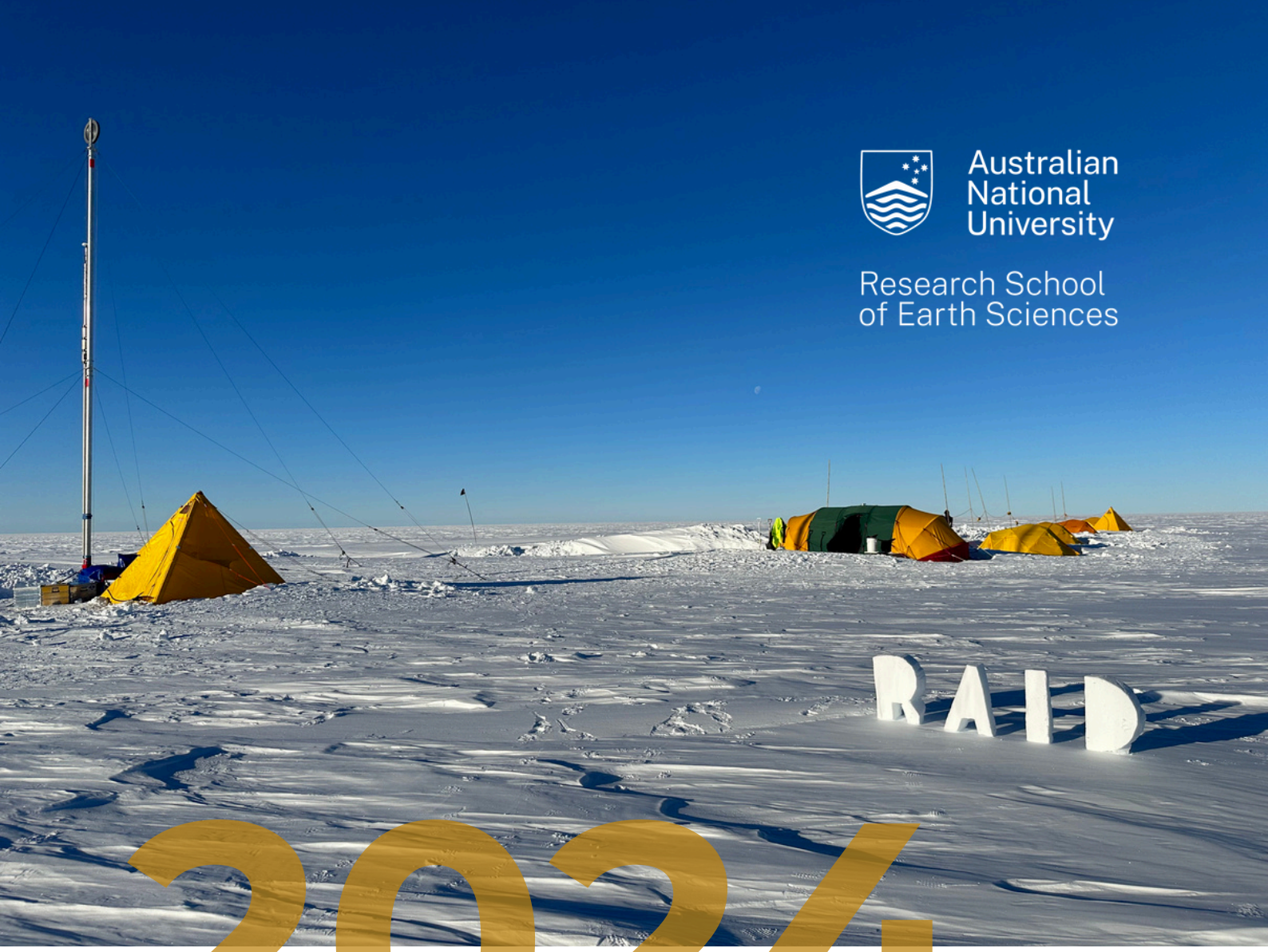

Australian National University

Research School of Earth Sciences

2024

Research School of Earth Sciences

ANNUAL REPORT

cricos provider #00120C

Cover Image Credit:

- Nerilie Abram

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TEQSA Provider ID: PRV12002 (Australian University)
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Credit: Adam Norman (left and right)

FROM THE DIRECTOR

TBA

STAFF

ACADEMIC STAFF

Director	Dorrit Jacob, Dr. rer. nat. Georg August University Germany (equivalent PhD) Diplom in Mineralogy, Johannes Gutenberg Univ, Germany (equivalent MSc)
Associate Directors	
Research & Engagement	Rhodri Davies, MSci PhD Cardiff, UK
Higher Degree Research	Stewart Fallon, BA MS San Diego, PhD ANU
Education	Louis Moresi, BA (Hons) Cambridge, DPhil Oxford
Professors	Nerilie Abram, BSC Advanced (Hons) Sydney, PhD ANU Andrew Berry, BSc (Hons) Sydney, DPhil Oxford Jochen Brocks, Dip Freiburg, PhD Sydney Rhodri Davies, MSci PhD Cardiff, UK Michael Ellwood, BSc (Hons) PhD Otago Stewart Fallon, BA MS San Diego, PhD ANU Andy Hogg, BSc ANU, PhD UWA (on secondment to ACCESS-NRI) Penny King, BSc (Hons) ANU, PhD Arizona State John Mavrogenes, BS Beloit, MS Missouri-Rolla, PhD Virginia Tech Meghan Miller, BA Whittier, MSc Columbia, MEng Cornell, PhD ANU Louis Moresi, BA (Hons) Cambridge, DPhil Oxford Andrew Roberts, BSc Massey, BSc (Hons) PhD DSc Victoria HonFRSNZ (Wellington) Malcolm Sambridge, BSc Loughborough, PhD ANU Hrvoje Tkalčić, DipEng in Physics Zagreb, PhD UC Berkley Paul Tregoning, BSurv PhD UNSW Greg Yaxley, BSc PhD Tasmania Jimin Yu, BSc MSc Nanjing University, PhD Cambridge
Associate Professors	Olivier Alard, PhD Macquarie, Habilitation Montpellier Marnie Forster, BSc MSc PhD Monash Ron Hackney, BSc (Hons) ANU, MSc Victoria University of Wellington, PhD UWA - IODP/ANZIC Director Dave Heslop, BSc (Hons) Durham, PhD Liverpool, Dr. habil. Bremen
Adjunct Professor	Phil Cummins, PhD UC Berkely
Fellows	Caroline Eakin, MSci Imperial College London, PhD Yale Andrew Kiss, BSc (Hons) PhD ANU Callum Shakespeare, BSc (Hons) ANU, PhD Cambridge

Research Fellows

Michael Anenburg, BSc MSc Ben-Gurion University of the Negev, PhD ANU
Antony Burnham, MSci MA Cambridge, PhD Imperial College London (to 01/07/2024)
Navid Constantinou, BSc MSc PhD Athens, Greece [ARC DECRA Fellow] (to 01/06/2024)
Yuhao Dai, BSc Peking University, China, PhD ANU
Chris Gouramanis, BSc La Trobe University, BSc ANU, PhD ANU (from 22/01/2024)
Katharine Grant, BSc Southampton, MSc JCU, PhD Southampton (to 01/09/2024)
Mark Hoggard, BA MSci MA PhD Cambridge [ARC DECRA Fellow]
Chiara Holgate, BEng UNSW, M.Hydrology Vrije Universiteit Amsterdam, PhD ANU
Wilma Huneke, BSc MSc Kiel, PhD Tasmania
Chengxin Jiang, BS and graduate study in geology China Univ of Geosciences, PhD Macquarie [ARC DECRA Fellow]
Michael Koch, BTech NIT Silchar, MTech IITG, PhD Kyoto University (from 04/11/2024)
Seann McKibbin, BSc (Hons) Newcastle, PhD ANU (to 16/08/2024)
Fabrizio Magrini, BSc MSc Milan, PhD Universita` Roma Tre
Nicola Maher, BSc (Hons) ANU, PhD UNSW [ARC DECRA Fellow]
Adele Morrison, BSc (Hons) ANU, GradDipEd Canberra, PhD ANU [ARC DECRA Fellow]
Anthony Purcell, BSc (Hons) PhD ANU
Kial Stewart, BSc (Hons), PhD ANU
Son Pham, BEng Hanoi, Postgrad Dip Intl Center for Theoretical Physics, PhD ANU
Luwei Yang, BSc Ocean University of China, PhD UTAS
Qing Zhang, BSc Hebei Normal Uni, MEng CUGB, PhD Wollongong

Postdoctoral Fellows

Wilton Aguiar, PhD Federal University of Rio Grande (Brazil)
Ana Casas Ramos, BChemEng Tuxtla ITTG, MGeochem (UNAM), Dr. rer. nat. Ludwig-Maximillans-Universitat Munchen (to 30/04/2024)
Joëlle D'Andres, BSc MSc ETHZ, PhD ANU
Thomas Duvernay, BSc MSc Universite Paris Diderot
Sam Eggins, BAppSci UNSW, PhD Tasmania
Elizabeth (Lizzie) Ellison, BSc (Hons) Durham, MSc Southampton, PhD Imperial College London
Georgy Falster, BSc (Hons) PhD Adelaide
Miriam Gauntlett, BA Cambridge, MSc UCL, PhD Oxford (from 05/08/2024)
Siavash Ghelichkhan, BSc Tehran, MSc PhD Ludwig-Maximillans-Universitat Munchen
Voon Hui Lai, BA UC Berkeley, MSc PhD California Inst of Technology
Augustin (Auggie) Marignier, MSci PhD University College London
Louise Maubant (from 19/02/2024)
Rebecca McGirr, BSc (Hons) Sydney, PhD ANU
Tom Merry, MSci Cambridge, PhD Imperial College London (to 16/01/2024)
Konstantinos Michailos (from 01/08/2024)
Laura Miller, MSci Imperial College London, PhD ANU (from 15/04/2024)
Liam Morrow, PhD Queensland University of Technology (from 04/11/2024)
Laura Otter, BSc JGU, MSc joint JGU and MPIC, PhD Macquarie

Postdoctoral Fellows (continued)

Robert Pickle, BS UC at Davis, MSc Brown, PhD Auckland
William Scott, MSci PhD Imperial College London
Sheng Wang, BSc (Hons) Wuhan, MSc Univ Chinese Acad Sci, PhD ANU (to 24/05/2024)
Zhi Wei, BSc CUMT (China University of Mining and Technology), PHD UCAS (University of Chinese Academy of Sciences)
Ping Zhang, BSc Jilin Univ, MSc Univ Sci&Tech China, PhD ANU

Emeritus Professors

Richard Arculus, BSc PhD Durham, FAIMM
Vickie Bennett, BSc PhD UCLA
Ian Campbell, BSc UWA, PhD DIC London
Steve Cox, BSc UTas, PhD Monash
Patrick De Deckker, BA MSc (Hons) Macquarie, PhD DSc Adelaide
Stephen Eggins, BAppSc UNSW, PhD UTas
David Ellis, MSc Melbourne, PhD UTas
Neville Exon, BSc (Hons) UNSW, PhD Kiel
Ross Griffiths, BSc PhD ANU, FAIP, FAA
Rainier Grun, Diplo Geol, Dr.rer.nat.habil Köln, DSc ANU, FAAH
Ian Jackson, BSc Qld, PhD ANU, FAA
Brian Kennett, MA PhD ScD Cambridge, FAA, FRS
Kurt Lambeck, BSurv NSW, DPhil DSc Oxford, FAA, FRS
Hugh O'Neill, BA Oxford, PhD Manchester, FAA, FRS
Brad Pillans, BSc PhD ANU, HonFRSNZ
Michael Roderick, BAppSc QUT, PGDipGIS Qld, PhD Curtin
Ian Williams, BSc PhD ANU

Honorary Professors

Stephen Foley, BSc (Hons) Southampton, MSc Memorial Univ Newfoundland, PhD Tasmania
Clinton Foster, BSc (Hons) Adelaide, PhD Qld
Andrea Gerson, PhD Strathclyde Scotland
William Maher, BAppSci (Hons) MAppSci Melbourne, PhD Southampton
Eelco Rohling, BSc MSc PhD Utrecht
Neil Williams, BSc (Hons) ANU, MPhil PhD Yale
Lesley Wyborn, BSc (Hons) Sydney, Dip Ed UC, PhD ANU

Honorary Associate Professors

Yuri Amelin, MSc PhD Leningrad State
Richard Armstrong, BSc MSc Natal, PhD Witwatersrand
Robert Burne, BSc Wales, DPhil Oxford
C. Mark Fanning, BSc Adelaide
George Gibson, BSc Edinburgh, PhD Otago
David Huston, BSc Colorado School of Mines, MSc Arizona, PhD Tasmania (from 18/10/2024)
A. Lynton Jaques, BSc (Hons) WA, PhD UTas
Simon McClusky, BSurv PhD UNSW
Terry Mernagh, BSc (Hons) PhD Newcastle
Brad Opdyke, AB Columbia, MS PhD Michigan

Honorary Associate Professors (continued)	Roger Skirrow, BSc WA, Postgrad Dip Sci (Hons) Newcastle, MSc Carleton Univ, PhD ANU Richard Stern, BSc (Hons) Waterloo, PhD Stony Brook
Honorary Senior Lecturers	Grace Shephard, BSc (Adv. Hons I), PhD Sydney Andrew Valentine, BA MSc Cambridge, DPhil Oxford
Honorary Lecturers	Sebastien Allgeyer, PhD Paris Diderot, France Lynne Bean, BSc Sydney, DipEd Syd Teachers College, Grad Dip, PhD ANU Antony Burnham, MSci MA Cambridge, PhD Imperial College London (from 01/07/2024) Janaina Nunes Avila, BSc MSc UFRGS, PhD ANU Anja Rosenthal, MSc Tech Univ Bergakademie Freiberg, PhD ANU Guozhi Xie, BSc Hefei Univ Technol, PhD Univ Chinese Acad Sci
Visiting Fellows	John Foster, BSc Sydney, MSc PhD ANU (to 14/02/2024) Wei Gan Tobias Gruetzner-Handke, Diploma Geology (equiv Masters) Universitat Mainz, Dr.rer.Nat. Westfalische Wilhelms Universitat Munster (to 31/03/2024) Vadim Kamenetsky, BSc (Hons), PhD Russian Academy of Sciences (to 12/03/2024) Chris Klootwijk, BSc Utrecht, MSc Utrecht, PhD Utrecht David Mole, MSc Univ College London, PhD UWA (to 01/06/2024) Phillip O'Brien, BSc (Hons) PhD Melbourne (to 28/04/2024) Ping Wang Yusuke Yokoyama Kaifeng Zhao

RSES Morning Tea to mark International Women's Day

PROFESSIONAL STAFF

School Manager	Geoff Pearson, BA, BTh, MBA, FIML
Executive Assistant to the Director & the School Manager	Telesia (Sia) Adams
Administration Manager	Adam Norman, BSc (Hons) Trent
Building and Facilities Officer	Eric Ward, Cert V Frontline Management, Quest/ANU
WHS Officer	Elmira Mohamed, BSc, MSc, IUST, PhD ANU
Education Developer	Honor McGregor, BSc Macquarie, GradDipEd (Science)
Senior HDR Administrator	Robyne Anderson, B.Bus (USC)
Student Administration Officier	Kevin Thow, BA Macquarie, MPolScADv ANU
Receptionist	Mant Bares, BA Louisiana, MFA University of Michigan (to 30/08/2024)
Research Group Administrators	Josephine (Jos) Magro Adam Daley, Cert IV Procurement & Contracts (to 11/10/2024) Mary Hapel (from 24/10/2024)
IODP/ANZIC Program Manager	Sarah Kachovich, Bsc (Hons) UOW, PhD University of Queensland Kelly-Anne Lawler (Program Manager during Sarah Kachovich's maternity leave)
IODP/ANZIC Administrator	Kelly Kenney (to 27/06/2024) Liz Arnold (from 12/11/2014)
IODP/ANZIC Communications Officer	Janelle Kennard
21st Century Weather, Government and Industry Liaison (3-year appointment)	Lucía Gamarra Cuba, BSc (Peru), GDipFin, M Integrated Water Mgt, Griffith (from 21/08/2024)
21st Century Weather Administrator	Sarah Andrew, BSc University of Auckland, BSc(Hons) PhD ANU (from 16/09/2024)
Collections Officer	Claudia Reppin (to 10/01/2024) Mikey Elliott (from 01/07/2024)

Laboratory Operations

Manager

Andrew Latimore, BEng University of Canberra

Technical Support

David Clark, Cert III Metal Fabrication AdvDipEng CIT
Rebecca Esmay, BSc (Sr Thesis) SUNY Purchase
Pengxiang Hu, PhD ANU & Chinese Academy of Sciences
Petr Lanc, AssocDip Bus (Applied Computing) CIT
Yile Liu, BEng MEng ANU
Hayden Miller, AdDipMechEng CIT
Yao Qian, BEng Anhui Univ, MSc Beijing Normal Univ, PhD ANU
Angus Rummery, Cert III CIT (x3)
Hideo Sasaki, AssocDip CIT (to 22/03/2024)

Geochemical Instrument Operations

Manager

Brett Knowles, BSc PhD Wollongong

Technical Support

Halimulati Ananuer (from 08/08/2024)
Hah Jung (Jay) Chin, BA MArchSci ANU
Babs Fairchild, BSc Hons (Chem) U Adel, PhD (Phys) U Melb, Cert IV TAE URMIT (from 18/03/2024)
Bowen Fang, BEng, Jilin University (JLU); Research MSc, University of Science and Technology of China (USTC) (to 31/05/2024)
Michael Förster, PhD Macquarie University
Yoann Gréau, PhD Macquarie University (from 08/08/2024)
Heze (Felix) Gong, MSc Kyoto University (Japan), MEc ANU (from 14/11/2024)
Kathryn Hayward , BCom Wollongong, MNHD MPhil PhD ANU (from 18/03/2024)
Janet Hope, BSc James Cook
Laura Rodriguez Sanz, BSc Venezuela, MEnvStudies, PhD Autonomous (Barcelona)
Yue Wang, BSc and MSc Jilin University, PhD Chinese Academy of Geological Sciences
Jiade Wu, BSc and MSc USTC, PhD ANU
Yang Wu, BEng China Univ, MSc Univ Newfoundland, PhD ANU
Sonja Zink, BSc Hanover, Diploma (MSc) Hanover

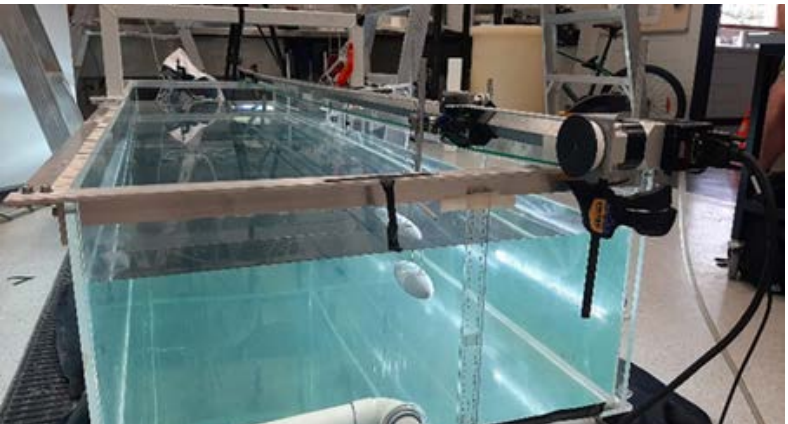
Geophysical Data & Computation

Manager	Herb McQueen, BSc Qld, MSc York, PhD ANU
Scientific Programmers	Julian Byrne, BSc (Hons) ANU, PhD Monash Jiawen He, Bachelor of IT (Hons) ANU (to 13/07/2024)
Software Engineer	Angus Gibson, BCompSci (Hons) PhD ANU Micael Oliveira, BSc PhD Coimbra (to 22/04/2024) Dale Roberts, BSc (Hons) PhD Adelaide (from 28/08/2024)
Research Officers	Juan Carlos Graciosa, BSc MSc University of San Carlos, PhD Monash Sima Mousavi, BSc MSc, Tehran University, PhD Leipzig Michelle Salmon, BSc (Hons) PhD Victoria (Wellington) (to 27/04/2024)
Technical Support	Kimberley Berends Rajesh Erigela, BTech Jawaharlal Nehru Technological University, PGDip NIELIT-India, MScEng Swinburne Filip Bozinovic, Cert 3 Electro-technology (from 12/02/2024 to 13/12/2024) Venkata Sai Jaswanth Kota, B.Tech (CSE) G.I.E.R. Rajahmundry, India, MScIT La Trobe (from 08/07/2024) Ramkumar Voore, B.Tech (CSE) LPU INDIA, MScDS La Trobe

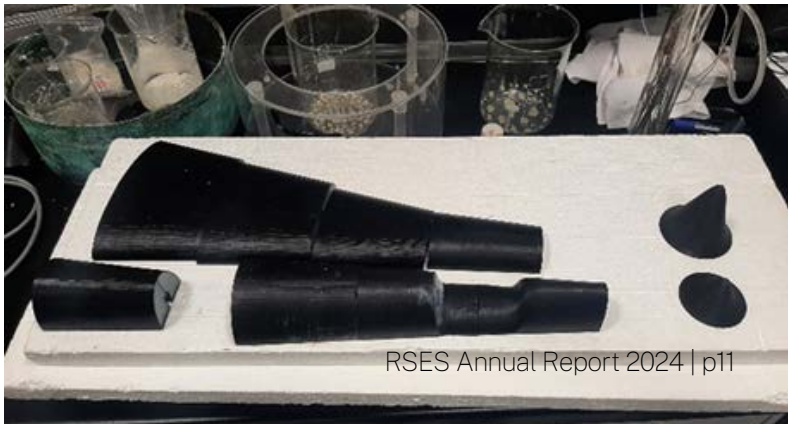
COG Support

Research Officers	Laura Velasquez Jimenez, BSc Pontificia Universidad Javeriana, MSc PhD James Cook

Laboratory Operations - Submarine experiment



Laboratory Operations - Rotating table 3-D printed profiles



IN MEMORIAM

David Green

Professor David Green passed away suddenly but peacefully on the morning of Friday, 6th September 2024, at Queenborough Rise Nursing Home.

