RELLIE M. GODDARD

Postdoctoral Research Fellow

Also known as: Catherine R.M. Goddard
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Academic positions

2023– **Postdoctoral Research Fellow, Lakehead University**
- Project: Gold distribution in deformed quartzites
- Supervisor: Dr Noah Phillips

2023–2023 **Postdoctoral Research Fellow, University of British Columbia, Okanagan**
- Project: Metal distributions in deformed sulphides and oxides
- Supervisor: Dr Brendan Dyck

2021–2023 **Postdoctoral Investigator, Woods Hole Oceanographic Institution**
- Project: Transformation plasticity as a transient creep mechanism in Earth's crust and mantle
- Supervisor: Dr Andrew Cross

Education

2021 **Oxford University, Department of Earth Sciences, NERC Doctoral Training Programme**
- Thesis: *Subgrain-size piezometry as a tool for measuring stress in polymineralic rocks*
- Supervisors: Professor Lars Hansen, Dr. David Wallis & Dr. Kathryn Kumamoto

2016 **Durham University Department of Earth Sciences, Masters by Research**
- Thesis: *Earthquakes, elevations and continental plateaux: An investigation into the absence of large thrust earthquakes at high elevations within fold-and-thrust belts*
- Supervisors: Professor Mark Allen, Professor Stefan Nielsen & Dr Nicola De Paola

2015 **Durham University Department of Earth Sciences, 1st Class (80%) BSc Geology Hons**
- Thesis: *The geology of the western Alps*

Peer-reviewed journal articles

Goddard, R. M., Kumamoto., K. M., Hansen, L. N., Wallis, D., Cross., A. J., and Thom, C. A. (*in revision*). Subgrain-size piezometry as a tool for measuring stress in polymineralic rocks. *Journal of Geophysical Research: Solid Earth* https://doi.org/10.22541/essoar.169755254.46171679/v1

Goddard, R. M., Hansen, L. N., Wallis, D., Stipp, M., Holyoke III, C., Kumamoto., K. M., and Kohlstedt, D. (2020). A subgrain-size piezometer calibrated for EBSD. *Geophysical Research Letters*. https://doi.org/10.1002/essoar.10503878.1

Dyck, B., **Goddard, R. M.,** Wallis, D., Hansen, L. N., and Martel, E. (2020). Metamorphic evolution of the Great Slave Lake shear zone. *Journal of Metamorphic Geology*, https://doi.org/10.1111/jmg.12576

Bidgood, A., Parsons, A., Lloyd, G., Waters, D., and **Goddard, R. M.** (2020). EBSD analysis of palisade quartz textures: A new criterion for identifying UHP metamorphism in continental terranes. *Journal of Metamorphic Geology*, https://doi.org/10.1111/jmg.12566

Wallis, D., Hansen, L. N., Kumamoto., K. M., Thom, C., Plümper, O., Ohl, M., Durham, W. B., Goldsby, D. L., Armstrong, D. E. J., Meyers, C. D., **Goddard, R. M.,** Warren, J. M., Breithaupt, T., Drury, M. R., and Wilkinson, A. J. (2020) Dislocation interactions during low-temperature plasticity of olivine strengthen the lithospheric mantle. *Earth and Planetary Science Letter*, https://doi.org/10.1016/j.epsl.2020.116349

Manuscripts available on request

Goddard, R.M., Cross, A.J., Lloyd, G., Kumamoto, K.M., Breithaupt, T., Dyck, B., Chen, H., Parsons, A., and Bidgood, A.K. (*in prep.*). Microstructural signatures of the coesite-quartz transformations: New insights from high-pressure experiments and EBSD.

Goddard, R. M., Wallis, D., Dyck, B., Hansen, L. N., Kumamoto, K. M., Ohl, M., Osinchuk, A., Cross, A. J., and Martel, E. (*in prep.)* The stress-depth profile of a major continental strike-slip shear zone.

Cross, A. J., **Goddard, R. M.,** Kumamoto, K. M., Goldsby, D. L., Hansen, L. N., Chen, H., Thom, C. A., Hein, D., and Nehring, A. (*in prep.*) Synchrotron radiation reveals transient weakening during mineral phase transformations.

