

Dr. Michael C. JOLLANDS

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CURRENT POSITION

Postdoctoral researcher at the Lamont-Doherty Earth Observatory, funded by a Swiss National Science Foundation Postdoctoral Mobility fellowship.

EDUCATION

Doctor of Philosophy: Australian National University (ANU), Australia 2012-2016
Thesis title: **Experimental studies of diffusion in olivine** (supervisor: Prof. Hugh O'Neill & Prof. Joerg Hermann)

Master of Geology & Bachelor of Science: University of Leeds, UK 2007-2011
Graduated First Class with honours.

ACADEMIC EMPLOYMENT

Premier Assistant/Senior researcher (aka postdoc) . University of Lausanne. 2015-2019
Supervisor: Prof. Othmar Müntener
Research: Diffusion chronometry to unravel temperature-time histories of rocks
Teaching: Lecturer, teaching assistant, co-supervisory responsibilities.

Lab manager. Australian National University. 2015
Laser Ablation Inductively Coupled Plasma Mass Spectrometry laboratory, Research School of Earth Sciences.

OTHER RELEVANT EMPLOYMENT

Consultant Geologist. Micromine Pty Ltd. 2011
Supervising drill rigs, geological mapping, core logging, report writing. Working on a large magnetite deposit in eastern Mongolia.

Intern: Exploration Geology. Asia-Pacific Investment Partners. 2011
Part of a team of geologists mapping a newly acquired license area in the Gobi desert, Southern Mongolia, with potential for Au, Cu mineralization.

AWARDS AND HONOURS

European Geoscience Union: 2021 Geochemistry, Mineralogy, Petrology and Volcanology Division Outstanding Early Career Scientist Award

Australian National University: Ringwood Memorial Scholarship (top ranked international student among 2012 PhD admissions); **International Postgraduate Research Scholarship** (tuition fees, stipend and other expenses paid by Australian government); **D.A. Brown Award** (Commitment to teaching in the Earth Sciences); **Mervyn Paterson Travel Award** (for travel to Ruhr Universitaet Bochum and University of Vienna); **Sue Kesson Travel Award** (for travel to Ruhr Universitaet Bochum)

University of Leeds: Alumni Scholarship (financial assistance for students from low-income backgrounds); **BP scholarship** (for top ranked students in the Earth Sciences)

GRANTS AND FELLOWSHIPS

2017: *SNF International Exchanges*, IZSEZO_177025, **CHF 14,100** for research stay at the Rensselaer Polytechnic Institute, New York, USA, project 'Aluminium diffusion in orthopyroxene'.

2018: *CUSO Short Course*: **CHF 6,900** to run a short course for Swiss PhD students: 'Diffusion in the geological sciences: theory and applications'.

2018: *SNF Postdoc Mobility*, P400P2_183872 / 1. **CHF 112,200** for 2 year research stay at Lamont Doherty Earth Observatory, New York, USA, project 'The effect of water on major and trace element diffusivity in olivine: an integrated experimental and petrological study'.

TALKS

Invited talks at conferences

Keynote: Jollands, M.C. (2015): Look before you leap: major and trace element diffusion in olivine. (Österreichische Mineralogische Gesellschaft Conference, Leoben, Austria)

Keynote: Jollands, M.C. (2016): Linking experimental and natural studies of diffusion: current understanding and future challenges (European Mineralogical Congress, Rimini, Italy)

Invited: Jollands, M.C., Kempf, E., Hermann, J. (2018) Fast diffusive loss of H from Si vacancies in olivine. (AGU Fall Meeting, Washington, D.C.).

CONFERENCE ORGANIZATION

Goldschmidt Conference 2018 (Boston): Session co-convenor (Session 06h Diffusion, Growth, and Reaction in High Temperature Environments: Small Scale Processes with Large Scale Implications).

European Geological Union Conference 2019 (Vienna): Session primary-convenor (proposed: Determinations, applications and complications of diffusion in minerals and melts)

Goldschmidt Conference 2021 (virtual): Session primary-convenor (Water in nominally anhydrous minerals: detection, distribution and consequences).

TEACHING EXPERIENCE

Course leader/lecturer

Physics and Structure of Minerals (2018), Masters level course at the Ecole Lemannique des sciences de la terre (ELSTE), a University of Lausanne-Geneva cooperative. 11 students, 5x3 hours + 2 hour assessment.

