

TysaCurriculum Vitae

Douglas R. Schmitt

*Canada Research Chair in Rock Physics, Tier I
Professor of Geophysics and Physics
Registered Professional Geophysicist, Alberta – P.Geoph.
Engineers Canada Fellow (Honourary) – FEC
Geoscientists Canada Fellow - FGC*



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University of Alberta	fax: (780) 492-0714
Edmonton, Alberta,	http://www.ualberta.ca/~dschmitt
Canada, T6G 2E1	email: dschmitt@ualberta.ca

Research Interests

Earth Material Physics: in situ stress measurement, borehole logging and seismic measurements, rock and porous media physical properties, time-lapse seismic monitoring techniques, optical interferometry and metrology.

Personal Data

Date of Birth: March 30, 1958
Canadian Citizen

Education

Sept. 1981 - July 1987

Seismological Laboratory, California Institute of Technology
Adviser: Dr. T. J. Ahrens
Ph.D. (Geophysics) June 1987
M.Sc. (Geophysics) June 1984
Resident Associate, Page House Undergraduate Dormitory, 1983-1987.

Sept. 1976 - April 1980

University of Lethbridge
B.Sc. (Distinction/Physics) May 1980

Experience

January 1989 - present

Department of Physics, University of Alberta
Canada Research Chair – Tier 1 – in Rock Physics (October 2002 – 2009,
renewed 2009-2016)
Professor of Geophysics and Physics (July 1999 - present)
Associate Professor of Geophysics (July 1994 - June 1999) with tenure
Assistant Professor of Geophysics (January 1989 - June 1994)

July 2013 – present

‘111’ Professor, Dept. of Geophysics and Information Technology, China
University of Petroleum, Beijing.

July 2012 – present

Adjunct Professor, Dept. of Geology, Utah State University, Logan, UT.

July 2005 – September 2009

Director, The Institute for Geophysical Research, Univ. of Alberta

January 2005 – July 2005

Visiting Scientist: Research School of Earth Sciences, Australian National
University, Canberra, Australia.

June 1996 - May 1997

Geophysikalisches Institut, University of Karlsruhe, Germany
Alexander von Humboldt Research Fellow

August 1987 - Dec. 1988

Department of Geophysics, Stanford University, Postdoctoral Research
Associate
Adviser: Dr. M. D. Zoback

July 1980 - Sept. 1981

Texaco Canada Resources Ltd, Calgary
Exploration Geophysicist

Research Identifications

ORCHID orcid.org/0000-0001-6920-0658

Scopus Author ID 7402515256

Researcher ID www.researcherid.com/rid/A-4091-2010

Research Adherents

Current Graduate Students

Mr. Christopher Nixon (M.Sc., Commence June, 2015) – borehole seismology

Mr. Ryan Ferguson (M.Sc., commence January, 2015) – High resolution seismic imaging at Baffin Island.

Mr. Zhizhen Wang, (Visiting Phd from China University of Petroleum – Qingdao), Carbonate Rock Physics

Ms. Franziska Naumann (Visiting M.Sc. from Uni-Freiburg, commence October, 2014), Offset VSP measurements

Mr. Sean Murray (M.Sc. student at Technische Universität München co-supervised with Prof. I. Moeck). Issues in hydraulic fracturing.

Ms. Deirdre Mallyon (M.Sc., commence September 2014), Alpine Fault Drilling, New Zealand

Mr. Tyson Epp (M.Sc., commence September 2014), Analysis of logs for ICDP Hotspot project.

Mr. Mohammadreza Malehmir (Ph.d., commence September 2012, transfer to my supervision July, 2013) Seismic anisotropy

Mr. Micah Morin (M.Sc., commence May 2013), Rock Physics and Geomechanical properties of bitumen saturated rocks.

Mr. Tariq Mohammed (M.Sc., commence June 2013. Transfer to Phd February 2015)

Mr. Arif Rabbani (Ph.d.. commence September 2012). Rock physics of bitumen saturated carbonates particularly P-T dependent fluid properties.

- *Shell Canada Enhanced Learning Fund Award (Assistance to Biot Conference, Vienna, July 2013)*

Mr. Yang Li (co-supervisor with Prof. Ian Jackson, Australian National University, Canberra, PhD). Dispersion of seismic waves in cracked media.

Ms. Sohely Parvin (M.Sc., commence May, 2012). Dielectric properties of potash deposits.

Ms. Ehahe Poureslami (Ph.d.; commence Sept. 2009; expected completion June, 2015), Geothermal exploration

- *SEG/EXXON Student Travel Award, 2013 SEG Annual Meeting*
- *Commence employment as Advanced Geophysical Analyst, ESG Ltd., Kingston, January, 2015.*

Current Postdoctoral, Research Associate, and Technical Staff Supervision:

Mr. Randy Kofman, Research Professional, commence June, 2010.

Mr. Xiwei Chen: Research Professional Intern, commence May 2013.

- *Best Student Integrated Poster, Geoconvention 2014 (Chen presenter)*

Mr. Nam Ong: Research Professional Intern, commence May 2014

Past Graduate Students (listed chronologically)

Ms. Qing Jia (M.Sc., commence June, 2012, completed February 23, 2015). State of stress in anisotropic formations, implications for crustal stress determination.

Mr. James Kessler (co-supervisor with Prof. James Evans, Utah State University, Logan, UT, PhD., complete August 22, 2014) Stress and fracture studies in the Snake River Plain as determined from Scientific Drilling.

- *ExxonMobil Research Grant, 2013 (allow to work at U of Alberta)*
- *Best Student Integrated Poster, Geoconvention 2014*

Mr. Mizan Chowdhury (M.Sc., commence September 2011, complete August 21, 2014), CO₂ Rock Physics,

Ms. Wei Xei (M.Sc., commence September, 2011, complete August 20, 2014). Geophysical studies associated with the Bow City Impact Structure. Currently Geophysicist at CGG-Calgary..

Dr. Heather Schijns, (Ph.d. commence October 2009, completed March 2014), currently employed at MGD Resources, Vancouver): Seismic anisotropy from VSP measurements, and low frequency forced oscillation methods.

- *NSERC Postgraduate Scholarship for Ph.D. (2009-2013)*
- *NSERC Michael Smith Foreign Study Supplement (to visit ANU, 2009-2010)*
- *Alberta Ingenuity Graduate Award (2010-2013)*

Dr. Jaime Meléne-Martinez (Ph.d., commence January 2011, completed January 27, 2014), Shale Anisotropy Rock Physics, currently Research Geophysicist, Instituto Mexicano del Petroleo, Mexico City.

Ms. Miryam Ortiz Osornio, (M.Sc. Univ. of Mexico, Ph.D. commence January 2007, withdrew 2014): Seismic Attenuation and Anisotropy

- *Full expenses paid to attend, IIWRP, Golden, Colorado, August, 2011*

Mr. Ross Bishop (M.Sc., commence September, 2011, withdrew August 2013, co-supervised with D. Potter). Analysis of Snake River borehole data.

Ms. Judith Chan (M.Sc. commence June, 2010, Completed August 2013), Geoscience study of the deep Hunt well, Fort McMurray, Alberta. Currently Geophysicist, CGG, Calgary,

- *Best Student Geophysical Presentation Award, CSPG-CSEG-CWLS Annual Meeting, Calgary, 2013.*

- *Best Poster, Helmholtz-Alberta Initiative Annual Student Meeting, Edmonton, September 2013.*
- *2013 Canadian Well Logging Society Student Award Winner, Calgary, February 2014.*

Mr. Seyi Idowu (Ph.d, commence Sept. 2009, withdrew December, 2012), Stress mapping and core damage. Incomplete. Currently Geophysicist at Arcis, Calgary.

Mrs. Xuefeng Duo, (M.Sc. commence May, 2008, completed August 2011): High resolution VSP analysis. Currently Geophysicist at CGGVeritas, Calgary.

Ms. Helen Yam, (M.Sc. commence Sept., 2008, Completed August 2011), CO₂ rock physics. Currently Geophysicist at Imperial Oil, Calgary.

- *Best Student Oral Presentation, 2011 CSEG/CSPG/CWLS Meeting, Calgary*
- *NSERC Postgraduate Scholarship for M.Sc.*
- *ICDP Summer School on Logging Scholarship, Windisheschenbach, Germany.*

Mr. Grey Riddle, (M.Sc. commence May, 2008, completed August 2011): Near surface tunnel detection studies. Currently Geophysicist at Shell Canada, Calgary.

Mr. Todd Bown, M.Sc., commence Sept. 2008, Completed August 2011, Karst Terrane Geophysics, Currently Geophysicist, Optiseis Ltd., Calgary.

Mr. Lei Zhang (M.Sc. with C. Currie, commence Jan. 2009, completed June 2011) core damage and stress. Currently Geophysicist at Terranotes Ltd., Toronto.

Mr. Oluwafemi Ogunsuyi, (M.Sc. commence January 2008, completed August, 2010): Near surface studies of a landslide zone, currently Geophysicist at Arcis, Calgary.

- *Honorable Mention Student Oral Paper, GeoCanada2010, Calgary, 2010.*

Dr. Aiman Bakhorji (M.Sc. Univ. Oklahoma, Ph.D. Dec. 2009): Carbonate properties, currently Chief research scientist in rock physics at Saudi Aramco, Dharan.

Ms. Heather Schijns (M.Sc. Dec. 2008), Seismic anisotropy from VSP measurements in hard rock, Currently, working as Exploration Geophysicist at MGD Resources, Vancouver.

Mr. Damien Meilleux (M.Sc.. Nov. 2008) Vertical Seismic Profiling Study of Lake Bosumtwi, Currently Shipboard Marine Seismic Data Acquisition at PGS, London, UK.

Mr. Evan Bianco (M.Sc. Sept 2008): Time lapse seismic monitoring. Currently Geophysicist at Agile Geophysical Consulting, Halifax.

Ms. Suvi Heinonen, (M.Sc., April 2008 – Univ. of Helsinki, Finland, co-supervisor P. Heikkinen), High resolution reflection profile processing of Outokumpu, Finland seismic data. Currently Ph.D. student at Univ. of Helsinki.

Mr. Xun Qi, (M.Sc., December 2007), Theoretical and Laboratory Studies of Seismic Attenuation. Currently Geophysicist at Husky Energy, Calgary.

Mr. Darrel Hemsing, (M.Sc. June, 2007): Seismic anisotropy studies, Currently processing geophysicist, Statcom Ltd., Calgary.