Analytical Expertise & Techniques

Electron backscatter diffraction (EBSD)
X-ray diffraction (XRD)
Micro computed tomography (micro-CT)
High-pressure experimental mineral physics
Electron microprobe analysis (EPMA)

Funding awards

The EXCITE Network (~£3000) - PI Transnational Access framework (2023, 2024)
National Science Foundation ($641,214 USD) – Co-PI NSF OCE-2224725 (2022)
The Keith Prout Crystallography Fund – PI Dpt Mineral Sciences, University of Oxford (2018)
Mike Coward Fund – PI The Geological Society of London (2018)
Old Members' Trust – PI University College, University of Oxford (2017, 2018)
Burdett-Couttes Fund – PI Dpt Earth Sciences, University of Oxford (2017, 2020)

Teaching Experience

2024 **Instructor,** *Canadian Tectonics Group short course on EBSD applied to structural geology and petrology*
2022 **Summer internship advisor**
Namitha Kumar: *Determining the strength of the oceanic lower crust: A geochemical and microstructural investigation of the Southwestern Indian Ridge*
2019–2020 **Masters advisor**
Joanna Male: *Changes in Gneiss through a transect of the Western Gneiss Region Norway*
2016–2020 **Demonstrator**, *Oxford University, Department of Earth Science*
2015–2016 **Demonstrator**, *Durham University, Department of Earth Science*

Professional service

Co-convener: Geological Association of Canada and the Mineralogical Association of Canada joint meeting
- Session title submitted: *It's our fault! Geological and geophysical insights into fault and shear zone processes*. (2024)

Session Chair: Gordon Research Seminar: Rock Deformation
- Session: *Characterizing deformation at the microscale (2022)*

Co-convener: American Geophysical Union
- Session T15E: *Zooming In to See the Big Picture: Using Nano- to Microscale Observations to Better Understand Tectonic Processes*. (2021)

Article reviewer: Journal of Structural Geology, Progress in Earth and Planetary Science.

Invited seminars

2024 *Canadian Tectonics Group:* Subgrain-size piezometry: a tool for measuring the strength of polymineralic rocks
2023 *Lakehead University:* Subgrain-size piezometry: a tool for measuring the strength of polymineralic rocks
2023 *University of Leeds, Geophysics and Tectonics seminar series within the School of Earth and Environment*: Microstructural Signatures of the Coesite-Quartz transformation: Insights from High-pressure Experiments and EBSD Analysis
2023 *University of Oslo, Njord seminar*: Subgrain-size piezometry as a tool for measuring stress in polymineralic rocks: new insights and applications
2023 *Northwestern University, Woman in Microscopy workshop on International Woman's Day*: There and back again: using microscopy to unlock the secrets of Earth's interior
2020 *University of Minnesota*: Measuring stress in ductile polyphase rocks
2020 *Utrecht University:* The rheology of polyphase rocks
2018 *University of British Columbia*: Comparing in-situ and ex-situ stress measurements in polymineralic rocks

Oral conference presentations

Invited. **Goddard R.M.,** Cross, A.J., Lloyd, G.E., Breithaupt, T., and Wallis, D. (2024) There and back again: Crystallographic signatures and rheological impacts of SiO_2 phase transformations. *EBSD Users meeting*

Invited. **Goddard, R.M.,** Cross, A.J., Wallis, D., Goldsby D.L., Le Roux, V., Kumamoto, K.M., Hansen, L.N., and Hein, D. (2022) Transient weakening and microstructures across the quartz-coesite phase transition. *American Geophysical Union Fall Meeting*

Invited. **Goddard, R.M.,** Cross, A.J., Kumamoto., K.M., Bidgood, A.K., Parsons, A.J., Lloyd, G.E., Waters, D.J. (2022) Microstructural Signatures of Quartz-after-Coesite: New Insights from High-Pressure Experiments. *Gordon Research Conference*

Goddard, R.M., Cross, A.J., Kumamoto, K.M., Bidgood, A.K., Parsons, A.J., Lloyd, G.E., and Waters, D.J. (2022) Microstructural Signatures of the Coesite-Quartz Transformation: New Insights from High-Pressure Experiments and EBSD Analyses. *Microanalysis Society EBSD conference*

Goddard, R.M., Wallis, D., Hansen, L.N., Kumamoto., K. M., Dyck, B., Ohl, M., Cross, A.J., and Martel, E. (2022) Tools for unpicking complex stress histories in continental and oceanic shear zones. *Tectonics Studies Group AGM*.

