

# Dr Matthew S. Tarling

Department of  
Earth and Planetary Sciences  
McGill University  
3450 University Street  
Montréal, Québec  
Canada  
+15148630392  
[matthew.tarling@mcgill.ca](mailto:matthew.tarling@mcgill.ca)  
twitter: [@RocksbyDefault](https://twitter.com/RocksbyDefault)  
[Google Scholar](#)

## Education

- 2015–2019 **PhD Geology**, *University of Otago*, Dunedin, New Zealand.  
Supervisors: Dr Steven A.F. Smith and Dr James M. Scott  
Thesis: The structure, petrology, and mechanics of a plate boundary-scale serpentinite shear zone: The Livingstone Fault, New Zealand.
- 2014–2015 **B.Sc. Geology**, *McGill University*, Montreal, Canada (GPA 4/4)
- 2009–2014 **B.Sc. Physics**, *McGill University*, Montreal, Canada (GPA 3.69/4)

## Academic positions

- 2021–present **Postdoctoral Researcher**, *McGill University*, Montréal, Québec, Canada.  
Supervisors: Profs. Christie Rowe & James Kirkpatrick  
Work: Machine learning in structural geology and tectonics: Application of convolution neural networks to large structural datasets.
- 2019–2021 **Postdoctoral Fellow**, *University of Otago*, Dunedin, New Zealand.  
Supervisor: Dr Steven A.F. Smith  
Work: Experimental petrology examining the interactions between serpentinisation and carbonation reactions and microstructure.
- 2013–2015 **Undergraduate research**, *Field Rheology Rowe Research Group*, McGill University.  
Supervisor: Prof. Christie D. Rowe.  
Work: Rock analogue deformation experiments examining shear distribution in scaly fabrics.
- 2012–2014 **Undergraduate research**, *Leslie Biophysics Research Lab*, McGill University.  
Supervisor: Prof. Sabrina R. Leslie.  
Work: Design, simulation and construction of a custom microscope including laser excitation system and imaging system for fluorescence microscopy.

## Peer-reviewed publications

- [1] Tulley, C. J., Fagereng, Å., Ujiie, K., Piazzolo, S., **Tarling**, M. S., & Mori, Y. Rheology of naturally deformed antigorite serpentinite: Strain and strain-rate dependence at mantle-wedge conditions. *Geophysical Research Letters*, 49, e2022GL098945, 2022.  
<https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2022GL098945>

- [2] **Tarling, M.S.**, Smith, S.A., Negrini, M., Kuo, L.W., Wu, W.H. and Cooper, A.F., 2022. An evolutionary model and classification scheme for nephrite jade based on veining, fabric development, and the role of dissolution–precipitation. *Scientific Reports*, 12(1):1-12, 2022. <https://www.nature.com/articles/s41598-022-11560-7>
- [3] **Tarling, M.S.**, Demurtas, M., Smith, S.A., Rooney, J.S., Negrini, M., Viti, C., Petriglieri, J.R. and Gordon, K.C., 2022. Crystallographic orientation mapping of lizardite serpentinite by Raman spectroscopy. *European Journal of Mineralogy*, 34(3):285-300, 2022. <https://ejm.copernicus.org/articles/34/285/2022/>
- [4] **Tarling, M.S.**, Smith, S.A., Rooney, J.S., Viti, C. and Gordon, K.C. A common type of mineralogical banding in serpentine crack-seal veins. *Earth and Planetary Science Letters*, 564:116930, 2021. <https://www.sciencedirect.com/science/article/pii/S0012821X21001898>
- [5] Lee J, Jung H, Klemd R, **Tarling M.S.**, Konopelko D. Lattice preferred orientation of talc and implications for seismic anisotropy in subduction zones. *Earth and Planetary Science Letters*. 537:116178, 2020. <https://www.sciencedirect.com/science/article/pii/S0012821X20301217>
- [6] **Tarling, M.S.**, Smith, S.A. and Scott, J.M., Fluid overpressure from chemical reactions in serpentinite within the source region of deep episodic tremor. *Nature Geoscience*, 2019. <https://www.nature.com/articles/s41561-019-0470-z>
- [7] **Tarling, M.S.**, Smith, S.A., Scott, J.M., Rooney, J.S., Viti, C. and Gordon, K.C., 2019. The internal structure and composition of a plate-boundary-scale serpentinite shear zone: the Livingstone Fault, New Zealand. *Solid Earth*, 10(4):1025–1047, 2019. <https://www.solid-earth.net/10/1025/2019/>
- [8] Scott, J.M., Smith, S.A., **Tarling, M.S.**, le Roux, P.J., Harris, C., Hoffmann, J.E., Scherzer, S. and Tulley, C.J., Element and Sr–O isotope redistribution across a plate boundary-scale crustal serpentinite mélange shear zone, and implications for the slab-mantle interface. *Earth and Planetary Science Letters*, 522:198-209, 2019. <https://www.sciencedirect.com/science/article/pii/S0012821X19303735>
- [9] **Tarling, M.S.**, Smith, S.A., Viti, C. and Scott, J.M., Dynamic earthquake rupture preserved in a creeping serpentinite shear zone. *Nature communications*, 9(1):3552, 2018. <https://www.nature.com/articles/s41467-018-05965-0>
- [10] **Tarling, M.S.**, Rooney, J.S., Viti, C., Smith, S.A. and Gordon, K.C., Distinguishing the Raman spectrum of polygonal serpentine. *Journal of Raman Spectroscopy*, 49(12):1978-1984, 2019. <https://onlinelibrary.wiley.com/doi/full/10.1002/jrs.5475>
- [11] Rooney, J.S., **Tarling, M.S.**, Smith, S.A. and Gordon, K.C., Submicron Raman spectroscopy mapping of serpentinite fault rocks. *Journal of Raman Spectroscopy*, 49(2):279–286, 2018. <https://onlinelibrary.wiley.com/doi/full/10.1002/jrs.5277>
- [12] Viti, C., Collettini, C., Tesei, T., **Tarling, M.S.** and Smith, S.A., Deformation processes, textural evolution and weakening in retrograde serpentinites. *Minerals*, 8(6):241, 2018. <https://www.mdpi.com/2075-163X/8/6/241>
- [13] Negrini, M., Smith, S.A., Scott, J.M. and **Tarling, M.S.**, Microstructural and rheological evolution of calcite mylonites during shear zone thinning: Constraints from the Mount Irene shear zone, Fiordland, New Zealand. *Journal of Structural Geology*, 106:86–102, 2018. <https://www.sciencedirect.com/science/article/pii/S0191814117302705>

