BENJAMIN L. MELOSH *(Ph.D.)*

Multi-disciplinary field geologist with expertise in structural geology, active tectonics and geothermal systems. Extensive mapping experience on five continents in broad range of conditions and geologic environments, compilation of digital map databases and three-dimensional structural model development.

Geology, Minerals, Energy and Geophysics
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EDUCATION

2011 - 2015: Ph.D. Structural Geology, McGill University, Montréal, Canada. GPA: 3.7.

Earthquake cycling in the brittle-plastic transition of a transform boundary, the Pofadder Shear Zone, Namibia and South Africa. (*Dissertation title*)

Detailed field mapping at regional to outcrop scale documented shear zone architecture at the base of the seismogenic zone in an exhumed Proterozoic fault. With respect to kinematics, scale and rock type this shear zone is an ancient analogue to the modern San Andreas fault. I developed a new field indicator of past earthquakes using insights from rock mechanics experiments, identified coseismic transient fluid pathways in the middle crust, investigated relationships between coseismic grain size reduction, shear zone strength and strain localization and calculated differential exhumation of the shear zone using a geothermobarometer.

2011: Secondary Ionization Mass Spectrometry (SIMS) workshop, University of California, Los Angeles, Feb. 21^{st} - 25^{th}.

2009: MSc, Earth Science, University of California at Santa Barbara (UCSB). GPA: 3.74.

Effects of active folding and reverse faulting on stream channel evolution and incision, Santa Barbara Fold Belt, California. (*Thesis title*)

Remote sensing-based mapping on a high resolution digital elevation model documented the most recent timing of folding, faulting and seismic hazard in the Santa Barbara region. I used the geomorphic expression of folding, abandoned paleochannels, stream incision rates and cross cutting relationships to decipher the relative timing and propagation of deformation in the rotating Santa Barbara micro block.

2005: BSc, Earth Science, University of California at Santa Cruz (UCSC). GPA: 3.53.

2002, 2003: UCSC Dean's List Award for Outstanding Academic Achievement.

2001: Jakarta International High School, Jakarta, Indonesia.

PROFESSIONAL EXPERIENCE

2015 - current: Research Geologist, USGS, Menlo Park, California

I am involved with new 1:24,000-scale geologic mapping in the eastern Coast Ranges of northern California along the Bartlett Springs fault corridor between Lake Berryessa and Clear Lake. I aim to develop 3D models of late Mesozoic terrane development and its structural influence on active faulting. I use traditional geologic mapping techniques complemented with modern datasets including LiDAR, Python-based earthquake hypocenter maps and BlenderGIS - GIS interfaces to develop and understand 3D structure and geologic evolution.

2014: Consulting structural geologist, Adage Ventures, Montréal, Québec.

I co-lead a structural field mapping team during the development of three-dimensional structural models for a geothermal prospect in central Guatemala. This work was included in a conference abstract and a publication.

2010: Consulting geologist and research assistant, Geoglobal Energy, Santa Rosa, California.

I led a field campaign over two 3 week periods in the central Andes of northern Chile. Through detailed field mapping and sampling our group helped decipher the structural controls on the Puchuldiza geothermal system. Results were incorporated into one conference abstract, a publication in preparation and a final report for Geoglobal Energy.

2005 - 2007: Staff Geologist, EBA Engineering, Santa Rosa, California.

Field sampling, report preparation, data analysis, drilling, tank removal, remediation system installation and project management during all stages of leaky underground storage tank removal and remediation.

2005: Research Assistant, USGS, Santa Cruz, California.

Literature research on the tides, currents, winds and wave patterns of California for the USGS publication: *National Assessment Of Shoreline Change Part 3: Historical Shoreline Change and Associated Coastal Land Loss Along Sandy Shorelines of the California Coast.*

PUBLICATIONS

Melosh, B.L., Rowe, C.D., Smit, L., Gerbi, C., Macey, P., (in final prep.) *Shear folding, strain localization, and earthquakes in an ancient San Andreas analogue, the Pofadder Shear Zone, Namibia and South Africa*

Melosh, B.L., Rowe, C.D., Gerbi, C., Bate, C.E., Shulman, D., 2016, *The spin zone: Transient mid-crust permeability caused by coseismic brecciation*, Journal of Structural Geology 87, 47-63.