Bidgood, A.K., Parsons, A.J., Lloyd, G.E., Waters, D.J., **Goddard, R.M.** (2019) EBSD analysis of palisade quartz textures: implications for coesite-quartz transformation, Tso Morari dome, Himalaya. *International Eclogite Conference*

Bidgood, A.K., Parsons, A.J., Lloyd, G.E., Waters, D.J., **Goddard, R.M.** (2019) EBSD analysis of palisade quartz textures: implications for coesite-quartz transformation, Tso Morari dome, Himalaya. *Metamorphic Studies Group Conference*

Goddard, R.M., Hansen, L.N., Wallis, D., Stipp, M., Holyoke III, C., Kohlstedt, D, Goldsby, D., Durham, W., Kumamoto., K. and Thom, C. (2018) Comparing in-situ and ex-situ stress measurements in polymineralic rocks. *American Geophysical Union Fall Meeting*

Hansen, L.N., Unwin, H., **Goddard, R.M.** and Wallis, D. (2018) Microstructural evolution investigated with equal channel angular pressing. *American Geophysical Union Fall Meeting*

Goddard, R.M., Hansen, L.N., Wallis, D., Stipp, M., Holyoke III, C., Kohlstedt, D, Goldsby, D., Durham, W., Kumamoto., K. and Thom, C. (2018) Investigating stress partitioning in polymineralic rocks constrained by subgrain-size piezometry and D-DIA experiments. *Gordon Research Seminar*

Goddard, R.M., Hansen, L.N., Wallis, D., Stipp, M., Holyoke III, C. and Kohlstedt., D. (2018) Piezometers for characterising stress distribution in polymineralic rocks. *Durham University, Structural Group*

Goddard, R.M., Hansen, L.N., Wallis, D., Stipp, M., Holyoke III, C. and Kohlstedt., D. (2018) Piezometers for characterising stress distribution in polymineralic rocks. *Tectonic Studies Group AGM*

Poster conference presentations

Kumar, N., Cross., A.J., Le Roux, V., **Goddard, R.M.** (2022) Determining the strength of oceanic lower crust: an geochemical, microstructural, and rheological investigation of ODP hole 735B, Southwest Indian Ridge. *American Geophysical Union Fall Meeting*

Hein, D., Hansen, L.N., Cross, A.J., **Goddard, R.M.,** Kumamoto, K.M., Thom, C., Chen, H., Nehring, A., Seyler, C., and Goldsby, D.L. (2022) Viscoelasticity and Transient creep of the Upper Mantle in Response to Large Stress Changes. *American Geophysical Union Fall Meeting*

Cross, A.J., **Goddard, R.M.**, Kumamoto, K.M., Chen, H., Goldsby, D.L., Hansen, L.N., Thom, C.A., Hein, D. (2022) There and back again: Transient Weakening Across the Quartz-Coesite Phase Transition Revealed in Synchrotron D-DIA Experiments. *Gordon Research Conference*

Hein, D., Hansen, L.N., Kumamoto, K.M., Thom, C., **Goddard, R.M.,** Cross, A.J., Chen, H., and Goldsby, D.L. (2022) Microstructural evolution in olivine aggregates undergoing high-stress forced oscillation. *Gordon Research Conference*

Cross A., Kumamoto, K.M., **Goddard, R.M.,** Chen, H., Thom, C., Goldsby, D.L., and Hansen, N. (2021) There and Back Again: Transformation Plasticity across the Quartz-Coesite and Fayalite-Ringwoodite Phase Transitions Revealed in Beamline D-DIA Experiments. *American Geophysical Union Fall Meeting*

