

Curriculum Vitae

Douglas R. Schmitt

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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 2018 –

Stephen and Karen Brand Professor in Unconventional Resources
Purdue University

January 1989 – December 2017

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 Researcher
Adviser: Dr. M. D. Zoback

July 1980 - Sept. 1981

Texaco Canada Resources Ltd, Calgary
Exploration Geophysicist

Research Identifications

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

Scopus Author ID 7402515256

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

Research Adherents

Current Graduate Students

Ms. Elizabeth Bullock (Visiting MSc student from U. of West Indies, Trinidad and Tobago, September 2017 to December 2017). Geothermal investigations.

Mr. Jianyong Xie (Visiting CSC PhD from China University of Petroleum – Beijing, September 2016 to December 2017). Anisotropy of shales

Mr. Luyi Shen (PhD commence September, 2015): State of stress in Alberta & geomechanics of oil recovery. (Note Mr. Shen is employed part time at the Alberta Geological Survey)

Mr. Kirk Scanlon (PhD commence September 2014, co-supervisor with Profs. Hendry and Martin, Dept. of Civil Eng., U of Alberta). Application of ground penetrating radar to quality of railway bed quality.

- *Outstanding Student Poster Award – Fall Meeting AGU 2017*

Mr. Wei Li (Vising CSC PhD from China University of Geosciences – Beijing, October 2015 – October 2017). Anisotropy of rocks associated with the Alpine Fault NZ.

Mr. Nam Ong, (M.Sc. commence September 2015). Wave speed measurements on bitumen saturated carbonates.

Mr. Christopher Nixon (M.Sc., Commence June, 2015, transfer to PhD September 2016) – borehole seismology. Deep seismic microseismic monitoring, vertical seismic profiling at Chicxulub impact structure.

- *Honorable Mention Student Poster Award – Geoconvention 2017*

Mr. Tyson Epp (M.Sc., commence September 2014), Strength determination of rock, influence on strength of viscous bitumen.

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

- *Best Student Oral Paper Award, 2015 Geoconvention, Calgary.*

Mr. Arif Rabbani (PhD. 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)*

Current Postdoctoral, Research Associate, and Technical Staff Supervision:

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

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

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

Past Graduate Students (listed chronologically)

Mr. Ryan Ferguson (M.Sc., commence January 1, 2015 to December 4, 2017) – High resolution seismic imaging at Baffin Island. Rock physics of iron ore deposits.

- *Queen Elizabeth II Scholarship – Fall Term 2016.*
- *SEG Graduate Scholarship – Fall Term 2016*

Dr. Mohammadreza (Reza) Malehmir (PhD, commence September 2012, transfer to my supervision July, 2013 to June 29, 2017) Seismic reflectivity from anisotropic media and application to seismology.

Mr. Micah Morin (M.Sc., commence May 2013 to June 29, 2017), Stress determination from image log analysis in NE Alberta.

Mr. Xu Dong (Visiting CSC PhD from China University of Petroleum – Qingdao, October 2015 to March 2017). Petrophysical measurements on low porosity rocks.

Dr. Yang Li (co-supervisor with Prof. Ian Jackson, Australian National University, Canberra, PhD, degree awarded August 31, 2016). Dispersion of seismic waves in cracked media.

Ms. Deirdre Mallyon (M.Sc., commence September 2014, completed August 22, 2016), Crustal geodynamics, currently market researcher at EOSense Ltd., Nova Scotia.

Dr. Elahe P. Ardakani, (Ph.D. commence September 2009, completed, August 12, 2016), Regional geothermal investigation in NE Alberta. Currently Research Geophysicist at Engineering Seismology Group, Kingston, Canada.

Dr. Zhizhen Wang, (Visiting Phd from China University of Petroleum – Qingdao, October 2014-October 2015 at U of Alberta), Carbonate Rock Physics, Currently Assistant Professor of China University of Petroleum, Qingdao.