Diffusion in the geological sciences: theory and applications (2019). Designed, taught and organized intensive short course for PhD students from Universities of Lausanne, Geneva, Fribourg and Neuchatel.

Guest lecturer

University of Lausanne: Physics and structure of minerals 2017, 2016 (single lecture re. diffusion)

ANU: Advanced geochemistry (single lecture re. diffusion in minerals)

Columbia University: Chemical Geology (two lectures re. diffusion and chronometry)

Demonstrator/assistant

University of Lausanne:/Ecole Polytechnique Federal de Lausanne: Géologie (in French); Field camp assistant – Lanzo massif (3rd year Petrology)

ANU: Field camp assistant – Introduction to mapping (2nd year); Sedimentary geology (2nd year); Blue Planet (Introduction to geology, 1st year), Labs: Metamorphic petrology (3rd year), Sedimentary Geology (2nd year)

SERVICE

Occasional reviewer for the following international journals: *Geology*, *American Mineralogist*, *Geochimica et cosmochimica acta*, *Contributions to Mineralogy and Petrology*, *Lithos*, *G-cubed*, *Earth and Planetary Science*

Letters, Journal of Geophysical Research: Solid Earth, Journal of Materials Chemistry C, European Journal of Mineralogy, Chemical Geology.

Reviewer for the USA's National Science Foundation.

Former Blog editor: *European Geosciences Union, Geochemistry, Mineralogy, Petrology and Volcanology section.*

PEER-REVIEWED PUBLICATIONS

Morgan, DJ; Jollands, M.C.; Lloyd, GE; Banks, DA (2014) Using titanium-in-quartz geothermometry and geospeedometry to recover temperatures in the aureole of the Ballachulish Igneous Complex, NW Scotland. Geological Society, London, Special Publications. 394: 145-165.

Jollands, M.C.; O'Neill, H.S.C.; Hermann, J (2014) The importance of defining chemical potentials, substitution mechanisms and solubility in trace element diffusion studies: the case of Zr and Hf in olivine. Contributions to mineralogy and petrology. 168: 1055

Jollands, M.C.; Padrón-Navarta, José Alberto; Hermann, J; O'Neill, Hugh St C (2016) Hydrogen diffusion in Ti-doped forsterite and the preservation of metastable point defects. American mineralogist 101: 1571-1583

Jollands, M.C.; Burnham, A.D.; O'Neill, H.S.C.; Hermann, J; Qian, Q (2016) Beryllium diffusion in olivine: A new tool to investigate timescales of magmatic processes. Earth and planetary science letters 450: 71-82

Jollands, M.C.; Hermann, J.; O'Neill, H.S.C.; Spandler, C; Padrón-Navarta, J.A. (2016) Diffusion of Ti and some divalent cations in olivine as a function of temperature, oxygen fugacity, chemical potentials and crystal orientation. Journal of petrology. 57: 1983-2010

Jollands, M.C.; O'Neill, H.S.C.; Van Orman, J; Berry, AJ; Hermann, J; Newville, M; Lanzirotti, A; (2018) Substitution and diffusion of Cr²⁺ and Cr³⁺ in synthetic forsterite and natural olivine at 1200–1500° C and 1 bar. Geochimica et cosmochimica acta 220: 407-428

Jollands, M.C.; Hanger, B.J; Yaxley, G.M; Hermann, J; Kilburn, M.R (2018) Timescales between mantle metasomatism and kimberlite ascent indicated by diffusion profiles in garnet crystals from peridotite xenoliths. Earth and planetary science letters 481: 143-153

Reynes, J; Jollands, M.C.; Hermann, J; Ireland, T (2018) Experimental constraints on hydrogen diffusion in garnet. Contributions to Mineralogy and Petrology 173: 69

Le Losq, C., Jollands, M. C., Tollan, P. M., Hawkins, R., O'Neill, H. S. C. (2019). Point defect populations of forsterite revealed by two-stage metastable hydroxylation experiments. Contributions to Mineralogy and Petrology, 174, 53.