- [14] 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. and Harrichhausen, N., Peña Castro, A.F., Nisbet, H., Rakoczy, P., Scibek, J., Smith, H., **Tarling, M.S.**, Timofeev, A., Young, E., Geometric complexity of earthquake rupture surfaces preserved in pseudotachylyte networks. *Journal of Geophysical Research: Solid Earth*, 123(9):7998-8015, 2018  
<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018JB016192>
- [15] Regalla, C.A., Rowe, C.D., Harrichhausen, N., **Tarling, M.S.** and Singh, J., Styles of underplating in the Marin Headlands terrane, Franciscan complex, California. *Geology and Tectonics of Subduction Zones: A Tribute to Gaku Kimura*, 534:155, 2018.
- [16] Jacob, J.B., Scott, J.M., Turnbull, R.E., **Tarling, M.S.** and Sagar, M.W., High-to ultrahigh-temperature metamorphism in the lower crust: An example resulting from Hikurangi Plateau collision and slab rollback in New Zealand. *Journal of Metamorphic Geology*, 35(8):831-853, 2017.  
<https://onlinelibrary.wiley.com/doi/full/10.1111/jmg.12257>
- [17] **Tarling, M.S.** and Rowe, C.D., Experimental slip distribution in lentils as an analog for scaly clay fabrics. *Geology*, 44(3):183-186, 2016.  
<https://pubs.geoscienceworld.org/gsa/geology/article/44/3/183/132001/>
- [18] Arsenault, A., Leith, J.S., Henkin, G., McFaul, C.M., **Tarling, M.S.**, Talbot, R., Berard, D., Michaud, F., Scott, S. and Leslie, S.R. Open-frame system for single-molecule microscopy. *Review of Scientific Instruments*, 86(3):033701, 2015.  
<https://pubs.geoscienceworld.org/gsa/geology/article/44/3/183/132001/>

## Invited talks

- [1] Solicited keynote speaker for the 2022 Gordon Research Conference on Rock Deformation: Combining Laboratory Measurements with Observational Constraints to Understand Tectonic Processes. Bates College, Lewiston, Maine. 7-11 August 2022.
- [2] Solicited speaker for the 2022 Northern California Earthquake Hazards Workshop (NCEHW): Colouring Outside the Earthquake: Creepy Crawly Faults. United States Geological Survey. 25-27 January 2022.
- [3] **Tarling, M.S.**, Smith, S.A., Rooney, J.S., Viti, C. and Gordon, K.C. Serpentine crack-seal veins: a unique record of fluid conditions during faulting. Session GMPV6.1: "Fluid-rock interaction: Kickstarter of metamorphic, deformation and geo-engineering processes". *EGU General Assembly*, April 2021. *Solicited Speaker*.
- [4] Solicited speaker for Lakehead University Geology Department Research Seminar, Lakehead University, Thunder Bay, Ontario. February 2021.
- [5] Solicited speaker for IGPP (Institute for Geophysics and Planetary Physics) Seminar, University of California, Santa Cruz, June 2020.
- [6] Solicited speaker for BiSEPPS (Biweekly Seminar in Earth, Planetary, and Physical Sciences) Seminar, Harvard University, MA. April 2020.
- [7] Solicited speaker for Japan Geoscience Union Meeting. Session S-CG50: "Intraslab and Intraplate earthquakes". Declined invitation due to time commitments, May 2019.
- [8] **Tarling, M.S.**, Smith, S.A.F., and Viti, C. Dynamic earthquake rupture preserved in a creeping serpentinite shear zone. Session SM2.5: "The Mechanics of Faulting from shallow

to deep earthquakes: Interplay between multiple length scales". *EGU General Assembly*, April 2019. *Solicited Speaker*.