Mr. Sean Murray (M.Sc. student at Ludwig-Maximilians-Universität München co-supervised with Prof. I. Moeck, September 2015 through December 2015, Completed January, 2016). Stress determination at Fox Creek Alberta. Currently sales manager of Tapp-Car startup.

Ms. Franzisika Naumann (Visiting M.Sc. from Uni-Freiberg, Oct. 2014 through April 2015, completed December 16 2015), Analysis of geophysical information at the Kimberley borehole, Idaho.

Ms. Sohely Parvin (M.Sc., commence May, 2012, completed September 2015). Dielectric properties of potash deposits. Currently employee at Statistics Canada.

Ms. Qing Jia (M.Sc., commence June, 2012, completed February 23, 2015). State of stress in anisotropic formations, implications for crustal stress determination. Currently Ph.d. student at University of Calgary.

Dr. 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. Currently geomechanics specialist at Occidental Petroleum, Houston.

- *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, Currently employee at Statistics Canada.

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 Melénez-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 early 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 Senior 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 Senior Staff Geoscientist at 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 Exxon-Mobil Development Company, Houston.

Dr. Ulrich Theune (Ph.D., Aug. 2004, Diplom, 1998, Karlsruhe), Finite element modelling of seismic wave propagation. Research Geophysicist, Statol, 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. Yanqun (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:

Mr. Bradley King, Research Assistant, May 2017-December 2017, physical properties of cores from New Afton mine.

Ms. Farhanah Mohammed, Science Internship Program, May 2017-December, 2017, physical properties of potash materials.

Mr. Nam Ong: Research Professional Intern, (May 2014 to August 2015, continue to M.Sc.)

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 PhD. 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 Research Associate, Geophysics, UBC, 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 Excercise,
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. Léa Remaud, post-MSc Internship Student, Université Joseph Fourier, Grenoble, Fall 2015.
42. Syeda S., Abidi, Ryan. A. Borowiecki, Stepan Lavrinenko, Laura A. Osorio-Gutierrez, and Evan MacDonald (2016), IPG research capstone projects.
43. Bradley King, PHYS 499, Winter, 2017.
44. Siobhan Prise, PhD visitor, from Leeds University, August, 2017.
45. Aditya Bhattacharya, PHYS 499, Fall, 2017.

