Nicolas Harrichhausen

CNRS Postdoctoral Researcher, ISTerre, Université Grenoble Alpes, Grenoble, France
email: n.harrichhausen@univ-grenoble-alpes.fr
website: https://harrichhausenfaults.weebly.com/

Education

2021 **University Of California, Santa Barbara (UCSB)**, PhD Earth Science – USA
Dissertation: "Fault accommodation of permanent strain in the northern Cascadia forearc"
Advisor: Prof. Kristin Morell

2016 **McGill University**, MSc Earth Science – Canada
Dissertation: "Role of colloidal transport in the formation of high-grade gold veins at Brucejack, British Columbia"
Advisor: Prof. Christie Rowe

2011 **University of Victoria (UVic)**, BSc (Hons.) Earth Science – Canada
Dissertation: "Structural Geology of the SPN Property: South Central British Columbia"
Advisor: Prof. Stephen Johnston

Professional experience

2023 - Present **Centre National de la Recherche Scientifique (CNRS) Postdoctoral researcher**
Institut des Sciences de la Terre (ISTerre), UGA, Grenoble, France

2021 - 2023 **Centre National d'Études Spatiales (CNES) Postdoctoral fellow**
Institut des Sciences de la Terre (ISTerre), UGA, Grenoble, France

2014 - 2021 **Research Assistant**
McGill University, UVic, UCSB

2011 - 2014 **Exploration Geologist**
Pretium Resources, Vancouver, British Columbia, Canada

2010 - 2010 **Exploration Geologist**
C.J. Greig & Associates, Penticton, British Columbia, Canada

2006 - 2009 **Survey Technician**
Glen Mitchell Land Surveying, Victoria, British Columbia, Canada

Publications

2023 **Harrichhausen, N.**, Finley, T., Morell, K. D., Regalla, C.A., Bennett, S.E.K., Leonard, L.J., Nissen, E., McLeod, E., Lynch, E. M., Salomon, G., Sethanant, I. Discovery of an active forearc fault in an urban region: Holocene rupture on the XEOLXELEK–Elk Lake fault, Victoria, British Columbia, Canada. *Tectonics*, e2023TC008170.

2023 **Harrichhausen, N.**, Audin, L., Baize, S., Johnson, K. L., Beauval, C., Jarrin, P., Marconato, L., Rolandone, F., Jomard, H., Nocquet, J.-M., Alvarado, A., Mothes, P.A. Fault source models show slip rates measured across the entire width of the fault zone best represent the observed seismicity of the Pallatanga–Puna fault, Ecuador. *Seismological Research Letters.*

2022 **Harrichhausen, N.**, Morell, K. D., Regalla, C.A., Lynch, E.M., Leonard, L.J. Eocene Terrane Accretion in Northern Cascadia Recorded by Brittle Left-lateral Slip on the San Juan Fault. *Tectonics*, e2022TC007317.

2021 **Harrichhausen, N.**, Morell, K. D., Regalla, C.A., Bennett, S.E.K., Leonard, L.J., Lynch, E.M., Nissen, E. Paleoseismic trenching reveals Late Quaternary kinematics of the Leech River fault: Implications for forearc strain accumulation in northern Cascadia. *Bulletin of the Seismological Society of America,* 111(2), 1110–1138.

2018 Rowe, C.D., Ross, C., Swanson, M.T., Pollock, S., Backeberg, N.R., Barshi, N.A., Bate, C.E., Carruthers, S., Coulson, S., Dascher-Cousineau, K., **Harrichhausen, N.**,... Geometric complexity of earthquake rupture surfaces preserved in pseudotachylyte networks. *Journal of Geophysical Research: Solid Earth,* 123(9), 7998-8015.

2018 Regalla, C. A., Rowe, C. D., **Harrichhausen, N.**, Tarling, M., Singh, J. Styles of underplating in the Marin Headlands Terrane, Franciscan Complex, California. *Geology and tectonics of subduction zones: A tribute to Gaku Kimura: Geological Society of America Special Paper*, 534, 155-173.