Phillips, C., Seyler E., Lusk, A. D., and **Goddard, R.M.** (2021) How Stressed Out is it Really? Mapping Stress Heterogeneity at the Thin Section Scale. *American Geophysical Union Fall Meeting*

Bidgood, A.K., Parsons, A.J., Lloyd, G.E., Waters, D.J., and **Goddard, R.M.** (2021) EBSD-based criteria for the identification of the former presence of coesite: application to a metagranite from the Tso Morari dome, Himalaya. *Tectonic Studies Group Annual Meeting*

Male, J.E., Parsons, A., **Goddard, R.M.,** Gopon, P. and Waters, D.J. (2020) Spatial variations of deformation in the Wester Gneiss Region: implications on UHP exhumation. *Metamorphic Studies Group virtual research in progress meeting*

Goddard, R.M., Hansen, L.N., Wallis, D., Dyck, B. and Kumamoto., K.M. (2020) The Great Slave Lake shear zone: A test of models of stress distributions in continental shear zones. *The Royal Society meeting: Understanding earthquakes using the geological record*

Goddard, R.M., Hansen, L.N., Wallis, D., Dyck, B. and Kumamoto., K.M. (2019) Using subgrain-size piezometry to measure stress in polymineralic mylonites of the Great Slake Lake shear zone. *American Geophysical Union Fall Meeting*

Kumamoto, K.M., **Goddard, R.M.,** Hansen, L.N., Wallis, D., Thom, C., Cross, A.J., Goldsby, D.L., Dillman, A. and Kohlstedt, D.L. (2019) Low-temperature plasticity of the upper mantle: Olivine, orthopyroxene, and harzburgite. *American Geophysical Union Fall Meeting*

DePaola, N., Nielsen. S., Monnickendam, M., Dawood, F., **Goddard, R.M.,** Tesei, T. and Allen, M.B. (2019) What is the contribution (if any) of off-fault damage to the earthquake energy budget? *American Geophysical Union Fall Meeting*

Wallis, D., Hansen, L.N., Kumamoto, K.M., Thom, C., Plümper, O., Goldsby, D.L., Durham, W.B., Armstrong, D.E.J., **Goddard, R.M.,** Breithaupt, T., Warren, J.M., Kohlstedt, D.L. and Wilkinson, A.J. (2018) Dislocation interactions control the strength of olivine deforming by low-temperature plasticity. *Gordon Research Conference*

Goddard, R.M., Hansen, L.N., Wallis, D., Stipp, M., Holyoke III, C., Kohlstedt, D, Goldsby, D., Durham, W., Kumamoto., K. and Thom, C. (2018) Stress partitioning in polymineralic rocks constrained by subgrain-size piezometry and D-DIA experiments. *Gordon Research Conference*

Goddard, R.M., Hansen, L.N., and Wallis, D. (2017) Piezometers for stress distribution in polymineralic rocks. *European Geosciences Union Summer School*

Goddard, R.M., Allen, M.B., DePaola, N., Nielsen. and Saville, C. (2016) Earthquakes, Elevations and the Construction of Continental Plateaux. *European Geosciences Union General Assembly*

Goddard, R.M., Allen, M.B., DePaola, N., Nielsen. and Saville, C. (2016) Earthquakes, Elevations and the Construction of Continental Plateaux. *Tectonics Study Group AGM*

Awards

Microanalysis Society EBSD conference	Best Talk by an Early-Career Researcher (2022)
John W. Most Fieldwork Prize	Dept Earth Sciences, University of Durham (2015)
Highest grade in the faculty of Science	University College, University of Durham (2014 & 2015)

Outreach

Alumnae Speaker	EDI Application Workshop, Oxford (March 2023)
Editor of the outreach blog: Evidently Scientifical	(2020–2023)
Physical Sciences Year 12 Study Day	University College, Oxford University (March 2018)
Demonstrating on UNIQ Summer School	Dpt Earth Sciences, Oxford University (2017–2018)
Oxfordshire Science Festival	NERC Environmental Research DTP (2017)
A-Level Maths Tuition	University College, University of Durham (2014–2015)