External Dissertation Examiner at Other Institutions

1. Dr. Rafael Medeiros de Souza, Ph.D., Univ. of Western Australia, Nov 20, 2017.
2. Dr. Qi Zhao, Civil Engineering, Ph.D., University of Toronto, July 25, 2017.
3. Dr. Sven Schilke, Geophysics, Ph.D., École des Mines, Paris, June 17, 2017.
4. Dr. Gao Le, Geophysics, Ph.D., Univ. of Saskatchewan, March, 2017.
5. Dr. Biao Li, Civil Engineering, Ph.D., Univ. of Calgary, 2015.
6. Ms. Asma Dewan, Geophysics, M.Sc., Memorial Univ. of Newfoundland, 2014.
7. Dr. Corriea Lopes, Geophysics, Curtin University, Western Australia, 2013
8. Dr. Andrew St. Onge, Geophysics, U of Calgary, 2013
9. Dr. Faranak Mahmoudian – Rock Physics, Univ. of Calgary, 2013.
10. Mr. Devon Parry – Geophysics, MSc., Laurentian Univ., 2013.
11. Mr. Trevor Coulman – Geophysics, MSc., U. of Saskatchewan, 2012
12. Dr. Jason Nycz - Meteoritics and Geophysics, Ph.D., U of Calgary, 2012.
13. Dr. Saurabh Datta Gupta – Applied Geophysics – Indian School of Mines, Dhanbad, 2012.
14. Ms. Thakane Ntholi – Geoscience, M.Sc., Univ. of Cape Town, 2012
15. Dr. Inga Moeck – Habilitation Referee, GFZ-Potsdam, 2011
16. Dr. Xueping Zhao – Geophysics, U of Toronto, 2010
17. Dr. Zimin Zhang – Geophysics, U of Calgary, 2010
18. Dr. Dina Makarynska – Geophysics, Curtin University, Western Australia, 2010.
19. Dr. Draga Talinga – Geophysics, U of Calgary, 2009
20. Ms. Yulia Stoeyen – Geophysics, U of Victoria, 2008
21. Dr. Ying Zou – Geophysics, University of Calgary, 2005
22. Dr. Rachel Newrick – Geophysics, University of Calgary, 2004.
23. Dr. Thomas Bohlen – Habilitation Referee, Uni-Kiel, 2004.
24. Dr. Robert Vestrum – Geophysics, University of Calgary, 2003.
25. Dr. Lan Lan Yan, Ph.D. – Geophysics, University of Calgary, 2002.
26. Mr. Ken Hedlin, M.Sc. - Geophysics, University of Calgary, 2001.
27. Dr. Jennifer Leslie, Ph.D. - Geophysics, University of Calgary, 1999.
28. Dr.. Sam Sun, Ph.D. - Geophysics, University of Calgary, 1999.
29. Dr. S. Bezdan, Ph.D.-Geophysics, University of Saskatchewan, 1998.
30. Dr. Peter Amerl, Ph.D. - Physics, University of Calgary, 1998.
31. 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. **Li, Y.**, E.C. David, S. Nakagawa, T.J. Kneafsey, D.R. Schmitt, and I. Jackson, *A broadband laboratory study of the seismic properties of cracked and fluid-saturated synthetic glass media*, submitted J. Geophys. Res.-Solid Earth, December 12, 2017.
2. Lofi, L., D. Smith, C. Delahunty, E. Le Ber, L. Brun, G. Henry, J. Paris, S. Tikoo, W. Zylberman, P.A. Pezard, B. Celeriér, D.R. Schmitt, **C. Nixon**, S.P.S. Gulick, J.V. Morgan, T. Bralower, E. Chenot, G. Christeson, P. Claeys, C. Cockell, M.J.L. Coolen, L. Ferrière, C. Gebhardt, K. Goto, H. Jones, D.A. Kring, X. Long, C. Lowery, C. Mellet, S. Green, R. Ocampo-Torres, L. Perez-Cruz, A. Pickersgill, M. Poelchau, A. Rae, C. Rasmussen, M. Rebolledo-Vieyra, U. Riller, H. Sato, J. Smit, N. Tomioka, J. Urrutia-Fucugauchi, M. Whalen, A. Wittmann, and K.E. Yamaguchi, *Drilling- and logging-induced features illustrated from IODP-ICDP Expedition 364 downhole logs and borehole imaging tools*, submitted Scientific Drilling, December 7, 2017.
3. Massiot, C., B. Celerier, M-L, Doan, T. Little, D. McNamara, J. Townend, D.R. Schmitt, J. Williams, V. Toy, R. Sutherland, L. Janku-Capova, P. Upton, and P. Pezzard, *The Alpine Fault hangingwall viewed from within: structural analysis of acoustic image logs in the DFDP-2B borehole, New Zealand*, submitted G³, Nov. 28, 2017.
4. **Scanlon, K.**, M. Hendry, C. Martin, and D.R. Schmitt, *A simulation-based investigation into increasing the consistency of ground-penetrating radar-derived ballast degradation estimates through winter data collection*, submitted J. Rail Rapid Trans., 15 pp., November 9, 2017.
5. Christeson, G.L., S.P.S. Gulick, J.V. Morgan, C. Gebhardt, D.A. Kring, E. Le Ber, J. Lofi, **C. Nixon**, M. Poelchau, A.S.P. Rae, M. Rebolledo-Vieyra1, U. Riller, D.R. Schmitt, A. Wittmann, T.J. Bralower, E. Chenot, P. Claeys, C.S. Cockell, M.J.L. Coolen, L. Ferrière, S. Green, K. Goto, H. Jones, C.M. Lowery, C. Mellett, R. Ocampo-Torres, L. Perez-Cruz, A.E. Pickersgill, C. Rasmussen, H. Sato, J. Smit, S.M. Tikoo-Schantz, N. Tomioka, J. Urrutia-Fucugauchi, M.T. Whalen, L. Xiao, K.E. Yamaguchi, and W. Zylberman. *Extraordinary rocks from the peak ring of the Chixculub Impact Crater: Physical property measurements from IODP/ICDP Expedition 364*, submitted EPSL, October 13, 2017.
6. Stork, A.L., **C.G. Nixon**, C.D. Hawkes, C. Birnie, D.J. White, D.R. Schmitt, and B. Roberts, *Is CO₂ injection at Aquistore aseismic? A combined seismological and geomechanical study of early injection operations*, submitted Int. J. Greenhouse Gas Control, October 1, 2017.
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2. **Kessler, J.A.**, D.R. Schmitt, **X. Chen**, J.P. Evans, and J.W. Shervais, *Predicting uniaxial compressive strength from empirical relationships between ultrasonic P-wave velocities, porosity, and core measurements in a potential geothermal reservoir, Snake River Plain, Idaho*, ARMA 17-391, 9 pp, 51st U.S. Rock Mechanics/Geomechanics Symposium, San Francisco, June 25-28, 2017.
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1. Hall, K.W., H. Isaac, M. Bertram, K. Bertram, D. Lawton, A. Constantinou, D.R. Schmitt, **R. Kofman**, J. Eccles, V. Lay, S. Buske, J. Townend, M. Savage, A.

