

FRED RICHARDS

Imperial College Research. Fellow, Imperial College London

Expertise in geodynamics, near-surface geophysics, igneous petrology and geomorphology.

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Date of Birth: 17/01/1991

Nationality: British

EMPLOYMENT

Oct 2019 – Present: Department of Earth Science and Engineering, Imperial College London.

Imperial College Research Fellow

Research areas: Dynamic topography, glacial isostatic adjustment, long-term sea-level variations, deep Earth structure, sedimentary architecture of cratonic basins, mineral resources and long-term landscape evolution.

Publications: Deep Earth buoyancy structure, 3D mantle viscosity variation and glacial isostatic adjustment.

Funding: Imperial College London

Sep 2018 – Sep 2019: Department of Earth and Planetary Sciences, Harvard University.

Schmidt Science Fellow

PI: Prof. Jerry Mitrovica

Research areas: Dynamic topography, glacial isostatic adjustment, long-term sea-level variations, deep Earth structure, sedimentary architecture of cratonic basins and mineral resources.

Publications: Oceanic lithosphere-asthenosphere system, supercontinent insulation, asthenospheric temperature anomalies, lithospheric architecture and mineral deposits, interaction between mantle dynamics and palaeoclimate.

Funding: Schmidt Science Fellows.

EDUCATION

Oct 2014 – Aug 2018: Bullard Laboratories, Department of Earth Sciences & Jesus College, University of Cambridge.

PhD Earth Sciences (Geophysics) – passed with no corrections.

Thesis: *Global Analysis of Predicted and Observed Dynamic Topography*

Supervisors: Prof. Nicky White & Dr. Paul Bellingham (ION Geophysical Ltd.)

Summary: Earth's surface is sculpted by thickening and thinning of the crust in response to the lateral motion of tectonic plates but also by upwelling and downwelling flow in the underlying mantle. This latter contribution, known as "dynamic topography", is poorly understood but has important consequences for climate, mineral deposit formation and hydrocarbon generation. Through collaboration with industry partners and development of innovative numerical schemes, I have generated new datasets and improved existing models to fit these observations. An important outcome of this work is that the mantle flows much more rapidly than previously believed, meaning that the Earth's surface deforms on much shorter wavelengths and timescales. This finding has major ramifications for the evolution of petroleum systems and the study of past ocean circulation and climate change. Codes I have written to account for this behaviour have been successfully implemented by BP to appraise and de-risk hydrocarbon prospects. My first publication, *Cenozoic Epeirogeny of the Indian Peninsula*, was given the G-Cubed Editors' Highlight award for its innovative and integrated approach. Through my work investigating Earth's viscosity structure, I have initiated and coordinated collaborations with researchers from several universities in the US, UK, Germany and Australia, including Columbia, LMU Munich and ANU. I have also collaborated successfully and extensively with researchers in my own department, developing codes to model lithospheric cooling and fluvial incision.

Funding: Natural Environment Research Council Earth System Science DTP.

Oct 2010 – Jun 2014: Department of Earth Sciences & St. Anne's College, University of Oxford.

MSc Earth Sciences: 1st Class Honours with Distinction – graduated top of the class.

MSc Thesis: *The Origin, Structural Evolution and Potential Field Signatures of the Tasmanid Seamount Chain* – **highest mark in year (84%).**

Supervisors: Dr. Lara Kalnins & Prof. Tony Watts

3rd-year dissertation: *Was Episodic Glaciation a Feature of the Mesozoic "Greenhouse"* – **highest mark in year (80%).**

SELECTED AWARDS & HONORS:

2019–2023 1 of 20 selected for 4-year Imperial College Research Fellowship.

2018–2019 1 of 14 selected in inaugural class of Schmidt Science Fellows.

2018 Royal Astronomical Society Keith Runcorn Prize for best thesis in geophysics and planetary science – runner-up.

2017 G³ Editors' Highlight for first-author research paper ("Cenozoic Epeirogeny of the Indian Peninsula").

2015 Elected Fellow of the Royal Astronomical Society.

2015 Jesus College Doctoral Research Grant.

2014–2018 Natural Environment Research Council PhD Studentship, Cambridge Earth Sciences Department.