Busby, C.J., Andrews, G.D.M., Koerner, A.K., Brown, S.R., **Melosh, B.L.** and Hagan, J.C., 2016, *Progressive derangement of ancient (Mesozoic) E-W Nevadaplano paleochannels into modern (Miocene-Recent) NNW trends in the Walker Lane belt, Central Sierra Nevada* Geosphere, Special Issue (Eds K. Putirka and C. Busby) "Origin of the Sierra Nevada and Walker Lane", Geosphere 12, 135-175.

Libbey, R.B., Williams-Jones, A.E., **Melosh, B.L.**, Backeberg, N.B., 2015, *Characterization of geothermal activity along the North American - Caribbean Plate boundary in Guatemala: The Joaquina geothermal field*, Geothermics 56, 17 - 34.

Melosh, B.L., Rowe, C.D., Smit, L., Groenewald, C., Lamert, C.W., Macey, P., 2014, *Snap, Crackle, Pop: Dilational fault breccias record seismic slip below the brittle-plastic transition.* Earth and Planetary Science Letters 403, 432 - 445.

Melosh, B.L., Keller, E.A., 2013, *Effects of active folding and reverse faulting on stream channel evolution, Santa Barbara Fold Belt, California.* Geomorphology 186, 119-135.

Busby, C.J., Koerner, A.A., **Melosh, B.L.**, Hagan, J.C., Andrews, G.A., 2013, *The Sierra crest graben-vent system: A Walker lane pull-apart within the ancestral Cascades arc.* Geosphere, v. 9, no. 4, 736 - 780.

MAPS

Melosh, B.L., unpublished mapping, 2009, *Geologic map of the Disaster - Arnot Peak area*, U.S. Geological Survey EDMAP award number 09HQPA0004 to C.J. Busby.

Melosh, B.L., Busby, C.J., 2010, *New geologic findings from the Puchuldiza geothermal concessions and surrounds*, commissioned by GeoGlobal Energy Inc.

COMPUTER SKILLS

Experienced in Python, QGIS, Blender, Github, ArcGIS, Matlab, Adobe Suite, LaTeX, Parallels, Global Mapper, Surfer, Grapher6, Stereonet, FaultKin, Word, Excel, PowerPoint, Keynote, Open Office, PC or Mac.
Proficient in JavaScript, CSS, ENVI, Perplex and Thermocalc.

AWARDS AND GRANTS ($28,673 to date)

2014: Leroy Fellowship, Award for graduate research excellence, McGill University. $4,820
2013: Alexander McGregor Fellowship, Award for graduate research excellence, McGill University. $11,000
2013: Geraldine Davidson Fellowship, Award for graduate research excellence, McGill University. $400
2013: J B Lynch Fellowship, Award for graduate research excellence, McGill University. $600
2013: Geotop Scholarship, Graduate Research Scholarship. $5000
2012: Howard Scholarship, Award for graduate research excellence, McGill University. $2053
2011: Geologic Society of America: Graduate Research Award. $4000
2009: USGS EDMAP grant to map Miocene volcanics on the central Sierra Nevada range crest.
2008: Preston Cloud Memorial Award for UCSB geology first time presenters. $300
2005: Weber/Holt UCSC summer field scholarship award. $500

JOURNAL REFEREE

2016: Geomorphology
2013: Earth Surface and Landform Processes

FIELD TRIPS

Melosh, B.L., McLaughlin, R.J., 2016, Inherited structural complexity and active deformation in the eastern Coast Ranges, California, Structural Geology and Tectonics Forum, Rohnert Park, CA.

MENTORING EXPERIENCE

2013-2014: Supervised the senior thesis of a McGill undergraduate student Charlotte Bate. Her work included measuring the fractal dimension of coseismic breccias and 2D clast rotation, results were incorporated into a publication in preparation.

2012: Mentored masters student Louis Smit from University of Cape Town during one month in the field in southern Namibia and northern South Africa. His work focused on detailed structural measurements, understanding 3D relationships, efficiency in the field, rock description and sampling. Louis' work is incorporated into one publication and two publications in preparation.

ADDITIONAL RESEARCH EXPERIENCE

2015: Assistant core logger to the Deep Fault Drilling Project on the Alpine Fault in Wataroa, New Zealand.

During a period of one month I assisted with logistical efforts, core logging, drill cutting organization and subsampling, security detail, clean up and transport of operations.