- Gorman, and R. Kellett, *Always finding faults: New Zealand*, SEG Annual Meeting, Houston, Sept. 24-29, 2017.
2. **Nixon, C.G., D.R. Schmitt, R.S. Kofman, D. White, A. Stork, M. Kendall, and K. Worth**, *Technical Descriptions in Long-term 115°C Borehole Digital Micro-seismic Monitoring at the PTRC Aquistore CO₂ Sequestration Project* 79th EAGE Conf. & Exhib. 2017 Workshop Programme, 4 pp., Paris, June 12-15, 2017.
 3. **Wang, Z., R. Wang, D.R. Schmitt, Y. Zhou, and F. Wang**, Carbonate rock physics modelling at ultrasonic and seismic frequencies, submitted 4th Int. Workshop on Rock Physics, Trondheim, May 29-June 2, 2 pp., 2017.
 4. **Li, W., D.R. Schmitt and C. Zou**, *Numerical Study of the Effect of Beam Skew on Pulse Transmission Measurement in Tilted Transversely Isotropic Media*, 2 pp., *ibid.*
 5. **Malehmir, R., and D.R. Schmitt**, *Physical and Numerical Modeling of Acoustic Reflectivity from Elastic Anisotropic Media*, 2 pp., *ibid.*
 6. **Mohammed, T., and D.R. Schmitt**, *The mechanism behind the IP response of sandy sediments*, 2 pp., *ibid.*
 7. **Rabbani, A., and D.R. Schmitt**, *Ultrasonic wave propagation and reflection in ultra-heavy oil*, 2 pp., *ibid.*
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 9. **Li, W., X. Chan, C. Zou, and D.R. Schmitt**, *Variation of anisotropic beam skew with pressure during velocity measurements in transversely isotropic media*, Geoconvention 2017, Calgary, 15-19 May, pp. 5, 2017.
 10. **Ardakani, E.P. and D.R. Schmitt**, INVITED, *Geothermal energy potential of Western Canada Sedimentary Basin in the Athabasca Region, Northeast Alberta, Canada*, 2 pp. *ibid.*
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 13. **Ong, O.N., D.R. Schmitt, J. Nycz, and K. Gray**, *Experimental study of a heavy oil carbonate under thermal recovery conditions: A case from the Grosmont FM*, 5 pp., *ibid.*
 14. **Nixon, C.G., R.S. Kofman, D.R. Schmitt, S. Gulick, S. Saustrop, J. Morgan, and IODP/ICDP Exp. 364 Science Party**, *Vertical seismic profiling of the Chicxulub impact basin peak ring*, 5 pp., *ibid.*
 15. **Malehmir, R., N. Kazemi, and D.R. Schmitt**, *Resolving ambiguity in AVO and AVAz inversion*, 5 pp., *ibid.*
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 17. **Christeson, G.L., C. Gebhardt, S.P.S Gulick, E. Le Ber, J. Lofi, J.V. Morgan, C.G. Nixon, A. Rae, and D.R. Schmitt & IODP-ICDP Exp. 364 Science Party**, *Physical properties of the Chicxulub Impact breccia drilled at IODP/ICDP Expedition 364*