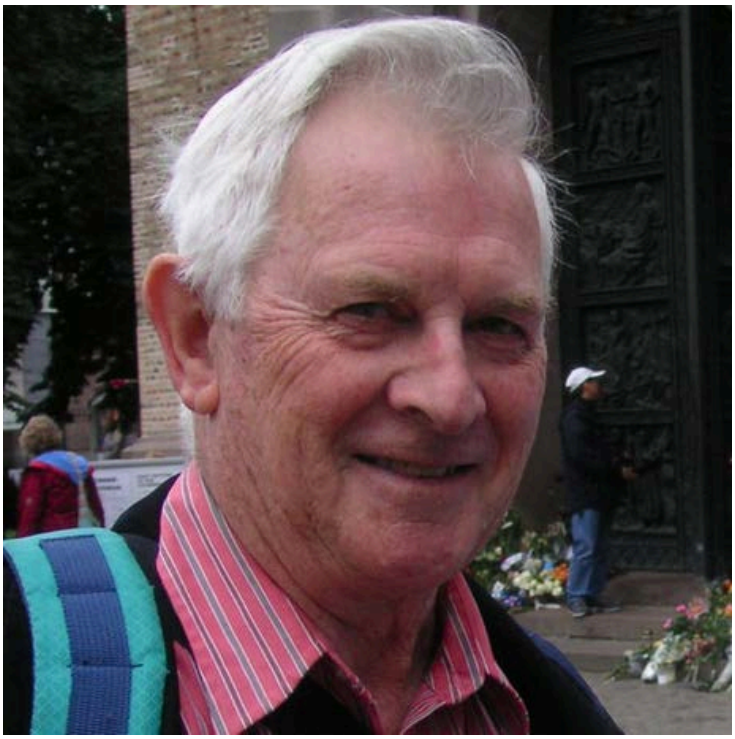
David was a distinguished scientist born in Tasmania whose remarkable academic career included significant contributions to experimental petrology and mantle geochemistry. After obtaining his PhD from Cambridge University under Professor C.E. Tilley, David led groundbreaking research at the Australian National University (ANU) and later at the University of Tasmania. His work on basalt petrogenesis and the study of lunar samples is still foundational to our understanding of geological processes.

In 2006, David was awarded Member of the Order of Australia (AM) for his service to the earth sciences, particularly petrology and geochemistry, through research, educational, and advisory roles and contributions to public policy formulation. He was also a former Director of the Research School of Earth Sciences at ANU from 1994-2001 and a Fellow of the Australian Academy of Science, among many other prestigious achievements throughout his career.

David Green was a mentor and friend to many, supervising numerous PhD students worldwide. He and his late wife, Helen, who passed away in June 2024, were known for their warmth and hospitality, welcoming students and colleagues into their home as extended family.

David is survived by his six children—Kathryn, Ronald, Elizabeth, Paul, Jeanette, and Ian—their partners, 17 grandchildren, 5 great-grandchildren, and his brother Trevor.

Rest in peace, David, and thank you for your extraordinary contributions to science and the many lives you touched throughout your remarkable life.



IN MEMORIAM

Hugh Davies

In April, Honorary Professor Hugh Davies, known as the Father of Geology in Papua New Guinea, passed away at the age of 89. He will be remembered for his invaluable contributions to the region's geology and his exceptional mentorship of numerous Papua New Guinean students. His work has greatly influenced the understanding of PNG's geology and earned him honours from both the PNG Government and Australia.

Starting as a young geologist in 1955, Professor Davies moved to PNG in 1956, where he spent decades mapping its geology and studying its volcanoes. He held key roles in the government and later at the University of Papua New Guinea, mentoring many aspiring geologists.

Outside academia, he contributed to disaster relief efforts and authored influential books, including "Earth Tok" and "Aitape Story: The Great New Guinea Tsunami of 1998."

Hugh Davies
Photo credit: Papua New Guinea Post-Courier

Nick Ware

Nick Ware

In memory of Nick Ware, from 6th February 1944 to 4th July 2024.

Nick passed away in hospital after an extended illness. Nick began working at RSES in 1969 and worked for 35 years as the electron microprobe operator, back when we had our microprobe and a constant stream of material to analyse. Among many other endeavours, he was part of the team that analysed the lunar samples, developed Synroc, and defined pyrolite, to name just a few.

A service to remember Nick will start at 12 pm on Thursday, July 18th, at Norwood Park, 65 Sandford St Mitchell, with some catering afterwards. A remote live-streaming option will be available.

In lieu of flowers please donate to either of the charities Dementia Australia or Bush Heritage Australia.

POSTGRADUATE STUDENTS

PhD Candidates

Adroli, Nurmalia Mauludin
Ahnaf, Jemi Saputra
Arcot Parthiban, Ramkumar
Baeza, Leonardo Ismael
Baile, Riley John
Baillie, Graeme
Barnes, Ashley
Bhagtani, Dhruv
Bilton, Leon Serwin
Bishop, Caleb
Bonning, Geoffrey
Carrasco Godoy, Carlos Ignacio
Chandler, Ross Berge
Chang, Haining
Cheng, Ming
Cheng, Yun-Ze
Copeland, Jackson
Costa de Lima, Thuany Patricia
De Freitas Rodrigues, Rodrigo
Di, Yankun
Dodd, Lachlan
Dong, Shixian
Egbo, Miracle Oluebube
Eggins, Sam
Ellepola, Anupiya Vidarshana
Fang, Bowen
Gao, Yajie
Goswami, Pranami
Gray, Sharon
Grun, Robin
Hsu, Shao-Chen
Hu, Jinyin
Huang, Zhijie
Hussain, Jabir
Ingles, Christopher
Jayasoma, Kushani
Jeffree, Jemima
Ji, Xuan
Jiang, Shihao
Jones, Alysha May
Kasaundhan, Hitank
Keane, Kathryn
Kinsley, Jordan Alexander
Kirby, Rachel Sarah
Krestianinov, Evgenii
Lawler, Kelly-Anne
Leong, Edgar
Leong, Kit Ieng
Leong, Timothy Sung Jue
Lewis, Hilary
Liang, Man
Liyanage, Tharika Mayomi
Loidolt, Christina
Lu, Neng
Makushkina, Anna
Martin, Stacey Servito
Medd, Oliver Merlin
Meng, Hangyu
Mina, Alana Andrea
Naina, Naina
Nakrong, Nipaporn
Nugraheni, Rosmalia Dita
Nugroho, Hendro
O'Brien, Helen Jane
Owens, Ryan John
Pandey, Abhay
Pasic, Bozana
Patkar, Aditya Dilip
Perumbodathu Sudhakran, Deepa
Pradeep, Vishnupriya
Rama, Jemima
Ray, Srijita
Roosmawati, Nova
Sajeev, Sruthy
Sakti, Artadi Pria Sakti
Sanjayan Nair Bindhu, Ammu
Scheiter, Matthias Konrad Johannes
Sebastian, Nita
Sembatya, Naiga Erios
Sombutsirinun, Phudit
Sun, Weipin
Sun, Yaojia
Sweetman, James
Turner, Ruby
Turunctur, Buse
Weber, Rikki
Wilsbacher, M Catherine
Wu, Jiade
Ye, Tao
Yeung, Ho Sonia
Yung, Claire
Zhao, Siyuan
Zhou, Jiarun
Zhao, Song

MPhil Candidates

Baile, Riley John
Bilton, Leon Serwin
Wu, Yunqi (Yoli)

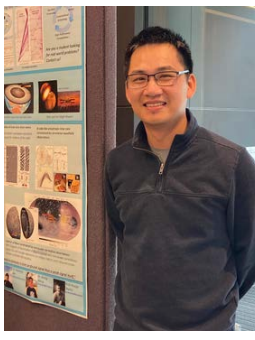
STAFF HONOURS & AWARDS

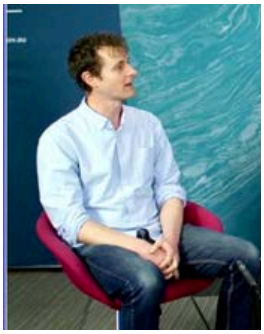
STAFF MEMBER	AWARD	AWARDING BODY
Stephen Cox	2024 Haddon Forrester King Medal	Australian Academy of Science
Georgy Falster	Superstar of STEM	Science and Technology Australia
Nerilie Abram and Hrvoje Tkalčić	Elected Fellow	Australian Academy of Science
Jochen Brocks	Geochemistry Fellow	Geochemical Society and European Association of Geochemistry
Son Pham	Zatman Lecture	SEDI (Study of the Earth's Deep Interior, a committee of IUGG)
Hrvoje Tkalčić	Honorary Doctorate	University of Zagreb
Patrick De Deckker	Medal for Excellence in Scientific Research	Royal Society of Victoria
Rebecca McGirr, Auggie Marignier, Mark Hoggard	Directors' Strategic Award recipients	RSES
Stewart Fallon and Hrvoje Tkalčić	Dean's Award for Excellence in Supervision	College of Science & Medicine (CoSM)
Emeritus Professor Ian Campbell	Norman L. Bowen Award and Lecture	AGU

Clockwise from top left: Stephen Cox, Georgy Falster, Nerilie Abram, Hrvoje Tkalčić, Jochen Brocks, Son Pham, Patrick De Deckker, Rebecca McGirr, Stewart Fallon, Mark Hoggard, Ian Campbell








THESES AND AWARDS

PhD theses completed (Supervisor in parentheses)

Song Zhao, “Australian Northwest Shelf sedimentation through the Pleistocene: orbital climate variability and sedimentation anomalies” (Katharine Grant)

Evgenii Krestianinov, “Chronology of planetesimal accretion and magmatism derived from U-Pb and Rb-Sr systematics of ungrouped achondrites” (Yuri Amelin)

Liyanage Tarika Mayomi, “Finding a family for an orphan biomarker - searching for modern, biological sources of cheilanthane molecular fossils” (Jochen Brocks)

Naina Naina, “Missing pieces in the deformation and thermal history along the Cambro-Ordovician Delamerian Orogen, South Australia” (Greg Yaxley)

Siyuan Zhao, “New Insights into the Active Tectonic Processes of the Indonesia-Australia-New Guinea Collision Zone” (Simon McClusky)

Jordan Kinsley, “Bridging the (redox) gap: reconciling biomarker and inorganic proxy records in the Middle Cambrian Currant Bush Formation” (Jochen Brocks)

Yajie Gao, “The role of amphibole in crust-mantle magma differentiation: its trace-element signatures and the halogen effect” (John Mavrogenes)

Carlos Carrasco Godoy, “Quantifying porphyry copper deposit fertility from zircon geochemistry using predictive modelling: from theory to applications” (Ian Campbell)

Nova Roosmawati, “Developing a Probability of Collapse Model for Residential Buildings in Lombok Island, Indonesia” (Meghan Miller)

Aditya Patkar, “In Situ Oxygen Isotopes and Water Concentrations: Analytical Developments and Applications to Extraterrestrial Materials” (Penny King)

Srijita Ray, “The solubility of monazite in carbonate melts at upper mantle and crustal conditions” (Greg Yaxley)

Jemima Rama, “The impact of mesoscale flows on the identification, energy partitioning and propagation of near-inertial internal waves” (Callum Shakespeare)

Matthias Scheiter, “Studies in Monte Carlo Inversion and Generative Deep Learning” (Malcolm Sambridge)

Rachel Kirby, “Metal on the surface of asteroids: geochemistry, petrogenesis and thermal history of IIE iron meteorites and their relationship to ordinary chondrites” (Penny King)

Thuany Costa de Lima, “Structure of Earth's deep interior from seismic and correlation wavefields” (Hrvoje Tkalčić)

Jiade Wu, “Unraveling the Influence of the North Atlantic Ocean on Atmospheric CO2 through Carbonate Chemistry: Insights from ODP Site 984” (Jimin Yu)

Buse Turunctur, “Studies in sparsity constrained approaches to geophysical inversion” (Malcolm Sambridge)

MPhil thesis completed (Supervisor in parentheses)

Guadalupe Alvarez Rodriguez, “A comparison of vertical land motion observed by GPS and Space Gravity” (Paul Tregoning)

Master of Earth Sciences (Advanced) (Supervisor in parentheses)

Putri Ratna, “Interplate Coupling along Java Subduction Zone based on GPS Study.” (Phil Cummins)

Minxing Fu, “Mapping the lid of magma reservoir under the Yellowstone Caldera.” (Chengxin Jiang and Louis Moresi)

Honours completed

Semester 1

Catherine Smith, "Constraining sea level magnitude during Marine Isotope Stage 3 by dating uplifted fossil corals from Kikai Island, Japan." (David Heslop and Yusuke Yokoyama)

Ingrid Smith, "Deciphering the biological relationship of copper isotopes to its biological control." (Michael Ellwood)

Thomas Halliday, "The effects of zonal openings on basin-scale temperature distribution in a rapidly rotating annulus.." (Kial Stewart)

Jessica Biddle, "Radiocarbon Dating of Historical Tsunami Deposits located at Kiri-Kiri, Sanriku Coast, Iwate Prefecture, Japan." (David Heslop and Yusuke Yokoyama)

Semester 2

Lachlan Anderson, "Genesis of the REE-Bearing Ironstones of the Yin Complex, Gascoyne Province, Western Australia." (John Mavrogenes)

Sebastian Bland, "Tricks of the Trade: Reconstruction of Indo-Pacific Trade Wind Strength through the Middle Pleistocene." (Bradley Opdyke)

Jack Dent (POTE), "Distributed Acoustic Sensing: Seismic Insight into Environmental Signals." (Meghan Miller)

Saakshi Dhakal (POTE), "Probing the Magneto-Ionic Medium of the Milky Way Using Pulsars." (Amit Seta)

Harriet Easterbrook (POTE), "Glacier-Scale Resolution of Antarctic Monthly Mass-Change from GRACE and GRACE-FO." (Rebecca McGirr)

Samuel Hill, "Characterisation of the Orion massive sulfide deposit and surrounding prospects, Wunaamin Miliwundi Orogen, Western Australia." (John Mavrogenes)

Sarah Kelley, "Electrochemical Alkalinity Production for Atmospheric Carbon Dioxide Removal." (Michael Ellwood)

Timothy Scarr (POTE), "The Use of Supervised Learning Classification Algorithms for the Spatio-Temporal Interpolation of Bushfire Progression Mapping." (Nicholas Wilson)

Moss Thompson, "Coral-ation or Cores-ation: Do Porites Corals Record Geochemical Evidence of the World’s Largest Oil Spill?" (Stewart Fallon)

Jocelin Tsang, "Exposure Models for Reliable Forecasts of Earthquake Damage: Are they good enough? Case study for Java, Indonesia." (Phil Cummins)

STUDENT HONOURS & AWARDS

Higher Degree Research

Alan and Julia Beck Scholarship	Edgar Leong and Sruthy Sajeev
Jaeger Scholarship	Ruby Turner

Undergraduate (2024 Nominees)

Ken Campbell First Year Prize	Josie Lemm
Edward Irving Prize for Geophysics	Andrea Groth
W B Clarke Second Year Prize in Earth Sciences	Jarell Cubarrubia
Irene Crespin Prize for Palaeontology	CJ Johnston
GSA Mike Rickard Third Year Prize	Dominic Gibson and Katya Orlova
Graduate Women NSW (Canberra) Prize in Climate Science	Jacinta Rees
AL Hales Scholarship	Moss Thompson
Regolith Scholarship	Sebastian Bland
Ian McDougall Scholarship	Samuel Hill

UNDERGRADUATE & POSTGRADUATE COURSES

Earth & Marine Science Programme

Course Code	Course Description	**Convenor**, Teaching staff	Number of students
Semester 1			
EMSC1006/6107	The Blue Planet: An Introduction to Earth System Science	**M.Ellwood,** N. Abram, A. Morrison, G. Falster	129
EMSC2022	Introduction to Global Geophysics	**M. Miller**, D. Heslop, V. Hui Lai, L. Moresi	23
EMSC2023	Fundamentals of Geology	**G. Yaxley**, C. Gouramanis	38
EMSC3020/6019	Geobiology & Evolution of Life on Earth	**J. Brocks**, S. Kealy, S. Haberle	38
EMSC3023/6023	Marine Biogeochemistry	**M. Ellwood**	19
EMSC3024/6024	Magmatism & Metamorphism	**A. Berry**, G. Yaxley, O. Alard	9
EMSC3032/6032	Melting Polar Ice Sheets	**P. Tregoning**	10
EMSC3033	Applied Geophysics	**D. Heslop**, R. Hackney, R. Pickle	12
EMSC3039/PHYS3039	Climate Dynamics	**C.Shakespeare, K. Stewart,** N. Maher	21
EMSC4017/8017	Research Methods and Proposal	**C. Shakespeare**, C. Gouramanis	10
EMSC4033/8033	Computational Geosciences: Problem-solving, Logical Thinking and Programming	**L. Moresi**	9
EMSC4122/8022	Analytical Techniques	**S. Fallon**	8

Earth & Marine Science Programme

Course Code	Course Description	**Convenor**, Teaching staff	Number of students
Semester 1 (continued)			
EMSC4706/8706	Natural Hazards	**P. Cummins**	7
EMSC8032	Research Proposal & Presentation	**D. Heslop**	3
Winter			
EMSC3019/6119	Coral Reef Field Studies	**S. Fallon**, M. Ellwood, G. Falster	27
Semester 2			
EMSC1008/6008	EARTH: The Chemistry and Physics of our Planet	**A. Berry, C. Eakin**	59
EMSC2021/6021	Fundamentals of Climate Science	**C. Shakespeare** A. Morrison L. Yang	48
EMSC2024/6124	Geochemical Cycles	**J. Brocks**, O. Alard, D. Jacob	15
EMSC3002	Structure and Tectonic Evolution of the Australian Plate	**L. Moresi**, C. Jiang, C. Gouramanis	17
EMSC3007/6007	Economic Geology	**J. Mavrogenes**	11
EMSC3022/6022	Planetary Science	**P. King**, O. Alard	36
EMSC3025/6025	Remote Sensing of Water Resources	**P. Tregoning**, R. McGirr	19
EMSC3034/6034	Dynamic Earth: Plates, Plumes and Mantle Convection	**R. Davies**	13
EMSC4017/8017	Research Methods and Proposal	**H. Tkalčić**	10
EMSC4123/8023	Data Analysis	**M. Sambridge**, F. Magrini	11
EMSC4712/8712	Electronics and Data Analysis	**M. Sambridge**, J. Machacek	9
EMSC8032	Research Proposal & Presentation	**D. Heslop**	2

Earth & Marine Science Programme			
Course Code	Course description	**Convenor**, teaching staff	Number of students
New Colombo Plan			
EMSC3050/8014	NCP Field trip (Japan)	**D. Heslop**, S. Mousavi	12
All Year			
EMSC3050/8014	Special Topics	**L. Moresi**, **D. Heslop**, and 10 supervisors for each Special Topic project	9
Honours and MES(A) Courses			
All Year			
EMSC4005	Earth and Marine Sciences Honours Thesis	**C. Shakespeare**	18
EMSC4008	Physics of the Earth Honours Research Project	**C. Shakespeare**	4
EMSC8030	Earth Science Research Project	**D. Heslop**	6
Physics Programme (Research School of Physics)			
Semester 2			
PHYS2201	Classical Mechanics	C. Shakespeare	44
PHYS3070	Physics of the Earth	**H. Tkalčić**, L. Moresi	1
Biological Anthropology Programme (Research School of Humanities & the Arts, School of Archaeology and Anthropology)			
ARCH3042/6542	Scientific Dating in Archaeology and Palaeoenvironmental Studies	D. Heslop	34
Environmental Science Programme (Fenner School of Environment & Society)			
ENVS3013/6303	Climate Change: Past, Present and Future	**N. Abram**	64

AUSTRALIAN & NEW ZEALAND INTERNATIONAL SCIENTIFIC DRILLING CONSORTIUM (ANZIC)

Director	Dr. Ron Hackney
Program Manager	Dr. Sarah Kachovich Kelly-Anne Lawler (Program Manager during Sarah Kachovich's maternity leave)
Members	Janelle Kennard Kelly Kenney (to 27/06/2024) Liz Arnold (from 12/11/2014)

Overview

ANZIC is the Australian & New Zealand International Scientific Drilling Consortium. ANZIC provides access to international projects harnessing state-of-the-art scientific drilling infrastructure, so scientists in our region can address fundamental questions about Earth's dynamic history, processes, structure and future. The Research School of Earth Sciences has hosted the ANZIC office for more than a decade.