In proceedings

2023 **Harrichhausen, N.**, Finley, T., Morell, K. D., Regalla, C.A., Bennett, S.E.K., Leonard, L.J., Nissen, E., McLeod, E., Lynch, E. M., Salomon, G., Sethanant, I. Paleoseismic study of the XEOLXELEK–Elk Lake fault: A newly identified Holocene fault in the northern Cascadia forearc near Victoria, British Columbia, Canada. *Proceedings of the 11th International INQUA Meeting on Paleoseismology, Active Tectonics and Archeoseismology, Aix-en-Provence, France.* 90–93

Technical reports

2016 **Harrichhausen, N.**, Rowe, C.D., Board, W.S., Greig, C.J. Structural setting of a high-grade, electrum-bearing, quartz-carbonate vein stockwork at the Brucejack deposit, northwestern British Columbia (NTS 104B). *Geoscience BC Summary of Activities 2015*, Geoscience BC, Technical Report 2016-1

In review

- **Harrichhausen, N.**, Morell, K.D., Regalla, C.A. Forearc faults in northern Cascadia do not accommodate elastic strain driven by the megathrust seismic cycle. In review at *Seismica.*
- Lynch, E.M. Regalla, C., Morell, K.D., **Harrichhausen, N.**, Leonard, L.J. Late Pleistocene to Holocene transtension in the northern Cascadia Forearc: Evidence from surface ruptures along the Beaufort Range fault. In review at *Seismica.*
- Marconato, L., Doin, M.-P., Audin, L., Nocquet, J.-M., Jarrin, P., Rolandone, F., **Harrichhausen, N.,** Mothes, P., Mora-Páez, H., Cisneros, D. Motion of the Northern Andean Sliver in Ecuador-Colombia observed by InSAR. In review at *Earth and Planetary Science Letters.*

In Prep

- **Harrichhausen, N.**, Marconato, L., Audin, L., Lacan, P., Baize, S., Jomard, H., Alvarado, A., Mothes, P.A. Rolandone, F., Martin, I. O., Arcila, M. Distributed right-lateral faults accommodate strain at the northern boundary of the Quito-Latacunga tectonic block in the Northern Andean Sliver.

Awards, Grants, and Scholarships

2022 11th International INQUA PATA days travel grant. (€750)

2021 Centre National d'Études Spatiales (CNES) postdoctoral fellowship. (Two years salary)

2021 University of Victoria Dr. Margaret Perkins Hess Research Fellowship in Earth, Ocean, Astronomy and Environmental Sciences. (declined)

2018 Geological Society of America (GSA) research grant. ($2,358)

2017 National Science and Engineering Research Council of Canada Postgraduate Scholarship-Doctoral (NSERC PGS-D). ($63,000 CAD)

2016 University of Victoria Graduate Entrance Award. ($5,000 CAD)

2016 University of Victoria Fellowship. ($10,000 CAD)

2015 Geoscience British Columbia Scholarship. ($5,000)

2015 William Henry Howard Scholarship, McGill University. ($2,500 CAD)

2015 Society of Economic Geologists (SEG) Graduate Student Fellowship. ($10,000 USD)

2014 Murata Family Fellowship ($9,533 CAD)

2014 National Science and Engineering Research Council of Canada Collaborative Research and Development (NSERC-CRD) Grant with Prof. Christie Rowe and Pretium Resources. (NSERC - $66,223 CAD; Pretium Resources - $41,818 CAD + in-kind field expenses)

2011 Best honours thesis presentation, UVic

2010 University of Victoria President's Award. ($1,500 CAD)

2004 University of Victoria Entrance Scholarship. ($2,500 CAD)

2004 BC Provincial Government Scholarship.

2004 BC Provincial Government Passport to Education Scholarship.

2004 Penticton Minor Hockey Scholarship. ($4,500 CAD)

Invited talks and seminars

February 2024 University of Alaska, Anchorage, USA.

January 2024 Institut des Science de la Terre (ISTERRE), Université Grenoble Alpes, France.

December 2023 Institut de Terre & Environment de Strasbourg (ITES), Université de Strasbourg, France.

June 2023 Geological Survey of Canada, Pacific Geoscience Centre seminar series. (Online)

February 2023 European Centre for Research and Teaching in Geosciences and Environment (CEREGE), Aix-en-Provence, France.

June 2022 NATO SPS project 'Geo-environmental security from earthquakes in Kazakhstan and Kyrgyzstan': Quaternary dating and hazards workshop, Aix-en-Provence, France.

June 2021 United States Geological Survey, GMEG seminar series. (Online)

May 2020 Dept. of Earth Science, University of California, Santa Barbara, USA

March 2017 British Columbia Geological Survey Earthbound talks, Victoria, Canada

Meeting Abstracts

October 2023 **Harrichhausen, N.**, Marconato, L., Audin, L., Baize, S., Jomard, H., Lacan, P., … Arcila, M. (2023). Mapping active faults in the northern Andes using Pleiades satellite tri-stereo imagery. Journées CNES Jeunes Chercheurs, Toulouse, France.