2014 BP Prize for best MSc Thesis, Oxford Earth Sciences Department.

2013	Burdett-Coutts Prize for top mark in Final Honour School, Oxford Earth Sciences Department.
2013	Shell Prize for top mark in Geochemistry, Oxford Earth Sciences Department.
2011-2014	St. Anne's College & University of Oxford Scholar for performance in examinations.
2007-2009	St. Paul's Scholar for academic excellence, St Paul's School.
2004-2006	3 x Headmaster's Commendation for academic excellence, Winchester College.

PUBLICATIONS

Accepted, submitted or in prep.	Richards, F. D. , Hoggard, M. J., Ghelichkhan, S., Lau, H. C. P. & Koelemeijer, P., Negative Buoyancy Anomalies in LLSVPs Reconcile Dynamic Topography and Geoid Observations, <i>in prep. for submission to Nature Geosci.</i> Hoggard, M. J., Shorttle, O., Richards, F. D. , White, N. J. & MacLennan J. C., Reconciling Geophysical and Geochemical Observations of Supercontinent Insulation, <i>in review at Earth Planet. Sci. Lett.</i>
2020	Richards, F. D. , Hoggard, M. J., Crosby, A. G., Ghelichkhan, S. & White, N. J., Structure and Dynamics of the Oceanic Lithosphere-Asthenosphere System, <i>Physics of the Earth and Planetary Interiors</i> , 106559, doi: 10.1016/j.pepi.2020.106559. Richards, F. D. , Hoggard, M. J., White, N. J. & Ghelichkhan, S., Quantifying the relationship between short-wavelength dynamic topography and thermomechanical structure of the upper mantle using calibrated parameterization of anelasticity, 125 , e2019JB019062, doi: 10.1029/2019JB019062. Hoggard, M. J., Czarnota, K., Richards, F. D. , Huston, D. L., Jaques, A. L., & Ghelichkhan, S., Global distribution of sediment-hosted metals controlled by craton edge stability, <i>Nature Geoscience</i> , 13 , pp. 504-510, doi: 10.1038/s41561-020-0593-2. Klöcking, M., Hoggard, M. J., Rodríguez Tribaldos, V., Richards, F. D. , Guimarães, J. A., MacLennan, J. C. & White, N. J., A tale of two domes: Neogene to recent volcanism and dynamic uplift of northeast Brazil and southwest Africa, <i>Earth Planet. Sci. Lett.</i> , 547 , 116464, doi: 10.1016/j.epsl.2020.116464. Mitrovica, J. X., Auermann, J., Coulson, S. L., Creveling, J. R., Hoggard, M. J., Jarvis, G. T. & Richards, F. D. , Dynamic Topography and Ice Age Paleoclimate, <i>Ann. Rev. Earth Planet. Sci.</i> , 48 (1), pp. 585-621, doi: 10.1146/annurev-earth-082517-010225. Ghelichkhan, S., Fuentes, J. J., Hoggard, M. J., Richards, F. D. & Mitrovica, J. X., The Precession Constant and its Long-Term Variation, <i>Icarus</i> , 114172, doi: 10.1016/j.icarus.2020.114172. Czarnota, K., Hoggard, M. J., Richards, F. D. , Teh, M., Huston, D. L., Jacques, A. L. & Ghelichkhan, S., Minerals on the edge: Sediment-hosted base metal endowment above steps in lithospheric thickness, <i>Exploring for the Future: Extended Abstracts</i> , Geoscience Australia, Canberra. Huston, D. L., Champion, D. C., Czarnota, K., Hutchens, M., Hoggard, M. J., Ware, B. D., Richards, F. D. , Tessalina, S. D., Gibson, G. M. & Carr, G., Lithospheric-scale controls on zinc-lead-silver deposits of the North Australian Zinc Belt: evidence from isotopic and geophysical data, <i>Exploring for the Future: Extended Abstracts</i> , Geoscience Australia, Canberra.
2019	Hoggard, M. J., Czarnota, K., Richards, F. D. , Huston, D. L. & Jaques, A. L., Gigayear stability of cratonic edges controls global distribution of sediment-hosted metals. [Online]. 7 May 2019. Available from: doi:10.31223/osf.io/2kjvc.
2018	Richards, F. D. , <i>Global Analysis of Predicted and Observed Dynamic Topography</i> (Doctoral thesis), doi: 10.17863/CAM.31532. Richards, F. D. , Kalnins, L. M. & Watts, A. B., Cohen, B. E. & Beaman R. J., The Morphology of the Tasmanid Seamounts: Interactions Between Tectonic Inheritance and Magmatic Evolution, <i>Geochem. Geophys. Geosyst.</i> , 19 , pp. 3870-3891, doi: 10.1029/2018GC007821. Richards, F. D. , Hoggard, M. J., Cowton, L. R. & White, N. J., Reassessing the Thermal Structure of Oceanic Lithosphere with Revised Global Inventories of Basement Depths and Heat Flow Measurements, <i>J. Geophys. Res.: Solid Earth</i> , 123 , pp. 9136-9161, doi: 10.1029/2018JB015998.
2016	Richards, F. D. , Hoggard, M. J. & White, N. J., Cenozoic Epeirogeny of the Indian Peninsula, <i>Geochem. Geophys. Geosyst.</i> , 17 , pp. 1525-2027, doi: 10.1002/2016GC006545.