In 2024, we added scientific continental drilling to our significant history of ocean drilling, signing Australia up as the newest member of the International Continental Scientific Drilling Program (ICDP). The historic agreement was signed in May, providing additional international collaborative opportunities for Australia's geoscience research community.

Our involvement in ocean drilling will continue through new partnerships which took shape this year as the current agreements of the International Ocean Discovery Program (IODP) came to an end in September.

Activity

In 2024, ANZIC facilitated the participation of five scientists and two Outreach Officers in IODP and ICDP expeditions:

- Prof. Simon George (Macquarie University) - IODP Expedition 401: Mediterranean–Atlantic Gateway Exchange
- Luca Magri (University of Tasmania) - IODP Expedition 402: Tyrrhenian Continent-Ocean Transition
- Lucinda Duxbury (University of Tasmania) - IODP Expedition 403: Eastern Fram Strait Paleo-Archive
- Assoc. Prof. Ron Hackney (Australian National University) - IODP Expedition 405: Japan Trench Tsunamigenesis
- Assoc. Prof. Will Grant (Australian National University) - Outreach Officer on IODP Expedition 405: Japan Trench Tsunamigenesis
- Lisa Smith (Curtin University) - Outreach Officer on IODP Expedition 405: Japan Trench Tsunamigenesis
- Dr Linda Armbrecht (University of Tasmania) - ICDP project SWAIS2C: Sensitivity of the West Antarctic Ice Sheet to 2°C of warming

ANZIC (continued)

Activity (continued)

We provided significant funding for post-expedition research to eight expeditioners, totalling $270,000, via our Post Drilling Analytical Funding scheme.

Twenty-one projects benefited from nearly $300,000 worth of ANZIC's Continent & Ocean Research & Education (CORE) Funding in 2024, including two from the ANU (one from RSES). This funding enables new projects which advance the field of scientific drilling, including analytical research using the vast library of cores, samples and data collected during 55 years of scientific drilling. In addition, eight postgraduate students, including two from RSES received $46,000 funding in our Marine Geoscience Postgrad Project Grants.

We continued to connect students and ECRs to the world of scientific drilling by:

- Facilitating the participation of five students and three mentors in IODP's two weeks of science at sea with the JR Academy which focused on cross-cultural thinking with Indigenous students from around the world
- Hosting two Marine Geoscience Masterclasses (nearly 50 students)
- Funding attendance of nine students to international IODP summer schools

Staff News

ANZIC Program Manager, Dr Sarah Kachovich, took maternity leave this year and we were lucky enough to have Kelly-Anne Lawler step into her shoes. After farewelling our administrator, Kelly Kenney, mid-year, we were pleased to welcome Liz Arnold to the team in November.

Grants

AuScope Opportunity Fund ($80,000): Land-to-Sea-2: sub-ice sampling to constrain West Antarctic Ice Sheet stability and linked coastal zone impacts (Hackney and Kachovich)

Honours/Awards

Sarah Kachovich was recognised for completing the two-year Superstars of STEM development program run by Science and Technology Australia.

Emeritus, Honorary Staff and Visitors

We hosted Dr Stuart Henrys from GeoDiscoveryNZ for a timely and much needed two-month visit in November and December.

ANZIC (continued)

Extended Travel and Outcomes

- Hackney: Interim Mission Specific Platform Facility Board Meeting and Science Planning Workshop, International Ocean Drilling Programme (14–22 March, Japan) - ensured Australian and New Zealand interests were represented at planning meetings for a new scientific ocean drilling initiative led by Europe and Japan and commencing in 2025.
- Hackney: *JOIDES Resolution* Facility Board meeting (8–10 May, Hawaii) - final annual meeting of the board overseeing operations of the now-retired US scientific drilling vessel, JOIDES Resolution. Participation ensured awareness of ANZIC's ongoing funding and interest in future collaboration with the US in scientific ocean drilling.
- Hackney, Alard, Kachovich, Kenney, Lawler, Kennard: ANZIC CORE Legacy Forum "Celebrating Oceanic Rediscoveries & Exploration" of legacy scientific ocean drilling collections (30 May, Melbourne) - opportunity for the ANZIC community to network around presentations and discussions on the scientific impact of ANZIC IODP Legacy Analytical Funding ($2 million granted to over 100 projects over 12years).
- Hackney (with Rawling, AuScope): Annual governance meetings of the International Continental Scientific Drilling Consortium (3–8 June, India) - Australian representation as a new member of this long-running international collaboration for scientific drilling on the continents.
- Hackney, Kenney, Brocks, Haberle: ANZIC Proposal Planning Workshop (13–14 June, Adelaide) – community discussion of strategies to maximise benefits from Australia's new membership in the International Continental Scientific Drilling Program.
- Hackney: Annual Meeting of the Asia Oceania Geosciences Society (24–28 June, South Korea) - new contacts with potential ANZIC partners in the Asia Oceania region.
- Hackney: Final Annual Forum and Program Member Office meeting of the IODP (2–6 September, Japan) - Australia and New Zealand recognised as key contributors to IODP over the last decade and as valued partner in post-IODP international scientific drilling initiatives.
- Hackney: IODP Expedition 405: Tracking Tsunamigenic Slip Across the Japan Trench (29 October – 20 December, east coast of Japan) - ANU participation in a high profile international scientific drilling project.

Photo: Professor Ron Hackney. Photo: Jamie Kidston/ANU

Outreach Activities & Service Roles External to ANU

ANZIC maintained a high level of engagement with our wide-reaching member community through:

- running the CORE Legacy Forum for scientists from across Australia and New Zealand to celebrate and learn what has been discovered by exploring – and re-exploring – sub-seafloor cores and samples, with the help of our legacy funding!
- outreach activities during the year, including participating in Science Olympiads, Science Meets Parliament, the Queensland Virtual STEM Academy and the ANU Research Infrastructure Expo
- extensive media coverage for IODP Expedition 405, and participation by Ron Hackney and Will Grant from ANU (ANU media estimate the potential audience as 5 million people).
- keeping researchers at member institutions, including the ANU, up to date with upcoming opportunities in international scientific drilling through our monthly ANZIC email Bulletin and busy social media channels.

CLIMATE & OCEAN GEOSCIENCE

Area Head Prof. Paul Tregoning

Academic members Prof. Nerilie Abram, Dr. Sebastien Allgeyer, Prof. Leanne Armand, Dr. Pamela Barrett, Dr. Navid Constantinou, Dr. Yuhao Dai, Prof. Stephen Eggins, Dr Lizzie Ellison, Prof. Michael Ellwood, Prof. Stewart Fallon, Dr. Georgy Falster, Dr. Chris Gouramanis, Dr. Katharine Grant, Emeritus Prof. Ross Griffiths, Dr. David Heslop, Dr. Chiara Holgate, Dr. Wilma Huneke, Dr. Laura Jimenez, Dr. Andrew Kiss, Dr. Jia Liu, Dr. Simon McClusky, Dr. Rebecca McGirr, Dr. Herb McQueen, Dr. Nicola Maher, Dr Louise Maubant, Dr. Adele Morrison, Dr. Bradley Opdyke, Emeritus Prof. Brad Pillans, Dr. Anthony Purcell, Dr. Mahdiyeh Razeghi, Prof. Andrew P Roberts, Prof. Eelco Rohling, Dr. Callum Shakespeare, Dr. Kial Stewart, Dr. Rachel Wood, Dr. Nicky Wright, Dr. Luwei Yang, Prof. Jimin Yu, Dr. Xiang Zhao

Overview

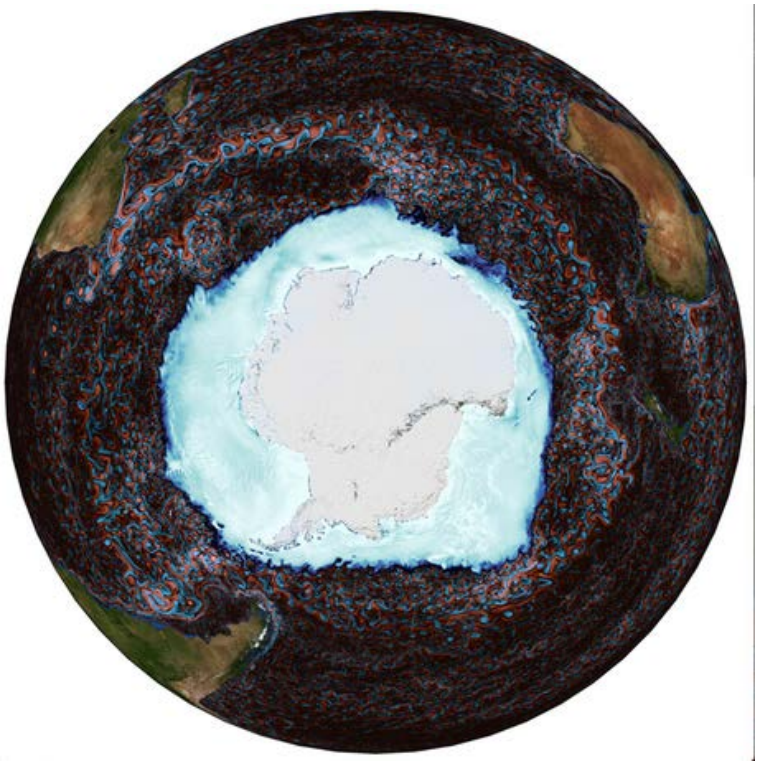
Climate and Ocean Geoscience (COG) had a busy and successful year during 2024. Two academics were awarded ARC Discovery Early Career Awards (Dr Georgy Falster, Dr Siavash Ghelichkhan) and Dr Adele Morrison was successful with an ARC Discovery Project grant. The Centre of Excellence for the Weather of the 21st Century commenced, with Professors Nerilie Abram, Andy Hogg and Dr Nicola Maher heading the ANU node of the centre. Many staff and students of COG attended the Australian Antarctic Research Conference in November 2024 as part of ongoing research funded by the Australian Centre of Excellence in Antarctic Research (ACEAS). Research achievements during 2024 included articles published on Southern Ocean dynamics, tracking of the nothern transport of Antarctic bottom water using satellites, quantification of the contributions of continents to changes in regional and global sea levels, quantification of climate sensitivities to CO_2 levels, analysis of lake sediment cores from Western Australia, assessment of the 2017-2019 drought in Australia, the emergence of tipping points in Antarctic climate records, the commissioning of the first southern hemisphere laser ablation stable isotope instrument and research on local CO_2 accounting using radiocarbon. These examples highlight the breadth of research undertaken by COG researchers during 2024.

Ice drilling near Denman Glacier in East Antarctica recovered samples that will be used to reconstruct the climate history of this region over the last 500 years (image: Nerilie Abram).

Climate & Ocean Geoscience (continued)

Research Highlights

In 2024 the Climate and Fluid Physics group continued our long-running research into ocean, atmosphere and climate dynamics. Multiple group members were involved in a Reviews of Geophysics article "Closing the loops on Southern Ocean dynamics". The publication of this review article, along with an associated The Conversation piece, was the culmination of multiple years of effort which started with an Elizabeth and Frederick White Research conference on the same topic, held at the ANU back in 2022. The review highlights our knowledge of the critical Southern Ocean region in the context of current rapid ocean and climate change, and priorities for future research in this field. One such priority identified was the development of new methodologies to better utilise the (very limited) existing observations of the region. Addressing this priority, PhD student Jemma Jeffree published a paper in the Journal of Geophysical Research: Oceans based on her Honours thesis which developed a new method of using GRACE satellite observations to measure the northward transport of the dense 'bottom waters' formed around the Antarctic continent. The new method uncovers significant interannual variations in bottom water transport, emphasising the need for a longer time series to detect a trend due to climate change. In other Southern Ocean-related work, PhD student Jim Sweetman led a study measuring the melting rate of icebergs (which account for half of the annual mass loss from Antarctica) in the Climate and Fluid Physics Laboratory. His results, published in the Journal of Fluid Mechanics, provide the data necessary for the improved representation of iceberg melting in climate system models, as well as explaining some of the curious variations in ice morphology seen in the field. Beyond the Southern Ocean, the Climate and Fluid Physics group also made significant contributions in atmosphere and climate dynamics in 2024. Nicola Maher published a new large model ensemble data set and diagnostics package in Geoscientific Model Development. This work provides a critical tool for climate scientists to assess how climate variability (such as ENSO) will change as the climate warms, using the latest models and analysis methodologies. Callum Shakespeare and Michael Roderick also published a paper in the Journal of Advances in Modeling Earth Systems resolving a long-standing climate conundrum: why the relative humidity over the oceans is always around 80%, independent of location or global warming level. The new study shows that this behaviour is due to the universal geometry of the vertical flows of air directly above the ocean surface that transport moisture higher into the atmosphere.

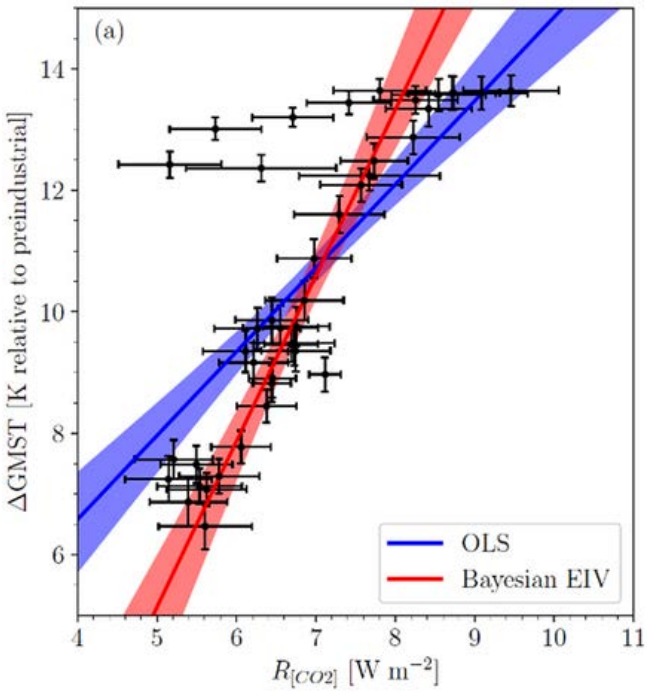


The cover image of the September 2024 issue of Reviews of Geophysics highlighting the review article on Southern Ocean Dynamics co-led by COG researchers (Bennetts, Shakespeare et al., 2024). The image shows the near-surface vorticity field (red/blue swirls indicate anticlockwise/clockwise rotating currents) and sea ice concentration at its winter maximum extent (bright white surrounding the Antarctic continent) in a snapshot from the ACCESS-OM2-01 coupled ocean and sea ice model at 0.1° resolution.

Image produced by Adele Morrison and Andrew Kiss

Climate & Ocean Geoscience (continued)

In 2024, the Palaeo- and Environmental Magnetism research group published a paper on Bayesian errors-in-variables estimation of specific climate sensitivity. As atmospheric CO_2 increases due to human activities, the Earth will warm. But how much warming can be expected? Climate sensitivity describes how much global average surface temperature will warm with a given increase in atmospheric CO_2. While this is a simple definition, estimating climate sensitivity is difficult because Earth's climate system is complex with several poorly understood interacting parts. One approach to estimating climate sensitivity is to quantify how Earth's climate changed because of variations in atmospheric CO_2 through geological time. This information is invaluable, but it is patchy and has large uncertainties that make estimating climate sensitivity challenging. Existing statistical techniques may underestimate climate sensitivity and, thus, underestimate future warming. We developed an alternative Bayesian approach to determining climate sensitivity that overcomes the underestimation problem and demonstrated its performance using geological data from the Eocene epoch. This work was published in Paleoceanography and Paleoclimatology (doi:10.1029/2024PA004880) with the figure below used as the cover image.



Estimation of climate sensitivity based on Eocene atmospheric CO_2 radiative forcing and global mean surface temperature (GMST). Our published Bayesian errors-in-variables (EIV) approach overcomes the underestimation bias used in more traditional approaches such as ordinary least squares (OLS).

In 2024, the Palaeo- and Environmental Magnetism research group pursued a wide range of research topics. Work continued on palaeomagnetic analysis of lake sediment cores from Western Australia as part of ARC Discovery Project DP220102167. This research is part of a wider collaboration with the University of Melbourne to reconstruct Australian palaeosecular variation of Earth's magnetic field during the Holocene. A new collaboration was formed with researchers investigating marine sediments as part of the CANYONS voyage to Cape Darnley region of East Antarctica. This work is part of the Australian Centre for Excellence in Antarctic Science and has involved the creation of palaeomagnetic stratigraphies to provide absolute age control and core-to-core correlations. Our long running collaboration with Prof. Yusuke Yokoyama from the Atmosphere and Ocean Research Institute, The University of Tokyo, continued in 2024. Yusuke visited the Palaeo- and Environmental Magnetism as a Partner Investigator in the Australian Centre for Excellence in Antarctic Science. Together we are investigating rapid changes in the geomagnetic field and how such changes control Earth's vulnerability to extreme space radiation. The Palaeo- and Environmental Magnetism group also placed a strong focus on palaeoclimatic reconstruction. This involved numerous collaborative publications focussed on the development of new proxy-records to reconstruct ancient hydroclimates, quantify sediment depositional processes on along the coasts of East Antarctica and Northwest Australia, and estimation of long-term climate sensitivity.

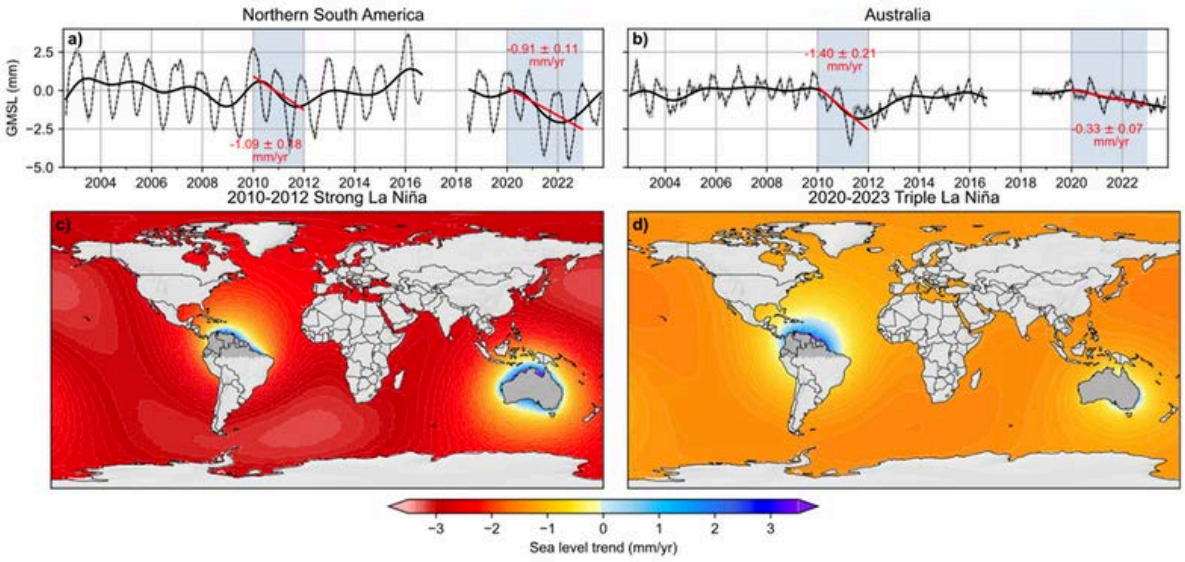
Climate & Ocean Geoscience (continued)

Research into past and future climates in 2024, under the leadership of Nerilie Abram, was supported by the Centre of Excellence for Climate Extremes, the Australian Centre for Excellence in Antarctic Science and the newly established Centre of Excellence for the Weather of the 21st Century. We welcomed Lucía Gamarra Cuba to the group as our Government and Industry Liaison for 21st Century Weather, and Sarah Andrew as our node administrator. At the start of 2025, Dr Chiara Holgate will take up her role as a senior research fellow in Weather Resources for the Centre. A group highlight this year was Dr Georgy Falster's award of an ARC DECRA Fellowship, which she will be commencing at the University of Adelaide in early 2025. In the lab we have focused on developing our capabilities for the handling and analysis of Antarctic ice samples thanks to the efforts of Laura Rodriguez Sanz and Laura Velasquez Jimenez, and honours student Dine Yoo has been developing the water isotope record for the 30 metres of ice chips collected at Mill Island in the 2023/24 Denman Terrestrial Campaign. PhD student Kelly Lawler is making good progress towards completing her PhD on Southern Ocean radiolarians in 2025, and presented her research at the Australian Antarctic Research Conference in November. At this conference Nerilie Abram also gave a talk on the review that she has been leading on Emerging Tipping Points in Antarctica. During 2024 our group also made some notable advances in understanding Australian droughts, including characterising the 2017-2019 Tinderbox Drought (Devanand et al., 2024, Science Advances), demonstrating that the intensity of this 3-year drought was beyond what could have been anticipated based on historical variability of Australian rainfall (Falster et al., 2024, Weather and Climate Extremes), and reviewing what is known about the physical mechanisms of drought in Australia (Holgate et al, submitted, Communications Earth and Environment). Towards the end of 2024 our group also received funding from Minderoo Foundation as part of a new research program into predicting Lethal Humidity with the University of New South Wales and University of Oxford. In 2025 this project will see our group build on research aimed at quantifying climate accountability.