April 2023 **Harrichhausen, N.**, Marconato, L., Audin, L., Baize, S., Jomard, H., Lacan, P., … Arcila, M. (2023). Distributed right-lateral faults accommodating strain at the northern boundary of the Quito-Latacunga microblock of the Northern Andean Sliver. EGU Annual Meeting, Vienna, Austria.

April 2023 Marconato, L., Doin, M. P., Audin, L., **Harrichhausen, N.**, Nocquet, J.-M., Jarrin, P., Rolandone, F. (2023). Can we observe North Andean Sliver motion using long InSAR time-series analysis? EGU Annual Meeting, Vienna, Austria.

January 2023 **Harrichhausen, N**. Audin, L., Baize, S., Johnson, K.L., Beauval, C., Jarrin, P., Rolandone, F., Nocquet, J.-M., Mothes, P. Assessing slip rates for PSHA using SHERIFS: Example from the Pallatanga–Puna fault system. 6th Workshop of the Fault2SHA ESC Working Group, Chieti, Italy.

December 2022 Lynch, E. M., Regalla, C., Bennett, S. E., Morell, K. D., Leonard, L. J., **Harrichhausen, N.**, Nissen, E. Holocene Paleoseismicity in the Northern Cascadia Forearc: Non-steady Slip on the Right-lateral Oblique Beaufort Range Fault, Vancouver Island, Canada. AGU Fall Meeting, Chicago, IL, USA.

October 2022 Morell, K.D., **Harrichhausen, N.**, Finley, T., Regalla, C.A., Bennett, S.E.K., Nissen, E., Lynch, E. M., Leonard, L.J., Sethanant, I., Salomon, G., McLeod, E. Paleoseismic trenching and lidar data reveal a previously unrecognized Quaternary-Active fault in the Cascadia forearc of southern Vancouver Island, Canada. GSA Connects Meeting, Denver, CO, USA.

October 2022 **Harrichhausen, N**. Audin, L., Baize, S., Johnson, K.L., Beauval, C., Jarrin, P., Rolandone, F., Nocquet, J.-M., Mothes, P. Assessing slip rates for PSHA using SHERIFS: Example from the Pallatanga–Puna fault system. LMI days, Quito, Ecuador.

September 2022 **Harrichhausen, N.**, Finley, T., Morell, K. D., Regalla, C.A., Bennett, S.E.K., Leonard, L.J., Nissen, E., McLeod, E., Lynch, E. M., Salomon, G., Sethanant, I. Paleoseismic study of the XEOLXELEK –Elk Lake fault: A newly identified Holocene fault in the northern Cascadia forearc near Victoria, British Columbia, Canada. 11th International INQUA Meeting on Paleoseismology, Active Tectonics and Archeoseismology, Aix-en-Provence, France.

May 2022 Marconato, L., Audin, L., Doin, M. P., **Harrichhausen, N**. Active tectonics in Ecuador: study of a major crustal fault system through multi-sensor InSAR time-series analysis, geomorphology and paleoseismology. In Tectonic Relief Basins–Andes Workshop, Grenoble, France.

May 2022 **Harrichhausen, N.**, Loveless, J. P., Morell, K. D., Regalla, C., Lynch, E. M. Using numerical modelling to investigate the driving forces of permanent forearc deformation in northern Cascadia. EGU Annual Meeting, Vienna, Austria.

October 2021 Regalla, C., Morell, K., **Harrichhausen, N.,** Lynch, E., Leonard, L.J., Bennett, S.E.K., Nissen, E., Finley, T. Forearc faulting in northern Cascadia, where, when, and why? (Invited Presentation). GSA Connects, Portland, OR, USA.

October 2021 Lynch, E.M., Regalla, C.A., Morell, K. D., Bennett, S.E.K., Leonard, L.J., **Harrichhausen, N.**, Nissen, E. Geomorphic mapping and paleoseismic trenching reveal multiple latest Pleistocene to Holocene earthquakes on the right-lateral, oblique Beaufort Range fault, northern Cascadia forearc, Britsh Columbia, Canada. GSA Connects, Portland, OR, USA.

October 2020 **Harrichhausen, N.**, Morell, K., Regalla, C., Johns, M.J., Makahnouk, W.R.M., Lynch, E.M. Kinematics and timing of the San Juan fault in northern Cascadia: Implications for Eocene terrane accretion of Siletzia. GSA Connects (Online).

May 2019 **Harrichhausen, N.**, Morell, K. D., Regalla, C.A., Bennett, S.E.K., Leonard, L.J., Lynch, E.M. Paleoseismic trenching reveals spatially-variable behavior on the Leech River fault. GSA Cordilleran Section Meeting, Portland, OR, USA.