2013: Investigating the structural controls on gold deposits in an Archean greenstone-tonalite belt, Atikokan, ON, Canada.

I was involved as a field assistant during structural field work, regional mapping and drill core description over a period of one week. Results were incorporated into the PhD dissertation of Nils Backeberg, a member of our research group.

2011 - 2012: Mapping the basal thrust of the Nakluft Nappe Complex with high resolution differential GPS in southern Namibia.

Over a one month period I helped with detailed (*cm* scale) mapping which was used as part of a high resolution coseismic stress study. This work was incorporated into one conference abstract and the Masters thesis of Tim Sherry, a member of our research group.

2010: Geologic mapping and stratigraphy of western Xinjiang China, to investigate the Neogene collision of the Pamir and Tien Shan Mountains.

Over a period of one month I helped measure 3 *km* of statigraphic section, take structural measurements and assist with geologic mapping and reconnaissance. This work was incorporated as part of the PhD dissertation of a graduate student from UCSB.

2009: Field mapping in the central Sierra Nevada, California, to investigate the changing styles of Miocene volcanism.

During a 2 month period I led a mapping and sampling campaign in the Carson-Iceberg wilderness in central California. I developed a three-dimensional model of the field area to look at the interaction of syn-tectonic magmatism and deposition of fluvial reworked volcanics deposited in a range-crest graben. This work was included in one publication and three conference abstracts.

2007: Geothermal system field site characterization, southern Andes, Chile.

Over a one month period I was involved with hot spring reconnaissance and sampling trip to help characterize the potential for the Tolhuaca geothermal system in southern Chile.

2004: Landslide stability investigation surrounding geothermal wells at Wayang Windu, West Java, Indonesia.

During one week I assisted and learned from geologists performing a slope stability and remediation study after several well pads had been damaged by landslides at the Wayang Windu geothermal field.

TEACHING EXPERIENCE

2011 - 2015, Graduate Teaching Assistant, McGill University

Summer Field Geology (3 times), Structural Geology (3 times), Sediments to Sequences, Earth and Life History, Mineral Deposits, Geochemistry.

2007 - 2009 Graduate Teaching Assistant, UC Santa Barbara

Summer Field Geology, Field Studies in Geological Sciences, Natural Disasters (2 times), Geomorphology, Dinosaurs (2 times), Environmental Science, Engineering Geology.

PROFESSIONAL AFFILIATIONS

Seismological Society of America (since 2014)
Canadian Tectonics Group (since 2011)
American Geophysical Union (since 2007)
Geological Society of America (since 2007)

SYNERGISTIC ACTIVITIES

Volunteer for community outreach high school science night, Goleta CA (2011, 2012)
Volunteer rafting guide for Cordilleran River Works (CRW)
Member of the Royal Geologic Society of Goleta (2007 - 2010)
Surfrider foundation volunteer - beach clean up day (2005, 2007)
Meet a scientist day - research talks to elementary school students, Sebastopol, CA (2006, 2007)
Co-founder of the Sonoma County United Meeting of Biology And Geology (SCUMBAG)(2006)
Volunteer for the trail maintenance crew in Sugarloaf Ridge and Annadel State Parks, Sonoma County, CA (2005, 2006)

ADDITIONAL EXPERIENCE

Languages:

Fluent in reading, writing, and speaking Spanish.
Proficient in reading, writing, and speaking Bahasa Indonesia.
Introductory French.

Hobbies:

Multi-instrumentalist: Guitar, Mandolin, Banjo, Dobro, Harmonica.
Climbing, rafting, surfing, mountain biking, skiing, brewing.

PRESENTATION ABSTRACTS

Rowe, C.D., Griffith, A.W., Ross, C., **Melosh, B.L.**, Young, E., 2016, *Insights into earthquake rupture and recovery from paleoseismic faults (Invited)*, S14B-01, American Geophysical Union, San Francisco, CA.

Melosh, B.L., Rowe, C.D., Gerbi, C., 2015, *Coseismic brecciation at fault stepovers and transient fluid pathways in a mid-crustal San Andreas analogue: The Pofadder Shear Zone, Namibia and South Africa*, T12A-04, American Geophysical Union, San Francisco, CA.