The Radiocarbon Laboratory led by Stewart Fallon has expanded collaborations with the Queensland Police and NSW Police to age unidentified human remains. The lab commissioned a new High Temperature Elemental Analyzer for the analysis of Oxygen isotopes in organic material for isotope geolocation. The group has also developed and commissioned the first southern hemisphere laser ablation stable isotope instrument, primarily used to reconstruct climate from trees. The group continued its research on local CO_2 accounting using radiocarbon to trace fossil fuel emissions. PhD students Bowen Fang and Tao Ye continued to explore coral and giant clam records for past climate. PhD student Oliver Medd is working on examining environmental links to tree death in the Snowy Mountains. PhD student Deepa Sud has developed a CO2 air sampling material based on amine to capture CO_2 to determine the fossil fuel component.

Dr Louise Maubant joined the Geodesy Group as an IWF postdoc and has led the research on using SWOT (Surface Water and Ocean Topography) satellite data to quantify changes in water elevation in Australian water bodies. The research is published in Geophysical Research Letters. Dr Sia Ghelichkhan was on paternity leave in the latter half of 2024; however, a $500K contract was signed with SmartSat CRC to fund research into developing groundwater modelling capability, for commencement in Sia's group in 2025. Ongoing funding from Geoscience Australia has seen the continuation of GRACE Follow-On data processing, leading to a Geophysical Research Letters publication by Rebecca McGirr on the effects of changes in continental hydrology on global and regional sea level. We found that significant changes in continental water storage, for example during periods of La Nina, can change sea levels by several millimetres due to direct gravitational attraction and gravitational rotation effect. Several academics and students attended the Australian Antarctic Research Conference in Hobart in November, with poster presentations by Kit Leong and Rebecca McGirr. Paul Tregoning attended the GRACE Follow-On Science Team meeting in Potsdam in October and presented preliminary results of the ANU Release-03 temporal gravity fields.

Climate & Ocean Geoscience (continued)



Total water storage change (in terms of equivalent change in global mean sea level) for changes in continental water in northern South America and Australia during the 2010-2012 and 2020-2023 La Nina periods (McGirr et al., Geophysical Research Letters, 2024).

Staff News

- Nerilie Abram elected as a Fellow of the Australian Academy of Science
- Nerilie Abram and Nicola Maher selected as Australian representatives for the scoping of the IPCC 7th Assessment Report.
- Chiara Holgate graduated from the 2023-24 Superstars of STEM program, and Georgy Falster was selected for the 2025-26 program.
- Navid Constantinou completed his DECRA Fellowship and moved to a continuing Senior Lecturer position at the University of Melbourne
- Promotions:
  - Dr Rebecca McGirr was promoted to the ANU academic level B.

New Appointments

- Dr Chiara Holgate: 21st Century Weather, Senior Research Fellow in Weather Resources (4-year appointment)
- Lucía Gamarra Cuba: 21st Century Weather, Government and Industry Liaison (3-year appointment)
- Dr Sarah Andrew: 21st Century Weather, node administrator
- Dr Louise Maubant: Institute for Water Futures, 2-year postdoc appointment
- Dr Lizzie Ellison was appointed to a 2-year position to work on the ocean biogeochemistry component of the ACCESS climate model as part of the National Environmental Science Program.

Grants

- Sia Ghelichkhan, ARC DECRA Fellowship ($475K)
- Adele Morrison, Matt England, Madi Rosevear, ARC Discovery ($540K)
- Georgy Falster, ARC DECRA Fellowship ($438K)
- Nerilie Abram awarded funding from Minderoo Foundation
- Commencement of the new ARC Centre for 21st Century Weather, with Chief Investigators Abram, Maher and Hogg

Climate & Ocean Geoscience (continued)

Student News

Several new PhD students commenced in COG during 2024:

- Anupiya Ellepola (supervised by Callum Shakespeare and Luwei Yang)
- Pranami Goswani is undertaking a dual Ph.D. between ANU and IGGCAS, Beijing. Pranami arrived at ANU this year and will continue her research into magnetotatic bacteria working with Andrew Roberts.
- Deepa Sud (supervised by Stewart Fallon) commenced and will be studying carbon capture and measuring fossil fuel CO2 emissions using radiocarbon.

PhD Completions

- Sarah Jackson (supervised by Nerilie Abram) was awarded her PhD for research into “Climate variability in coastal East Antarctica over the past millennia: insights from the Mount Brown South ice core water isotope record”. Sarah is now working in a postdoctoral position at the University of Bern.
- Dhruv Bhagtani (supervised by Andy Hogg) submitted his PhD thesis on “Ocean Gyres Driven By Wind Stress and Surface Buoyancy Forcing” and has moved to a postdoctoral position at Princeton.
- Evelyn Baker completed her Ph.D. at Imperial College London with Dave Heslop as her second supervisor. She is now a postdoctoral researcher at the University of Oxford.

Master of Philosophy Completions

- Guadalupe Alvarez (supervised by Paul Tregoning) completed her Masters in the Geodesy Group, "A comparison of vertical land motion observed by GPS and Space Gravity”

Honours Completions

- Harriet Easterbrook (supervised by Rebecca McGirr) completed her Honours on “Satellite remote sensing of snow depth on Antarctic sea ice: an inter-method comparison”.
- Thomas Halliday (supervised by Kial Stewart) completed his Honours on “The effects of zonal openings on basin-scale temperature distribution in a rapidly rotating annulus”.
- Catherine Smith completed her Honours project “Constraining sea level magnitude during Marine Isotope Stage 3 by dating uplifted fossil corals from Kikai Island, Japan” supervised by Dave Heslop from RSES and Yusuke Yokoyama from the University of Tokyo. Catherine will commence her PhD at ANU in 2025.
- Jess Biddle completed her Honours project “Radiocarbon Dating of Historical Tsunami Deposits located at Kiri-Kiri, Sanriku Coast, Iwate Prefecture, Japan” supervised by Dave Heslop from RSES and Yusuke Yokoyama from the University of Tokyo. Jess will commence her PhD at ANU in 2025.
- Sebastian Bland completed his Honours project “Trick of the Trade: Reconstruction of Pacific Ocean Trade Wind Energy through the Middle Pleistocene” with Brad Opdyke and Dave Heslop as his supervisors. Sebastian will commence his PhD in the U.K. in 2025.
- Moss Thompson (supervised by Stewart Fallon) completed his Honours project “Coral-ation or Cores-ation" Do Porites Coral Record Geochemical Evidence of the World’s largest Oil Spill”.

Emeritus, Honorary Staff and Visitors

- Michael Roderick remains an active Emeritus staff member in Climate and Fluid Physics.
- Prof. Brian Arbic (University of Michigan) joined the Climate and Fluid Physics group on sabbatical and will remain with us until mid-2025.

GEOCHEMISTRY

Area Head

Prof. Greg Yaxley (to 01/04/2024)
Prof. Andrew Berry (from 01/04/2024)

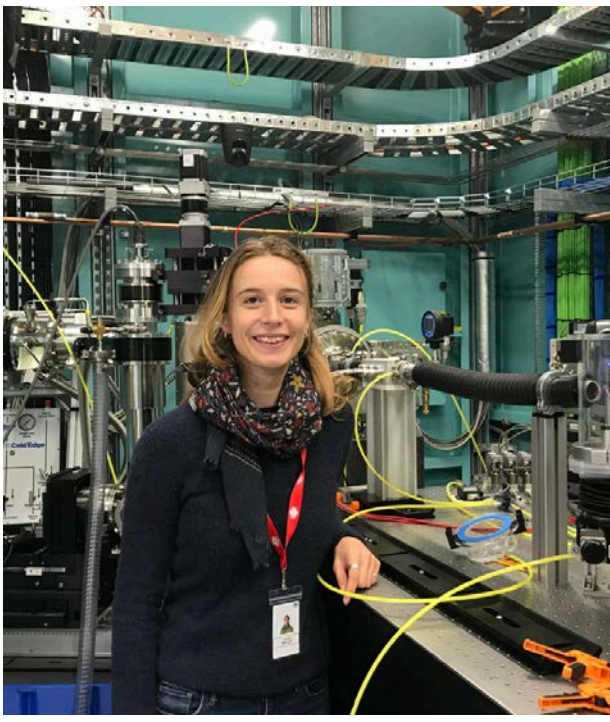
Academic Members

Dr. Olivier Alard, Dr. Yuri Amelin, Dr. Michael Anenburg, Prof. Andrew Berry, Prof. Jochen J. Brocks, Dr. Antony Burnham, Emeritus Prof. Ian Campbell, Dr. Ana Casas Ramos, Dr. Joëlle D'Andres, Dr. Marnie Forster, Prof. Trevor Ireland, Prof. Dorrit Jacob, Prof. Penny King, Prof. John Mavrogenes, Dr. Seann McKibbin, Dr. Laura Miller, Dr. Laura M. Otter, Dr. Zachary Sudholz, Dr. Qing Zhang, Emeritus Prof. Richard Arculus, Emeritus Prof. Vickie C. Bennett, Emeritus Prof. Ian Williams, Honorary Prof. Lesley Wyborn

The Geochemistry Group continued research in critical minerals and the resources needed for the green energy transition. 2024 saw the launch of the ARC ITTC in Critical Resources for the Future, of which Berry, Yaxley and Mavrogenes are Chief Investigators.The Centre will receive ~$10 million ($5 million ARC and $5 million Partner Organisations) over 5 years. The Rio Tinto Centre for Future Materials was also launched in 2024 and Berry received funding for a project on extracting copper from magmatic brines. We also received critical minerals funding from the ARC (Discovery Project on niobium, Yaxley, and Linkage Project with GSWA, CSIRO, Dreadnought Resources, WA1 Resources and Encounter Resources, Mavrogenes), CSIRO for an IPhD with Lynas (Yaxley), Geoscience Australia for research on critical mineral by-products of Zn deposits (Mavrogenes), MinEx CRC for "Bar-Coding Metallogensis" in the Australian continental crust (Forster), MMG Limited for garnet as a prospecting tool (Mavrogenes), the Geological Survey of Queensland for "Geochronology 3.0" (Alard), Ionic Rare Earths for work on REE clays (Mavrogenes), and Northern Energy and Mining Inc to study iron-sulphur-copper-gold deposits (Mavrogenes).

In other research areas we had ARC DP funded on the lithosphere (Yaxley and Alard), mass extinctions using molecular fossils (Brocks), and characterising and conserving rock art (King). We also received a grant from the Australian Pacific Science Foundation (APSF) on "reading the shark barcode" (Alard). Work continued on using the high-pressure capabilities of the Experimental Petrology Laboratory to synthesis novel materials, in collaboration with the University of Sydney and UNSW (Berry). Insights from fundamental geochemistry were used to develop a novel extraction technology for rare earth elements, which was in patented in Australia, the USA, China, South Africa, India, Madagascar, and Malaysia (Berry). In outreach and education, Mavrogenes and D'Andres contributed to a short course "Critical Minerals: Science, Statecraft and Society" hosted by the National Security College at ANU, and King was involved with organising a workshop on hyperspectral mineralogy at ANU in collaboration with CSIRO and GA. Researchers in the group continued to use national and international synchrotron facilities with an experiment undertaken at Diamond Light Source in the UK and multiple experiments at the Australian Synchrotron.

ARC Postdoctoral Fellow Laura Miller at the MEX1 beamline of the Australian Synchrotron



Geochemistry (continued)

Congratulations to Jochen Brocks who was elected a Geochemistry Fellow by the Geochemical Society and European Association of Geochemistry and who also had a fossil fish named after him (Ferruaspis brocksi)! Michael Anenburg was awarded an ARC Early Career Industry Fellowship and Catharina Heckel a Humboldt Feodor Lynen Fellowship.

RSES now hosts a node of the AuScope Geochemistry Network (Alard). The node is supported by two instrument specialists (Gréau and Halimulati) and funding for maintenance. A Nu-MC-ICP-MS was also transferred to ANU from Macquarie University and upgraded thanks to a grant from NCRIS (Alard). In other laboratory news new Q3 ICPMS (A8900) and Q-ICPMS (A7900) instruments were installed and commissioned and two laser ablation systems were upgraded. A LIBS was purchased and commissioning is in progress. A new visible-near IR-mid IR spectrometer with transmission, reflectance (including attenuated total reflection) and microscope options was also installed. In the newly renamed NanoPhase Facility a new laser was commissioned for use with the Photo-induced Force Microscope. The SHRIMP area benefited from a new sample-preparation laboratory, the recruitment of Jiade Wu and a long term visit by Richard Stern from the University of Alberta.

Staff News

- Dr. Ana Casas Ramos completed her postdoctoral fellowship at RSES and moved to a position in the Research School of Physics.
- Sonja Zink finished working in the Florey Building and moved to a position with Dr. Olivier Alard.
- Dr. Kathryn Hayward started working in the infrared and synthesis labs in the Florey Building two days per week.
- Penny King completed her term as the College of Science Associate Dean (Research) on March 1, 2024.
- Promotions:
  - Laura Otter was promoted to ANU academic level B.
  - Olivier Alard was promoted to Level E (Full Professor).

External Events

- Cathy Zhang, James Ruse Agricultural High School, was mentored by Penny King for an HSC Science Extension project on “Box modelling the transfer of sulfur on Mars using Earth as a geochemical analogue”. Cathy won 1st place in the Yr 11-12 Earth and Environmental Science Investigation Category for the 2024 Science Teachers Association of NSW Young Scientist Awards! She also was nominated to represent Parramatta for the ASTA i-Cubed awards a national level competition.
- Penny King gave one of six invited talks at the NASA MEPAG/ExMAG Workshop “Connecting Community Scientific Hypotheses to Mars Sample Science” on “Water on Mars”
- Penny King gave an invited talk at the “Interstellar Frontiers: Bridging SETI, astrobiology and the Square Kilometre Array” conference on “Advancing a Systems Framework for Linking Astronomy, Astrobiology and Geology”
- George Gibson attended a 3-day industry workshop in Townsville in April on mineralisation in the Mount Isa Inlier and presented details of current research on the relationship between ore formation and basin inversion. Attendance was by invitation only.
- Prof. Vickie Bennett was the organiser of a session on “Early Earth Processes: Crust-Mantle evolution in the Hadean and Archean Eons” at the 2024 Goldschmidt Conference, Chicago, USA.
  - She presented a talk entitled: Early Earth evolution characterized by extensive and persistent Hadean-formed mantle domains as recorded in isotopic (^{142}Nd,^{176}Hf, ^{143}Nd) patterns of Meso-Eoarchean (2.8-3.9 Ga) terranes, SW Greenland.
    - https://conf.goldschmidt.info/goldschmidt/2024/meetingapp.cgi/Paper/23825

GEOPHYSICS

Area Head Prof. Hrvoje Tkalčić

Academic Members Prof. Rhodri Davies, Dr. Thomas Duvernay, Dr. Caroline M. Eakin, Dr. Miriam Gauntlett, Dr. Sia Ghelichkhan, Dr. Mark Hoggard, Dr. Chengxin Jiang, Dr. Michael Koch, Dr. Voon Hui Lai, Dr. Xiaolong Ma, Dr. Fabrizio Magrini, Dr. Auggie Marignier, Dr Konstantinos Michailos, Prof. Meghan S. Miller, Prof. Louis Moresi, Dr. Liam Morrow, Dr. Thanh-Son Pham, Dr. Zhi Wei, Dr. Robert Pickle, Prof. Malcolm Sambridge, Dr Will Scott, Dr. Ping Zhang, Adj. Prof. Phil Cummins, Em. Prof. Steve Cox, Em. Prof. Ian Jackson, Em. Prof. Brian Kennett

Fieldwork Highlights

2024 was a busy year for field-based research in the Geophysics area. The fieldwork was conducted by many members of the Geophysics area, including M.S. Miller, C. Eakin, V-H. Lai, P. Zhang, R. Pickle, S. Mousavi, C. Yiang, M. Hoggard, A. Marignier, M. Gauntlett, K. Michaelos, J. Dent, R. Erigela, F. Bozinovic and others.

Early in the year, fieldwork was conducted for a CRC project titled "Accelerating exploration and extraction of renewable natural hydrogen," led by Eakin, L. Moresi, C. Jiang, and M.S. Miller at RSES. As part of this project, two seismic nodal arrays were deployed on the eastern Eyre Peninsula in South Australia, comprising 150 instruments deployed in March and another 100 instruments in November. The data is used to construct 3D seismic velocity models of the sub-surface to assess potential source mechanisms, migration pathways, and accumulation traps for natural hydrogen. In addition to this South Australian fieldwork, two service runs of the broadband deployment SNAKEY (Seismic Network Around Kangaroo Eyre Yorke) were completed. This deployment is anticipated to continue into 2025.

M.S. Miller, V-H. Lai, and colleagues also started a new DAS field experiment in Milford Sound, New Zealand, tracking avalanches, rock falls, and earthquakes in collaboration with the Victoria University of Wellington.

In 2024, R. Pickle, P. Zhang, and M. Miller completed the ARC Linkage project “SWAN” fieldwork in Western Australia with partners GSWA and GA.

Research Activity Highlights

One of the major projects was the conclusion of an initial study on developing Trans-Conceptual inversion algorithms, a new paradigm for geosciences.

This year marked four new distributed acoustic sensing (DAS) publications based on data collected in New Zealand on the Alpine Fault and their first urban experiment in Melbourne.

A new major project began in conjunction with the Geological Survey of Western Australia on the WA-Array, with various analyses undertaken on the structure, seismicity and seismic anisotropy for phase one of the continental array, covering south-western WA and the Yilgarn Craton.

We further demonstrate the key role that Earth's deep interior plays in shaping the surface of our planet, vital for our ongoing efforts to reconstruct the temporal evolution of dynamic topography, and its role in controlling the evolution of surface environments.

Geophysics (continued)

We showed that the Earth's inner core could be in a state of slow thermal convection despite being solid and that it is impossible to rule out thermal convection as a dynamic state of the inner core. We also showed the existence of a ring-like structure or torus of low seismic wave velocity in the upper parts of the liquid outer core parallel to the equatorial plane.

We demonstrated the existence of a significant vertical upward force during the eruption of the Tonga underwater volcano in 2022. We showed that the underwater explosion raised a significant volume of ocean water.

Apart from these research highlights, a major focus was the development of computational infrastructure for adjoint-based inverse geosciences, through the G-ADOPT project (https://gadopt.org/).

During the year the Common Framework for Inference project (CoFI) was further developed, with new releases to the community. This is an open source software project enabling access to advanced inference software across the physical sciences. It is an initiative of InLab (The Inference Lab. http://inlab.au/) which is run out of the group.

Observational Seismology

2024 was a busy year for field-based research in the group with several new collaborations and projects taking off.

The first of these was for our CRC-Project on "Accelerating exploration and extraction of renewable natural hydrogen" led by Eakin, L. Moresi, C. Jiang and M.S. Miller at RSES. This represented a new research direction for RSES into the nascent field of natural hydrogen exploration, working alongside industry partner H2EX, and colleagues in magnetotellurics at the University of Adelaide. As part of this project two seismic nodal arrays were deployed on the eastern Eyre Peninsula in South Australia comprising 150 instruments deployed in March and another 100 instruments in November. Many staff members from the geophysics area contributed to the substantial fieldwork effort including Robert Pickle, Filip Bozinovic, Sima Mousavi, Jack Dent, Konstantinos Michaelos and Miriam Gauntlett. These arrays recorded the ambient noise wave-field over the course of their 30-day deployment. The data is being used to construct 3D seismic velocity models of the sub-surface to assess potential source mechanisms, migration pathways and accumulation traps for natural hydrogen.