May 2019 Lynch, E.M., Regalla, C.A., Morell, K. D., **Harrichhausen, N.**, Leonard, L.J. Scarpe diem: Late Quaternary Ruptures on the Beaufort Range fault, British Columbia, Canada. GSA Cordilleran Section Meeting, Portland, OR, USA.

May 2019 Regalla, C., Morell, K., Graham, A., Lynch, E.M., **Harrichhausen, N.**, Leonard, L.J., Bennett, S.E.K., Terry, C., Fischi, J. Geometry and mechanics of inherited forearc faults on Vancouver Island. GSA Cordilleran Section Meeting, Portland, OR, USA.

December 2018 **Harrichhausen, N.**, Morell, K.D., Regalla, C., Bennett, S.E.K, Leonard, L.J., Lynch, E.M. Eocene to Recent permanent forearc deformation in Northern Cascadia, southern Vancouver Island, British Columbia, Canada. AGU Fall Meeting, Washington, DC, USA.

December 2017 **Harrichhausen, N.**, Morell, K. D., Regalla, C., Lynch, E. M. New evidence for Oligocene to Recent slip along the San Juan fault, a terrane-bounding structure within the Cascadia forearc of southern British Columbia, Canada. AGU Fall Meeting, New Orleans, LA, USA.

October 2017 Lynch, E.M., Regalla, C., Morell, K., **Harrichhausen, N.** Geomorphic evidence for recent ruptures on the Beaufort Range fault in the northern Cascadia forearc of British Columbia, Canada. GSA Annual Meeting, Seattle, WA, USA.

October 2017 Morell, K., Regalla, C., Amos, C.B., Bennett, S.E.K., Graham, A., Leonard, L.J., Lynch, E.M., **Harrichhausen, N.** Lidar data, geologic mapping, and paleoseismic trenching reveal late Quaternary fault ruptures in the Cascadia forearc of southwestern British Columbia. GSA Annual Meeting, Seattle, WA, USA.

July 2016 **Harrichhausen, N.,** Rowe, C.D., Board, W.S., Greig, C.J. Trapping nanoparticles: A structural approach for concentrating precious metals in vein-hosted ore deposits: Structural Geology and Tectonic Forum, Sonoma State University, CA, USA.

December 2015 **Harrichhausen, N.,** Rowe, C. D., Board, W. S., Greig, C. J. Relationship between amorphous silica and precious metal in quartz veins. AGU Fall Meeting, San Francisco, CA, USA.

December 2015 Ross, C., Rowe, C. D., Pollock, S. G., Swanson, M., Tarling, M., Backeberg, N. R., … **Harrichhausen, N.** … Multi-surface Earthquake Rupture Recorded in Pseudotachylyte Vein Geometries, Norumbega Shear Zone, southern Maine. AGU Fall Meeting, San Francisco, CA, USA.

May 2015 **Harrichhausen, N.,** Rowe, C.D., Tarling, M., Board, W.S., Greig, C.J. Role of colloidal transport in the formation of high-grade gold veins at Brucejack, British Columbia. GAC-MAC Joint Assembly, Montreal, Canada.

September 2014 **Harrichhausen, N.,** Rowe, C.D., Tarling, M., Board, W.S., Greig, C.J. Role of colloidal transport in the formation of high-grade gold veins at Brucejack, British Columbia: Preliminary field work. Canadian Tectonics Group Meeting, Sudbury, Canada.

Teaching experience

Teaching Assistant

Winter 2020 **Earth 103: Fundamentals of Structural Geology (UCSB)**
Deformation of rocks–faulting, folding and flow. Theory and observations at scales ranging from mountain belts to microscopic. Taught and graded lab sections and field trips, and lead review sessions. ~30 students.

Summer 2019, 2018 **Earth 6: Mountains, Boots, and Backpacks (UCSB)**
Introductory field school. Led field mapping exercises and helped organize and teach a multi-day field school. ~25 students.

Winter 2019, Fall 2017 **Earth 20. Geological Catastrophes (UCSB)**
Introductory geoscience course focused on geological catastrophes. Taught and graded three separate lab sections. 25 to 30 students.

Winter 2018 **Earth 10: Antarctica, Antarctica, the Last Place on Earth (UCSB)**
Introductory geoscience course focused on Antarctica. Taught and graded three separate lab sections. 25 to 30 sutdents.

Summer 2017 **EOS 300. Introductory Field School (UVic)**
Introductory field school. Assisted in organizing and teaching a multi-day school. ~30 students.