Mr. Marek Welz, (M.Sc., September 2006): Environmental blast monitoring for fish habitat studies in the N.W.T., Currently contract manager for mining field surveys worldwide.

Mr. Jawwad Ahmad (M.Sc., September 2006): Processing and interpretation of a high resolution seismic profile, Chinchaga River Region, Alberta. Currently Geophysicist Saudi-Aramco, Dharaan.

- *Honorable Mention, Best Paper Award, CSEG, May 2005.*

Mr. Tiewei He (M.Sc., August, 2006): Laboratory measurements of the frame moduli of rock. Currently processing geophysicist, Geomodeling Technology Corp., Calgary.

Dr. Yajun (Sarah) Zhang (Ph.D, June, 2006), Heavy oil time lapse studies. Currently Research Geophysicist at Saudi Aramco, Saudi Arabia.

Mr. Mingyou Zhang (M.Sc. Dec. 2005): Inversion of time lapse seismic observations (co-supervised with Dr. M. Sacchi). Currently geophysicist at GEDCO, Calgary.

Mr. Jason (Zhigang) Han (M.Sc., July, 2005): Laboratory measurements of elastic wave anisotropy (co-supervised with Dr. V. Kravchinsky), Currently Geophysicist at Encana Resources, Calgary.

- *Recipient of Best Geophysical Student Poster Award, CSEG, May 2005.*
- *Recipient of Best Geophysical Student Poster Award, CSEG, May 2004.*

Dr. Marko Mah (Ph.D. April, 2005; M.Sc, 1999, U of Alberta): NSERC scholarship recipient, experimental studies of effective media theory and anisotropy. Currently Geophysicist, Husky Energy, Calgary.

- *NSERC Scholarship student*
- *University of Alberta Dissertation Scholarship.*

Dr.. Pavlo Cholach (Ph.D., Dec. 2004; Diplom, 1998, Kiev): Modelling of Anisotropy. Currently Geophysicist at Taqa Resources, Calgary.

- *Recipient of Best Student Poster Award, CSPG/CSEG Joint Meeting, June 2003.*

Mr. Fabian Domes (Diplom, 2004, co-supervisor W. Friedeman, Uni-Karlsruhe): Near surface seismic tomographic studies. Diplom research conducted and thesis written under my supervision. Currently Ph.D. student in Geophysics – U of Edinburgh, U.K.

Dr. Ulrich Theune (Ph.D., Aug. 2004, Diplom, 1998, Karlsruhe), Finite element modelling of seismic wave propagation. Research Geophysicist, Statoil, Trondheim, Norway (Jan. 2006).

- *Schlumberger Research Fellowship, Summer 2002, Cambridge, U.K*

Mr. Gabriel Solano (M.Sc., 2004), VSP zero offset data processing and attenuation estimates in the oil sands. Currently Geophysicist at Shell International, Houston.

Dr. Yousef Bouzidi (Ph.D, 2003; M.Sc. Columbia University, 1985): Experimental tests of acoustic wave reflectivity from porous media. Currently Professor of Geophysics, the Petroleum Institute, Abu Dhabi, UAE.

- *Recipient of Outstanding Student Paper Award, Tectonophysics Section, American Geophysical Union Fall Meeting 2001.*

Mr. Wendell Pardasie (M.Sc., 2003), Geophysical study of a Sweetgrass Dike, Southern Alberta. Currently Geophysicist, Microseismic Services, Schlumberger, Calgary.

Mr. Shah Shareef (M.Sc., 2002), Elastic properties from laser speckle interferometry. Currently R&D Geophysicist, Nanometrics, Ottawa, Ontario, August, 2007.

Mr. Wolfgang G. Engler (M.Sc., 2002), Laser speckle interferometry: a stochastic investigation. Currently Ph.D. student in Geophysics, U of Alberta.

Dr. Kristen Buchanan (nee Beaty) (M.Sc. 2000): Determination of near-surface variability using Rayleigh waves. Presently Assistant Professor in Physics, Univ. of Colorado.

- *NSERC graduate scholarship recipient*
- *Awarded top student paper for the 2000 Society of Exploration Geophysicists International Conference.*
- *Awarded Governor General's Gold Medal, at U of Alberta Commencement, Fall 2004.*

Dr. Joseph B. Molyneux (Ph.D. 2000; M.Sc. 1994), Measurement of attenuation through highly scattering media, metamorphic rock velocities. Presently Research Geophysicist at Exxon-Mobil Resources, Houston.

Mr. Adam Baig, (M.Sc. 1999, Ph.D. at Princeton, 2003): Some aspects of wave propagation in gradient media. Currently Geophysicist, Engineering Seismology Group, Kingston, Ontario.

- *NSERC graduate scholarship recipient*

Mr. Micheal Grech (M.Sc. 1998): Amplitudes measured in wellbore seismic experiments. Currently owner of successful catering company, Calgary.

Dr. Yongyi Li (Ph.D. 1997; M.Sc. 1992) Damage to core retrieved from depth: Relationship to in situ stress and effects on laboratory physical property measurements. Presently Research Geophysicist at Shell Resources, Calgary.

Dr. Ahmed Kebaili (Ph.D. 1996): New methodologies of quantitatively measuring anisotropy in the laboratory and from wellbore seismic experiments. PanCanadian Petroleum (1996-98), Presently Geophysicist in Abu Dhabi.

Mr. Yanguan (Matthew) Wang (M.Sc, 1994) A fast method for forward modelling of direct and reflected seismic travel-times in wellbore seismics: Application in tomographic imaging. Presently Geophysicist at Conoco-Phillips, Calgary.

Past Postdoctoral and Research Associate Supervision:

Dr. Gautier Njiekak, Postdoctoral Researcher, (October 2009 to December 2014), physical properties of carbonates.

Ms. Judith Chan, Research Associate (continued from M.Sc.), September 1, 2013 to March 31, 2014. Currently geophysicist at CGG, Calgary.

Dr. Madeline Lee, Postdoctoral Researcher, April 1, 2013 to February 28, 2014. Currently at NRC, Ottawa.

- *Bhatia Women's Postdoctoral Fellowship*

Mr. Mark Novakovic: Research Professional Intern, June 2013 to December 2013, currently M.Sc. student in Geophysics at Western University.

Mr. Lucas Duerksen, Geophysical Technician, July 2008 to May, 2012, currently technician in Dept. of Environmental and Civil Engineering, U of Alberta.

Dr. Sanaa Aqil, Postdoctoral Researcher, April, 2007 to April 2011, physical properties of potash. Currently Petrophysicist at Halliburton Services, Calgary.

Dr. Ali Oncel, Research Associate (July 1, 2008 to Dec 31, 2009), currently Professor of Engineering Geophysics, *İstanbul Üniversitesi, Turkey*.

Mr. Marek Welz [B.Sc., 1990; M.Sc., 2006, Geophysics, U of Alberta] (2001-2007) – Scientific and organizational assistance for field programs. Currently mining exploration Geophysicist, Vancouver.

Dr. Dean Rokosh [Ph.D. Geology, U of Alberta, 2001] (Jan. 2002-May, 2005) – Scientific and organizational assistance for all facets of research. Currently Scientist at the Alberta Geological Survey, Edmonton.

Mr. Michael Lazorek [Environment, BCIT] (1999-Sept. 2002): Management of field studies for heavy oil projects. Completed M.Sc. in Geology at U of T. Currently petroleum Geologist at Conoco-Phillips, Calgary.

Dr. Mamadou Diallo [Geophysics, University of Tuebingen, Germany] (Feb. 2001-May 2002): Rock physics. Currently Research Scientist, ExxonMobil Upstream Research Company, Houston, TX.

Dr. Ismael Rumzan, [Mechanical Engineering, Imperial College, London] (1999-May 2002): Finite element modelling of stress relief and core fractures. Now Web Course Developer/Instructor, Faculty of Extension, U of Alberta.

Dr. Yinbin Liu [Geophysics, USCD and Beijing] (1999-March 2002): Modelling of complex wave propagation. Currently independent geophysical consultant, Vancouver.

Dr. Irene Meglis [Geophysics, PennState] (1998-2001): Laboratory rock and fluid property determinations. Seismic monitoring studies, now in Fort McMurray, Alberta.

Dr. Ulrich Zimmer [Geophysics, Tech. Uni. Berlin, 2000] (2000-2001): Processing and Acquisition of seismic monitoring seismic data, currently at Shell Research Laboratories, Houston.

Dr. Eric Molz [Physics, U of Alberta] (1995): Laboratory methods of compressional and shear wave anisotropy determination. Presently at Baker-Hughes, Houston.

Dr. Craig Hickey [Physics, U of Alberta] (1993): Time lapse seismology. Now at National Acoustics Laboratory, Univ. of Mississippi.

Dr. Holger Spann [Geophysics, Frieberg] (1991-92): Modelling of fluid flow in a hydraulic fracturing experiment Presently supervisor of environmental geotechnical research for nuclear waste management at PreussenElektra, Hannover, Germany.

Mr. Jay Haverstock [B.Sc. Physics and Mathematics, U of Alberta] (1991-1997): Electronics and computer technician. Currently IT professional.

Mr. Roger Hunt [M.Sc., Physics, McMaster] (1995-1998): Technical and analytic assistance with interferometry project.

Undergraduate (Physics 499), Course Based M.Sc. Thesis, and Visiting Student Supervision

1. R. Vestrum (1992) - Phase velocities in anisotropic minerals (Note, Mr. Vestrum completed his Ph.D. studies in anisotropy at the U of C, he has made some fundamental work on the influence of anisotropy on seismic migration and was awarded the Karcher Award of the SEG in 2002)
2. C. Fink (1993) - Seismic attenuation measured from wellbore
3. C. Bruins (1996) - Migration of low fold 3D seismic coverage
4. D. Michaelis (1997) - Velocity anisotropy of shales from Alberta
5. W. Curry (1999) - Single fold seismic monitoring
6. S. Jastafarian-Ostbin (2002), Elastic wave anisotropy of shale experiments.
7. D. Meilleux – University Louis Pasteur, Strasbourg, Internship (2002)
8. D. Collis (2003), Elastic anisotropy of a Colorado Shale
9. C. Brillon (2003), Determination of Sonic Log Velocities from Full Waveform Logging Tools – Application to the Mallik 5L-38 Scientific Well.
10. A. Berthelot – University Louis Pasteur, Strasbourg, Internship (2003)
11. R. Zaari (2004), Speckle interferometry.
12. J. Holzhauer - University Louis Pasteur, Strasbourg, Internship (2004)
13. M. Cannon (2004) – Ultrasonic calibrations.
14. Micheal de Groot, (2004) NSERC summer student
15. Meghan Brown (2005), General lab and field duties.
16. Jennifer Badry (2006), General lab and field duties. Phys 499 on refraction.