In addition to this South Australian fieldwork, two service runs of the broadband deployment SNAKEY (Seismic Network Around Kangaroo Eyre Yorke) were completed. These sites lie over the southeastern margin of the Gawler Craton and fill a gap in the seismic coverage of Australia. This deployment is anticipated to continue into 2025.

In 2024 we also ramped up our research activities in Western Australia as part of our new collaboration with the Geological Survey of Western Australia on the WA-Array. This initiative aims to cover the entire state of Western Australia at 40 km station spacing over the next decade. In 2024 the first phase of data collection was completed covering south-western WA and the Yilgarn Craton. Using this valuable new dataset Nitarani Bishoyi (FRT scholar) and Miriam Gauntlett (new postdoctoral scholar arrival) studied the seismic anisotropy of this ancient and cratonic region of Australia. The results are to be submitted for publication in early 2025.

Lastly, our project with Geoscience Australia, to characterise the sedimentary cover across Australia with passive seismic methods, wrapped up with a publication in Geophysical Journal International led by postdoctoral scholar Auggie Marignier. During 2024 we further expanded this method in application to the United States. A follow up manuscript has been submitted for publication.

Geophysics - Observational Seismology (continued)

Staff news

- Dr Tom Merry – departed to join University of Cambridge as a postdoctoral fellow.
- Dr Miriam Gauntlett – joined in August as a postdoctoral fellow.
- Promotions:
  - Dr Mark Hoggard was promoted to the ANU academic level C.

Student news

Leon Bilton submitted his MPhil thesis.
Nitarani Bishoyi was a visiting student under the Future Research Talent program.

Field retrieval team for the Eyre Peninsula Nodal Array in November 2024. From left to right: Miriam Gauntlett, Sima Mousavi, Caroline Eakin and Jack Dent.

Mathematical Geophysics

During the year the Common Framework for Inference project (CoFI) was further developed, with new releases to the community. This is an open source software project enabling access to advanced inference software across the physical sciences. It is an initiative of InLab (The Inference Lab. http://inlab.au/) which is run out of the group.

Other major projects included the conclusion of an initial study on development of Trans-Conceptual inversion algorithms. A new term for the geosciences. This work is combined theoretical and computational project and was submitted for publication during the year and is a collaboration between ANU, Univ. of Durham UK and CSIRO.

Geophysics - Mathematical Geophysics (continued)

A second study was the conclusion in development of the BayesBay Markov chain Monte Carlo software. This has been releases as open source and forms a central part of a publication submitted during the year.

Another study is the development of DCIP inversion, with a focus on testing different forms of regularization aimed at characterization and delineation of mineral bodies. A paper on this was also submitted later in the year.

Dr. Auggie Marigner joined the CoFI team to work on DCIP inversion in conjunction with CSIRO partners. He submitted a paper later in the year on his results.

Later in the year Dr. Michael Koch joined the team to lead our efforts in a newly funded project on Quantum gravity sensors in conjunction with external partners Q-Ctrl Pty Ltd.

Staff news

Arrivals: Dr. Auggie Marignier; Dr. Michael Koch
Departures: Ms. Jiawen He.

Student news

Matthias Scheiter was awarded his Ph.D. during the year during the graduation ceremony with a thesis entitled. “Studies in Monte Carlo Inversion and Generative Deep Learning”. He has taken up a post-doctoral position at the Univ. of Tasmania.

Buse Turunçtur was awarded her Ph.D. during the year with a thesis entitled. “Studies in Sparsity Constrained Approaches to Geophysical Inversion ”. She has taken up a post-doctoral position in the CSIRO – Data 61.

Grants

CRC-P grant 2024-2026 on evaluating the capability of a quantum gravity sensor for subsurface mineral and water detection.

Extended travel and outcomes

Sambridge and Magrini attended the EGU 2025 meeting and presented their work on Bayesian inversion, software development and Trans-conceptual algorithms.

Outreach

Malcolm Sambridge

- RSES Outreach committee (Chair) (till June)
- RSES IDEA committee member

Geophysics (continued)

Computational and Observational Geodynamics

In 2024, our group made significant advances in computational and observational geodynamics, contributing high-impact publications and state-of-the-art community tools. A major focus was the development of computational infrastructure for adjoint-based inverse geosciences, through the G-ADOPT project (https://gadopt.org/). Originally funded by a cross-NCRIS platform grant (~$1.8M) and an ANU start-up investment (~$300K), this initiative has grown into a cornerstone for research within Australia and internationally. This work, integrating Firedrake, dolfin-adjoint, and the Rapid Optimization Library (ROL), was solidified by a landmark publication (Ghelichkhan et al. 2024), broadening the scope of data-driven geoscientific research.

Reflecting its impact, the platform secured an additional $1.4M from AuScope (through NCRIS' Coastal Research Infrastructure initiative) and continues to expand its global user base across multiple geoscientific domains. More than 100 participants attended domestic and international workshops, culminating in the third G-ADOPT workshop at ANU's Kioloa Coastal Campus in November 2024. Key application areas included:

- Mantle and lithosphere dynamics.
- Glacial isostatic adjustment and visco-elasticity.
- Multi-material simulations.
- Adjoint-based optimization problems.

The third G-ADOPT workshop, held at the ANU's Kioloa Coastal Campus, in November 2024.

2024 G-ADOPT workshop - Kioloa Coastal Campus

Geophysics - Computational and Observational Geodynamics (continued)

Research Highlights

Beyond infrastructure development, we applied these tools across several frontier areas:

- Volcanism & Mantle Evolution: We have further developed understanding of the dynamical mechanisms underpinning volcanism, utilising forward modelling tools to predict volcanic lava geochemistry from mantle source conditions (Duvernay et al. 2024), and enhancing geochemical data integration for mantle evolution studies (Jiang et al. 2024).
- Subduction Dynamics & Plate Tectonics: Several studies examined the subduction force balance and its influence on surface plate motions and slab morphology (culminating in Chen et al. 2024).
- Dynamic topography: Building on our solicited book chapter (Davies et al. 2023), we further demonstrate the key role that Earth's deep interior plays in shaping the surface of our planet in O'Malley et al. (2024). These studies are vital for our ongoing efforts to reconstruct the temporal evolution of dynamic topography, and its role in controlling the evolution of surface environments.
- Antarctic Mantle Dynamics & Ice Sheet Evolution: Rhodri Davies and Mark Hoggard, alongside colleagues Maria Seton (University of Sydney) and Jo Whittaker (University of Tasmania), secured a large ARC Discovery Project to constrain Antarctic mantle dynamics over the past 40 million years using a data-driven computational approach. This project will integrate Antarctic volcanic records with complementary geoscientific observations to produce the first Antarctic-wide reconstructions of topography and heat flow – critical surface manifestations of mantle convection that influence ice-sheet behaviour. The research will advance our understanding of why the Antarctic Ice Sheet (AIS) formed, how it has evolved, and reduce uncertainties in forecasting its response to climate change. This effort cements Australia's leadership in cutting-edge Antarctic science.
- Sea Level Change, GIA & Ice Sheet Dynamics: Our work, in collaboration with the Australian Centre for Excellence in Antarctic Science (ACEAS), explores Earth's surface and global sea-level response to melting polar ice sheets. A major publication is in preparation (led by Dr Will Scott), and a related domestic workshop recently attracted 30+ participants. Dr Mark Hoggard continues to publish several papers on the fundamental physics underpinning these processes.

Funding & Recognition

Our research continues to attract significant funding and collaborations:

- Discovery Project - Volcanoes on Ice - Davies & Hoggard.
- Geoscience Australia Partnership: Supporting geodynamic context for regional mineral systems and sea level rise.
- Ongoing ACEAS Funding: Advancing sea-level change quantification.
- AuScope (CoastRI Initiative, 4 years): Enhancing research software infrastructure for connecting land and sea.
- Supercomputing Resources: The group received over 50 Million SU on national supercomputing facilities via the NCMAS and ANUMAS schemes, which reinforces our national computing leadership and will underpin our research over the coming 12 months.
- Sia Ghelichkhan: Appointed to a continuing position at RSES and awarded a DECRA fellowship on solid Earth contributions to regional sea level change.

Group pot luck dinner!

Geophysics - Computational and Observational Geodynamics (continued)

Staff & Student News

Arrivals & Departures

- Mark Hoggard was promoted to Level C. Congratulations!
- Angus Gibson was promoted to the ANU's new specialist stream, at Level 8.
- Dale Roberts joined the G-ADOPT team as a new Research Software Engineer.
- Sia Ghelichkhan and Mark Hoggard welcomed new family members, baby Hannah and baby Finn, respectively.
- Sia Ghelichkhan secured a permanent position at RSES and now transitions to Climate and Ocean Geosciences, leading his own research group in groundwater.
- Rhys Hawkins completed his Jubilee Joint Research Fellowship and moved to One Zero Financial Systems.
- Liam Morrow joined the group in November on a project that focuses on developing a next-generation groundwater modelling platform.

Student Achievements

- Leon Bilton submitted his MPhil thesis: Prediction of crystallographic-preferred orientation in peridotites under steady-state and time-dependent strain.
- The group hosted six Future Research Talent (FRT) students, working on topics including:
  - Sea-level change modelling.
  - Mantle viscosity constraints.
  - Ice-sheet dynamics.
  - Thermal structure of the continental lithosphere.

FRT team receiving their awards

Leon Billton: Final Mphil Seminar, with supervisory panel.

Geophysics - Computational and Observational Geodynamics (continued)

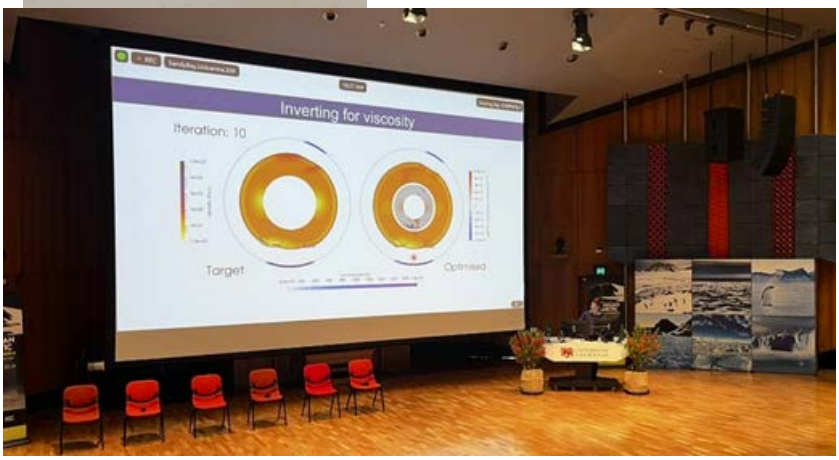
Outreach & Engagement

- EFTF: Delivery of final crustal architecture and lithospheric thermal models to Geoscience Australia's flagship Exploring for the Future program (Stephenson et al. 2024; Hoggard et al. 2024) and presented lithospheric research overview at the end-of-program showcase to industry and government stakeholders.
- Critical Minerals Course (Hoggard): Led an ANU training program on critical minerals, attracting 20+ participants from DISR, DFAT, Defence, Treasury, and Finance.
- Keynote Presentations:
  - RSES StuCon (Scott, Shephard).
  - Australian Antarctic Meeting (Scott).
  - EGU24 (Hoggard, Scott, Duvernay).
  - Goldschmidt2024 (Duvernay).
- Public Engagement & Events:
  - ANU Open Day (Scott, Jiang).
  - ANU Research Infrastructure Expo (Gibson, Scott, Duvernay, Davies).
  - ACEAS Sea Level Winter School (Scott).
  - RSES Postdoctoral Showcase (Duvernay).
  - ANU Summer 9s Mixed Football (Scott, Duvernay, Leong, Turner, Ghelichkhan, Davies, Shephard) Team: Tangerine Trilobites!
  - Royal Norwegian Embassy in Canberra Invited Talk (Shephard)
  - GSA-ACT Talks (Bilton, Hoggard)
  - ASEG-ACT Tech Talk (Shephard)
- "Bake Your PhD" Competition – Bread-ccia! (Leong)
- STEM Engagement (Shephard):
  - Curious Minds STEM mentoring for high school girls.
  - STEMpal pen pal program for primary school children.
- ASEG ACT Tech Talk (Shephard)
- WOMEESA (Women in Earth and Env. Sciences in Australasia) Committee (Shephard)

Our group continues to drive high-impact geodynamics research while fostering a vibrant and collaborative community. Looking ahead, we are excited to build on this momentum with new research directions, funding opportunities, and community engagement efforts.

Bake your PhD - Bread-ccia

Summer 9s - Tangerine Trilobites



Dr Will Scott presenting at the Australian Antarctic Meeting in Hobart in Late November 2024

Geophysics (continued)

Earthquake and Tsunami Hazard and Risk

During 2024, the group continued its focus on Indonesian earthquake hazard and risk, with two studies of damaging events, one a geodetic study of ground movement caused by the 2018 Lombok earthquake sequence, and the other a seismological study of the 2022 Cianjur earthquake in West Java. Both of these resulted in refined earthquake source models that shed light on regional tectonics and could be utilized in future studies of earthquake damage. In addition, progress was made on a new building exposure model for Indonesia, consisting of analysis of two earthquakes that resulted in identification of an acceptable choice of building fragility models for future work in Indonesia.

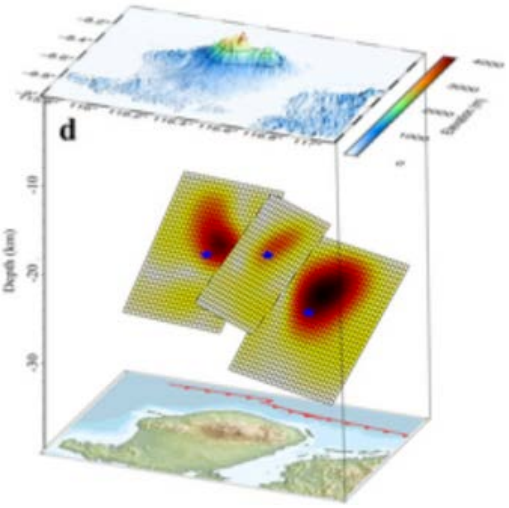


Figure 1:. Coseismic slip model for the three events of the 2018 Lombok earthquake sequence (Zhao et al., 2024)

In addition to work focussing on Indonesia, a study of a historical earthquake in SE Queensland, showed that it had been grossly mis-located. While the previous hypocenter was offshore, our more detailed analysis of felt reports and historical seismograms showed that it was actual onshore, in an are where other large events have occurred, which suggests the hazard there has been underestimated.

A new method was developed for tsunami source inversion, establishing for the first time that use of the adjoint tsunami equation can be used to develop an exact reciprocity principle for tsunamis, that will greatly facilitate future work on high-resolution tsunami source inversion.

Student news

Stacey Martin submitted his PhD thesis.

Emeritus, Honorary staff and Visitors

Nitarani Bishoyi was a visiting student under the Future Research Talent program.

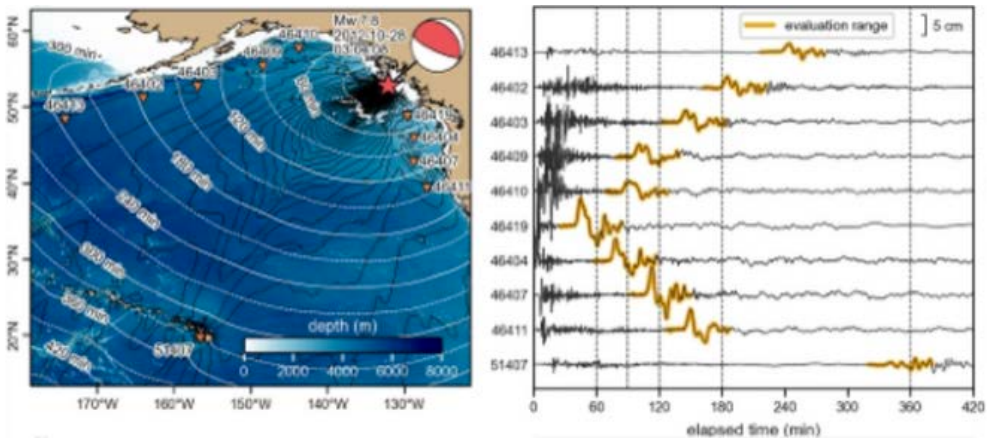


Figure 2: The focal mechanism of the 2012 Haida Gwaii earthquake, showing tsunami observation sites and travel times (left), as well as observed sea level waveforms with the tsunami waveform to be inverted highlighted (Takagawa et al., 2024)

Geophysics (continued)

Observational and Structural Seismology

During the year, the group's activities in distributed acoustic sensing (DAS) research really took off. M Miller and V-H Lai began their ARC DP grant on DAS arrays and the Miller was a panelist at the lauch of COMBS (Centre of Microcombs for Breakthrough Science) - the ARC Centre of Excellence. Miller is a CI of the CoE and a co-lead of the Precision Measurement Theme, which focuses on the technological development of frequency microcombs for DAS.

The group had 4 new DAS publications this year based upon data collected in New Zealand on the Alpine Fault and also their first urban experiment in Melbourne. Results from these experiments were presented at the AGU Fall Meeting, Seismological Society of America, Photonics Seismology in Canada and JpAGU in Japan as well as invited lectures. We also started a new DAS field experiment in Milford Sound, New Zealand tracking avalanches, rock falls, and earthquakes in collaboration with the Victoria University of Wellington.

This past year we also completed the fieldwork on the ARC Linkage project "SWAN" in Western Australia with partners GSWA and GA. The results from this grant were presented by R. Pickle, P. Zhang and M. Miller both domestically and internationally and are currently in review as publications. We continue to collaborate with GSWA on WA Array, GA on ground motion modeling, and with a CRC-P with H2EX led by C. Eakin.

Staff news

Dr Konstantinos Michailos – joined in August as a postdoctoral fellow

Student news

Nova Roosmawati completed her PhD titled 'Developing a Probability of Collapse Model for Residential Buildings in Lombok Island, Indonesia' and started a postdoc at the University of Western Ontario.

Siyuan Zhao completed his PhD titled 'New Insights into the Active Tectonic Processes of the Indonesia-Australia-New Guinea Collision Zone' and started a postdoc at the University of Leeds

Jack Dent completed his Honours titled 'Distributed Acoustic Sensing: Seismic Insight into Environmental Signals' and is continuing to work as a technician at RSES under AuScope Earth Imaging.

Emeritus, Honorary staff and Visitors

FRT scholar: Sonakshi Jain from IIT
Visitor A/Prof Hongjian Feng from Sun Yat-Sen University

Extended travel and outcomes

M. Miller, P. Zhang and R. Pickle travelled to Alaska to present at the Seismological Society of America Annual Meeting. Miller and Lai were invited to present DAS research at the Photonics Seismology Workshop in Vancouver, Canada and at the AGU Fall Meeting in Washington, DC.

Ping Zhang was awarded a University of Tokyo/ERI fellowship where she spent 3 months working with colleagues on seismic imaging of Mt. Fuji.

Geophysics (continued)

Global/deep/planetary Seismology

In a paper published in Geophysical Research Letters, Prof. Tkalčić showed that from measuring the travel time of earthquake doublets (repeating earthquakes) through the Earth's inner core, it can be concluded that its rotation oscillates relative to the Earth's mantle (the frame of reference here), with an oscillation period of a few decades (consistent with the RSES research group paper's findings published in Nature Geoscience in 2013). Geodynamicists are interested in this topic because the oscillation in the rotation of the inner core tells us about the internal dynamics of the planet, electromagnetic and gravitational torques, the inner core viscosity, and the length of day variations. Research in this area of global seismology and deep Earth will bring new surprises.

Another inner core paper followd, also on the inner core dynamics, in Scientific Reports. A group of seismologists (Prof. Tkalčić, Dr Jack Muir and Dr Lauren Waszek), mineral physicists (Prof. Maurizio Mattesini and Prof. Anatoly Belonoshko), and geodynamicists (Prof. Louis Moresi) showed that the inner core of the Earth could be in a state of slow thermal convection, despite being solid. They showed that from the data and uncertainty they have, it is not possible to rule out thermal convection as a dynamic state of the inner core.

