

## Dr Vincent J. Hare

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PALAEOCLIMATOLOGY – CARBON CYCLE – STABLE ISOTOPES – DATING METHODS

### EDUCATION

- 2009 **BSc**, Physics, University of Cape Town, South Africa  
*Distinction. Minors in Environmental Science and Mathematics.*  
*First Class Hons.  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  analysis of fossil biominerals, Stable Light Isotope Laboratory.*
- 2012 **MSc**, Archaeological Science, University of Oxford  
*Distinction.*
- 2016 **DPhil**, Archaeological Science, University of Oxford  
*Thesis title: “Rehydroxylation Dating”; Advisor: Christopher Bronk Ramsey*

### EMPLOYMENT

- 2019- *Lecturer*, University of Cape Town, South Africa.
- 2018 *Postdoctoral Fellow*, Stable Light Isotope Laboratory,  
University of Cape Town, South Africa.
- 2016-2017 *Postdoctoral Associate*, Department of Earth and Environmental Sciences,  
University of Rochester, NY, USA

### HONOURS/AWARDS

- 2012-2015 Clarendon Scholar, DPhil, University of Oxford
- 2011-2012 Clarendon Scholar, MSc, University of Oxford
- 2010 National Research Foundation Honours Scholarship, South Africa
- 2007-2010 Undergraduate Class Medalist, Environmental Science, Archaeology
- 2008-2009 Dean’s Merit List, University of Cape Town

### GRANTS

(\*\* indicates principle investigator status (PI), \* indicates co-PI status, and † indicates substantial named involvement)

- \* *John Fell Oxford University Press Research Fund*, co-applicant with Prof. Ramsey (PI) and the Dept. of Atmospheric Physics to construct an apparatus for the development of a new archaeological dating method - £49,990 (2013).
- \*\* *Diamond Light Source, Beamtime Award for Project SM14598-1*, probing rehydroxylation kinetics of fired clay minerals using synchrotron micro-IR imaging (2015).
- † *NSF Grant 1826666*, Exploring the history of coupled climatic and human influences on ecosystem changes during the last one million years, \$741,821.00 (2018).
- † *John Fell Oxford University Press Research Fund*. Optimisation of Compound Specific Radiocarbon Dating of Lipids using Supercritical Fluid Chromatography and first application on South African ceramic potsherds, ~ £2,000.00 (2018).
- † *Biogeochemistry Research Infrastructure Platform (BIOGRIP), Department of Science and Technology, Republic of South Africa*. Substantial drafting and involvement in isotope biogeochemistry node of national infrastructure platform, ~ £1,890,000.00 (2019).
- \*\* *National Research Foundation (NRF)/European Research Council (ERC) partnership*. Funding for collaborative research visit to Imperial College London, ~ £8,000.00 (2019).

## PUBLICATIONS

- |      |   |
|------|---|
| 2019 | <p>Staff, R.A., Hardiman, M., Bronk Ramsey, C., <b>Hare, V. J.</b>, Koutsodendris, A., Pross, J. <a href="#">Reconciling the Greenland ice-core and radiocarbon timescales through the Laschamp geomagnetic excursion</a>. <i>Earth and Planetary Science Letters</i>. 520, pp. 1-9.</p> <p>Sealy, J., Naidoo, N., <b>Hare, V. J.</b>, Brunton, S., Tyler Faith, J. Climate and ecology of the palaeo-Agulhas Plain from stable carbon and oxygen isotopes in bovid tooth enamel from Nelson Bay Cave, South Africa. <i>Quaternary Science Reviews</i>. In Press.</p> <p><b>Hare, V. J.</b>, Loftus, E. <a href="#">Scientific Dating Methods in African Archaeology</a>. Oxford Research Encyclopedia of African History, Oxford University Press (Book chapter in press)</p>  |
| 2018 | <p><b>Hare, V. J.</b>, Loftus, E., Jeffrey, A., Bronk Ramsey, C. <a href="#">Atmospheric CO<sub>2</sub> effect on stable carbon isotope composition of terrestrial fossil archives</a>. <i>Nature Communications</i>. 9, DOI:10.1038/s41467-017-02691-x</p> <p><b>Hare, V. J.</b>, Tarduno, J. A., Huffman, T., Watkeys, M., Phenyio, C. T., Manyanga, M., Bono, R.K., Cottrell, R. <a href="#">New archeomagnetic directional records from Iron-Age southern Africa (ca. 425– 1550 CE) and implications for the South Atlantic Anomaly</a>. <i>Geophysical Research Letters</i>, DOI: 10.1002/2017GL076007</p> <p>Devièse, T., Van Ham-Meert, A., <b>Hare, V. J.</b>, Lundy, J., Hommel, P., Orton, J. <a href="#">Supercritical fluids for higher extraction of lipids from archaeological ceramics</a>. <i>Analytical Chemistry</i>, DOI: 10.1021/acs.analchem.7b04913</p> |