FUNDING OBTAINED:

2019-2023	Imperial College Research Fellowship (£46,499 p.a. + £28, 200) – investigating impact of mantle dynamics and structure on mineral resource formation, landscape development, orbital dynamics, and ice sheet stability.
2018-2019	Schmidt Science Fellowship (\$100,000) – investigating impact of dynamic topography on Pliocene sea-level estimates.

- 2015** **Jesus College Travel Grant** – used to attend EGU 2015, Vienna.
- 2014–2018** **NERC PhD Studentship** – global analysis of predicted and observed dynamic topography.

SELECTED COURSES

- 2019** ASPECT Hackathon (Heber City, Utah) – development of new plugins for ASPECT software using C++.
- 2017** Forging Links between Petrology and Geophysics – two-week PhD course at Aarhus University.
- 2016** NERC Numerical Earth Science Modelling – one-week numerical modelling course at Durham University.
- 2015** Machine Learning with Python – one-day course learning how to implement machine learning techniques.
- 2014–2017** BP Energy Masterclass – two-day programme of talks from energy experts focused on addressing future challenges.

TEACHING & SUPERVISION

- 2020** PhD supervisor of James Hazzard, NERC-funded through Imperial College SSCP DTP.
- 2019** Lecturer for 3rd-Year Continental Tectonics course at Imperial College.
- 2017** Delivered lecture to Part III undergraduates on residual depth anomalies and dynamic topography.
- Mentored and supervised 2 visiting PhD students from Madagascar carrying out drainage inversions on Tasmania and Southern Africa.
- 2016–2017** Gave Bullard Laboratories computing talk and contributed several sections to computing guide.
- 2016** Mentored and supervised 4 MSci students during their final year research projects involving intracratonic basin analysis in Brazil, seismic oceanography in the Faroe-Shetland Channel and drainage inversion of China and Greece.
- 2014–2018** Supervised over 40 undergraduate students for Part II: Geophysics and Part III: Basin Analysis and Continental Tectonics.
- 2014–2018** Demonstrator for Part IB: Geophysics, Part II: Geophysics and Part III: Basin Analysis

PROFESSIONAL SERVICE

- 2020–Present** Events Team Leader, Royal Astronomical Society Early Career Network.
- 2016–Present** Journal Reviewer: AGU Books, Geochemistry, Geophysics, Geosystems, Geology, Geophysical Research Letters, Journal of Geophysical Research: Solid Earth, Marine Geophysical Research, Science Advances.

OUTREACH & PUBLIC POLICY ENGAGEMENT

- 2020** “What’s Our Planet Made Of?” outreach event at Hurlingham School
- Speaker at UCL Insight “Careers in Research within Academia” event.
- 2019** Co-organised AGU Fall Meeting Town Hall session entitled “Disaster Policies or Disastrous Policies? A Town Hall at the Junction of Natural Hazards, Society, Science Policy, and Communication”. Co-organised AGU Fall Meeting Town Hall session entitled “Disaster Policies or Disastrous Policies? A Town Hall at the Junction of Natural Hazards, Society, Science Policy, and Communication”.
- Wrote article on science policy interaction for Schmidt Science Fellows website (<https://schmidtsciencefellows.org/news/of-laws-and-sausages-fred-richards-on-public-policy-engagement/>)
- 2017** Organised and coordinated Planet Earth section of Cambridge Pint of Science festival; chaired “Breathe Easy: The Future of Energy Is Here” evening (16th May).
- 2016–2018** Workshops Coordinator for Cambridge University Science and Policy Exchange. Elected by committee of 12 peers; organised > 7 workshops for Cambridge students interested in science-policy interaction, 3 of which explored future of energy/Cleantech; successfully coordinated 4-member multicultural team; all have been oversubscribed and received excellent feedback; learnt to communicate science effectively to non-specialists in government and industry.
- 2015–2018** Helped contact speakers and find venues for Cambridge University Energy Network lectures and conferences.