17. Sobhi Alashwa (2007), GPR processing and general duties
18. Helen Gu (2007), WISEST high-school student, Dielectric properties on rock.
19. Steven Taylor (2009), General field and laboratory duties
20. Gordon Brasnett (2009, 2010), Phys 499, Refraction tomography, Seismic Processing
21. Kathryn Patzer (2010), General field and laboratory duties
22. James Schmitt (2010), 3D visualization
23. Mohammed Ahmed (2010) IPG Research Project, Geological model construction.
24. Brendan deMilliano (2011), borehole stress measurement
25. Brendan Snow (2011), laboratory velocity measurements.
26. Brendan Snow (2012), analysis of borehole stress information.
27. Maria Grohmann, Alberta-Saxony Summer Fellowship, Stress modelling
28. Michael Chau & Timothy Harrison (2012-2013) Eng. Phys. Capping Exercise,
29. Micah Morin (2012) Phys 499 Research, VSP attenuation
30. Xiwei Chen (2013) Phys 499 Research : Rock mechanics of basalts.
31. Afoke Muoboghare (2013), IPG Research Project, Petrophysics
32. Abimbola Afolabi (2013), IPG Research Project, Seismic Interpretation
33. Simon Vermorel and Paul Milan (2013), Strasbourg Interns
34. Megan Paranich, Geology Undergrad Thesis, 2013-14.
35. Nam Ong, Phys 499, Rock Anisotropy, Winter 2014.
36. Vyasulu Akkiraju & Deepjyoti Goswami, visiting Phd students, NGRI, Hyderabad. March-April, 2014.
37. Simon Gonzalez-Sirois, visiting M.Sc. student, INRS, Quebec, September to November, 2014.
38. Scott Courchense, Phys 499, Alberta Stress Measurement, Fall, 2014.
39. Elizabeth Ramsey, Phys 499, Biot Wave Propagation Modelling, Winter, 2015
40. Ryan Boroweicki, Phys 499, Reflectivity from anisotropic structure, Winter, 2015
41. Brendan deMilliano (2015), IPG Research Project: Stress determination.

External Dissertation Examiner at Other Institutions

1. Ms. Asma Dewan, Geophysics, M.Sc., Memorial Univ. of Newfoundland, 2014.
2. Dr. Corriea Lopes, Geophysics, Curtin University, Western Australia, 2013
3. Dr. Andrew St. Onge, Geophysics, U of Calgary, 2013
4. Dr. Faranak Mahmoudian – Rock Physics, Univ. of Calgary, 2013.
5. Mr. Devon Parry – Geophysics, MSc., Laurentian Univ., 2013.
6. Mr. Trevor Coulman – Geophysics, MSc., U. of Saskatchewan, 2012
7. Dr. Jason Nycz - Meteoritics and Geophysics, PhD., U of Calgary, 2012.
8. Dr. Saurabh Datta Gupta – Applied Geophysics – Indian School of Mines, Dhanbad, 2012.
9. Ms. Thakane Ntholi – Geoscience, M.Sc., Univ. of Cape Town, 2012
10. Dr. Inga Moeck – Habilitation Referee, GFZ-Potsdam, 2011
11. Dr. Xueping Zhao – Geophysics, U of Toronto, 2010
12. Dr. Zimin Zhang – Geophysics, U of Calgary, 2010
13. Dr. Dina Makarynska – Geophysics, Curtin University, Western Australia, 2010.
14. Dr. Draga Talinga – Geophysics, U of Calgary, 2009
15. Ms. Yulia Stoeyen – Geophysics, U of Victoria, 2008
16. Dr. Ying Zou – Geophysics, University of Calgary, 2005
17. Dr. Rachel Newrick – Geophysics, University of Calgary, 2004.
18. Dr. Thomas Bohlen – Habilitation Referee, Uni-Kiel, 2004.
19. Dr. Robert Vestrum – Geophysics, University of Calgary, 2003.
20. Dr. Lan Lan Yan, Ph.D. – Geophysics, University of Calgary, 2002.
21. Mr. Ken Hedlin, M.Sc. - Geophysics, University of Calgary, 2001.
22. Dr. Jennifer Leslie, Ph.D. - Geophysics, University of Calgary, 1999.
23. Dr.. Sam Sun, Ph.D. - Geophysics, University of Calgary, 1999.
24. Dr. S. Bezdan, Ph.D.-Geophysics, University of Saskatchewan, 1998.
25. Dr. Peter Amerl, Ph.D. - Physics, University of Calgary, 1998.
26. Dr. M. Slawinski, Ph.D.-Geophysics, University of Calgary, 1996.

Refereed Publications – Journal and Book Chapter (adherents in bold)Contributions submitted for Peer Review

1. Perozzi, L., B. Giroux, D.R. Schmitt, and **R. Kofman**, *Sensitivity of vertical seismic profiling for monitoring CO₂ storage in a low porosity reservoir: An example from the St. Lawrence Lowlands, Canada*, submitted Int. J. Green House Gas Control, ms. 40 pp., January 5, 2015.
2. **Rabbani, A.**, D.R. Schmitt, **R. Kofman**, and J. Nycz, *A laboratory procedure for the measurement of compressional and shear wave velocities in bitumen saturated carbonates from 10 C to 100 C*, submitted J. Can. Petr. Tech., ms. 27 pp., April 1, 2015.

Accepted and/or Published Fully Peer Reviewed Contributions (bold indicates adherent)

1. Schmitt, D.R., INVITED PAPER, *Seismic Properties*, in Slater, L, ed., *Geophysical Properties of the Near Surface Earth*, in Schubert, G., ed., ‘Treatise on Geophysics’, 2nd Edition, Vol. 11, 48-87, published online, April, 2015.
2. Liberty, L.M., D.R. Schmitt, and J.W. Shervais, *Seismic imaging through the volcanic rocks of the Snake River Plain: Insights from Project Hotspot*, Geophys. Prosp. 18 pp., doi: 10.1111/1365-2478.12277 2015.
3. Melanson, D.M., D.J. White, C. Samson, G. Bellefleur, E. Schetselaar, and D.R. Schmitt, *Mode-converted VMS ore lens reflections in vertical seismic profiles from Flin Flon, Manitoba, Canada*, Geophys. Prosp., ms. pp. 36 Accepted, December 24, 2014.
4. **Chan, J.** and D.R. Schmitt, *Examining the in situ metamorphic rock in northeastern Alberta using zero-offset VSP*, Int J Earth Sci (Geol Rundsch), 14 pp. DOI 10.1007/s00531-014-1110-x, , Published Online December 5, 2014.
5. **Chan, J.**, and D.R. Schmitt, *Elastic Anisotropy of a Metamorphic Rock Sample of the Canadian Shield in Northeastern Alberta*, Rock Mechanics and Rock Engineering, pp. 17, DOI 10.1007/s00603-014-0664-z, Published Online November 8, 2014.
6. Reiter, K., O. Heidbach, D.R. Schmitt, K. Haug, M. Ziegler, and I. Moeck, *A revised crustal stress orientation database for Canada*, Tectonophysics, 636, 111-124, doi: 10.1016/j.tecto.2014.08.006, 2014. .
7. Weides, S., I. Moeck, D.R. Schmitt, and J. Majorowicz, *An integrative resource assessment study for the siliclastic Granite Wash Unit, northwestern Alberta, Canada*, Environmental Earth Sciences, DOI 10.1007/s12665-014-3309-3ms. 14, pp., accepted April 19, 2014.
8. Glombick, P., D.R. Schmitt, **W. Xie**, **T. Bown**, B. Hathaway, and C. Banks, *The Bow City structure, southern Alberta, Canada: the deep roots of a complex impact structure?*, Meteoritics and Planetary Science, 24 pp., doi:10.1111/maps.12296, 2014.

9. **Ardakani, E.P.**, D.R. Schmitt, and **T.D. Bown**, *Detailed topography of the Devonian Grosmont surface from legacy high resolution seismic profiles, northeast Alberta*, *Geophysics*, 79 (4), pp. B135-B149, doi: 10.1190/geo2013-0268.1, 2014.
10. Majorowicz, J., **Chan, J.**, Crowell, J., Gosnold, W., Heaman, L., Kueck, J., Niewenhuis, G., Schmitt, D.R., Walsh, N., and Unsworth, M., *The first deep heat flow determination in crystalline basement rocks beneath the Western Canada Sedimentary Basin*, *Geophysical Journal International*, pp. 17, doi:10.1093/gji/ggu065, 2014.
11. **Meléndez-Martínez, J.**, and D.R.Schmitt, *Anisotropic elastic moduli of carbonates and evaporites from the Weyburn-Midale reservoir and seal rocks*, *Geophys. Prosp.*, 16, 363-379, DOI: 10.1111/1365-2478.12032, 2013.
12. **Njiekak, G.**, D.R. Schmitt, **H. Yam**, and **R.Kofman**, *CO₂ rock physics as part of the Weyburn-Midale geological storage project*, 16 pp., *Int. J. Greenhouse gas control*, <http://dx.doi.org/10.1016/j.ijggc.2013.02.007>, 16, S118-S133 2013.
13. **Bouzidi, Y.** and D.R. Schmitt, *Incidence-angle Dependent Acoustic Reflections from Liquid Saturated Porous Solids*, *Geophysical Journal International*, 191, 1427-1440, doi: 10.1111/j.1365-246X.2012.05695.x, 14 pp., 2012.,
14. Schmitt, D.R., C.A. Currie, and **L. Zhang**, *Crustal stress determination from boreholes and rock cores: Fundamental principles*, INVITED REVIEW PAPER, *Tectonophysics*, , doi:[10.1016/j.tecto.2012.08.029](http://dx.doi.org/10.1016/j.tecto.2012.08.029), 580, 1-26, 2012.
15. **Schijns, H.**, D.R.Schmitt, P.J. Heikkinen and I.T. Kukkonen, *Seismic anisotropy in the crystalline upper crust: Observations and modeling from the Outokumpu scientific borehole, Finland*, *Geophys. J. Int.*, 189, 541-553, doi: 10.1111/j.1365-246X.2012.05358.x, 2012.
16. Wilson, G. S., et al., *Neogene tectonic and climatic evolution of the western Ross Sea, Antarctica - chronology of events from the AND-1B drill hole*, *Glob. Planet. Change*, 96-97, 189-203, 2012.
17. Majorowicz, J., M. Unsworth, T. Chacko, A. Gray, L. Heaman, D.K. Potter, D.R. Schmitt, and T. Babadagli, *Geothermal energy as a source of heat for oilsands processing in northern Alberta, Canada*, in Hein, F.J., D. Leckie, J. Suter and S. Larter, (eds) *Heavy Oil/Bitumen Petroleum Systems in Alberta and Beyond*, AAPG Studies in Geology, 64, 1-22, 2012.
18. Jackson, I., **H. Schijns**, D.R. Schmitt, J. Mu and A. Delmenico, *A versatile facility for laboratory studies of viscoelastic and poroelastic rock*, *Rev. Sci. Instruments*, 82, Article Number 064501, DOI: 10.1063/1.3592154, 8 p, 2011.
19. **Heinonen, S.**, I.T. Kukkonen, P.J. Heikkinen, and D.R. Schmitt, *High resolution reflection seismics with deep drill hole data in Outokumpu, Finland*, in I.T. Kukkonen (ed), *Outokumpu Deep Drilling Project 2003-2010*, Geological Survey of Finland, Special Paper 51, 105-118, 2011.
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Non-refereed or Editorial Refereed Contributions