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248. Schmitt, D.R. and **J.B. Molyneux**, Velocities and anisotropy of rocks in an exposed amphibolite grade shear, Invited: European Geophysical Society, XX General Assembly, Hamburg, April, 1995.
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250. Schmitt, D.R., An Analytic solution for pore pressure and stress in hollow cylinders of rock: Implications in laboratory hydraulic fracturing tests, submitted, Amer. Geophys. Union Fall Meeting, San Francisco, Dec. 1994.
251. **Kebaili, A.** and D.R. Schmitt, Slowness surface determination from slant stack curves, 6th Intl. Workshop on Seismic Anisotropy, Trondheim, Norway, July 1994.
252. **Molyneux, J. B.** and D. R. Schmitt, Ultrasonic velocities in rock samples from the TransHudson Orogen, Can. Geophys. Union, Banff, May 1994.
253. Dufresne, M.B., R.A. Olsen, D.R. Eccles, M.M. Fenton, J.G. Pawlowicz, W.A.D. Edwards, R.J.H. Richardson, D.R. Schmitt, and B. McKinstry, The diamond potential of Alberta: A regional synthesis of the structural and stratigraphic setting, and other preliminary indicators of diamond potential, Can. Inst. Min. Met., Toronto, May, 1994.
254. Schmitt, D.R. and **Y.Y. Li**, Determination of the microcrack tensor in rock: Evaluation of coring induced damage, First North American Rock Mechanics Symposium, Austin, June, 1994.
255. Roth, F., K. Fuchs, M.D. Zoback, S. Hickman, D.R. Schmitt, B.N. Khakhaev, and L.V. Pezner, Stress field measurements in Eastern Europe, abstract submitted to VII Int. Symp. on the Observation of the Continental Crust through Drilling, Santa Fe, April, 1994.
256. Khakhaev, B.N., E.N. Kim, J. Okunex, S. Serekov, L.A. Pezner, S. Pevzner, L.E. Van-Kin, J. Palmer, F. Roth, K. Fuchs, K. Huber, B. Mueller, C. Chang, D. Moos, M.D. Zoback, S. Hickman, and D.R. Schmitt, Borehole breakout measurements in two superdeep boreholes in Russia, abstract submitted to VII Int. Symp. on the Observation of the Continental Crust through Drilling, Santa Fe, April, 1994.
257. Schmitt, D.R., Open fracture mapping from ultrasonic borehole televiewer logs: a potential indicator method for orienting stresses, Geol. Assoc. Can./ Min. Assoc. Can. Joint Annual Meeting, Waterloo, May, 1994.