SKILLS, LANGUAGES & INTERESTS

- Computing**
- Experienced programmer and numerical modeler in Python, Fortran, MATLAB, C++ and bash.
 - Proficient with specialist geoscientific mapping packages, e.g. GMT, ArcGIS and QGIS.

- Practiced user of finite-element convection code ASPECT and thermodynamic modelling packages, e.g. Perple_X, Theriak-Domino and alphaMELTS.
- Experienced user of Adobe Illustrator and InDesign; Microsoft Excel, Word and PowerPoint.
- Experienced user of specialist seismic data visualisation packages (Petrel and Kingdom).

Languages English – mother tongue, Italian – fluent, French – fluent & Russian – basic.

Sport

- Cycling: Organised 2-day London-Paris charity ride (**2017**); finished **2013** RideLondon 100-miler in 4hr 29 mins.
- Football: Hurricanes AFC (**2017–2018**), **2017** President's Cup winners and 2nd in Camden Sunday League; Jesus 1st XI (**2014–2015**); St. Anne's 1st XI (**2012–2014**), promoted to First Division in 2014.
- Rowing: Bullard Laboratories VIII (**2015–2017**), won blades in 2015; St. Anne's College 1st VIII, elevated St. Anne's to Division 1 for first time (**2012**); St. Anne's College 2nd VIII (**2011**), won crossed-blades.
- Skiing: Oxford 1st & 2nd VI, beat Cambridge in **2013** & **2010** Varsity Races; St Anne's 1st IV, fastest in team that won **2012** Oxford University Intercollegiate Cup.
- Triathlon: Finished 1st in 17-19 age category of **2008** London Triathlon.

Expeditions Organised cycling expedition around Iceland "Ring Road" (**2010**), participated in expeditions to South Africa (**2009**) & Morocco (**2007**).

Volunteering Worked with charities in the Drakensberg Mountains (RSA) building schools in deprived communities (**2009**).

FIELD EXPERIENCE

2017 **Field Trip Demonstrating:** Demonstrator on University of Cambridge Isle of Arran Undergraduate Field Trip.

2015 **Geochronology Sampling, GPS and Drone Surveying:** Field assistant on 4-week trip to Madagascar GPS and drone surveying raised coral terraces, collecting basalt for rare-earth element inversion, corals for U-Th dating and granitic/gneissic samples for apatite fission track analysis (AFTA) and apatite-helium Geochronology (AHe).

2013 **Oceanography:** two-day long cruise to Bermuda Atlantic Time Series, taking CTD measurements and processing ADCP and multi-beam bathymetry data.

2012 **Bedrock Mapping:** 5-week long mapping project on Bracco Ophiolite in Liguria, Italy.

INVITED TALKS & CONFERENCE PROCEEDINGS

(P) = research I personally presented.

2020 **Richards, F. D. (P)**, Coulson, S. L., Austermann, J., Hoggard, M. J., & Mitrovica, J. X., Impact of Dynamic Topography on Late Cenozoic Sea-Level Records: Examples from Australia, AGU Fall Meeting, San Francisco (USA), DI014-05.

Ghelichkhan, S., Hoggard, M. J., **Richards, F. D.**, & Mitrovica, J. X., Inferring Modern Ice Mass Flux from Satellite Geodetic Constraints on Long Wavelength Gravity: Contending with a Suite of Confounding Geophysical Signals, AGU Fall Meeting, San Francisco (USA), DI014-02.