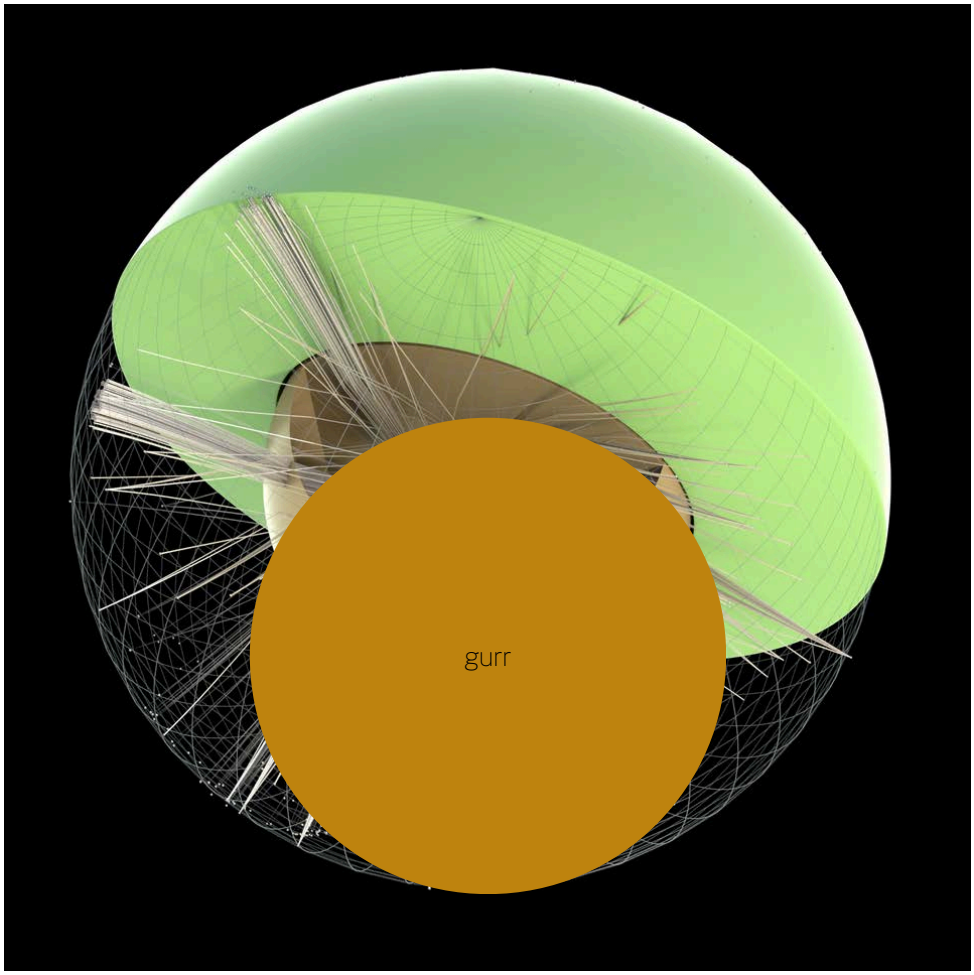
With colleagues Prof. Weijia Sun and Dr Qingya Tang from the University of the Chinese Academy of Sciences in Beijing, Prof. Tkalčić developed a new method for determining the direction from which the waves arrive at the station, and we verified it using data from nuclear explosions, whose exact locations are known. This method will be useful not only in planetary missions, where we usually only have one seismograph, but also for measurements in remote and still unexplored parts of the Earth, including the ocean depths. This was published in Seismological Research Letters.

In the paper published in Geophysical Journal International, Dr Pham, Prof. Tkalčić, and Ph.D. student Jinyin Hu showed how the results and interpretation of the physical mechanisms of earthquakes change when we take into account theoretical uncertainties.

In the paper published in the Journal of Geophysical Research, Ph.D. student Jiarun Zhou, Dr Pham and Prof. Tkalčić applied deep learning to the collection of longitudinal waves of large earthquakes through the Earth's core (PKIKP waves). This is the culmination of the Master's thesis of Jiarun Zhou, co-supervised by Dr Pham and Prof. Tkalčić, which turned into a doctorate.

Geophysics - Global/deep/planetary Seismology (continued)

Dr Xiaolong Ma and Prof. Tkalčić published a paper in the journal Science Advances on the existence of a ring-like structure or torus of low seismic wave velocity in the upper parts of the liquid outer core parallel to the equatorial plane. Most likely, compressional waves slow down in that part of the core due to the increased concentration of lighter chemical elements, essential to understanding the initial conditions for the magnetic field that is generated and maintained there. This discovery was widely reported in the world media with an Altmetric score of over 820 and appeared in 106 media outlets.



From Sydney Morning Herald: Prof. Tkalčić and his colleague Dr Xiaolong Ma have unveiled a new doughnut-shaped region of the Earth's liquid outer core.Credit: Drew Whitehouse, National Computational Infrastructure, ANU. https://www.smh.com.au/national/aussie-scientists-found-a-doughnut-in-earth-s-core-and-it-s-helping-keep-us-alive-20240829-p5k6fi.html

Ph.D. student Jinyin Hu, Dr Pham and Prof. Tkalčić reported their results on the 2022 eruption of the Hunga Tonga-Hunga Ha'apai volcano in Geophysical Research Letters. This is part of Jinyin Hu's doctoral thesis, also co-supervised by Pham and Tkalčić. They found the existence of a significant vertical upward force during the eruption and showed that the underwater explosion of the volcano raised a significant volume of ocean water. This article also yielded a remarkably high Altmetric score of over 450 and appeared in 57 media outlets worldwide.

Staff news

Departures: Dr Sheng Wang, Dr Jinju Zhou
Promotions: Dr Thanh-Son Phạm was promoted to the ANU academic level B.

Geophysics - Global/deep/planetary Seismology (continued)

Student news

Vishnupriya Pradeep started her Ph.D. during the year with a preliminary thesis entitled “Macquarie Ridge Complex Investigations Using Passive Seismology.”

Minog Kim from Pukyong University, South Korea, started her Ph.D. exchange year during the year with a thesis entitled “Seismological Studies of the Korean Peninsula and the Earth’s Outer Core.”

Tianyu Cui from the Institute of Geology and Geophysics of the Chinese Academy of Sciences (IGGCAS) started his Ph.D. exchange year during the year with a thesis entitled “Seismological studies of the core boundaries.”

Thuany Costa de Lima was awarded her Ph.D. during the year with a thesis entitled “Structure of Earth’s Deep Interior From Seismic and Correlation Wavefields”
She has taken up a continuing research position at Geoscience Australia.

Anya Makushkina submitted her Ph.D. thesis during the year with a thesis entitled “Deep Earth Structure in Fennoscandia: New Insights From Passive Seismic Imaging”
She has taken up a continuing research position as a data scientist at GFZ Helmholtz Centre for Geosciences.

Grants

2024-2026 “Lunar seismology: new missions” (lead chief investigator); subcontract with Fleet Space Technologies “Moon to Mars: Demonstrator program” funded by the Australian Space Agency.

2024-2026 “TReaty MOnitoring Research (TREMOR) Consortium: Improving capabilities to detect, locate, discriminate and characterize the depths, yields and emplacement conditions of nuclear explosion” (ANU chief investigator); US Air Force Research Lab (DoD/AFRL).

2024–2026 Budget for the, Nineteenth, Twentieth, and Twenty-First Contract Years for International Monitoring System (IMS) Primary Seismic Station PS02 and IMS Infrasound Station IS07 in Warramunga, Australia (Amendment No. 12); Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization.

Honours/Awards

- Prof. Tkalčić received Honorary Doctorate (Honoris Causa), University of Zagreb, Croatia.
- Prof. Tkalčić was elected a Fellow of the Australian Academy of Science.
- Prof. Tkalčić was awarded the Dean’s Commendation for Excellence in Education for Excellence in Supervision, College of Science, The Australian National University.
- Dr Phạm was awarded the Zatman lectureship from the Study of Earth’s Deep Interior (SEDI) Section at the International Association for Seismology and Physics of the Earth’s Interior.
- Dr Phạm & Prof. Tkalčić were awarded Top 25 Nature Communications Earth, environmental and planetary sciences articles for the year of publications.
- Dr Wang was awarded the prestigious ETH Fellowship at ETH Zürich.

Emeritus, Honorary staff and Visitors

Dr Jinju Zhou submitted the following paper to the Geophysical Journal Inernational:
Zhou (Jinju) and H. Tkalčić, Shallow Earth structure from P-wave coda autocorrelation using particle swarm optimization, submitted, 2024.

Geophysics - Global/deep/planetary Seismology (continued)

Extended travel and outcomes.

Prof. Tkalčić was a keynote lecturer on the Earth's correlation wavefield at the Cargèse School on Passive Imaging and Monitoring in Wave Physics: From Seismology to Infrasound sponsored by the ISTerre and IGE, Grenoble, Corsica, France. This travel also included seminars at the following universities and institutions:

- Observatoire de la Côte d'Azur (Geoazur), Nice, France
- Université Grenoble Alps, Institut des Sciencies de la Terre (ISTerre), Grenoble, France
- École Normale Supérieure de Lyon, (LGL-TPE), Lyon, France
- Instituto Nazionale di Geofisica e Vulcanologia (INGV) – Pisa, Italy
- University of Bologna and INGV – Bologna, Italy
- Seoul National University, Seoul, Korea
- Korea University, Seoul, Korea

Prof. Tkalčić received an honorary doctorate from the University of Zagreb and gave a public lecture at the Faculty of Science, followed by several talk shows on TV and radio.

Prof. Tkalčić and Ph.D. student Jinyin Hu travelled to the AGU Fall Meeting. Prof. Tkalčić gave an invited talk on the analyses of seismic sources and incorporating uncertainty into geophysical inversions, and Jinyin Hu presented two topics: one on the Tonga underwater explosion and another on the methodological advances of the seismic source inversion. Ph.D. student Thuany Costa de lima gave an invited talk on the Earth's inner core (online). The current and recent group members gave eight presentations in total.

Prof. Tkalčić gave a lecture on the Earth's inner core by the invitation of The Geological Society of Australia at a symposium in Adelaide.

Dr Phạm and Ph.D. student Abhay attended the Cargèse School on Passive Imaging and Monitoring in Wave Physics: From Seismology to Infrasound sponsored by the ISTerre and IGE, Grenoble, Corsica, France. They presented their work on the Antarctic and array seismology.

Dr Phạm was a visiting researcher at the Earthquake Research Institute, the University of Tokyo, Japan.

Ph.D. student Yun-Ze Cheng travelled to the USA to deliver an invited talk on recent advances in studies of Mars' interior and beyond at the conference entitled Mars Interior and Geophysics After InSight, College Park, MD, USA.

Outreach

- Prof. Tkalčić responded (in 2024) to TV crews, radio, and newspapers regarding earthquakes and seismology in general. He gave many interviews related to my research and discoveries to international media such as BBC World News, ABC News, Science Daily, CNN, Newsweek, Croatian Radio-Television, TV Nova, IFLS, Phys.org, Cosmos, Canberra Times, Sydney Herald, and Croatian Daily Newspapers and internet portals.
- Prof. Tkalčić has also given many interviews for Australian TV channels (e.g., ABC, Channel 9) and radio (e.g., ABC, SBS, Diffusion Science radio, SpaceTime) on global seismology, the role of the Warramunga Seismic and Infrasound facility in the world's peace, and on nuclear non-proliferation in more general terms. He wrote an article for The Conversation.
- Dr Phạm and Ph.D. student Hu were highly engaged with the media after the publication of the article in Geophysical Research Letters on the Tonga underwater volcano explosion.

Geophysics (continued)

Computational Geophysics and Algorithms

Student news

- FRT scholars (3 months):
  - Pramoda Prabaswara, IT Bandung, Indonesia, (Computational flow models for granular media)
  - Rianti Gina Violeta, Universitas Indonesia, (Dispersion computations for 2D granular media)

Grants

DP240102450 (announced 2023) – funding commenced, November 2024
CRC-P (natural hydrogen exploration, see Caroline Eakin's highlights for details)
NERC grant: ???
Royal Society Travel award: ???

Emeritus, Honorary staff and Visitors

Visiting researcher (1 year):

- Ping Wang, Nanjing Normal University, Nanjing (Numerical models of Uplift in the Himalayas)

Honorary / Visitors:

- Stuart Clarke, UNSW (Collaborator on subduction modelling, sub-surface flow)
- Julian Giordani, USyd (Underworld collaborator – mathematical developer)
- Tyagi Gollapalli, Monash (Underworld collaborator – geodynamics applications developer)
- Ben Knight, Curtin (Underworld collaborator – geochronology and other applications)

Rock Physics

Our work towards a comprehensive lab-based model for seismic wave dispersion and attenuation in the Earth's upper mantle is being continued by new PhD students Jian Yang (visiting from the China University of Petroleum in Qingdao) and Hitank Kasaundhan – seeking tighter constraints on the grain-size sensitivity of anelastic relaxation, and insight into the role of trace amounts of olivine-incompatible impurities.

GEOCHEMICAL INSTRUMENT OPERATIONS

Group leader Brett Knowles

Staff Halimulati Ananuer, Hahjung Chin, Babs Fairchild, Bowen Fang, Michael Förster, Yoann Gréau, Heze Gong, Kathryn Hayward, Janet Hope, Laura Rodriguez Sanz, Yue Wang, Jiade Wu, Yang Wu, Sonja Zink

In 2024, SHRIMP facility fully set up a new high-end sample preparation lab and implemented a new data information management system. We conducted 28 SHRIMP projects including 2 lab projects, 6 research projects and 20 service projects, collaborated with 29 researchers from 24 organizations, generating over $210k revenue. From our research results, 7 articles in high profile journals including nature communications have been published. Moreover, 4 new analytical methods have been developed to support earth sciences research.
We also provided teaching and training to 2 undergraduate courses (EMSC3022 and EMSC2024) and 9 PhD and honours students (7 from RSES and 2 from the wider ANU), hosted 18 lab tours from academic institutions, government and media from over 15 countries.

In 2024, the Stable Isotope Facility has continued producing high-quality oxygen and carbon isotopes analysis in carbonate samples, and supporting research projects within the RSES, and with collaborators overseas and across the university. A key focus of the facility this year has been the analysis of stable isotopes in Antarctic water samples, which has required implementing rigorous protocols for sample's handling to comply with biosecurity requirements outlined in import permits. To further support this line of research, we are setting up the methodology to perform anion quantification using Ion Chromatography in the facility. This work will take place in the Jaeger 1-G7 lab, but it is being developed in close collaboration with Brett Knowles and his team in Jaeger 7. The data generated from the stable isotope facility during 2024 has contributed to several ongoing projects, with some findings already presented in peer-reviewed publications, conferences, and undergraduate Honors projects that have been completed this year. The X-Ray Fluorescence (XRF) Core Scanner facility has also had a significant progress in 2024. After an extended period of pause due to the remediation work that was happening in the Jaeger 6 building, the facility reopened last September. Since then, we've made significant progress with XRF measurements on marine sediment cores, supporting various paleoclimate research projects. Looking ahead to 2025, we have exciting new projects on lake and marine sediments lining up to use the XRF scanner.

The spectroscopic facility has been rebranded as the NanoPhase Facility to reflect its enhanced capabilities and evolving focus on nanoscale analysis. Following the installation of the MirCat PiFM laser in late 2023, testing and initial applications began in early 2024. The laser is now fully operational and has successfully demonstrated its ability to measure CO_2 in volcanic glass and nitriles in fossilized organic materials. We continue to invite users to submit their samples for testing, particularly for these components, to further explore the laser's analytical potential.
To ensure reliable and high-quality PiFM measurements, a best practice routine has been developed. This routine includes contamination mitigation strategies, such as careful material selection and rigorous cleaning protocols, alongside detailed workflows for systematic analysis. Contaminants identified during the process have been thoroughly analyzed, and the resulting data have been published on Mendeley Data for broader accessibility and transparency.

Geochemical Instrument Operations (continued)

In December 2024, the Empyrean S3 XRD instrument was transferred from RSES to RSC. However, XRD analyses continue seamlessly at RSES using our fast and versatile Aeris benchtop instrument. The Aeris system is well equipped for a wide range of sample types, including powders, mineral separates, and solid materials such as hand specimens, thin sections, polished resin-stub samples, archaeological artifacts, pottery shards, stone tools, and even paper.

It's been a good year in the Marine Biogeochemistry group with a new member of the technical staff joining the team – welcome Babs Fairchild! We hosted a visitor from South Africa who learnt how to separate iron isotopes from ocean water samples and completed preparations for the next sampling voyage in 2025.

The Spectroscopy, Characterisation and Experimental Laboratory took ownership of a new Fourier Transform Infrared Spectrometer (FTIR) in July. This instrument provides unique capabilities of being able to undertake spectral analysis in the near, mid and visible IR frequencies and greatly expanding the range of materials that can be analysed. Other capabilities acquired during the year include a polishing facility and Leica surface profiling microscope. The group now has dedicated technical support with the appointment of a part-time senior technician – welcome Kathryn Hayward!

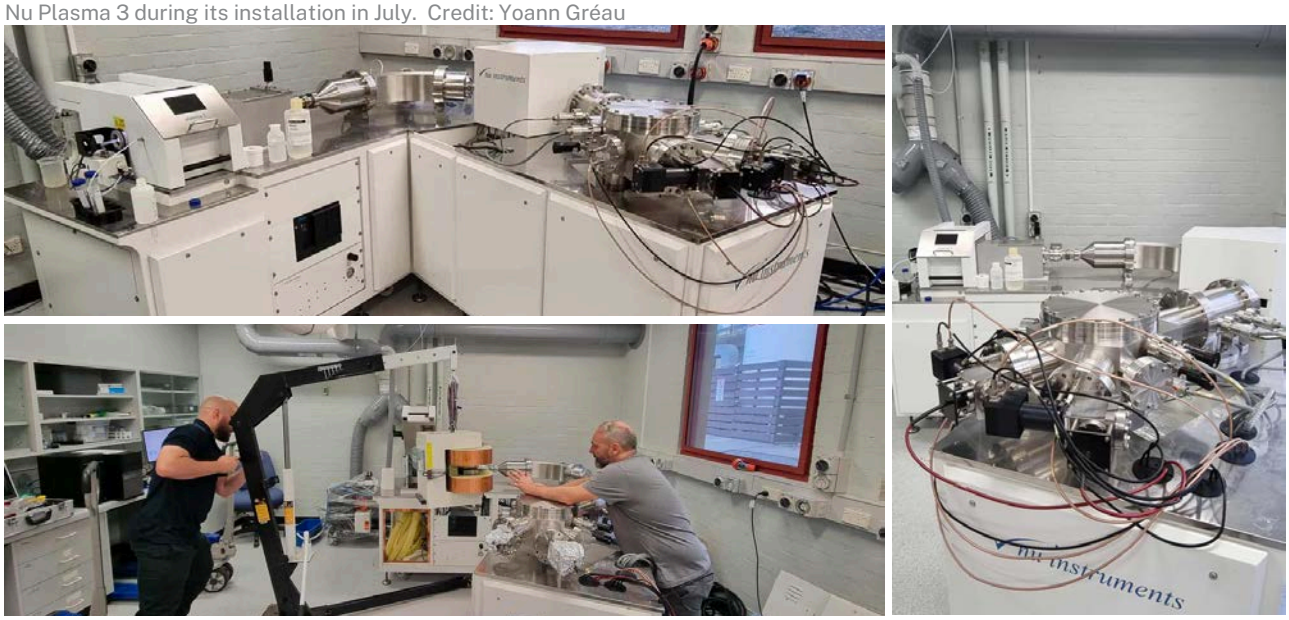
The New Fourier Transform Infrared Spectrometer (FTIR) in use. Credit: Kathryn Hayward

2024 was a year of change for the Jaeger 7 ICP-MS Facility, ultimately better enabling the team to support world-class research here at RSES. Commissioning of two new 193 nm excimer laser units was completed, ensuring we maintain this key capability for the coming decades. Further, delivery & validation was taken for the MEC-funded laser induced breakdown spectroscopy (LIBS) spectrometer and intensified camera. Working closely with our in-house workshop expertise, this will add significant analytical capabilities to our existing laser infrastructure. Lab management worked closely with ANU Procurement and key School stakeholders to prepare and execute a limited tender to update ICP-MS analytical capabilities further in the lab. This tender sought and succeeded in bringing to the School a new single-quadrupole ICP-MS to bolster our bulk analytical and trace elemental analyses, and further expanded the lab's capabilities through the addition of a 'triple' quadrupole ICP-MS, adding collision-reaction cell ICP-MS experiments broadening the range of sample matrices and isotopic ratio measurements possible within the Facility. We extend our thanks to the School stakeholders who were able to contribute to this Tender!

Geochemical Instrument Operations (continued)

Finally, we welcomed to the School an AuScope Geochemistry Node, housed in the J7 ICP-MS Facility, which involved the decommissioning of the original Thermo Finnigan NeptuneONE and ThermoFisher Element XR to facilitate the install of a nu plasma III multiple-collector ICP-MS. AuScope's support within the Facility will see the nu plasma III, as well as our laser and other ICP-MS instrumentation, well-supported and more broadly available to customers and researchers outside the RSES & ANU.