- [9] **Tarling, M.S.**, Smith, S.A.F., Viti, C., Rooney, J.S., and Gordon, K.C. Coseismic dehydration and amorphisation of serpentinite in a creeping shear zone. Session MR23A: "Physical Properties of Earth Materials (PPEM): The rheology and processes of transient and steady state rock deformation". *AGU Fall Meeting*, December 2017. *Solicited Speaker*.

---

## Teaching experience

- 2022 **Course instructor** for EPSC 303 Structural Geology – Fall 2022 semester  
Department of Earth and Planetary Sciences, McGill University  
  
Task: Third year structural geology course. Designed lectures with regular hands-on exercises, student-lead laboratory experiments and field trips to promote experiential learning
- 2022 **Co-instructor/Demonstrator** for EPSC 231 Field School 1 – Spring 2022 semester  
Department of Earth and Planetary Sciences, McGill University  
Lead Instructor: Prof Christie Rowe  
Task: Introductory field geology mapping course. Prepared and led field skills refresher days to prepare students prior to field camp. Assisted with teaching students observational field geology, geological field mapping and field interpretations during the field camp.
- 2020 **Co-instructor** for GEOL 251 Introduction to Field Geology  
Department of Geology, University of Otago  
Lead Instructor: Senior lecturer Dr Steven A.F. Smith  
Task: Introductory field geology mapping course. Training students in field observation, geological field mapping, field interpretation, and the basic geometry of geological structures in the field.
- 2018 **Demonstrator** for GEOL344 Advanced Field Studies  
Department of Geology, University of Otago  
Lead Instructors: Senior lecturers Dr Steven A.F. Smith and Dr James M. Scott  
Task: Advanced field geology mapping course. Training students in advanced geological field mapping, structural mapping, and stereographic projection.
- 2016-2018 **Demonstrator** for GEOL 251 Introduction to Field Geology  
Department of Geology, University of Otago  
Lead Instructor: Senior lecturer Dr Steven A.F. Smith  
Task: Introductory field geology mapping course. Training students in field observation, geological field mapping, field interpretation, and the basic geometry of geological structures in the field.

---

## Academic awards, distinctions, and grants

- 2021** Wares Science Innovation Prospectors Fund, *McGill University*. (\$50k CAD, Co-PI with Prof. James Kirkpatrick)
- 2019** Sciences Divisional List of Exceptional Doctoral Theses, *University of Otago*.
- 2016** Outstanding Student Paper Award, Tectonophysics section, *AGU Fall Meeting 2016*.
- 2015** University of Otago Doctoral Scholarship, *University of Otago* (\$35k NZD p.a. for 3 yrs.)
- 2014** Osisko Scholarship in Earth and Planetary Sciences, *McGill University*. (\$6k CAD)
- 2014** Dean's Multidisciplinary Undergraduate Research List, *McGill University*.

---

## Technical skills

### **Numerical modelling**

Numerical and analytical modelling of complex geological systems, including heat flow and heat transfer, mineral and fluid phase transformations, advective and diffusive fluid flow and rock deformation using Matlab and COMSOL Multiphysics.

### **Electron microscopy techniques**

Proficient in scanning electron microscopy techniques, including high resolution sample imaging, energy dispersive X-ray spectrometry (EDS), electron backscatter diffraction (EBSD) and Transmission Kikuchi Diffraction (TKD).

### **Computer programming**

Proficient in Matlab, developing proficiency in Python.

### **General computer software**

Proficiency in LaTeX, Word, Excel, Power Point, Adobe Illustrator and Photoshop.

### **CAD design**

Proficient in CAD Drawing using Autodesk Fusion 360 and CAD design for 3D printing.

### **Basic circuit design**

Proficient in basic circuit design and general electronics, including motor control, data capture using microcontrollers, high-temperature induction heating and resistive heating control.

### **Basic machining**

Base-level proficiency in machining including turning, milling, and drilling.

### **Petrographic preparation**

Fabrication of mineral mounts and polished petrographic thin sections. Stabilising and preparing fragile rock and mineral samples. Preparation of electron-transparent samples for transmission-type electron microscopy.

---

## Professional activities

2018-present

**Reviewer for:** Nature Geoscience, Geophysical Research Letters, Earth and Planetary Science Letters, Journal of Geophysical Research: Solid Earth, Contributions to Mineralogy and Petrology, European Journal of Mineralogy, Lithos, Scientific Reports, National Science Foundation, Minerals.

---

## Language skills

French	Native speaker
English	Native speaker