258. **Li, Y.Y.** and D.R. Schmitt, Drilling induced microcracks in Alberta Basement cores: Relationship to in situ stress, Geol. Assoc. Can./ Min. Assoc. Can. Joint Annual Meeting, Waterloo, May, 1994.
259. **Kebaili, A.** and D.R. Schmitt, Velocity anisotropy estimation in the vertical plane using VSP data, CSEG/CSPG Joint Convention, Calgary, May, 1994.
260. **Molyneux, J.** and D. R. Schmitt, Laboratory constraints of seismic reflectors in the Granite Lake area, Trans-Hudson reflection profile, N. Saskatchewan, CSEG/CSPG Joint Convention, Calgary, May, 1994.
261. **Li, Y.Y.,** and D.R. Schmitt, Determination of the microcrack porosity and mineral anisotropy of cores: Application to the Lithoprobe Alberta Basement Transect, CSEG/CSPG Joint Convention, Calgary, May, 1994.
262. **Wang, Y.,** and D.R.Schmitt, A dynamic reflection travelttime calculation method, to be presented, CSEG/CSPG Joint Convention, Calgary, May, 1994.
263. **Molyneux, J.** and D.R. Schmitt, Detailed investigation of the physical properties associated with a seismic reflection in the locality of a sheared zone, Lithoprobe Trans-Hudson Orogen Workshop, Saskatoon, April 1994.
264. Schmitt, D.R., **A. Kebaili, Y. Wang, J. Molyneux,** and **Y.Y. Li,** Seismic monitoring of enhanced oil recovery processes, 18th Annual AOSTRA/University/Industry Technical Review Meeting and Seminar, Calgary, March 1994.
265. Schmitt, D.R., Exploiting drilling induced core damage: application to stress estimation and core orientation in the Alberta Basement, Lithoprobe Alberta Basement Transects Workshop, Calgary, Feb. 1994.
266. Schmitt, D.R. Sensitivity of fractures to the stress field: Evidence from ultrasonic borehole televiewer surveys, Amer. Geophysical Union 1993 Fall Meeting, (Paper given in Special Session on Coupled Hydrologic and Tectonic Processes and also in a general Union session), San Franscisco, Dec. 1993.
267. **Molyneux, J.** and D. R. Schmitt, Laboratory constraints on the reflectivity of a highly sheared zone, Amer. Geophys. Union 1993 Fall Meeting, San Francisco, Dec. 1993.
268. Schmitt, D.R., R.J. Tait, and **H. Spann,** Solutions for pore pressures and stress in internally pressurized porous hollow cylinders, 34th U.S. Symp. on Rock Mech., Madison, June, 1993.
269. Schmitt, D.R., and **Y. Li,** Influence of the depth of a stress relieving hole on induced displacements: application in interferometric stress determination, 34th U.S. Symp. on Rock Mech., Madison, June, 1993.
270. Schmitt, D.R, **C. Hickey,** T. Chacko, Laboratory velocity measurements on rock from the Trans-Hudson Orogen transect, Geol. Assoc. Canada/Min. Assoc. Can. Annual Meeting, Edmonton, May 1993.
271. Schmitt, D.R., and **J. Molyneux,** Velocities of rocks associated with the Granite Lake, Saskatchewan, seismic reflectors, Can. Geophys. Union, Banff, May, 1993.
272. Schmitt, D.R. and **Y. Wang,** Tomographic inversion of surface to borehole seismic traveltimes: A comparative study of standard methods, Can. Soc. Expl. Geophys. Annual Meeting, Calgary, May, 1993.

273. Schmitt, D.R., **J. Molyneux**, and **C. Hickey**, Laboratory seismic impedance measurements: application to the Trans-Hudson Lithoprobe reflection profiles, , Can. Soc. Expl. Geophys. Annual Meeting, Calgary, May, 1993.
274. Schmitt, D.R., **J. Molyneux**, **C. Hickey**, and T. Chacko, Laboratory elastic wave impedance measurements on rocks associated with the seismic reflections near Granite Lake, Saskatchewan, Lithoprobe Trans-Hudson Transect Meeting, Regina, April, 1993.
275. 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.
276. 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.
277. 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.
278. Schmitt, D.R., and **A. Kebaili**, Layer stripping in the t-p domain to delineate seismic anisotropy, AGU Fall Meeting, San Francisco, Dec. 1992.
279. Schmitt, D.R., Rock physics studies at high pressure, Canadian Workshop on High Pressure Science and Technology, Vancouver, Sept. 1992.
280. **Kebaili**, **A.** and D.R.Schmitt, Estimation of anisotropy from borehole seismics, Int. Workshop on Seismic Anisotropy, Banff, May 1992.
281. **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.
282. **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.
283. **Kebaili**, **A.** and D.R.Schmitt, Anisotropy estimation using three component multiple offset VSP data, Canadian Soc. Exploration Geophysics Meeting, Calgary, May 1992.
284. **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.
285. 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.
286. 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.
287. Schmitt, D.R., Static physical properties of rocks from the Trans-Hudson orogen, Lithoprobe Trans-Hudson Orogen Transect Meeting, Saskatoon, March 1992.
288. Schmitt, D.R., A high pressure facility for physical property measurement on core, Lithoprobe Alberta Basement Transect Meeting, Calgary, March 1992.