Nu Plasma 3 during its installation in July. Credit: Yoann Gréau



Staff news

We welcomed to the team (and back to RSES) Babs Fairchild, working with Prof. Michael Ellwood in the Marine Biogeochemistry section, and Kathryn Hayward, working with Prof. Penny King in the Earth Systems Chemistry group. Sonja Zink moved back to Jaeger 5 to manage the ultra-clean chemistry labs and TIMS facilities.

Grants

Kathryn Hayward (IR & mineralogy) and Michael Förster (PiFM) are participants in the $280,000 AuScope Opportunity Fund project "State of the Art Spectral Characterisation of Complex Materials" with principal investigator Penny King.

Outreach activities & Service roles external to ANU

Science Communication:
Jan, 2024: Guest lecture: 'Geoscience at the nanoscale' Australian Science Innovations Program 2024 (non-profit) for Australian high school students. Lab demonstration of Raman and PiFM system to students.

2-4 Jul, 2024: Presentation of the novel PiFM method at the "Hyperspectral Mineralogy Workshop" by AuScope, CSIRO, and the ANU

GEOPHYSICAL DATA AND COMPUTATION

Group leader Herb McQueen

Staff Kimberley Berends, Julian Byrne, Rajesh Erigela, Angus Gibson, Juan Carlos Graciosa, Jiawen He, Laura Velasquez Jimenez, Venkata Sai Jaswanth Kota, Sima Mousavi, Micael Oliveira, Dale Roberts, Michelle Salmon, Ramkumar Voore

Geophysical Data and Computation staff support data collection, data management, processing, simulation, and analysis facilities in RSES. These include a large collection of seismic monitoring equipment in the ANSIR instrument pool supporting a national fieldwork capability, several special and general-purpose computing and data acquisition systems and local compute clusters, and programming support for processing on these and NCI supercomputer facilities.

Through the Australian Seismometers in Schools (AuSIS) program we operate a network of seismometers installed at 48 schools across the country. The program provides support for technical staff at the schools and the teachers who are using the AuSIS equipment in class work. Data from the sites is transmitted to ANU and made publicly accessible on our Australian Passive Seismic Server (AusPASS) and other international datacentres.

AuSIS sites are refreshed every few years to keep the operating well. This year that included the AuAPY site at Pukatja on Anangu land in the Northern Territory. Unfortunately, it had to be evacuated shortly after installation due to uncharacteristic flood event, but it has since been returned to operation.

Seismometer and display equipment set up at the school at Pukatja, NT.

AuSIS staff Sima Mousavi and Grace Shephard with the school staff and elders from the Pukatja community during the installation.

Geophysical Data and Computation (continued)

Twelve new Trillium Compact Horizon seismometers were purchased for the seismic instrument pool shared with Australian institutions through the ANSIR facility and a new Landcruiser 70 Utility was commissioned to refresh the fieldwork vehicle fleet. A number of redundant older systems were decommissioned and some permanent overseas installations retired from inventory.

GC&D staff also support a variety of ongoing field experiments. The ARC Linkage SWAN experiment concluded in Western Australia and the SNAKEY array of 20 broadband sites in SA was serviced several times during the year. Two stages of the EPNA dense nodal array were installed and retrieved on the Eyre Peninsula and the MATE (M8) backfill network has also gained new sites.

In New Zealand, the Auckland-Hauraki Node Array experiment (AH-NA) experiment continued to operate around Auckland, 160 nodal seismometers were installed in the WETA experiment around Taupo and the new FISSLE (Fiordland Seismological Sensing of Landslides & Earthquakes) DAS experiment was installed in Milford Sound.

Collaboration has begun with GSWA on WA Array telemetered stations and multiple ANSIR projects led by Geoscience Australia, GSWA, QUT and the University of Adelaide began during the year.

The ceres cluster of Dell servers was expanded with the addition of extra R650 and R750 servers with larger NVME scratch disks and newer GPUs to increase computational capacity and extra storage disks added. The kaiju cluster had a chassis problem, reducing its operational capacity for 6 months, but the terrawulf-3 cluster is working at near full capacity supporting RSES staff and students.

Staff news

Michelle Salmon, Jiawen He and Filip Bozinovic departed during the year.

Jack Dent, Robert Pickle, Caroline Eakin and Filip Bozinovic at the pullout of the EPNA/H2EX seismic array on the Gawler Peninsula.

LABORATORY OPERATIONS

Group leader Andrew Latimore

Staff Electronics Group - Andrew Latimore, Peter Lanc, Hideo Sasaki, Yile Liu
Mechanical Facility & Rock Physics High Pressure Lab - Hayden Miller
Paleoenvironments - Pengxiang Hu
Climate and Fluid Physics Laboratory - Angus Rummery
Experimental Petrology - David Clark
Radiocarbon Dating Laboratory - Rebecca Esmay
Paleomagnetic Group - Yao Qian

Introduction

The RSES Laboratory Operation Group is a team of technical and research support staff dedicated to supporting the academic research at the Research School of Earth Sciences (RSES) by maintaining essential instrumentation infrastructure. This group is organized around key scientific facilities, including the Electronics Group, Mechanical Facility, Palaeomagnetic Laboratory, Climate and Fluid Physics Laboratory, Experimental Petrology Laboratory, and Radiocarbon Dating Laboratory. These laboratories provide RSES with critical analysis capabilities and are managed by the professional staff of the Laboratory Operations Group.

The Electronics Group and Mechanical Facility offer electronic and mechanical engineering services to support the academic innovations of both RSES and the Australian National University (ANU). They are responsible for maintaining and servicing electronic systems within RSES and provide a development facility capable of engineering innovative electronic and mechanical solutions. The Electronics Group is also equipped with a circuit production facility featuring an automated component placement machine and a reflow oven.

Together, the RSES Laboratory Operation Group plays a key role in ensuring that the Research School of Earth Sciences remains a cutting-edge institution, helping to achieve the strategic goals of the University.

2024 Highlights

SHRIMP instrumentation enhancements

In 2024, the Electronics Group at the Research School of Earth Sciences undertook a major project to enhance the performance of the ultra-low bias current electrometer, the Cvar-PRO. This electrometer is a critical component used in the SHRIMP SI (Sensitive High Resolution Ion Microprobe Stable Isotope). The Electronics Group's efforts focused on both hardware and software improvements, with the primary goal of increasing the precision and stability of the device. The team successfully achieved an impressive external accuracy of 0.5 ‰ during its operation on the SHRIMP SI exceeding the design objective.

Laboratory Operations (continued)

The team also focused on improving the instrument performance by software systems that govern the electrometer. A major breakthrough was the development of a digital filtering algorithm designed specifically to eliminate 50Hz and 25Hz harmonic industrial noise sources that interfere with the sensitive input node. This algorithm ensures that only the most accurate readings are captured, even in environments with high levels of electromagnetic interference.

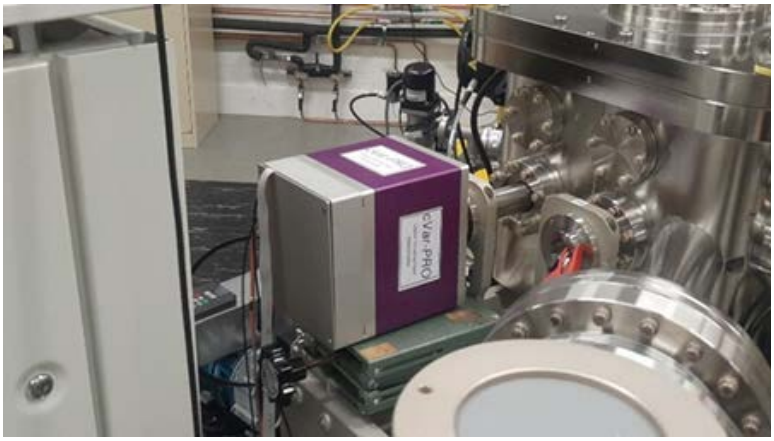


Figure 1 cVar-PRO Electrometer in operation on SHRIMP SI

The combined hardware and software advancements not only increased the accuracy of the Cvar-PRO but also enabled the SHRIMP instruments to analyse ion counts per second at levels that were previously unattainable with traditional resistive feedback electrometer designs. These improvements represent a significant leap forward in the capabilities of the SHRIMP SI and will have a lasting impact on the quality of the analyses performed at the Research School of Earth Sciences, supporting a wide range of cutting-edge research.

The Laboratory Operations Group is dedicated to enhancing laboratory equipment and systems by ensuring seamless compatibility between software and hardware. In 2024, other upgrades include the modernisation of the SHRIMP DVS (Distributed Vacuum System). This improvement featured wiring for new turbo pumps, backing pumps (with an adapter box), and vent valves, ensuring full compatibility with the existing interface and enabling complete remote control of the pumps.

Geophysics Seismology

The Laboratory Operations Group was able to provide technical support to the Geophysics Seismology department by further software and hardware development of the fleet of seismic digitiser instrumentation built by the RSES Electronics Group, equipment now several years old. In order to achieve this, the Group researched new electronic solution to replace obsolete integrated circuits, and developed a new programming method. A new Seismic digitiser programming box was constructed, providing on-site firmware updates for legacy Xilinx field programmable gate arrays (eliminating the need to remove the board) and extended support for new Flash memory integrated circuits. This unit will allow technical staff to install firmware updates to the existing fleet of LPR200 and terraSAWR seismic digitisers currently serving the Seismology department of Geophysics.

Figure 2 Field programmer for Seismic digitiser

Crystal Orientation Spectroscopy

During 2024 Yile Liu from the Laboratory Operations Group, worked with Professor Penny King on the Crystal Orientation Spectroscopy project developing a procedure to parse spectral data in various formats, streamlining the data processing workflow. Significant progress has been made in developing a machine learning framework designed to predict map data using the spectral library created with our own collected data, along with ongoing improvements to data pre-processing techniques. A rough example of mineral prediction, compared with results from other instrument scans, is shown in the following figure. Efforts are also focused on creating an automated procedure to extract endmembers from random spectra, which is still under development and will further provide insights into predicting mineral orientations.

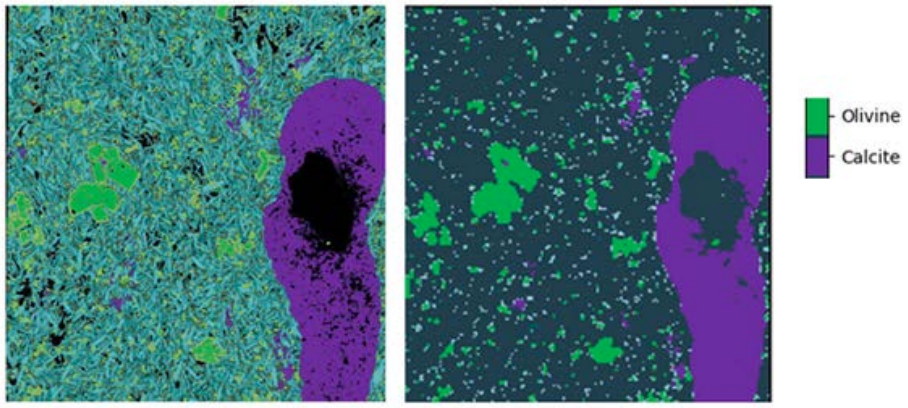


Figure 3 Mineral Prediction using machine learning techniques

Radiocarbon Dating Laboratory

During 2024, Peter Lanc from the Laboratory Operations Group, developed and installed a new sample handling and control unit for the Radiocarbon dating Laboratory's laser ablation system. LabVIEW based in-house laser control software required updating for new hardware. This includes support for different mass flow controllers and different types of interfaces to mass spectrometers. Other projects for the Radiocarbon Laboratory includes improvements to the in-house designed CO / CO2 data logger.

Geophysical Fluid Dynamics (GFD) laboratory

Throughout 2024 the RSES Laboratory Operation Group supported GFD's many existing projects with troubleshooting and software upgrades to follow hardware changes. For example, a new custom designed temperature reader interface for the evaporation experiment. Other notable projects include ice conductivity experiment, ice melting experiment, rotating table, submarine research motor control software. Senior technical officer Angus Rummery from the GFD laboratory's, used 3-D printing facility to construct complex models for the Submarine experiment and also built 3-D contours for use in the Rotating table apparatus.

Laboratory Operations (continued)

Geophysical Fluid Dynamics (GFD) laboratory

Throughout 2024 the RSES Laboratory Operation Group supported GFD's many existing projects with troubleshooting and software upgrades to follow hardware changes. For example, a new custom designed temperature reader interface for the evaporation experiment. Other notable projects include ice conductivity experiment, ice melting experiment, rotating table, submarine research motor control software. Senior technical officer Angus Rummery from the GFD laboratory's, used 3-D printing facility to construct complex models for the Submarine experiment and also built 3-D contours for use in the Rotating table apparatus.

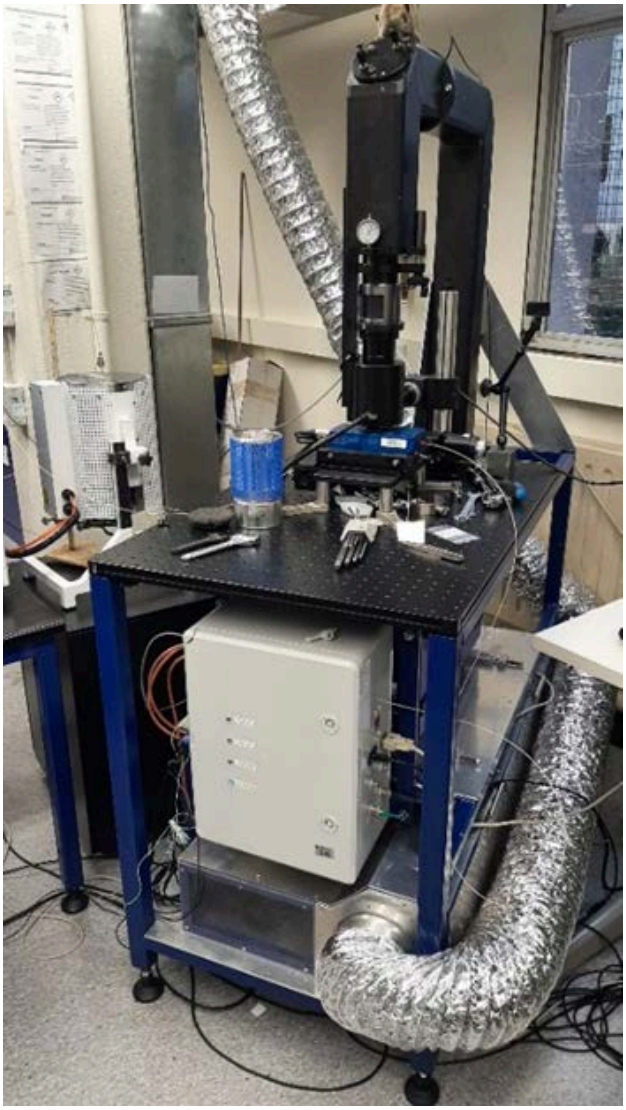
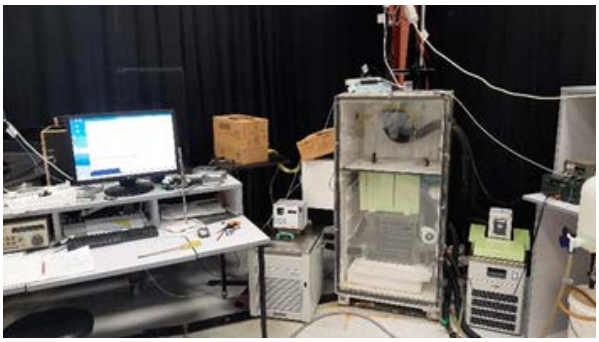


Figure 4 Radiocarbon Lab Laser ablation system

Figure 5 Ice conductivity experiment



Laboratory Operations (continued)

ICP-MS Laboratory

During 2024 the Group supported the ICP-MS Laboratory through prompt maintenance diagnostics and solutions for various electronics and mechanical related issues. In conjunction with service support, the Group provided engineering enhancements including, laser control software updates making user experience more efficient and support for new mass-flow controller. The renewed control software is now implemented with new hardware that enables the laser to be disabled after firing, this innovation reduces the amount of consumed gas per experiment, saving the Laboratory replacement expenses and fix costs.

Mechanical Facility

The RSES Mechanical Facility provides engineering design and fabrication services to the School and across the ANU campus. This year Hayden Miller successfully managed the RSES Mechanical Facility for 2024 with assistance from Angus Rummery. Important highlights from 2024 include:

- Preliminary design of new SHRIMP SI sample stage
- Batch of 50 terraSAWR Seismic recorder SD card covers and connection protectors.
- Three benches to accommodate new laser systems. ICPMS Lab
- Mount laser onto an adjustable stand and provide new beam path that is turned 90 degrees for the ICPMS Laboratory.
- Build two Attenuation Apparatus furnaces and one Rig #3 furnace for Rock Physics Group
- CO2 Flow chamber- Design/Fabricate for Geochemistry.
- Adjustable guarding plate for SHRIMP 2 centre slit in the multi collector.
- Perspex anionic exchange manifolds Climate & Ocean Geoscience

Staff News

In May 2024, Hideo Sasaki, who was previously the Senior Technical Officer for the Research School of Earth Sciences Electronics Group, transitioned to a new role as an Electronics Engineer in the technical services team at the Research School of Chemistry.

RESEARCH GRANTS AWARDED DURING 2024

Project/Grant Title	Administering Area	Lead CI	Awarded Date	Primary Funds Provider
Lunar Seismology: New Missions	ICP Environment Projects	Hrvoje Tkalčić	2024-01-31	Fleet Space Technologies Pty Ltd
QA/QC of Australian Ground-Motion Database	ICP Environment Projects	Meghan Miller & Nova Roosmawati	2024-02-01	Geoscience Australia
ANU ECR International Travel Grant	ICP Environment Projects	Augustin Marignier	2024-02-05	Australian National University (ANU)
TREaty MOnitoring Research (TREMOR)	ICP Environment Projects	Hrvoje Tkalčić	2024-02-12	US Govt Department of the Air Force (DAF)
ANU ECR International Travel Grant	Geochemistry	Joëlle D'Andres	2024-03-18	Australian National University (ANU)
ANZIC Post-cruise travel support funding	Ocean & Climate Geoscience	Yuhao Dai	2024-03-25	Australian ANZIC-IODP Office (NCRIS Subsidiary)
APR INTERN - 1300 Tidetech/ANU	Geophysical Fluid Dynamics	Adele Morrison	2024-04-11	University of Melbourne
Characterisation of garnets associated with the Dugald River Deposit	Geochemistry	John Mavrogenes	2024-04-12	MMG Dugald River Pty Ltd
Diffusion pathways of Ti in zircon	Geochemistry	Andrew Berry	2024-05-01	Curtin University
The ANU ECR International Travel Grant Scheme	ICP Environment Projects	Thomas Duvernay	2024-05-14	Australian National University (ANU)
Zero power 244-Cm Sources for Spacecraft Instruments	Geochemistry	David Blake &Thomas Bristow	2024-05-30	US Govt National Aeronautics and Space Administration (NASA)
Geochronoly3.0 Pilot Study	Geochemistry	Olivier Alard	2024-06-13	Geological Survey of Queensland
ANU ECR Travel Grant	RSES - Technical Services	Qing Zhang	2024-06-15	Australian National University (ANU)
By-products of zinc mining in Australia	Geochemistry	John Mavrogenes	2024-06-17	Geoscience Australia
Reading the Sharks bar-code: Sclerochronology of elasmobranch vertebrae through in-situ elemental and isotopic techniques.	Geochemistry	Olivier Alard	2024-06-21	Australia and Pacific Science Foundation