Papers, Articles, and Initial Reports

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- 251. Schmitt, D.R., **Y. Li, A. Kebaili, Y.Q. Wang, J. Molyneux, H. Spann,** and **J. Haverstock**, Geophysical and geotechnical characterization in support of shallow enhanced oil recovery processes, AOSTRA/University/Industry Technical Review Meeting and Seminar, Calgary, March 1993.

- 252. Schmitt, D.R., Study of stress release damage in Alberta Basement core: Potential indicators of stress levels in the crust, Lithoprobe Alberta Basement Transect Meeting, Calgary, March, 1993.
- 253. Schmitt, D.R., Study of stress release damage in Alberta Basement core: Potential indicators of stress levels in the crust, Lithoprobe Alberta Basement Transect Meeting, Calgary, March, 1993.
- 254. Schmitt, D.R., and **A. Kebaili**, Layer stripping in the t-p domain to delineate seismic anisotropy, AGU Fall Meeting, San Francisco, Dec. 1992.
- 255. Schmitt, D.R., Rock physics studies at high pressure, Canadian Workshop on High Pressure Science and Technology, Vancouver, Sept. 1992.
- 256. **Kebaili, A.** and D.R.Schmitt, Estimation of anisotropy from borehole seismics, Int. Workshop on Seismic Anisotropy, Banff, May 1992.
- 257. **Li, Y.**, and D.R. Schmitt, Optical interferometric stress measurements: laboratory calibration of a three dimensional model of stress relief, AGU-CGU joint meeting, Montreal, May 1992.
- 258. **Spann, H.**, D.R. Schmitt, and R.J. Tait, Distribution of pore pressure and stress in Biot hollow cylinders: application to laboratory hydraulic fracturing tests, AGU-CGU joint meeting, Montreal, May 1992.
- 259. **Kebaili, A.** and D.R.Schmitt, Anisotropy estimation using three component multiple offset VSP data, Canadian Soc. Exploration Geophysics Meeting, Calgary, May 1992.
- 260. **Li, Y.Y.**, and D.R. Schmitt, Stress logging in boreholes: laboratory calibration of a numerical model of stress-relief displacements, Canadian Soc. Exploration Geophysics Meeting, Calgary, May 1992.
- 261. Schmitt, D.R., High pressure rock property measurements: progress report on a new facility of stress relief displacements, Canadian Soc. Exploration Geophysics Meeting, Calgary, May 1992.
- 262. Schmitt, D.R., Subsurface stress orientations from wellbore wall topography, VI Int. Symp. on the Observation of the Continental Crust Through Drilling, Paris, April 1992.
- 263. Schmitt, D.R., Static physical properties of rocks from the Trans-Hudson orogen, Lithoprobe Trans-Hudson Orogen Transect Meeting, Saskatoon, March 1992.
- 264. Schmitt, D.R., A high pressure facility for physical property measurement on core, Lithoprobe Alberta Basement Transect Meeting, Calgary, March 1992.
- 265. Schmitt, D.R., Determination of open fracture porosity and stress orientation from digital ultrasonic televiewer logs: results from a highly fracture granodioritic pluton, AGU Fall Meeting, San Francisco, Dec. 1991.
- 266. Schmitt, D.R., **H. Spann, A. Kebaili, Y. Li, Y. Wang, H. Neiman, C. Fink , and J. Haverstock**, Development of borehole stress measurement technologies, AOSTRA /University/Industry Technical Review Meeting and Seminar, Banff, Oct 1991.
- 267. Schmitt, D.R., A field based system for the digitization of ultrasonic borehole televiewer data in real time, 13th Formation Evaluation Symp., Canadian Well Logging Society, Sept. 1991.

- 268. Schmitt, D.R. and M.D. Zoback, Evidence for dilatant hardening effects in the tensile failure of Westerley granite, XX General Assembly of the IUGG, Vienna, August 1991.
- 269. Schmitt, D.R., Ultrasonic borehole televiewer logging: Real time digitization during logging on a PC based system, 4th Intl. Symp. on Borehole Geophysics, Toronto, August 1991.
- 270. Schmitt, D.R. and M.D. Zoback, Pore pressure in low porosity rock & Fluid infiltration effects in the rupture of hollow cylinders of glass and low porosity rock, Stanford Rock and Borehole Physics Annual Meeting, Stanford, June 1991.
- 271. Schmitt, D.R., Discrimination of open fractures from borehole topographs, Canadian Society of Exploration Geophysicists Annual Meeting, Calgary, May 1991
- 272. Schmitt, D.R., Rock elastic moduli: Relevance to hydraulic fracturing stress determinations, Canadian Geophysical Union Annual Meeting, Banff, May 1991.
- 273. **Li, Y.,** and D.R. Schmitt, A new finite element stress-relief model applied to stress measurement by optical holography, Canadian Geophysical Union Annual Meeting, Banff, May 1991.
- 274. Schmitt, D.R., Fracture statistics derived from digital ultrasonic borehole televiewer logging, CIM/AOSTRA 1991 Technical Conference, Banff, April 1991.
- 275. Schmitt, D.R. and M.D.Zoback, Pore pressure effects in tensile rupturing of low porosity rocks: Possible evidence of dilatancy hardening, Amer. Geophys. Union, San Francisco, Dec. 1990.
- 276. Schmitt, D.R., **Y. Li, J. Stuhec, H. Neiman, E. Oberle, A. Humpreys, and J. Haverstock,** Ultrasonic borehole televiewer logging at the UTF: Implications for in situ stress, AOSTRA /University/Industry Technical Review Meeting and Seminar, Banff, Oct 1990.
- 277. Schmitt, D.R. and M.D.Zoback, Pore pressure effects in the tensile rupture of crystalline rock, Canadian Geophysical Union Annual Meeting, Ottawa, May, 1990.
- 278. Schmitt, D.R., M. Kanzaki, and R. Tronnes, Sodium Chloride high pressure melting experiments, GAC/MAC annual meeting, Vancouver, May, 1990.
- 279. Schmitt, D.R., Pore pressure effects in the tensile rupture of low porosity rock - implications for hydraulic fracturing, invited seminar to Petroleum Engineers of the CIM, Calgary branch, Calgary, May, 1990.
- 280. Schmitt, D.R., and M.D. Zoback, Determination of static bulk moduli, poroelastic co-efficients, and microcrack closure: application to Cajon Pass Core to 3507 m., Amer. Geophy. Union, San Francisco, Dec. 1989.
- 281. Schmitt, D.R., Stress determination methods in oil sands, AOSTRA/ University/Industry Technical Review Meeting and Seminar, Banff, Oct 1989.
- 282. Schmitt, D.R., Consequences of crustal stresses and their quantitative measurement, Scientific Drilling: Sedimentary Basins, Canadian Continental Drilling Program Workshop, Calgary, March, 1989.
- 283. Additional: More than 15 in previous 4 years

Seminars and Lectures (Invited)

- ISRM Commission on Crustal Stress and Earthquakes, Montreal, May 10, 2015.
- Strathcona Public Library, Lecture Program, April 17, 2015.
- Dept. of Geosciences, Karlsruhe Institute of Technology, March 31, 2015.
- Deutschen Geophysikalischen Gesellschaft 75 Jahrestagung, *Plenarvortrag (Plenary Lecture)*, Hannover, March 24, 2015.
- China University of Geosciences, Dept. of Geophysics, Beijing, March 19, 2015.
- China University of Petroleum – Beijing, Dept. of Geophysics, March 17, 2015.
- Annual CSEG Symposium, Calgary, March 4, 2014.
- Dept. of Geological Sciences, Jackson School of Geosciences, Univ. of Texas at Austin, February 10, 2015
- Inst. of Geophysics, Jackson School of Geosciences, Univ. of Texas at Austin, February 9, 2015.
- Royal Astronomical Society of Canada, Edmonton-Centre, September 8, 2014.
- Lab. of Oil and Gas Reservoir Tech., Chengdu Univ. of Tech., July 10, 2014.
- China National Petroleum Company Research (SW), Chengdu, July 8, 2014.
- Int. Workshop on Seismic Imaging, Ocean Univ. of China, Qingdao, July 5, 2014.
- China Academy of Sciences, Geology & Geophysics, Beijing, May 23, 2014
- Dharan Geoscience Society, Luncheon Talk, May 14, 2014.
- Saudi Aramco, Dharan, May 14, 2014
- King Fahd Univ. of Petroleum and Minerals, Dharan, May 13, 2014
- Abu Dhabi National Oil Company, Head Quarters, May 11, 2014.
- Nanjing University, Dept. of Geological Sciences, March 31, 2014.
- CSEG Microseismic Users Group, Calgary, March 18, 2014.
- ETH, Zurich, Geological Engineering Dept., March 11, 2014.
- Urban Drilling Panel, Lethbridge City Council, February 24, 2014.
- China University of Petroleum (2 hours), Geophysics, January 24, 2014.
- 2nd EAGE Workshop on Rock Physics, Muscat, January 12, 2014.
- Centre for Excellence in Mining Innovation, Sudbury, October 23, 2013
- Workshop on Anisotropic Rock, Potsdam, September 28, 2013
- University of Alberta Geophysics Alumni Reception, September 20, 2013.
- 6th Int. Symposium on Rock Mechanics, Sendai, Japan, August 22, 2013.
- Shell International, Rijswijk, Netherlands, May 1, 2013.
- Dept. of Earth Sciences, Uppsala Universitet, April 22, 2013.
- ICDP Japan Beyond-Brittle Project, Sendai, Japan, March 12-16, 2013.
- CSPG Gussow Conference, Banff, Alberta, November 6-8, 2012.
- Centre Eau Terre Environnement, INRS, Quebec, July 10, 2012.
- IODP/ICDP Montreal Summer School (3 hours), July 7, 2012
- Dept. of Earth Sciences, Bristol Univ., June 28, 2012
- Canadian Assoc. of Rock Mechanics, *Keynote Lecture*, Edmonton, May 9, 2012.
- APEGGA Geoskills 2012, Calgary, February 1, 2012
- Tom Oliver Annual Lecture, U. of Calgary, October, 21, 2011
- Université Joseph Fourier, Grenoble, February 25, 2011.
- DBR-Schlumberger, Edmonton, February 4, 2010.
- SEG, Stress Dependence Workshop, Houston, Oct. 30, 2009

