tight sand”, S. Sarkar, R. T. Langan, A. Jupe, J. Shemeta, and A. Rosca, *Expanded Abstracts of the SEG International Geophysical Conference in Istanbul 2012*, 4 pp.

39. “A short history of the shale gas phenomenon in North America”, R.T. Langan, *Expanded Abstracts of the 23rd International Geophysical Conference and Exhibition of the Australian SEG-PESA*, Melbourne, 2013, 3 pp.

40. “Case Study: The use of well control and two different VSP processing methods to characterize the location of the eastern flank of the Markham salt dome”, J. R. Warneke, M. Karrenbach, R. T. Langan, K. Loof, Salt Mining Research Institute, Proceedings of the Spring 2015 Technical Conference, Rochester, New York, U.S.A., 14 pp.

41. “Analysis of the null space in residual curvature inversion in traveltime tomography”, K.P. Bube and R.T. Langan, in preparation, for *Geophysics*.

42. "Beam methods for predictive suppression of multiples in deep water", in preparation, for *Geophysics*.

43. "Classification of tomographic perturbational methods for earth model estimation for migration of seismic reflection data", in preparation, for *Geophysics*.

OTHER PUBLICATIONS (INVITED AND BOOK CONTRIBUTIONS)

1. "Thermal Evolution of the Earth: Some Recent Developments", N. H. Sleep and R. T. Langan, In *Advances in Geophysics*, **23**, B. Saltzman (Ed.), Academic Press, New York, New York (1981).

2. "Seismic Imaging of the Wind River Mountains, Wyoming", A. R. Leeds, D. B. Jovanovich, J. Sharry, R. T. Langan, N. R. Hill, G. M. Jones, and T. M. Guidish, *Proceedings of the China Petroleum Society/Society of Exploration Geophysicists 1985 Meeting*, Beijing, China (1985).

3. "A Tomographic Solution to the Traveltime Problem in General Inverse Seismology", R. T. Cutler, R. T. Langan, P. A. Love, and T. N. Bishop, in *Advances in Geophysical Data Processing*, **2**, M. Simaan (Ed.), 199-221 (1985).

4. "Enhanced Imaging of the COCORP Seismic Line, Wind River Mountains", *Reflection Seismology: A Global Perspective*, Geodynamics Series Volume **13**, 223-236, J. Sharry, R. T. Langan, D. B. Jovanovich, G. Jones, N. R. Hill, and T. M. Guidish (1986).

5. "Cross-Well Seismology: A New Production Tool", R. T. Langan, B. N. P. Paulsson, J. P. Stefani, E. G. Finnstrom, and J. W. Fairborn, *Proceedings of the Joint Meeting of the Society of Exploration Geophysicists and the China Petroleum Society*, Daqing Oil Field, September 6-10, D. Johnston (Ed.) (1988).

6. "High Resolution Imaging of Carbonate Reservoirs Using Cross-Well Seismology", R. T. Langan, J. M. Harris, W. M. Bashore, D. L. Goggin, P. J. Griffith, S. K. Lazaratos, R. C. Nolen-Hoeksema, J. W. Rector, M. Van Schaack, K. E. Tucker, *Proceedings of the 13th Annual Saudi Aramco Laboratories Technical Exchange Meeting*, Saudi Arabia (1994).

7. "Geostatistical Integration of Crosswell Data for Carbonate Reservoir Modeling, McElroy Field, Texas", W. M. Bashore, R. T. Langan, K. E. Tucker, and P. J. Griffith, in *Hydrocarbon Reservoir Characterization: Geologic Framework and Flow Unit Modeling*, SEPM Short Course No. 34, E. L. Stoudt and P. M. Harris (Ed.), 199-225 (1995).

8. "Imaging of a stratigraphically complex carbonate reservoir with crosswell seismic data", R. T. Langan, S. K. Lazaratos, J. M. Harris, A. A. Vassiliou, T. L. Jensen, and J. W. Fairborn, *Carbonate Seismology*, Geophysical Development Series, No. 6, Society of Exploration Geophysicists, Tulsa, OK, 417-424, I. Palaz (ed.), 1997.

9. "Crosswell Seismic Profiling: Principle to Application", J.M. Harris and R. T. Langan, *AAPG Explorer*, January 1997.

Also, author/co-author of 14 abstracts for American Geophysical Union (AGU), Geological Society of America (GSA), and the American Association of Petroleum Geologists (AAPG).