- Luyt, J. **Hare, V. J.**, Sealy, J. The relationship of ungulate  $\delta^{13}\text{C}$  and environment in the temperate biome of southern Africa, and its palaeoclimatic application. Accepted in *Palaeogeography, Palaeoclimatology, Palaeoecology*.
- 2016 **Hare, V. J.**, Kärger, J., Moinester, M., Piasetzky, E. Testing the (time)<sup>1/4</sup> diffusion law of rehydroxylation in fired clays: evidence for sub-diffusion in porous nanomedia? *Diffusion Fundamentals*, 25 (5), pp 1-11.
- 2015 **Hare, V. J.**, Theoretical constraints on the precision and age range of rehydroxylation dating. *Royal Society Open Science*, DOI: 10.1098/rsos.140372
- 2013 **Hare, V.**, Sealy, J. Middle Pleistocene dynamics of southern Africa's winter rainfall zone from  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  values of Hoedjiespunt faunal enamel. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 374, pp. 72-80

## IN PROGRESS

(manuscripts presently in advanced development, or under review)

- 2019 **Hare, V. J.** Atmospheric  $[\text{O}_2]/[\text{CO}_2]$  ratios increase spacing between angiosperm and gymnosperm carbon isotope discrimination. In preparation for *Global Change Biology*.
- Hare, V. J.**, Khumalo, W., Loftus, E., Pickering, R. Reevaluation of hydrological change during the Last Glacial Maximum in southernmost Africa: Implications for abrupt change in mid-latitude westerlies. In preparation for *Quaternary Science Reviews*.

## SELECTED CONFERENCES/ABSTRACTS

- 2019 **Hare, V. J.**, Khumalo, W., Loftus, E., Pickering, R.. Changes in Southern Hemisphere westerlies from Last Glacial Maximum to mid-Holocene in southern Africa: a CMIP/PMIP ensemble-data comparison. Geophysical Research Abstracts Vol. 21 EGU2019-15442 (poster)
- 2018 Staff, R.A., Hardiman, M., Bronk Ramsey, C., **Hare, V. J.**, Koutsodendris, A., Pross, J. A comparison of the Greenland ice-core and IntCal timescales through the Laschamp geomagnetic excursion, utilising new  $^{14}\text{C}$  data from Tenaghi Philippon, Greece. EGU general assembly (poster)
- Hare, V. J.** Different responses of terrestrial  $\text{C}_3$  plant groups to paleo- $\text{pCO}_2$ ,  $\text{pO}_2$ , and implications for photosynthetic fractionation of stable carbon isotopes . Goldschmidt Conference (poster)
- 2017 Staff, R.A., Hardiman, M., Bronk Ramsey, C., **Hare, V. J.**, Koutsodendris, A., Pross, J. A comparison of the Greenland ice-core and IntCal timescales through the Laschamp geomagnetic excursion, utilising new  $^{14}\text{C}$  data from Tenaghi Philippon, Greece. EGU general assembly (poster)