- Dept. of Physics, U of Calgary, Feb. 24, 2009
- Dept. of Physics, U of Lethbridge, Feb. 10, 2009
- Dept. of Petroleum Engineering, U of Oklahoma, Dec. 5, 2008
- Dept. of Geology and Geophysics, U of Oklahoma, Dec. 4, 2008
- Pacific Geoscience Centre, Geological Survey of Canada, Nov. 27, 2008
- Dept. of Physics, U of Regina, Nov. 21, 2008
- Dept. of Physics, U of Saskatchewan, Nov. 20, 2008
- Dept. of Geology and Geophysics, U. of Saskatchewan, Nov. 19, 2008
- Society of Exploration Geophysicists, Mining Workshop, Las Vegas, Nov. 2008
- Amer. Assoc. Physics Teachers, Edmonton, July, 2008
- Geol. Soc. of CIM, Spec. Session on Adv. Technologies, Edmonton, May, 2008.
- Heavy Oil Workshop, Sponsored by CGGVeritas, Calgary, March 2008.
- Inst. Of Fluid Science, Tohoku University, Sendai, Japan, Feb. 2008.
- Amer. Association of Petroleum Geologists, Hedberg Conf., Banff, Oct. 2007.
- Society of Core Analysts, *Keynote Lecture* Annual Meeting, Calgary, Sept. 2007.
- Workshop on Scientific Drilling of the N. Anatolian Fault, Istanbul, Apr. 2007.
- Walter Johns Alumni Circle, Univ. of Alberta, Apr. 2007
- American Physical Society, Special Session on Energy, Denver, March, 2007.
- Society of Petroleum Engineers, Brazil Onshore, Natal, Brazil, Nov. 2006.
- Institute of Geology and Geophysics, Chinese Acad. of Sci., Beijing, July, 2006.
- Seismological Laboratory, Caltech, Pasadena, May, 2006.
- ExxonMobil Upstream Research Company, Houston, March, 2006.
- Institute of Seismology, Univ. of Helsinki, Finland, January 2006.
- Residual Stress Summit, Soc. Experimental Mech., UBC, Aug. 2005
- Research School of Earth Science, ANU, Canberra, June 2005.
- Earth Materials Group, ANU, Canberra, June 2005.
- Australian Society of Exploration Geophysicists, Canberra, May, 2005.
- Curtin University of Technology, Perth, March, 2005.
- Australian Institute of Physics, *Keynote Lecture*, Canberra, January, 2005.
- CSEG Luncheon Talk, Geophysics and Oil Sands, Calgary, November 22, 2004.
(webcast at <http://www.insinc.com/onlinetv/cseg22nov2004/>)
- Dept. of Physics, University of Lethbridge, February 10, 2004.
- Dipartimento di Geologia, Paleontologia e Geofisica, Università degli Studi di Padova, Italy, June 2002.
- Dipartimento di Scienze della Terra "Ardito Desio", Università degli Studi di Milano, Italy, May 2002.
- Canadian Society of Exploration Geophysicists, Plenary Session, Calgary, May 2002.
- Dept. of Physics, University of Toronto, January 2002.
- Dept. of Civil Engineering, University of Alberta, March 2001.
- Dept. of Physics, University of Alberta, September 1998.
- Seismological Laboratory, California Institute of Technology, August 1998.
- Geophysikalisches Institut, Uni-Kiel, April 1997.
- Geophysikalisches Institut, Uni-Munster, April 1997.
- Geophysikalisches Institut, Uni-Karlsruhe, November 1997.
- Dept. of Geology and Geophysics, University of Calgary, April 1996.

- European Geophysical Society, XX General Assembly, Hamburg, April, 1995.
- Department of Geology, University of Alberta, Edmonton, February, 1995.
- Course on Stress Measurement, 34th U.S. Sym. on Rock Mech., Madison, June 1993.
- Dept. of Geophysics and Astronomy, Univ. of British Columbia, Vancouver, April 1993.
- Department of Physics, University of Alberta, Edmonton, March 1993.
- Geophysical Institute, Universitat Karlsruhe, April 1992
- TOTAL, La Defense, Paris, April 1992
- CIM Petroleum Engineers, Calgary, April 1990.
- Department of Geology, University of Alberta, Edmonton, September 1989.

Evidence of Contributions to the Scientific Community

Editing and Reviewing

- Associate Editor of the *Journal of Geophysical Research (Solid Earth)* since December 1998. At JGR the Associate Editor selects appropriate reviewers and directly advises the editor as to the paper's suitability (as of November, 2012 have shepherded over 200 manuscripts).
- In addition to the above editorship I am frequently asked to perform reviews for *Geophysical Journal International*, *Geophysics*, *Geophysical Research Letters*, the *International Journal of Rock Mechanics and Mining Science*, *Experimental Mechanics*, *Journal of Applied Geophysics*, *Tectonophysics*, and *Journal of Geophysics and Engineering*.
- I have also reviewed papers for *Geology*, *Earth and Planetary Science Letters*, the *Canadian Journal of Exploration Geophysics*, *GSA-Today*, the *Journal of Applied Physics*, the *Canadian Journal of Earth Sciences*, the *Canadian Geotechnical Journal*, the *Canadian Society of Petroleum Geologists - Mannville Memoir*, the *U.S. and North American Symposia on Rock Mechanics*, the *Society of Exploration Geophysicists Annual International Meetings*, the *IEEE Transactions on Instrumentation and Measurement*, the *Journal of the Acoustical Society of America*, the *Ocean Drilling Program Journal*, *Journal of Asian Earth Sciences*, *Journal of Hydrology*, *Marine and Petroleum Geology*, the *Turkish Journal of Earth Sciences*, the *Arabian Journal of Earth Sciences*, *Int. Journal of Solids and Structures*, *Engineering Fracture Mechanics*, the *European Journal of Physics*, *Interpretation*, *Rock Mechanics-Rock Engineering*, and the *Journal of Structural Geology*.
- In addition to my service on the NSERC 08 Solid Earth Sciences Panel (2005-2008) have reviewed research proposals for *National Science and Engineering Research Council of Canada (Research and Discovery Grants, LITHOPROBE Supporting Science, and Industrial Oriented Projects)*, the *National Science Foundation (U.S.)*, the *Agence Nationale de la Recherche (France)*, the *Petroleum Research Fund (American Chemical Society)*, the *United States Geological Survey*, the *South African National Research Foundation*, the *Rustaveli Foundatin (Georgia)*, and the *Petroleum Research Atlantic Canada Foundation*.
- In a typical given year I am asked to write upwards of three or more confidential letters of recommendation or commendation for major awards and faculty hiring and promotion from North America, Europe, and the Middle East.

Service on Panels, Boards, and to the Community*Current*

- Appointed to Board of Examiners (Decision making body in granting professional status in Alberta), Association of Professional Engineers, Geologists, and Geophysicists of Alberta (2003-present).

Past

- Appointed to the International Continental Drilling Program Science Advisory Group (Proposals adjudication and steering), 2010-2014.
- Appointed as vice-chair of the Science and Technology Panel of the Integrated Ocean Drilling Program 2010-2013) after serving as a member since 2008. I was to follow as chair (2012-2014) but the panel was disbanded in the reorganization of IODP in 2013. Host of mid-2008 panel meeting, Edmonton, July.
- Member of the International Advisory Committee for the 2013 International Symposium on Stress Measurement, Sendai, Japan, September 2013.
- Appointed to the NSERC *ad hoc* Research Tools and Instrument committee for Evaluation Group 1506: Geosciences, 2012 and 2013 competitions.
- Appointed to the DRST International Committee to oversee development of a downhole geophysical tool for quantitative stress determination, first meeting at Tokyo, July 20-21, 2011.
- Led a team of Canadian scientists in successfully obtaining funding from NSERC to allow Canada's continuation in the International Continental Drilling Program.
- Appointed to NSERC Solid Earth Sciences Grant Selection Committee 08, (July 2005 to June 2008).
- Review Chairman, October, 2005 to October 2010 and Technical Editor (March 2000 to Sept. 2005): *Society of Petroleum Engineers Reservoir Evaluation & Engineering* (SPEREE), The Review Chairman has a similar role to that of the Associate Editor.
- Host and Co-organizer with L. Lines and M. Batzle of the 2007 Society of Exploration Geophysicists annual Development and Production Forum held at the Univ. of Alberta, July 27-August 2, 2007. Conference was preceded by a 3 day field trip to Fort McMurray, Alberta. Conference had 89 registered participant from around the world. As special issue of *The Leading Edge* was published in the Fall of 2008 with a larger Soc. of Exploration Geophysicists edited book to currently in press.
- Appointed to the Expert Review Board of the Int. Energy Agency Weyburn CO₂ Sequestration Project, (February 2006, only Canadian scientist on this panel)
- Serve on special APEGGA 'Geophysical Instruments' committee to develop professional guidelines for use of near surface geophysical methods.
- Appointed to Executive Committee of the Mineral and Rock Physics Group of the American Geophysical Union (2002-2004). This group oversees student awards, meeting organization, and annual reception sponsorship as well as other activities that promote mineral and rock physics research.