Hollyday, A., Austermann, J., Lloyd, A. J., Hoggard, M. J., **Richards, F. D.**, Rovere, A., Sea level indicators atop a slab window in southern Argentina – using geodynamic models to understand subduction behavior, its imprint on Earth's surface, and implications for Pliocene sea level, AGU Fall Meeting, San Francisco (USA), DI011-0002.

Hoggard, M. J., Czarnota, K., **Richards, F. D.**, Huston, D. L., Jaques, A. L., & Ghelichkhan, S., Sediment-hosted metal deposits and the billion-year stability of cratonic lithosphere, AGU Fall Meeting, San Francisco (USA), V007-0006.

Huston, D. L., Champion, D. C., Czarnota, K., Hutchens, M., Hoggard, M. J., Ware, B. D., **Richards, F. D.**, Tessalina, S. D., Gibson, G. M. & Carr, G. R., Zinc on the edge: lithospheric controls on the distribution of basin-hosted zinc deposits, AGU Fall Meeting, San Francisco (USA), V007-0007.

Richards, F. D. (P - invited), Earth's Dynamic Topography: Implications for Mantle Structure and Sea-Level Records, Geophysical Fluid Dynamics Seminar, ETH Zürich, Zürich (CH).

Richards, F. D. (P - invited), Gigayear stability of cratonic edges controls global distribution of sediment-hosted metals, Society of Economic Geologists Vision 2020 Meeting, Whistler (CA). Postponed to 2021.

Richards, F. D. (P - invited), Hoggard, M. J., Ghelichkhan, S. & Lau, H. C. P., What Are LLSVPs? Geodynamic Insights into Lower Mantle Chemistry and Structure, SEDI 2020, Taipei (TW).

Richards, F. D. (P - invited), Gigayear stability of cratonic edges controls global distribution of sediment-hosted metals, Mineral Deposits Group Seminar, Natural History Museum, London (UK).

Hoggard, M. J., Czarnota, K., **Richards, F. D.**, Huston, D. L., Jaques, A. L., & Ghelichkhan, S., Treasure maps, sustainable development, and the billion-year stability of cratonic lithosphere, *Geophysical Research Abstracts*, **22**, EGU, Vienna (AT), EGU2020-7105.

Richards, F. D. (P - invited), Mapping Seismic Tomography into Earth Structure: Implications for Dynamic Topography, Lithospheric Stability, and Sea-Level Reconstructions, Bullard Laboratories Wednesday Seminar, University of Cambridge, Cambridge (UK).

Richards, F. D. (P - invited), Mapping Seismic Tomography into Upper Mantle Structure: Implications for Dynamic Topography and Sea-Level Reconstructions, Earth and Planets Seminar, Imperial College, London (UK).

2019

Richards, F. D. (P - invited), Hoggard, M. J., Ghelichkhan, S. & Lau, H. C. P., What Are LLSVPs? Geodynamic Insights into Lower Mantle Chemistry and Structure, AGU Fall Meeting, San Francisco (USA), DI23A-03.

Richards, F. D. (P), Coulson, S. L., Austermann, J., Hoggard, M. J., & Mitrovica, J. X., The Effect of Dynamic Topography on Pliocene Sea-Level Reconstructions Around Australia, AGU Fall Meeting, San Francisco (USA), PP31C-1655.

Richards, F. D. (P), Hoggard, M. J., & White, N. J., Using Calibrated Anelasticity Parameterisations to Infer the Physical State of the Upper Mantle, AGU Fall Meeting, San Francisco (USA), S22C-05.

Hoggard, M. J. & **Richards, F. D.**, Calibrated mapping of upper mantle seismic tomography into viscoelastic Earth structure, AGU Fall Meeting, San Francisco (USA), PP31C-1654.

Hoggard, M. J., Czarnota, K., **Richards, F. D.**, Huston, D. L. & Jaques, A. L., Base metals and sustainable development: Drawing treasure maps with seismic tomography, AGU Fall Meeting, San Francisco (USA), S23F-0710.

Klöcking, M., Rodríguez Tribaldos, V., Hoggard, M. J., **Richards, F. D.**, Guimarães, J. A., MacLennan, J. C. & White, N. J., Mechanisms for Dynamic Support in Northeast Brazil and Southwest Africa, AGU Fall Meeting, San Francisco (USA), DI31A-06.