289. 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.
290. 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.
291. 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.
292. 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.
293. 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.
294. 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.
295. Schmitt, D.R., Discrimination of open fractures from borehole topographs, Canadian Society of Exploration Geophysicists Annual Meeting, Calgary, May 1991
296. Schmitt, D.R., Rock elastic moduli: Relevance to hydraulic fracturing stress determinations, Canadian Geophysical Union Annual Meeting, Banff, May 1991.
297. **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.
298. Schmitt, D.R., Fracture statistics derived from digital ultrasonic borehole televiewer logging, CIM/AOSTRA 1991 Technical Conference, Banff, April 1991.
299. 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.
300. 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.
301. 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.
302. Schmitt, D.R., M. Kanzaki, and R. Tronnes, Sodium Chloride high pressure melting experiments, GAC/MAC annual meeting, Vancouver, May, 1990.
303. 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.
304. 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.
305. Schmitt, D.R., Stress determination methods in oil sands, AOSTRA/ University/Industry Technical Review Meeting and Seminar, Banff, Oct 1989.

306. Schmitt, D.R., Consequences of crustal stresses and their quantitative measurement, Scientific Drilling: Sedimentary Basins, Canadian Continental Drilling Program Workshop, Calgary, March, 1989.

307. Additional: More than 15 in previous 4 years

Seminars, Colloquia, and Keynote Presentations

- Canadian Society of Exploration Geophysicists Distinguished Lecture Tour: September, 2017 to June, 2018.
- Chengdu Univ. of Science and Technology, Dept. of Geophysics, May 4, 2017.
- Sichuan University – Chengdu, Dept. of Geosciences, May 3, 2017.
- China University of Petroleum – Beijing, Dept. of Geophysics, April 28, 2017
- China University of Geosciences, Dept. of Geophysics, April 27, 2017
- ICDP SEISMS Workshop, LDGO, New Jersey, March 30, 2017.
- Geological Sciences, U. of Saskatchewan, Saskatoon, March 1, 2017.
- Earth & Planetary Science, Purdue, West Lafayette, November 5, 2016.
- Technische Universität Bergakademie Freiberg, Germany, October 19, 2016.
- Soc. of Petroleum Engineers, Geomechanics Division, Calgary, October 4, 2016.
- University of Auckland, February 15, 2016
- Victoria University Wellington, February 8, 2016
- ISRM Commission on Crustal Stress and Earthquakes, Montreal, May 10, 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.
- 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.
- 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.