Bloch, E., Jollands, M.C., Gerstl, S.A., Bouvier, A-S, Plane, F, Baumgartner, L.P., (2019) Ultra-High Resolution of Experimental Diffusion Profiles in Minerals using Local Electrode Atom Probe Tomography. Geochimica Cosmochimica Acta 265, 85-95

Jollands, M.C., Muntener, O (2019) Testing Orthopyroxene Diffusion Chronometry on Rocks From the Lanzo Massif (Italian Alps). JGR Solid Earth 124, 7822-7841.

Jollands, M.C., Kempf, E., Hermann, J., Muntener, O. (2019). Coupled inter-site reaction and diffusion: rapid dehydrogenation of silicon vacancies in natural olivine. Geochimica Cosmochimica Acta 262, 220-242.

Jollands, M.C., Zhukova, I, O'Neill, H. S. C., Hermann, J . (2020) Mg diffusion in forsterite from 1250-1600 °C. American Mineralogist. 105, 525-537.

Jollands, M.C., Bloch, E., Muntener, O. (2020) New Ti-in-quartz diffusivities reconcile natural Ti zoning with timescales and temperatures of upper crustal magma reservoirs. Geology 48, 654-657.

& Jollands, M.C., Bloch, E., Muntener, O. (2020): Reply to comment on the above, Geology.

Jollands, M.C., Blanchard, M., Balan, E. (2020) Structure and theoretical infrared spectra of OH-defects in quartz. European Journal of Mineralogy 32, 311-323.

Bloch, E., Jollands, M. C., Devoir, A., Bouvier, A-S, Ibanez-Mejia, M., Baumgartner, L.P. (2020) Multispecies diffusion of yttrium, rare earth elements and hafnium in garnet. Journal of Petrology 61, ega055.

Jollands, M.C., Ellis, B., Tollan, P.M.E., Müntener, O. (2020) An eruption chronometer based on experimentally determined H-Li and H-Na diffusion in quartz applied to the Bishop Tuff. *Earth and Planetary Science Letters* 551, 116560.

Jollands, M.C. (2020) Assessing analytical convolution effects in diffusion studies: applications to experimental and natural diffusion profiles. *PLoSone* 15, e0241788.

Muir, J., **Jollands, M.C.**, Zhang, F., Walker, A.M. (2020) Explaining the dependence of M-site diffusion in forsterite on silica activity: a Density Functional Theory approach. *Physics and Chemistry of Minerals* 47, 1-16.

Jollands, M.C., O'Neill, H.St.C, Berry, A.J., Le Losq, C., Rivard, C., Hermann, J. (2021) A combined FTIR and Cr K-edge XANES study of the substitution and diffusion of H in Cr-doped forsterite. *European Journal of Mineralogy* 33, 113-138.

Demers-Roberge, A., **Jollands, M.C.**, Tollan, P.M.E, Müntener, O. (accepted 2021) H diffusion in orthopyroxene and the retention of mantle water signatures. *Geochimica Cosmochimica Acta*

Scicchitano, M. R., **Jollands, M.C.**, Williams, I. S., Hermann, J., Rubatto, D., Kita, N.T., Nachlas, W.O., Valley, J., Escrig, S., Meibom, A. (accepted 2021) Oxygen diffusion in garnet: experimental calibration and implications for timescales of metamorphic processes and retention of primary O isotopic signatures. *American Mineralogist*

In review/revision

Bloch E.M, **Jollands, M.C.**, Tollan, P., Plane, F., Bouvier, A-S., Hervig, R., Berry, A., Newville, M, Zaubitzer, C., Escrig, S., Müntener, O., Ibañez-Mejia, M., Alleon, J., Meibom, A., Baumgartner, L.P., Marin-Carbonne, J. (in review, *EPSL*) Diffusion anisotropy of Ti in zircon and implications for Ti-in-zircon thermometry.

Jollands, M.C., Muir, J., Padrón-Navarta, J.A., Demouchy, S. (in revision, *CMP*) Hydrogen mobility in forsterite re-evaluated in the framework of diffusion coupled to inter-site reaction

Jollands, M.C., Bloch, E.M., Van Orman, J., Hermann, J., O'Neill, H.S.C. (in review, *PEPI*) Scandium diffusion in forsterite: concentration dependence, inter-site reactions and the effect of trivalent cations on Fe diffusion

Jollands, M.C., Tollan, P., Baumgartner, L., Müntener, O. (in review, *MinMag*) Hydrogen diffusion mechanisms in quartz: insights from H-Li, ²H-H and ²H-H-Li exchange experiments