Coulson, S. L., Austermann, J., Hoggard, M. J., **Richards, F. D.**, Boreggine, M. J. & Mitrovica, J. X., The Role of Dynamic Topography on Glacial Inception in North America, AGU Fall Meeting, San Francisco (USA), C14B-07.

Ratner, J., Krippner, J., Szymanski, L. M., **Richards, F. D.**, Buchanan, P. R., Wood, K., Zamora-Reyes, D., Ladlow, C. & Houttuijn Bloemendaal, L., Disaster Policies or Disastrous Policies? A Town Hall at the Junction of Natural Hazards, Society, Science Policy, and Communication, AGU Fall Meeting, San Francisco (USA), TH15I.

Czarnota, K., Willford, J., Roberts, D., Skirrow, R. G., Huston, D. L., Bastrakov, E., Ley-Cooper, A. Y., Brodie, R. S., Liu, S., Stewart, A., Bonnardot, M. A., Champion, D. C., Fomin, T., Doublier, M. P., Henson, P., Duan, J., Gorbатов, A., Hoggard, M. J., **Richards, F. D.**, Walsh, S. D., Northey, S., Schofield, A., Fraser, G., Blewett, R. & Murr, J., Exploring for the Future in Australia: Characterizing and Assessing the Lithosphere for Resource Discovery, AGU Fall Meeting, San Francisco (USA), PA43B-04.

Richards, F. D. (P - invited), Mapping Upper Mantle Heterogeneity and Its Impact on Dynamic Topography, Geodynamics Seminar, Lamont-Doherty Earth Observatory, Columbia University, Palisades (USA).

Richards, F. D. (P - invited), Hoggard, M. J., Ghelichkhan, S. & Lau, H. C. P., The Role of LLSVPs in Reconciling Observations and Predictions of Earth's Dynamic Topography, IUGG, Montréal (CA), IUGG19-3669.

Hoggard, M. J., Czarnota, K., **Richards, F. D.**, Huston, D. L. & Jaques A. L., Billion-year Stability of Thick Lithospheric Edges Controls the Global Distribution of Sediment-hosted Base Metals, IUGG, Montréal (CA), IUGG19-3664.

Czarnota, K., Hoggard, M. J., **Richards, F. D. (P)**, Huston, D. L. & Jaques, A. L., Billion-year stability of cratonic edges controls location of global sediment-hosted metals, *Geophysical Research Abstracts*, **21**, EGU, Vienna (AT), EGU2019-3741.

Richards, F. D. (P - invited), Hoggard, M. J., Ghelichkhan, S. & Lau, H. C. P., Reconciling Observations and Predictions of Earth's Dynamic Topography, *Geophysical Research Abstracts*, **21**, EGU, Vienna (AT), EGU2019-3744.

2018

Czarnota, K., Champion, D. C., Hoggard, M. J., **Richards, F. D.**, Huston, D. L., Skirrow, R. G., Doublier, M. P., Gorbатов, A. & Duan, J., Temporal coupling of crustal and continental lithospheric mantle growth with implications for the spatial distribution of giant mineral deposits, AGU Fall Meeting, Washington DC (USA), T41A-03.

Hoggard, M. J., Lickley, M., Powell, E. M., Latychev, K., **Richards, F. D.**, Ghelichkhan, S., Austermann, J. & Mitrovica, J. X., Self-consistent mapping of 3D lithospheric and asthenospheric viscoelastic structure using seismic tomography & anelasticity parameterisations, AGU Fall Meeting, Washington DC (USA), G43B-0714.

Richards, F. D. (P), Hoggard, M. J., Cowton, L. R. & White, N. J., Reassessing the Thermal Evolution of Oceanic Lithosphere Using Updated Basement Depth and Heat Flow Measurements, AGU Fall Meeting, Washington DC (USA), T23E-0431.

Richards, F. D. (P - invited), Reconciling Observations and Predictions of Earth's Dynamic Topography, BiSEPPS Seminar, Harvard University, Cambridge (USA).

Richards, F. D. (P - invited), Global Dynamic Topography and its Impact on Australian Sea-Level, Friends of PlioMax Meeting, Lamont-Doherty Earth Observatory, Columbia University, Palisades (USA).

Richards, F. D., Hoggard, M. J. & White, N. J., Re-examining Age-Depth Cooling Using High Accuracy Oceanic Basement Depths, *Geophysical Research Abstracts*, **20**, EGU, Vienna (AT), EGU2018-12852.