- Hare, V. J.** Archaeomagnetism in South Africa and the history of the South Atlantic Anomaly. Geological Society of America 113th annual meeting, Honolulu, Hawai'i (conference presentation)
- Devièse, T, **Hare, V. J.**, Van Ham-Meert A., Lundy. New Approach to Residue Analysis in Archaeological Ceramics Using Supercritical Fluids. 16th European Meeting on Supercritical Fluids (EMSF), Lisbon, Portugal (poster)
- Hare, V. J.** Updates of new RHX developments in fired clay minerals: implications for future RHX dating. Saxon Academy of Sciences, Leipzig, Germany. (invited talk)
- 2015 **Hare, V. J.**, Genevey, A., Gallet, Y. [New constraints on historical dipole field decay: Four centuries of archaeointensity from Cape Town, South Africa.](#) AGU Fall Meeting, San Francisco, CA (poster)

#### POPULAR SCIENCE

- 2017 Tarduno, J., Hare, V. [Does an anomaly in the Earth's magnetic field portend a coming pole reversal?](#) The Conversation (republished in IFLS.com, Newsweek.com)

#### CURRENT PROJECTS/INTERESTS

Modelling photosynthetic **fractionation of carbon isotopes** in deep time.

Development of **rare isotopologues of CO<sub>2</sub>** as tracers for the carbon cycle and as pCO<sub>2</sub> proxies from fossil biominerals and other carbonates; in particular the use of TILDAS for such measurements.

Studying **anomalous diffusion** in clay minerals with MAS NMR, micro-IR imaging, and synchrotron FTIR, with a view to developing a new dating technique (initiated with colleagues at the Department of Physics, University of Leipzig).

#### TEACHING EXPERIENCE

##### University of Cape Town, 2011

Tutor, Stable Light Isotope Course

##### University of Oxford, 2014-2016

Laboratory Demonstrator, Department of Physics (Practical Course Laboratory EL0: Electronics laboratory for 1<sup>st</sup> year students). Tutorials to undergraduate Archaeology/Anthropology students. Lectures to MSc Archaeological Science Students on Dating Methods.

##### University of Cape Town, 2019-

Honours module: Dating Methods. World Archaeology 1. Stable Light Isotope Short Course.

## SOFTWARE PROFICIENCIES

*Working knowledge:* MATLAB, python, R, GMT, labVIEW, L<sup>A</sup>T<sub>E</sub>X

*Basic knowledge:* fortran, VB, C++

## PROFESSIONAL SKILLS/EXPERTISE

*Experimental skills, practical knowledge:*

Isotope ratio mass spectrometers, cryogenic magnetometers, FTIR spectrometers, scanning electron microscopes, pretreatment protocols for stable isotope analysis (C,N,O,H) and <sup>14</sup>C dating, palaeomagnetic sampling and measurement. Design and construction of thermoelectric controllers and high-precision environmental chambers. Geospatial data analysis, netCDF data formats, numerical modelling. Monte Carlo methods and uncertainty analysis.

*Research Experience:*

Visiting researcher, Insitut de Physique du Globe de Paris, France, 2011, 2013, 2014

Visiting researcher, GEM, STFC Rutherford Appleton Laboratory, U.K., 2013

Visiting researcher, Diamond Light Source, U.K., 2016

Visiting researcher, Isotopologue Palaeosciences Laboratory, Department of Earth and Environmental Sciences, University of Michigan, 2019

*Reviewer:*

IPCC Sixth Assessment Report (AR6): The Physical Science Basis (Chapter 5 : Global carbon and other biogeochemical cycles and feedbacks), Quaternary Science Reviews, Quaternary Geochronology, Applied Clay Science, Journal of the American Ceramic Society, Archaeometry

## OTHER ACTIVITIES

Junior Dean, welfare, Middlebury College Oxford Humanities Program, 2015-2016

Convenor of interdepartmental seminar series “Climate and Chronology” (Earth Sciences-Geography-Archaeology) at Oxford University, 2015-2016

Nature conservation projects in South Africa, 2008-present

## PROFESSIONAL AFFILIATIONS

Member, American Geophysical Union, 2015-present

Member, European Geosciences Union, 2018-present

Regional Representative (Africa), Past Global Changes (PAGES) 2018-present

Secretary, Southern African Society for Quaternary Research (SASQUA), 2019

Last updated: October 3, 2019