Winter 2017 **EOS 202. Structural Geology (UVic)**
Introductory structural geology. Taught and graded one lab section and led review sessions. ~30 students.

Fall 2016 **EOS 120. The Dynamic Earth (UVic)**
Introductory geoscience. Taught and graded one lab section. ~30 students.

Winter 2016 **EPSC 303. Structural Geology (McGill University)**
Introduction to structural geology. Assisted in teaching and grading one class. ~30 students.

Fall 2015 **EPSC 240. Introductory Geological Field Methods (McGill University)**
Introduction to geological field methods including mapping, rock description, and remote sensing. Assisted in teaching and grading one class. ~30 students.

Winter 2015 **EPSC 303. Introductory Petrology (McGill University)**
Taught and graded one lab section. ~30 students.

Field experience

2023–2024 (5 weeks) **Middle branch of the Northern Anatolian Fault, Turkey**
Geomorphic mapping, shallow geophysical surveys, and a paleoseismic trench excavations on the Middle branch of the northern Anatolian fault.

2023 (2 weeks) **Queretaro, Mexico**
Geomorphic mapping and a paleoseismic trench of a normal fault reactivated by anthropogenic subsidence of the city of Queretaro.

2022 (5 weeks) **Northern Andes, Ecuador**
Geomorphic mapping and mapping of faults exposed in road cuts throughout the Andes.

2018 – 2021 (6 weeks) **Paleoseismic trenching, Vancouver Island, Canada**
Four paleoseismic trenches over the Leech River fault, Beaufort Range fault, and the XEOLXELE~~K~~–Elk Lake fault.

2016 – 2021 (6 months) **Vancouver Island, British Columbia, Canada**
Geologic and structural mapping of the San Juan fault across Vancouver Island. Included two weeks of self supported remote field work with no vehicle access. Geomorphic mapping of active faults.

2015 (1 week) **Dixie Valley, Nevada, USA**
Geologic and structural mapping of the Dixie Valley fault.

2015 (1 week) **Marin headlands, California, USA**
Geologic and structural mapping of faults in the Marin Headlands accretionary wedge complex.

2015 (1 week) **Norumbega Shear Zone, Maine, USA**
Geologic and structural mapping pseudotachylyte veins in the exhumed Norumbega shear zone.

2011 – 2015 (6 months) **Brucejack, northwestern British Colmbia, Canada**
Drillcore observations, geological mapping, underground mine mapping of an epithermal gold deposit.

2010 (2 weeks) **South central British Columbia, Canada**
Geological mapping of a volcanic massive suplhide deposit.

Mentorship, service, and outreach

2021 – Present **Reviewer**
Manuscript reviewer for *Tectonophysics, Geomorphica, Tektonika, Geophysical Journal International, Journal of South American Earth Sciences, Seismica, JGR: Solid Earth,* and *Earth and Space Sciences.*

2023 **CBC radio interview**
Canadian broadcasting corporation (CBC) radio interview (link here) to explain our discovery and study of the XEOLXELE~~K~~–Elk Lake fault in suburban Victoria, BC, Canada.

2023 **Thesis and defense reviewer**
Batul Nemer. Masters in Natural Hazards in Civil Engineering. Time-dependent models for on-fault earthquakes in a PSHA study. l'Université Libanaise, Beirut, Lebanon and Université Grenoble Alpes, France.

2022 **EGU Session Co-chair**
Deformation, seismicity, and hazards of low-strain, slowly deforming regions session at the European Geophysical Union annual meeting. *note: I filled in for co-conveners so I am not listed in the program.

2020 – 2021 **GEMMS Mentor**
Mentored undergraduate students from the UCSB Dep. of Earth Science.

2018 – 2021 **SAGE trail alliance member and volunteer**
Built and maintained hiking and mountain biking trails.

2019 **UCSB Science Night Outreach Program Volunteer**
Displayed fossils and rock specimens to elementary school students.

2017 **UCSB Graduate Student Society: Faculty Representative**
Represented graduate students at department faculty meetings.

2016 – 2017 **UVic Earth Science Graduate Student Society: President**
Organized graduate student events and represented the society at department faculty meetings and university-wide graduate student meetings.

2014 – 2016 **Society of Economic Geology McGill Student Chapter: Treasurer**
Managed finances for, and helped organize a field trip to Brazil for ~ 15 graduate students.

2014 – 2016 **McGill Graduate Student Society: Faculty Representative**
Represented graduate students at department faculty meetings.

2010 – 2011 **UVic School of Earth and Ocean Science: Undergraduate teaching assistant**
Volunteer teaching assistant for introductory earth science courses.