Richards, F. D. (P - invited), Resolving Discrepancies Between Observed and Predicted Dynamic Topography, Earth and Planets Seminar, Imperial College, London (UK).

2017 **Richards, F. D. (P)**, Hoggard, M. J. & White, N. J., Resolving Discrepancies Between Observed and Predicted Dynamic Topography on Earth, AGU Fall Meeting, New Orleans (USA), DI11A-0255.

Hoggard, M. J., **Richards, F. D.**, Ghelichkhan, S., Austermann, J. & White, N. J., Reconciling Long-Wavelength Dynamic Topography, Geoid Anomalies and Mass Distribution on Earth, AGU Fall Meeting, New Orleans (USA), DI13B-02.

Richards, F. D. (P), Hoggard, M. J. & White, N. J., The Importance of Asthenospheric Temperature Anomalies in Maintaining Observed Dynamic Topography, *Geophysical Research Abstracts*, **19**, EGU, Vienna (AT), EGU2017-19094.

2016 **Richards, F. D. (P)**, Hoggard, M. J. & White, N. J., Oceanic Residual Depth Anomalies Maintained by a Shallow Asthenospheric Channel, AGU Fall Meeting, San Francisco (USA), DI51B-2666.

Al-Attar D., **Richards F. D. (P)**, Hoggard M. J. & White, N. J., Spectral Discrepancies between Observations and Predictions of Global Dynamic Topography, AGU Fall Meeting, San Francisco (USA), DI43B-05.

Richards, F. D. (P), Hoggard, M. J. & White, N. J., Cenozoic vertical motions of the western continental margin of Peninsular India, *Geophysical Research Abstracts*, **18**, EGU, Vienna (AT), EGU2016-9093.

2015 **Richards, F. D. (P)**, Kalnins, L. M., Watts, A. B., Cohen, B. E. & Beaman, R. J., The Tasmanid Seamounts: A window into the structural inheritance of ocean floor fabric, AGU Fall Meeting, San Francisco (USA), V21A-3034.

Hoggard, M. J., **Richards, F. D. (P)** & White, N. J., Landscape evolution of Peninsular India in response to Cenozoic epeirogeny, AGU Fall Meeting, San Francisco (USA). EP53A-0992.

Kalnins, L. M., Cohen, B. E., Godfrey Fitton, J., Mark, D., **Richards, F. D.** & Barfod, D., The East Australian, Tasmanid, and Lord Howe Volcanic Chains: Possible mechanisms behind a trio of hotspot trails, AGU Fall Meeting, San Francisco (USA), DI41A-2591.

Richards, F. D. (P), Kalnins, L. M., Watts, A. B., Cohen, B. E. & Beaman, R. J., The Morphology of the Tasmanid Seamounts: Interactions between Tectonic Inheritance and Magmatic Evolution, *Geophysical Research Abstracts*, **17**, EGU, Vienna (AT), EGU2015-10857.

REFEREES

Dr. Gareth G. Roberts, Professor of Cymatogeny, Bullard Laboratories, Department of Earth Sciences, University of Cambridge.
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Prof. Jerry X. Mitrovica, Frank Baird, Jr. Professor of Science, Department of Earth and Planetary Sciences, Harvard University.
Email: jxm@eps.harvard.edu, Tel: +1 617 496 2732.

Prof. Nicholas J. White, Professor of Cymatogeny, Bullard Laboratories, Department of Earth Sciences, University of Cambridge.
Email: njw10@cam.ac.uk, Tel: +44 (0) 1223 337063.

Prof. Jacqueline Austermann, Assistant Professor, Department of Earth and Environmental Sciences, Columbia University.
Email: jackya@ldeo.columbia.edu, Tel: +1 845 365 8971.

Prof. Anthony B. Watts FRS, Professor of Marine Geophysics, Department of Earth Sciences, University of Oxford.
Email: tony@earth.ox.ac.uk, Tel: +44 (0) 1865 282121.

Dr. Sanne Cottaar, University Lecturer, Bullard Laboratories, Department of Earth Sciences, University of Cambridge.
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Dr. Lara M. Kalnins, Royal Society of Edinburgh Independent Research Fellow, School of Geosciences, University of Edinburgh.
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