- Member Interim Scientific Measurements Panel (iSciMP) for Integrated Ocean Drilling Program - (2001-2003). The mandate of this temporary committee is to advise scientific and funding agency policy boards on issues related to scientific measurements, data archiving, and publication of scientific results in the context of American, Japanese, and European ocean drilling platforms that will serve in the new Ocean Drilling Program. I hosted the third meeting of this panel in Edmonton, December 12-14, 2002.
- J. Tuzo Wilson Award Committee, Canadian Geophysical Union, 2002, 2003, 2006.
- One of two university members of the Technical Advisory Board for the Downhole Seismic Imaging Consortium - a joint Mining Industry (Noranda, Falconbridge, Inco) and Geologic Survey of Canada project (1996 - 2002).
- The university member of the Alberta Energy, Research and Technology University Grants Panel. (1997-1998)
- Member: Geology and Geochemistry Steering Subcommittee of LITHOPROBE (1992 to 1998).
- Steering Committee of Canadian Continental Drilling Program (1992-1996) This committee of the Geoscience Council of Canada was disbanded in 1996 and the Council charged me with responsibility for the remaining funds in order that I will be able to maintain a Canadian presence for information gathering within the International Continental Drilling Community.

Other Activities

- Co-Convenor and Chair of Special Session 'New Directions in Rock Physics Research', CGU Meeting, May, 2013.
- Co-Convenor and Chair of Special Session 'Geothermal Energy: Drilling, Geology, Geophysics', 2012 American Geophysical Union Fall Meeting, San Francisco, December 2012.
- Co-Chair of the session 'New Directions in Stress Measurement' at the 2012 American Rock Mechanics Association annual meeting, Chicago, June, 2012.
- Convenor of Special Session on Postglacial Rebound Related Faulting at the 2011 AGU Fall Meeting, San Francisco, December, 2011.
- Co-organizer of the 9th North American Workshop on Porous Media, Ensenada, October, 2011.
- Organizer of special session on stress measurement at the CSPG/CSEG/CWLS Joint meeting, Calgary, May, 2011
- Organizer of special heavy oil and geophysics symposium, CSEG annual meeting, Calgary, May 2004.
- Attended the VIII Int. Symposium on the Observation of the Continental Crust Through Drilling, Tsukuba, invited guest of the Geological Survey of Japan, Feb. 1996.
- Co-chair of session on stress determination, Amer. Geophys. Union Fall Meeting, San Francisco, Dec. 1995.

- Co-convener with Dr. V. Haak, Dr. J. Erzinger, and Dr. J. Mutter, Special session on the relationship between geophysical surface and wellbore observations, Int. Union Geod. Geoph. Meeting, Boulder, to be held July 13, 1995.
- Co-chair and technical session organizer with Dr. D. Yale, Stress Measurement Session, First North American Rock Mechanics Symposium (Austin, TX) June, 1994.
- Co-chair (Invited) of session of Stress Measurement session at the 34th U.S. Symposium on Rock Mechanics (Madison, WI), June, 1993.
- Convened, Organized and Co-chaired special session entitled "Quantitative Measurement of the Crustal Stress Tensor" at the joint American Geophysical Union - Canadian Geophysical Union meeting, Montreal, May 1992.
- Set Professional Entrance Examinations for APEGGA in General Geophysics, Seismic Data Processing, and General Physics since 1992.

Collaborations

Scientific Drilling Expeditions

- 2002 – ICDP Mallik Project, NWT, Canada
- 2004 – ICDP Lake Bosumtwi Structure, Ghana
- 2006 – ICDP Outokumpu Drill Hole, Finland
- 2006-07 – ANDRILL Antarctic Sediment Drilling
- 2009 – ICDP/IODP New Jersey Passive Margin Drilling, U.S.
- 2010-12– current ICDP Project Hotspot, Snake River Plain, Idaho, U.S.
- 2011 – current ICDP Deep Fault Drilling Program, Alpine Fault, New Zealand
- 2011 – current ICDP Collisional Orogeny of the Scandinavian Calidonides, Sweden.
- 2011 – current Helmholtz-Alberta Initiative, Hunt well geophysics, Alberta

Current (not including Scientific Drilling Projects)

- Prof. Ian Jackson (Australian National University, Canberra): low frequency moduli of saturated cracked media.
- Prof. Oliver Heidbach (GFZ-Potsdam), Prof. Inga Moeck (GFZ-Potsdam and TMU), and Ms. Kristine Haug (Alberta Geological Survey): Stress Map 2.0 – revising the stress map of the Western Canada Sedimentary Basin in 3D.
- Dr. Jason Nycz (Laracina Energy) and Mr. Ken Gray (OSUM Energy): Rock physics of bitumen saturated carbonates.
- Prof. Bernard Giroux (INRS Québec City) and Dr. Connie Schmidt-Hattenberger (GFZ-Potsdam): Effects of CO₂ on rock elastic and electrical properties.

Past

- Prof. C. Hickey (U of Mississippi) on tunnel detection.
- Geological Survey of Canada, VSP studies at Flin Flon, Manitoba (D. White).

- Invited member of the McMurdo Ice Shelf scientific drilling project, Antarctica, 2006-2007 by Profs T. Wilson and R. Jarrard.
- Mr. Scott Dallimore + multidisciplinary working group, development of scientific drilling of the permafrost project for IPY (2006)
- Dr. Ilmo Kukkonen (Geological Survey of Finland), and Prof. Pekka Heikkinen, U of Helsinki, and Prof. Bernd Milkereit, VSP studies in the Outokumpo Drill hole, Finland (2006).
- Alberta Geological Survey and Terrain Sciences, Geological Survey of Canada, high resolution seismic survey of a buried channel, Rainbow Lake, Alberta (2004)
- Dr. Larry Lines, U of Calgary, Heavy oil geophysical studies.
- Dr. Derek Martin, Dept. of Civil Engineering, U of Alberta, and Mr. Corey Froese, Geological Hazards, Alberta Geological Survey: development of a geophysical model for a large urban land slide in Northern Alberta.
- Dr. Bernd Milkreit (U of T) – Seismic studies associated with the Mallik gas-hydrate well, NWT (2002) and Lake Bosumtwi lake drilling (2004).
- Bill Tonn, Biology, U of Alberta, Monitoring of fish kills due to mine blasts, NWT, 2002.
- Dr. T. Joseph and Syncrude Research, Ground motion measurement due to heavy hauler motion (2001-2002)
- VisionSmart Ltd., Edmonton, collaboration on the instrumentation of Turtle Mountain, Alberta.
- Dr. Roberto Francese and Prof. Analisa Zaja, Univ. di Padua, and Prof. M. Giudici, Univ. di Milano – Near surface seismic studies in Milan, Italy (2002)
- University of Saskatchewan and Geological Survey of Canada, VSP and surface seismic imaging of uranium deposits: Athabasca Basin, Northern Saskatchewan (February 2001).
- Geophysical Institute, Univ. of Karlsruhe, Dr. K. Fuchs, Mr. K. Huber, Department of Geophysics, Stanford University, Dr. M.D. Zoback (Ultrasonic wellbore logging of deep boreholes in the former U.S.S.R. and Eastbloc countries). We have supplied a televiewer digitization system as part of our contribution to an international effort to geophysically log deep wellbores
- Mobil Research Corp., Dallas, Dr. D. Yale, (Microcrack damage in core, relationship to stress)
- Esso Research, Dr. J. Eastwood (Seismic monitoring of steam reservoirs) We are collaboratively working with Imperial oil on a new, inexpensive method of seismically monitoring reservoirs undergoing steam injection.
- Geological Survey of Canada, Drs. B. Milkereit and D. Eaton (Wellbore seismic studies in mining camps in Ontario and Quebec) using equipment in my laboratory, we have carried out a number of wellbore seismic experiments that attempt to image shear zones for purposes of mine delineation. This work has developed into the present day Downhole Seismic Imaging Consortium.
- Univ. of New Brunswick, Dr. J.C. White (Physical properties of highly deformed metamorphic rocks) Dr. White is conducting TEM and SEM examinations of the minerals within highly deformed metamorphic rocks.
- Alberta Research Council, (Produced Open-File report on diamond potential in Alberta) I contributed two chapters on the large-scale geophysical structure of

- Alberta and on methods of kimberlite exploration. I have been informed that this is the best selling Open File report produced to date.
- University of Saskatchewan and Potash Corporation of Saskatchewan, Shallow VSP logging for characterization of overburden.
 - University of Alberta, Dr. T. Chacko - Geology (Trans-Hudson metamorphic rock bulk moduli), Dr. R. Burwash - Geology (Alberta Lithoprobe transect core properties), Dr. R. Tait - Mathematics (Theory of pore pressure distributions in rock)
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Honors and Awards

- 2015: Technical Merit Award, Canadian Society of Exploration Geophysicists
- 2009: Renewal of Canada Research Chair Tier 1 in Rock Physics
- 2009: Canadian Society of Exploration Geophysicists Meritorious Service Award
- 2008: University of Lethbridge Distinguished Alumnus of the Year.
- 2002: Awarded Canada Research Chair in Rock Physics, Tier 1.
- 1999: Recipient - The University of Alberta 1998-9 Faculty of Science Research Award (Awarded to one faculty member per year who is no more than 12 years from the Ph.d. and awarded on the basis of research carried out at the University of Alberta)
- 1996: Humboldt Research Fellow, A. von Humboldt Foundation, Bonn.
- 1984 - 1986: Sir J. Lougheed Awards of Distinction, (Alberta Graduate Scholarship)
- NSERC post-graduate fellowship, (unable to accept due to tenure out of Canada)
- Alberta Sugar Factories (Physics)
- 1977, 1979 Queen Elizabeth Scholarship

Kudos

- 2013: Fellow Geoscientists Canada (FCG) (for volunteer service to APEGA for more than 10 years)
- 2013: Engineers Canada Fellow (FEC) (for volunteer service to APEGA for more than 10 years)
- 2011: Invited 'Tom Oliver' Lecturer, University of Calgary, October, 2011.
- 2008: Association of Professional Engineers, Geologists, and Geophysicists of Alberta (APEGGA) Voluntary Service Award.
- 2005: Instantel Innovation Awards, from Instantel for novel use of monitoring equipment (with M. Welz).
- 2005 and 2002: Outstanding Technical Editor Award, Society of Petroleum Engineers.
- 2005: Honorable Mention: Best Poster Paper (U. Theune presenter) CSEG meeting.
- 2001: Honorable Mention: Paper (K. Beaty presenter) within top 25 of 628 at the 2000 Society of Exploration Geophysicists International Convention.
- 2001: Profiled in 'All we can do is give them the skill to keep learning: An interview with Doug Schmitt', CSEG Recorder, 26(10), 24-32, 2001. I was the first Canadian academic to be profiled in this new Recorder feature.
- 2000: Nominee - NSERC E.W.R. Steacie Memorial Fellowship
- 1998: Honorable Mention: Paper (J. Molyneux presenter) within top 5% at the 1998 Society of Exploration Geophysicists Convention, Dallas
- 1987: Honorable Mention as Runner Up: Best paper at the 1986 Society of Exploration Geophysicists Convention, Houston