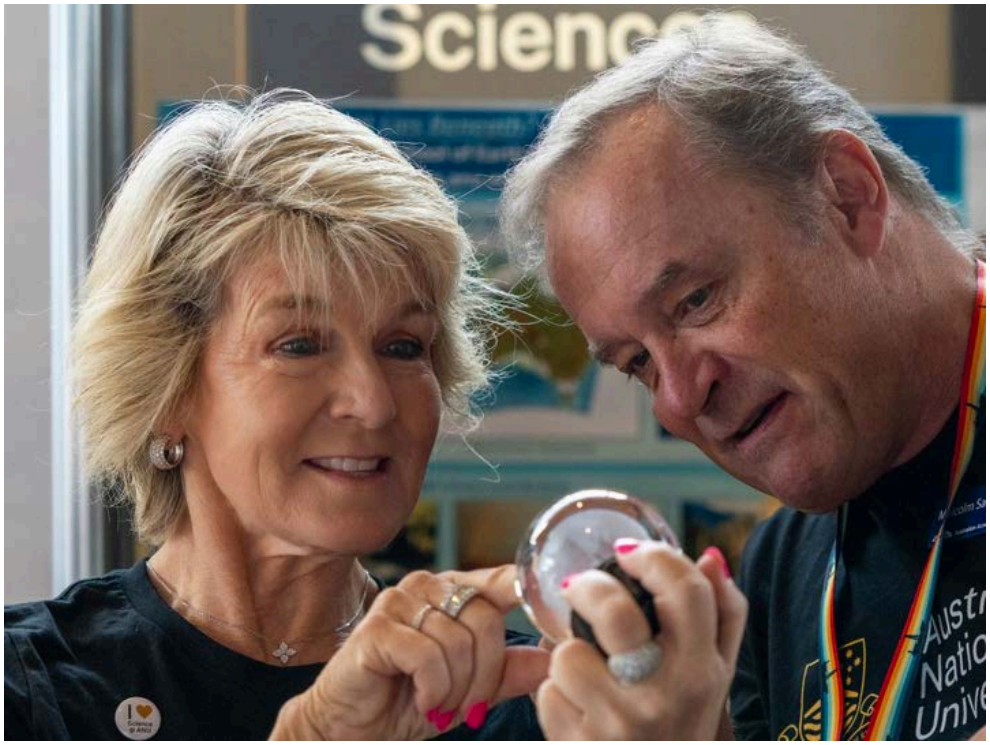
Project/Grant Title	Administering Area	Lead CI	Awarded Date	Primary Funds Provider
NESP 2 - Climate Systems Hub Activity Schedule 5	Ocean & Climate Geoscience	Sarah Kirkpatrick & Nerilie Abram	2024-07-01	Commonwealth Department of the Environment and Energy
Project 3.1253 RIIP22 ECE Analytical Instrument Refresh ANU	Geochemistry	Olivier Alard & Brett Knowles	2024-07-01	AuScope Ltd (subsidiary of NCRIS)
Project 3.55 - NCRIS2023 Earth Composition and Evolution ANU	Geochemistry	Olivier Alard & Dorrit Jacob	2024-07-01	AuScope Ltd (subsidiary of NCRIS)
Student Travel Grant - SEG 2024: Sustainable Mineral Exploration and Development	Geochemistry	John Mavrogenes	2024-07-05	Society of Economic Geologists Foundation, Inc.
ANU ECR Travel Grant 2024	ICP Environment Projects	Chengxin Jiang	2024-07-11	Australian National University (ANU)
ANU ECR Travel Grant - 2024	Geochemistry	Laura Otter	2024-07-15	Australian National University (ANU)
iPhD - Understanding Critical Minerals: the Rocha da Rocha Rare Earth Element-Niobium-Scandium Deposits in Northeast Brazil	Geochemistry	Antony Burnham	2024-08-20	Brazillian Rare Earths Ltd
iPhD - Understanding Critical Minerals: Niobium-Tantalum in Mount Weld REE World-class Deposit	Geochemistry	Greg Yaxley	2024-10-23	Commonwealth Scientific and Industrial Research Organisation (CSIRO)
The copper mine of the future: Metal extraction from natural magmatic brines (CuBrine)	Geochemistry	Andrew Berry	2024-11-01	Rio Tinto London Ltd.
Frameworks and Methods for Social-Environmental-Technological Integration - CFFM WP001	Geochemistry	Sujatha Raman & Rini Astuti	2024-11-01	Rio Tinto London Ltd.
State-of-the-art spectral characterisation of complex materials	Geochemistry	Penny King	2024-12-01	AuScope Ltd (subsidiary of NCRIS)
Land-to-Sea-2: sub-ice sampling to constrain West Antarctic Ice Sheet stability and linked coastal zone impacts	ANZIC	Ron Hackney & Sarah Kachovich	2024	AuScope Opportunity Fund

School Seminar Series

RSES school seminars were held fortnightly in 2024, featuring 21 speakers who were gender-balanced and represented a variety of career stages. The speakers were evenly distributed across the three areas of the school — Geophysics, Geochemistry, and Climate and Ocean Geoscience — and came from a diverse mix of local, national, and international institutions.

Speaker and Institution	Seminar Title
Louis Moresi (RSES)	A vision for reusable modelling for cross-disciplinary research
Luc Doucet and Hugo Olierook (Curtin University)	Exotic mantle-derived melt in the context of supercontinent cycles
Xiaoming Liu (University of North Carolina)	Geochemical adventures on Earth's surface
Sylvie Demouchy (Université de Montpellier)	Everything flows, but how? Inferring the role of novel agents of ductile deformation in olivine
Shane Keating (UNSW)	Chasing storms: Investigations of ocean eddies from sea, space, lab and laptop
Amy Prendergast (University of Melbourne)	Hominin responses to changing environmental conditions in the Lower and Upper Palaeolithic in the Levant
Jan Dettmer (University of Calgary)	Integrating fiber-optic instrumentation in geohazards monitoring and geophysical inference
Chen Zhao (University of Tasmania)	Subglacial hydrology reshapes projected Antarctic sea-level rise
Ruoyu Sun (Tianjin University)	Mercury stable isotopes: Theory, measurement, and applications in modern and past environments
Indrani Mukherjee (UNSW)	A billion years of geological drama: boring or brilliant?
Stephen Foley (Macquarie University)	Incipient melts of the mantle and the deep carbon cycle
Morgan Blades (University of Adelaide)	Half a billion years of basin evolution in northern Australia; the greater McArthur Basin
Josephine Brown (University of Melbourne)	Glacial and Holocene variability of ENSO, monsoons and the South Pacific Convergence Zone: insights from palaeoclimate modelling
Ludmila Adam (University of Auckland)	Seismic and physical properties of sedimentary and volcanic rocks: from Earth to the Moon and Mars
Madelaine Rosevear (University of Melbourne)	How does the ocean melt Antarctic ice shelves? Recent insights from observations and high-resolution models.
El Mestel (Victoria University of Wellington)	Seismicity, sub-surface structure, and partnership with Tangata Whenua of Taupō volcano, Aotearoa New Zealand

Speaker and Institution	Seminar Title
John Hernlund (Tokyo Institute of Technology)	If Planet=Function(Formation), what is the Function() like? How will we learn it?
David Heslop (RSES)	Paving the way for green steel: Australia's role in reducing global carbon emissions
Axel Schmitt (Curtin University	The world's youngest syenite-carbonatite system underneath Laacher See, Germany: A testbed for carbonatite genesis
Amando Lasabuda (University of Sydney)	The Cenozoic era of the Barents Sea, Norwegian Arctic: A forward modelling of basin and landscape dynamics and implications for ocean circulation between the Atlantic and the Arctic
Malcolm Sambridge (RSES)	When one of things you don't know is the number of things that you don't know.



ANU chancellor Julie Bishop and Professor Malcolm Sambridge examine Earth's innermost inner core.

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Clockwise from top left: Dr Voon Hui Lai, Professor Meghan Miller and Professor John Townend. Image: Rory O'Sullivan, Chorus, Dr. Nicola Maher Represents Young Climate Scientists at the Australian Parliament, David Heslop making a gravity measurement.

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Caroline Eakin removing instruments in the Eyre Peninsula.

Red text: information from 2023 to be verified for 2024

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	Chair	NASA SciX advisory board
	Co-lead	Computational Infrastructure in Geodynamics (NSF supported)
	Member	Teacher Earth Science Education Program - Advisory Committee
	Member	Community Infrastructure for Geodynamics Executive committee (www.geodynamics.org).
	Board Member	Teacher Earth Science Education Programme
Dr. M. Norman	Science Editor	GEOLOGY (Geological Society of America)
Prof. B. Pillans	Chair	National Rock Garden Steering Committee
	Director	National Rock Garden

Photo: Penny King

Photo: Brad Pillans at Lake George. Credit: Elesa Kurtz

Red text: information from 2023 to be verified for 2024

NAME	POSITION	COMMITTEE / BOARD
Prof. A.P. Roberts	Member	Proposal Evaluation Panel for research at Mario Zucchelli Station, Antarctica, Programma Nazionale di Ricerche in Antartide (National Antarctic Research Program), Ministry of Universities and Research, Italy
	Member	College of Assessors, New Zealand Ministry of Business Innovation and Employment
	Member	Canvassing Committee, Geomagnetism, Paleomagnetism and Electromagnetism Section, American Geophysical Union
	Plenary Lecture	Australian Earth Science Convention, Perth, Australia
	Speaker	Mawson Medal Lecture, Australian Academy of Science
	Invited speaker	FORC Workshop, Institute for Rock Magnetism, Minneapolis, USA
	Session chair	Dynamic Earth Special Symposium: Rock magnetism, Global reconstruction and supercontinent cycles, Australian Earth Science Convention, Perth, Australia
	Session chair	Iron cycling in natural and anthropogenic environments, Conference on Rock Magnetism, Minneapolis, Minnesota, USA
Prof. M. Sambridge	Member	Physical Sciences - Prime Ministers prizes for Science committee
	Vice President	Australian Academy of Science for the Physical Sciences
	Physical Sciences Secretary	Australian Academy of Science
	Member	Australian Academy of Science - Awards review committee
	Physical Sciences lead	Australian Academy of Science Champions of diversity group
	Chair	Presidential Nominating Committee for the Australian Academy of Sciences
	Chair	Bye-law review committee, Australian Academy of Sciences
	Chair	European Geosciences Union Gutenberg medal committee

NAME	POSITION	COMMITTEE / BOARD
Prof. H. Tkalčić	Chair	American Geophysical Union Seismology Section Fellows Review Committee
	Member	Australian Academy of Science Research Mobility Grants Assessment Panel
	Member	International Association of Seismology and Physics of the Earth's Interior (IASPEI/IUGG) - Executive Committee (elected)
	Member	Study of the Earth's Deep Interior (SEDI/IUGG) - Executive Committee
	Member	Geofizika – Editorial Board
	Member	Physics of the Earth and Planetary Interiors (PEPI) – Editorial Board
	Member	Scientific Reports – Editorial Board
	Proposal evaluator	US National Science Foundation Geophysics Program (NSF)
	Proposal evaluator	Australian Research Council (ARC)
	Proposal evaluator	ETH Zürich Grants (ETH; Switzerland)
	Proposal evaluator	Deutsche Forschungsgemeinschaft (DFG; Germany)
	Proposal evaluator	European Research Council (ERC)
Hon. Prof. L. Wyborn	Member	EGU Earth and Space Science Informatics Committee
	Member	AGU Indigenous Action Task Force
Prof. G.M. Yaxley	Member	Centre for Advanced Microscopy (CAM) Scientific Steering Committee

STUDENT NEWS
Stucon

Held from 17-18 October 2024 in the Jaeger 1 Seminar Room, Stucon is a student-led conference that was meticulously curated to provide participants with a platform to showcase their research and achievements. All students - undergraduate, honours, masters, and PhD - were invited to participate in this esteemed event.

Poster Competition Winners

People Choice's Oral Presenter
Oliver Medd - *A New LA-IRMS Device for Stable Isotop Dendrochronology in Australia*

People Choice's Poster Presenter
Yun-Ze Cheng - *Feasibility Study of Lunar Seismic and Correlation wavefield*

Best Design Poster Presenter
Claire Yung - *an Ice Shelf Basal Melt Parameterization with turbulence suppression due to stratification*

Kahoot Quiz
Oliver Medd, Prof. Stewart Fallon, Halik Taha

Stucon

Bake Your Ph.D. Winners

From the 2024 Bake Your PhD competition. Left to right: Ammu Sanjayan Nair Bindhu, Edgar Leong, Kelly Lawler, Rosmalia Nugraheni, Hitank Kasaundhan, and Phudit Sombutsirinun. Photo: Nic Vevers/ANU

Judges Choice's Bake Your Ph.D.

Rosmalia Nugraheni - *A scenic blue celestine geode and columnar joint: the evidence occurrence of basaltic dyke*

People Choice's Bake Your Ph.D.

Kelly Lawler - *Cupcake Oceanography: A Taste of Southern Ocean Radiolarian Communities from Ice Shelf to Deep Sea*

GEOBALL 2024

GEOBALL 2024 was held on 23 August 2024 in the Poseidon Room at the Hellenic Club in the City. The theme was "Into the Abyss" and attendees dressed up in space- and marine-themed formal wear.

Student Representatives

Nurmalia Adroli
Hitank Kasaundhan

Fieldtrips

NSW South Coast

Students from EMSC1008 (EARTH) explored the spectacular geology of the NSW South Coast in September. Throughout the week the students learned key skills such as how to make a cross-section, geological map, and stratigraphic column, as well as keeping a field notebook. Well done to all students for completing the trip! Special thanks to Andrew Berry as trip leader, Oliver Medd, Laura Miller, Caroline Eakin, Ram Parthiban, Edgar Leong, (and Kevin Thow back at RSES) for all their hard work that ensured the trip was a success.

Understanding Geological Hazards trip

Credit: David Heslop

Sixteen ANU undergraduate students visited Japan as part of a joint course with the University of Tokyo, titled "Understanding Geological Hazards." The students worked with their Tokyo counterparts, exploring natural hazards through DFAT's New Colombo Plan. Their hands-on learning included visits to areas impacted by the 2011 Great East Japan Earthquake and Tsunami. Guided by experts from the Mt. Fuji Research Institute, the students also hiked to the Hōei crater on Mt. Fuji to explore volcanic hazards.

Fieldtrips (continued)

Wee Jasper Field Trip

At the beginning of April this year, the EMSC2023 Fundamentals of Geology class visited the Wee Jasper area. Under Brad Opdyke's guidance, they learned to distinguish between different rock formations and studied Devonian sandstones, limestones, shales, and volcaniclastics. Divided into groups, they conducted fieldwork while encountering kangaroos, wombats, and wild pigs. In the evenings, they enjoyed meals prepared by Oliver Medd and around a campfire. Their time in the field was cut short by rain and site access issues, but they are already looking forward to their next excursion.

Cooma Field Trip

Credit: Antony Burnham

On 20 April 2024, an intrepid group of third year students joined Antony Burnham for a day trip to Cooma to observe the world-famous metamorphic sequence, a selection of granites and some basalt flows (illustrated). As this trip wasn't an official part of the Magmatism and Metamorphism course, the students are to be commended for their enthusiasm, and they were rewarded with fine autumn weather. (Not having to mark notebooks afterwards was the reward for the leader.) As in previous years, the chance to wield a sledgehammer was the highlight for many.

Fieldtrips (continued)

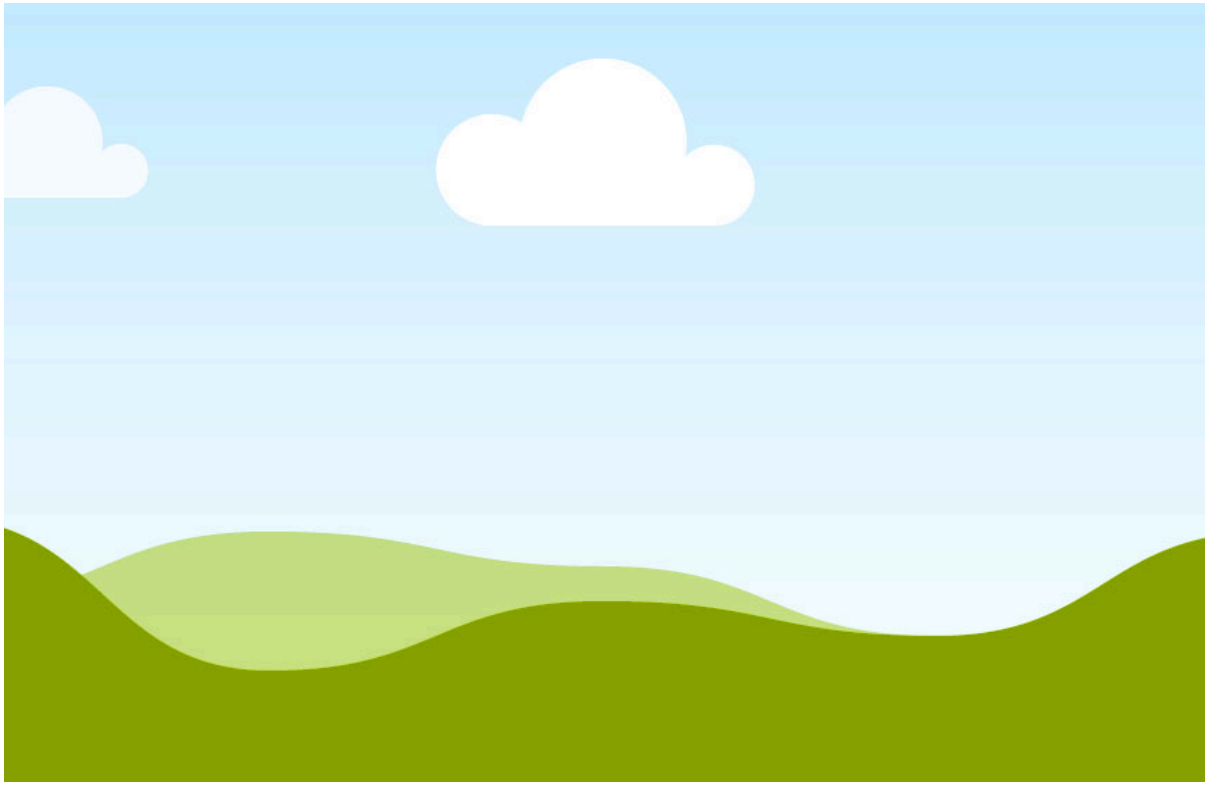
Snowy Mountains Fieldtrip

Photo: Dr Johanna Speirs and Dr Shane Bilish from SnowyHydro talking to students

First-year students in EMSC1006 embarked on a field trip to Kosciuszko National Park, exploring the dynamic interactions between climate, ecology, and geology that have shaped the Snowy Mountains landscape. On Saturday, they hiked to Blue Lake, observing firsthand how environmental factors—both present and from the last glacial period—have modified the terrain. On Sunday, they visited Guthega Dam, where they engaged with climate scientists from SnowyHydro and gained valuable insights into water management and climate research.

Planetary Science

tbd



tbd

Fieldtrips (continued)

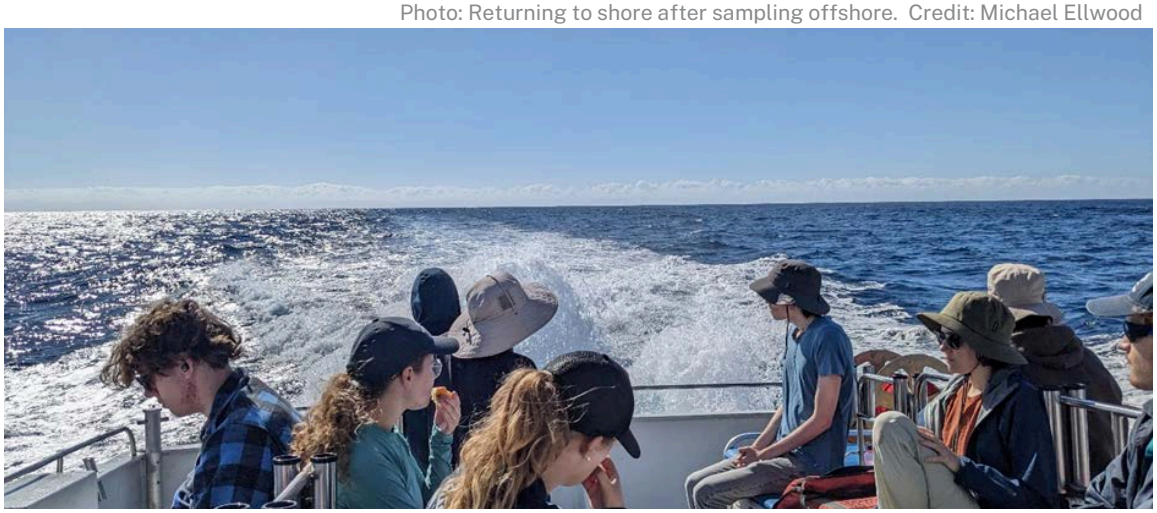
Coral Reef Field Studies

Photo: Dr Johanna Speirs and Dr Shane Bilish from SnowyHydro talking to students

27 students participated in EMSC3019 Coral Reef Field Course and spent 7 days at the Orpheus Island Research Station, Qld. They participated in reef walks, snorkelling, and lectures. All the students designed and undertook research projects related to coral reef environments.

NAROOMA - MARINE BIOGEOCHEMISTRY

Photo: Returning to shore after sampling offshore. Credit: Michael Ellwood



In 2024, students participated in a Marine Biogeochemistry field trip based out of Narooma on the south coast of New South Wales. The fieldwork involved travelling about 12 nautical miles offshore, passing Barunguba Montague Island, to collect seawater samples from various depths. These samples were gathered to support the practical learning objectives of the course, providing students with firsthand experience in marine sampling techniques and oceanographic data collection. The collected samples were subsequently analysed during the laboratory component of the course, where students applied biogeochemical methods to investigate key chemical properties of the marine environment.

Photo: Some of the wildlife as we passed Barunguba, Montague Island. Credit: Michael Ellwood

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