Media and Presentations to the General Public

- Ice quake and induced seismicity interview on AM630 CHED (January 5, 2018)
- Deep Fault Drilling Program: Interviews on AM630 CHED (May 19, 2017), Edmonton Sun (May 20, 2017), CBC Alberta News (May 21, 2017).
- Quirks and Quarks, CBC Radio,: Answer to question on ‘Is the weight of the earth changing’, February 4, 2017.
- U of Alberta Undergraduate Society Speaker Series, Geophysical studies of impact structures, January 27, 2017.
- Department of Physics Astronomical Observatory, Public Outreach Series, “Geophysics of the Chicxulub Impact Structure”, Bob Donaldson, Nov. 3, 2016.
- Quirks and Quarks, CBC Radio, “My Summer Field Program – Chicxulub Drilling”, interview (not yet aired), September 10, 2016.
- One News, TV New Zealand, “Scientists look for info on South Island Quake due within 30 years”, Lisa Davies, January 20, 2016.
- Strathcona Public Library, Lecture Program, ‘Earthquakes and hydraulic fracturing, April 17, 2015.
- Royal Astronomical Society of Canada, Edmonton-Centre, “Hunting for buried impact craters”, September 8, 2014.
- Bow City Impact Crater Announcement, CBC Edmonton AM, CBC Calgary Eyeopener CBC Canada International, CTV Newsnet, CTV Edmonton, New Radio 770 Calgary, CHED Edmonton, CBC, CTY, News Radio, CHED Bow City Meteorite Impact, Canadian Press (cross Canada), Globe and Mail, BrooksBulletin, Taber Times, Sun Newspapers, Web based Astrobio.net <http://www.astrobio.net/news-brief/an-impact-from-the-past/>, May 7-9, 2014.
- Urban Drilling Panel, Lethbridge City Council, “Technical Issues Regarding Hydraulic Fracturing” <http://www.lethbridge.ca/City-Government/City-Council/Pages/Urban-Drilling-CIC.aspx>, February 24, 2014.

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, 2016 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 *Nature Geoscience*, *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*, *Advances in Materials Science and Engineering*, *Computers and Geotechnics*, *Cold Regions Science and Technology*, *Fuel*, the *Journal of Structural Geology*, *International Journal of Earth Science*, *Ultrasonics*, and the *American Rock Mechanics Association conferences*.
- 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 Foundation (Georgia)*, *PRESTIGE (Postdoctoral Research Fellowships in France)*, the *Australian Research Council*, the *Petroleum Research Atlantic Canada Foundation*, and the *Canada Research Chairs Program*.
- 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).
- Co-Chair, AGU-SEG Joint Meeting on Rock Physics, Hilo, Hawaii, July 2016. Currently co-editor of special collection of rock physics papers for JGR.

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

- Member, Scientific Committee, 2016 EAGE-SCE Int. Symp. On Digital Rock Physics, Beijing, March 30-31, 2016.
- 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
 - 2012 – Whatsadusie Seismic Profiling Project
 - 2014 – Deep Fault Drilling Project – DFDP-2
 - 2016- - VSP Measurements at DFDP-2
- 2011 – current ICDP Collisional Orogeny of the Scandinavian Calidonides, Sweden.
- 2011 – current Helmholtz-Alberta Initiative, Hunt well geophysics, Alberta
- 2011 – current ICDP Koyna Reservoir Triggered Earthquakes, Maharashtra, India
- 2015 – current ICDP/IODP Chicxilub Impact Drilling Project, Yucatan, Mexico.
- 2015 – current SaskPower Boundary Dam CO₂ Injection Project, Estevan, Saskatchewan.

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

- 2017-18: Canadian Society of Exploration Geophysicists Distinguished Lecturer
- 2015: Technical Achievement 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

- 2015: T. Mohammed, Best Student Oral Paper Award, geoConvention 2015: CSPG/CSEG/CWLS Joint Convention, Calgary, March.
- 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.

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

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. Over the period of 1998 to 2013, 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.

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), 17 (2016). 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

- Dept. of Physics Tenure Committee, 2016-
- Dept. of Physics, Science Internship Program Representative, 2016-
- 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 – July, 2016***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). We are also developing in my laboratory a low frequency instrument that will allow us precise determinations of dynamic bulk moduli, an immediate goal for this is determining the bulk viscosity of bitumen that may also be an analog for silicate melt.
- 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/IODP Expedition 364 Chicxulub K-Pg Impact Crater: We were invited to the Science Team for this project that drilled into the peak ring uplifts of the Chicxulub impact structure, offshore Yucatan, Mexico in April-May, 2016. Our task in collaboration with the University of Texas was to obtain zero offset vertical seismic profile (VSP) data necessary to calibrate the surface seismic and to provide accurate in situ values of seismic wave speeds. Student Nixon will attend the core sampling meeting in Bremen in September, 2016 in order to obtain materials for testing in our laboratory.
- 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. student 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.