Adherent Awards and Kudos

- 2013: J. Chan - Best Student Geophysics Poster Paper, geoConvention 2013; CSPG/CSEG/CWLS Joint Convention, Calgary, May.
 - 2011: H. Yam – Best Student Oral Paper: Recovery 2011, CSPG/CSEG/CWLS Joint Convention, Calgary, May.
 - 2010: O. Ogunsuyi – Honorable Mention: Best student Geophysical student oral presentation, GeoCanada meeting, Calgary.
 - 2005: J. Han – Awarded top student poster CSEG meeting
 - 2005: Honorable Mention: Best Student Paper (J. Ahmad presenter), CSEG meeting
 - 2005: Y. Zhang – Awarded honorable mention best student poster CSEG meeting
 - 2004: J. Han – Awarded top student poster CSEG meeting
 - 2004: K. Beaty – Governor General’s Gold Medal, Univ. of Alberta
 - 2004: J. Han – Awarded top student poster at the joint CSEG meeting.
 - 2003: P.Y. Cholach – Awarded top student poster at the joint CSEG/CSPG meeting.
 - 2002: M. Mah – University of Alberta Dissertation Scholarship.
 - 2002: U. Theune – Schlumberger Summer Research Fellowship (tenure at Cambridge, U.K.)
 - 2001: Y. Bouzidi - Recipient of Outstanding Student Paper Award, Tectonophysics Section, American Geophysical Union Fall Meeting 2001.
 - 2001: K. Beaty - Awarded top student paper at the SEG International Meeting, Calgary.
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Professional Associations and Activities

- American Geophysical Union
 - Canadian Geophysical Union
 - Society of Exploration Geophysicists (Active Member)
 - Canadian Society of Exploration Geophysicists
 - Canadian Well Logging Society
 - Association of Professional Engineers, Geologists, and Geophysicists of Alberta
 - Society of Experimental Mechanics
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Contributions to Education

University of Alberta Geophysics Field School

I am a strong believer in the need for hands on experience in the field as an integral part of the training of any geophysicist. Since, 1998, I have worked to develop an intensive geophysics field program that is part of the U of Alberta Geophysics undergraduate degree. This field school is carried out in Southern Alberta before the start of the fall semester. The students collect a 5-km long seismic reflection profile, hammer refraction seismic data, ground penetrating radar, electromagnetic and DC resistivity profiling, gravity, magnetic, and GPS differential surveying. The data acquired during this period is analyzed in detail during the following year and is used in a number of different geophysics courses. The field school became a full course in the calendar: GEOPH 436 in Fall 2008. I obtained funding for the field school from Shell Canada for the period 2007 to present and from Conoco-Phillips (2011-present).

Courses Taught (numbers indicate number of students followed by year course taught)

- **Physics 137 - Introductory physics** (calculus based wave propagation and electromagnetism) for engineering students. Students: 116 (1993), 117 (1994), 117 (1995).
- **Geophysics 221 - Introduction to Geophysics** Introduction to global geophysics for earth science undergraduates: 53 (1999), 67 (2000), 44 (2001), 46 (2002) - Developed extensive set of notes on the website <http://rubble.phys.ualberta.ca/~doug/G221>
- **Geophysics 227 - Introductory seismic exploration** course for non-geophysics students. Students: 19 (1993), 15 (1994), 15 (1995).
- **Geophysics 326 - Introduction to Seismic Imaging** 3rd year level course for geophysics and engineering students covering the fundamentals of ray seismology and seismic imaging. 10 (2004)
- **Geophysics 332 - Physical Properties of Geomaterials:** Undergraduate overview of rock physics and mechanics. Implications for geophysics and petrophysics. Students: 8 (2001); 7 (2003), 19 (2005), 16 (2009), 14 (2010). 29 (2012). Note: A more advanced version of this course is also taught to the 'International Geophysics' cohort of M.Sc. students at the China University of Petroleum, Beijing as part of my 111 Professor duties.
- **Geophysics 421 - Advanced seismology** A study of the elastic theory of body and surface waves with implications for determining the structure of the earth at all scales. Students: 7 (1990), 6 (1991), 5 (1992), 10 (2000), 2 (2004 – reading course only)
- **Geophysics 426 - Geophysical signal analysis** Basics of data sampling, filtering, and deconvolution. Extensive use of high level programming languages in assignments. Note that course content detailed at <http://rubble.phys.ualberta.ca/~doug/G426/g4261997.html>. Students: 7 (1995 spring), 15 (1995 fall), 15 (1997 fall).

- **Geophysics 428 - Methods in Geophysics** An extensive field camp consisting of gravity, magnetic, electrical, and reflection seismic measurements followed by analysis of these data over both terms of the year. Students: 12 (1989), 7 (1989-90), 5 (1990-91), 4 (1991-92), 8 (1992-93). This course superseded by Geophysics 437 and 438.
- **Geophysics 436 – Geophysical Field School** – The field school was officially made a for credit course for the first time in 2008. 16 (2008), 18 (2009), 10 (2010), 18 (2011), 25 (2012)
- **Geophysics 437 - Potential Methods Laboratory** - Matlab based analysis of gravity, magnetic, and electrical data acquired in the field. Note taught as reading course in special cases. Note: I am presently in the process of rebuilding the Geophysics Field School at a new site in Southern Alberta. The field school serves for data collection for Geophysics 437 and 438. Students: 1 (1995), 1 (1997), 7(1998)
- **Geophysics 438 - Aspects of Seismic Data Processing** - A laboratory class in which students design a seismic data processing stream using Matlab and apply this to a simple common midpoint reflection profile. Note that the data and content is available to under the title 'Seismic Processing for Numbskulls' at <http://rubble.phys.ualberta.ca/~doug/G438/438outline.html>. Students: 10 (1996), 8 (1998), 7(1999), 17(2000), 12 (2001), 7 (2002), 16 (2003), 10 (2004), 20 (2007), 16 (2009), 18 (2010).
- **Mathematical Physics 467 - Mechanics of Deformable Media** for senior level undergraduate and graduate students in Physics, Mathematics, and Geophysics (stress, strain, constitutive equations, viscosity, fluid dynamics, and applications. Students: 4 (1994).
- **Geophysics 616 - Tectonic theories** - Focus on rock physics. Students: 8 (1994).
- **Geophysics 620 - Rock Physics** - Graduate level introduction to earth material physics: 5 (1998), 7 UofA + 3 UofC via Linked Classroom to U of C (1999), 10 UofA + 4 UofC (2003), 10 (2005), 5(2007), 13(2009), 15 (2011).

External Professional Development Courses:

1. Canadian Petroleum Institute:
 - Executive Program (Calgary): 1998, 2000 - Introductory Seismic Exploration
 - Cuban Exploration Geophysicists (Edmonton): 1998 - Vertical Seismic Profiling
 - PEMEX: (Ciudad del Carmen, Mexico): 1999 - Vertical Seismic Profiling
 - PEMEX: (Ciudad del Carmen, Mexico): 2001 - Introductory Seismic Data Processing
 - ONGC: (Dehra Dun, India): 2003 – Reservoir Geophysics
 - PEMEX: (Villahermosa, Mexico): 2003 – Introductory Seismic Data Processing
2. CSEG: (Calgary) Doodle-Train Professional Development Week: Basic Rock Physics for Geoscientists (Nov. 2004, 2005, 2006).

Departmental and University Responsibilities

- Heavily involved in the development and planning of the new Integrated Petroleum Geoscience Course Based M.Sc. program between the Depts. Of Physics and Earth and Atmospheric Sciences to commence in 2009. Program was approved by the Ministry of Advanced Education in February, 2009.
- NSERC Representative at the University of Alberta, August 2008 to Dec. 2010.
- Physics Chair Selection Committee, 2009-2010
- Director, Institute for Geophysical Research, July, 2005 to August, 2009.
- Stood for Departmental Chair Competition, 2004.
- Chair, C.R. Stelck Chair in Petroleum Geology Selection Committee, Spring, 2003.
- Academic Reviewer from the University of Alberta: Department of Civil and Environmental Engineering Graduate Review – External Team, April 14-15, 2003.
- Member – Faculty of Science Committee for Kaplan Nomination and Faculty of Science Research Award, 2000, 2002, 2008.
- Co-ordinator: Geophysics Focus Area Group, Department of Physics, 1997 - 2004.
- Member: Chair's Advisory Committee for Hiring – Canada Research Chairs Condensed Matter Tier II and Space Physics Tier II, 2002. Subatomic Tier I, 2004.
- Chair: Chair's Advisory Committee for Hiring - Geophysics Appointments, 2001 & 2002 competitions.
- Selection Committee, Chair of the Physics Department, (Reappointment of Prof. J. Samson), 2000-2001.
- Evaluation Team: for U of Alberta Mining and Petroleum Engineering Graduate Programs, December 1999.
- Chairman: Geophysics Curriculum Committee, Department of Physics,
 1. 1991-92: Responsible for the design and implementation of a Course Based Master's Program in Geophysics.
 2. 1993-94: Rewrote Geophysics undergraduate course descriptions. Developed Geophysics undergraduate scheduling with biyearly rotation of higher-level courses to increase student enrolments.
 3. 1994-96: Development an Undergraduate Industrial Internship Program in Geophysics to allow students to gain more experience prior to graduation.
 4. 1999-00: Redeveloped Honours and Specialization programs. Introduced two new courses on Rock Physics and Geophysical Inversion.
- Member: Five Year Department Plan Committee, 1995-6.
- Member: Geodynamics Position Advisory Committee (1997-98).
- Global Seismology and Electromagnetic Positions Advisory Committee (1999-00).
- Member: Subatomic Physics Position Advisory Committee (1998).

- Member: Space Physics Position Advisory Committee (1998).

Précis of Current Research – December, 2014***Fundamental Rock Physics***

- Low frequency seismic laboratory measurements: Ph.D. student Heather Schijns in collaboration with Dr. Ian Jackson at the Australian National University made making laboratory measurements of saturated and cracked rocks to understand better the velocity and attenuation dispersion within them. This work is continuing with co-supervision of Ph.D. student Y. Li (at ANU).
- Acoustic reflectivity: Former Ph.D. student Bouzidi developed a novel experimental system and analysis methodology that allows us to make detailed measurements of the variations of reflectivity from porous media. Ph.D. student Malehmir is currently using this system to investigate in detail the variations in reflectivity angle of incidence and azimuth over anisotropic media including a large synthetic quartz crystal plate.
- Mechanical properties of geophysical liquids: The properties of a fluid saturating the pores of rocks is a key factor in determining the overall seismic response; and there is a need to know these properties under conditions of pressure and temperature. Ph.D. student Rabbani has constructed a unique ultrasonic system to provide us highly accurate measures of sound speeds in brines and bitumen. We are currently extending this system in hopes of also obtaining density and viscosity.