Libbey, R.B., Williams-Jones, A.E., **Melosh, B.L.**, Backeberg, N.R., 2014, *Geological and geochemical reconnaissance of a non-volcanic geothermal prospect in Guatemala, Joaquina geothermal field*, Geothermal Research Council Transactions, Portland, OR.

Melosh, B.L., Rowe, C.D., Gerbi, C., 2014, *Belly of the Beast: Detailed Mapping in the Deformation Core of a Quartz-plastic Transitional Zone Fault, Implications for Deep Fault Seismicity on Major Strike Slip Faults*, Structural Geology and Tectonics Forum, Golden, CO.

Rowe, C.D., **Melosh, B.L.**, Lamothe, K., Schnitzer, V., Bate, C.E., 2013, *Earthquake Breccias*, AGU Fall meeting abstract T52A-01, San Francisco, CA. Invited.

Melosh, B.L., Rowe, C.D., Groenewald, C., Smit, L., Lambert, C., Macey, P., 2013, *Snap, Crackle, Pop: Dilational fault breccias record seismic slip below the brittle-plastic transition*, poster 177, GSA Abstracts with Programs. Vol. 45, No. 7, p.520, Denver, CA.

Melosh, B.L., Rowe, C.D., Groenewald, C., Smit, L., Lambert, C., 2013, *Snap, Crackle, Pop: Dilational fault breccias record seismic slip below the brittle-plastic transition*, poster 177, Southern California Earthquake Center annual meeting, Palm Springs, CA.

Busby, C., Putirka, K., Renne, P., **Melosh, B.L.**, Hagan, J., and Koerner, A.A., 2013. *A Tale of two Walker Lane Pull-Aparts.* Geological Society of America, Cordilleran Section, Abstracts with Programs, May 2013.

Melosh, B.L., Rowe, C.D., Smit, L., 2012. *A continuous transect through the lower seismogenic zone of a transform boundary: The Pofadder Shear Zone, Namibia and South Africa.* Abstract T33F-2729 presented at 2012 AGU Fall Meeting, San Francisco, Calif., 3-7 Dec.

Sherry, T.J., **Melosh, B.L.**, Rowe, C.D., 2012. *Connecting multi-scale fault geometry with field observations: insights into fluid-fault rock relations.* Abstract T13E-2673 presented at 2012 AGU Fall Meeting, San Francisco, Calif., 3-7 Dec.

Busby, C., Schmitt, A., **Melosh, B.L.**, Putirka, K., Melosh, G., Iriarte, S., and Andrews, G., 2012. *Ignimbrite stratigraphy of the "volcanic" western cordillera and adjacent altiplano in the region of the Puchuldiza geothermal area (19° 15'S to 19° 25'S), northern Chile*, GSA Abstracts with Programs, Vol. 44, No. 7.

Melosh, B.L., Rowe, C.D., Smit. L., 2012. *Seismicity and strain partitioning recorded in a differentially exhumed continental transform shear zone: Pofadder Shear Zone, Namibia and South Africa.* Canadian Tectonics Group annual conference; Oct 26-28; Ottawa, ON.

Melosh, B.L., Rowe, C.D., 2011, *Preliminary lithologic and structural mapping of a continental scale transform boundary, Pofadder Shear Zone, Namibia and South Africa.* Canadian Tectonics Group annual conference; Oct 21-23; Charlevoix, QC.

Busby, C.J., Hagan, J.C., Koerner, A.A., Putirka, K., Pluhar, C.J., and **Melosh, B.L.**, 2010. *Birth of a plate boundary.* Geological Society of America Abstracts with Programs, v. 42, no. 4, p. 80.

Melosh, B.L., Keller, E.A., 2009, *Effects of Active Folding and Reverse Faulting on Stream Channel Evolution: Santa Barbara Fold Belt, California.* GSA Abstracts with Programs, Vol. 41, No. 7, p. 300.

Busby, C.J., Putirka, K.D., Hagan, J.C., Koerner, A., **Melosh, B.L.**, 2009, *Controls of Extension on Miocene Arc Magmatism in the Central Sierra Nevada, (CA).* Eos Trans. AGU, 90(52), Fall Meet. Suppl., Abstract V41B-2173.

Melosh, B.L., Keller, E.A., 2008, *Active crustal shortening interpreted through its fluvial signature: Santa Barbara, California.* AGU Fall meeting, Abstract H53B-1014.