Conventional Rock Physics

- Physical properties of CO₂ saturated rock: A number of current and past members in my group are studying experimental measurements on the effects of CO₂ on wave propagation in standard porous materials, carbonates (Weyburn project), and sandstones. Measurements have recently been successfully conducted over the range of pressures and temperatures covering gas, liquid, and supercritical regimes. This work is now being extended by M.Sc. student Mohammed to electrical conductivity in collaboration with INRS (Quebec) and GFZ-Potsdam.
- Dielectric constants of potash: MSc student Pervin is currently making new dielectric measurements of the dielectric constants of the minerals, fluids, and rock types associated with the large potash deposits of Saskatchewan, Canada. This work has implications towards the use of GPR techniques in underground mines and is sponsored by the Potash Corporation of Saskatchewan.
- Anisotropy of earth materials: We have developed an experimental methodology to examine both the static and dynamic elastic properties under the assumption that a material is transversely isotropic. This is being applied to unconventional reservoir rocks in collaboration with the Alberta Geological Survey and to fault related schists and mylonites with groups from Univ. of Southern California, Univ. of Wisconsin-Madison, University of Auckland, and the University of Otago, Dunedin.

- Physical properties of carbonates: Ph.D. student Bakhorji recently completed an extensive series of laboratory ultrasonic elastic wave measurements on a suite of carbonates from the Arab D reservoir, Saudi Arabia. This work has now grown into a significant effort to understand the seismic properties of bitumen saturated carbonates. We have constructed new equipment to make determinations of the physical properties of the bitumen which by itself is a fascinating viscoelastic material. Special configurations are also required for making P and S wave measurements on the relatively fragile core materials.

Scientific Drilling

- ICDP Alpine Fault, New Zealand: My group has been heavily involved with this project since 2011. At this writing I have just returned from an extended stay at the DSDP-2B drill site in the Whataroa River Valley, Westland, New Zealand. I am primarily responsible for the hydraulic fracturing stress measurement tests and am heavily involved in the logging associated with the drilling. Unfortunately, technical problems and much higher temperatures than anticipated resulted in the premature end to this drilling campaign; and we intend to return with a revised drilling plan in less than 2 years.
- ICDP Hotspot Project: Schmitt's group is responsible for the logging and near borehole geophysics for the three ~1900 m coreholes of the Hotspot project. The last borehole has just been completed with a final high temperature logging campaign (>130 C) at Mountain Home, Idaho. There is nearly 6 km of core collected in this study as well as an extensive collection of borehole logging and seismic data that is now being analyzed by Phd student Kessler (at Utah State) and M.Sc. student Bishop. M.Sc. students Epp and Naumann are studying in detail the geophysics associated with one of these wells. We are working collaboratively with Prof. Liberty's group at Boise State University on the analysis of the seismic data.
- Helmholtz-Alberta Initiative studies of the 2363 m deep 'Hunt' well near Fort McMurray Alberta: We were able to obtain access to an serendipitous 2363 m deep borehole to study the geothermal potential of the deep crystalline crust in NE Alberta. We have carried out an extensive series of logging, VSP, and surface seismic measurements in the vicinity of this well. We re-entered the well in late 2013 for advanced sonic and borehole televiewer image logging. We intend to complete these field studies in 2014 with fluid sampling and optical image logging.
- ICDP Koyna Drilling Project: This is a project intended to drill directly into the zones of induced seismicity that appears to be related to the annual crustal loading by the reservoirs in the Koyna region of India. I have been involved in planning workshops for the drilling project and have hosted two Indian Ph.D. students in my laboratory who carried out P and S wave speed and strength measurements on core samples taken from boreholes drilled through the Deccan traps. This drilling may take commence in 2015 and involve 2 main boreholes each to at least 5 km.

Near Surface Geophysics

- Buried Meteorite Impact at Bow City, Alberta: We were asked to assist the Alberta Geological Survey in obtaining additional geophysical data associated with a circular structure detected in careful mapping of stratigraphic horizons. This structure does appear to be of extraterrestrial origin with slump blocks at the sides and a central peak. We collected new high resolution seismic data in mid-2013 over this site.

Research Contributions

My research group has been and remains active in a number of areas related broadly to Rock Physics with work ranging from more fundamental studies of wave propagation in porous and anisotropic media through more conventional laboratory measurements on core samples to scientific drilling. My main research contributions fall into the categories of:

I. Fundamental rock physics: Work in this area has focused on primarily laboratory of mechanical wave propagation associated with fluid saturated porous media, on anisotropy, and more recently on wave speed dispersion in cracked media. The first two topics have been studied using an acoustic goniometer system that not only facilitates studies of wave transmission through plates within a water tank but also allows for precise measurements of the first surface acoustic reflectivity. This system has been used on a water-saturated porous synthetic sandstone allowing for detailed measurements of the attenuation and wave speed of the Biot 'slow' or 'second' P-wave. Further, the reflectivity measurements from this same plate confirm long-standing but unproven theoretical assumptions regarding the boundary conditions associated with wave behaviour at a fluid-porous solid interface.

This same system is currently being employed in measurements of the reflectivity of anisotropic media; and measurements have so far been made on a large single crystal of oriented quartz (of known elastic properties) and on a series of anisotropic laminated composites. This work has implications to the study of seismic reflectivity as a tool to probe in situ rock properties using the 'Amplitude Versus Offset' method of applied seismology.

Current fundamental studies are now focusing on the effects of water saturation on wave speeds and attenuation at 'seismic' frequencies and how these will vary relative to 'high' frequency ultrasonic measurements.

II. Conventional rock physics: My laboratory has been active in making P and S wave measurements on a variety of differing rock types, these experiments are run at pressures up to 300 MPa (3 kbar). Studies of rock anisotropy have focused on highly strained Proterozoic meta-sediments, on sedimentary rocks from the Western Canada Sedimentary Basin, and on ophiolitic dunites of varying degrees of serpentinization from Greece.

Recent work has focused on the effects of fluid saturation in carbonates. New experimental developments now allow my group to make measurements of the effect of temperature and pore pressure on CO₂ saturated rock samples. This work shows that the density changes as CO₂ transforms from gas to liquid or supercritical fluid produces large changes in the seismic wave speeds that should allow seismic monitoring of such processes to be detectable with geophysical monitoring.

III. Crustal stress determination: One ongoing theme of my work has been the study of crustal stress and the development of methodologies to make such measurements. As

part of my graduate thesis work, I tested a methodology that employed ‘holographic interferometry’ to stress determination and tested this technique within a mine pillar. This work evolved with the development of a new correlation based technique to calculate ‘speckle interferograms’ that were interpreted to measure both elastic moduli and stress values within a material. A solution for the micron scale stress relief displacements in the vicinity of a small drilled hole was obtained from numerical modeling.

I have also contributed to the practice of the hydraulic fracturing technique for stress measurement by carrying out extensive laboratory tests that examined pore pressure and interval pressurization rates on the initiation of fracture propagation. I was most fortunate to be asked to lead the hydraulic fracturing efforts for the ANDRILL project and in late 2007 obtained the first quantitative stress measurements in Antarctic on the South McMurdo Sound borehole.

The study of drilling induced core fracturing is one final contribution my group has made towards better understanding of crustal stress states. We have modeled the stress states required to produce various fracture shapes and shown that these alone can provide simple indicators of the faulting environment encountered. This work is now continuing with a larger study focused on laboratory testing and use of the results in the interpretation of core fractures in the Western Canadian Sedimentary Basin.

The boom in hydraulic fracture stimulation around the world has led to public concerns with regards to pollution of ground-waters and of induced seismicity. This is consequently leading to the development of a new ‘stress map’ of the Western Canada Sedimentary Basin that will include estimates of stress magnitudes and faulting environment. This work is being carried out with Prof. Inga Moeck, the new U of Alberta Chair in Geothermal Studies, as well as governmental regulatory agencies in B.C., Alberta, and Saskatchewan.

IV. Scientific Drilling

My interests in rock physics and crustal stress have led me to be active in scientific drilling campaigns. My group has not been involved with the Mallik (N.W.T., Canada, 2002), Lake Bosumtwi (Ghana, 2004), Outokumpu (Finland, 2006), ANDRILL (2006-2007), Offshore New Jersey (U.S., 2009), and the now just completed (November 2012) Snake River Plain (Idaho, 2010-2012). Our contributions in these efforts have focused on borehole and core measurements. We have been involved with vertical seismic profiling of many of these wells and have taken part or led the logging activities. Currently, my group is being asked to participate in numerous other international drilling projects with upcoming drilling taking place near the Alpine Fault, NZ; the Anatolian Fault, Turkey; and potentially in Sweden and India.

One key advantage of participating in such international activities is access to unique data sets and core materials that would otherwise be nearly impossible to obtain. This has allowed us, for example, to carry out an integrated study at Outokumpu of the effects of

in situ natural fractures through an already anisotropic rock on the overall anisotropy of the formation.

My participation on the Scientific Advisory Group for the International Continental Drilling Program and currently as vice-chair of the Science and Technology Panel of the Integrated Ocean Drilling Program is evidence of external recognition of my group's contribution to this growing aspect of the geosciences.

V. Near Surface Geophysics

My group has been very active in different aspects of near surface geophysics, and we attempt to bring a physical property biased interpretation to the work. While this is not necessarily central to the Rock Physics theme, it does provide again opportunity to different geological situations; and provides a foil for comparison with our laboratory and drilling work. These projects also often provide excellent training vehicles for M.Sc. level students. In the past we have examined the seismic heterogeneity of the permafrost in the NWT and have imaged deep glacially incised valleys in N. Alberta. Currently, we are working in collaborations to locate clandestine tunnels along the U.S.-Mexican border, to better understand the structure of a large landslide in N. Alberta, and to work on imaging methods through basalt covered sediments in Idaho.

Most recently, we have been carrying out studies of a potential buried meteorite impact structure near Bow City, Alberta. Initial studies have included re-analysis of legacy industry data. These were followed up by a high resolution seismic survey conducted in July, 2013.