Earth and Planetary Sciences Honours Major Coordinator

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School of Earth and Planetary Sciences

Curtin University

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Website

Curtin Online Course Handbook

https://handbook.curtin.edu.au/courses/course-ug-earth-and-planetary-sciences-honours-major-bsc-honours--mjrh-epsciv1

General Enquiries

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Contents

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What is Honours all about?

The Earth and Planetary Sciences Honours Major (BSc) (Honours) program at Curtin is a supplementary higher-level qualification to a Bachelor degree. It is undertaken as one year of full-time study during the calendar year, commencing formally at the beginning of Semester 1 (Full Year option) or Semester 2 (Mid-Year option). Honours involves research training to a professional standard, which is recognised by industry.

It is designed to provide advanced training in Earth and planetary sciences to better prepare graduates for employment as professional geoscientists or those continuing studies toward a higher degree. In addition to the scientific aspects, the aim of the program is to develop many of the essential traits and skills of a geoscientist, including an ability to plan and implement an investigation and effectively communicate the outcomes of an investigation to peers.

What are the Course Learning Outcomes?

A graduate of Earth and Planetary Sciences Honours Major (BSc) (Honours) can:

1	Have demonstrated knowledge and understanding in the Earth and planetary sciences field of study that is at a level that is informed by knowledge of the forefront of the field of study, within a research context.
2	Can apply their knowledge and understanding in a manner that indicates a professional approach to Earth and planetary sciences, and have competencies demonstrated through devising and sustaining arguments (to both specialist and non-specialist audiences) and solving advanced problems within their Earth and Planetary Sciences field of study.
3	Understand the constructs of the scientific method and apply these principles in the Earth and Planetary Sciences field of study by communicating new knowledge, including using digital technologies.
4	Can gather and interpret relevant research data within the Earth and planetary sciences field of study to inform judgements that include reflection on relevant social, scientific or ethical issues, including being aware of the diversity of international perspectives associated with the Earth and planetary sciences field of study, and how these impact upon the practice of the Earth and planetary sciences.
5	Understand the global and cultural issues within the Earth and Planetary Sciences field of study and how these impact on the practice of professions in this field.

6 Display a very high standard of professional behaviour, complying with applicable legislation and including effective time management, both independently and as a team member.

What does Honours involve?

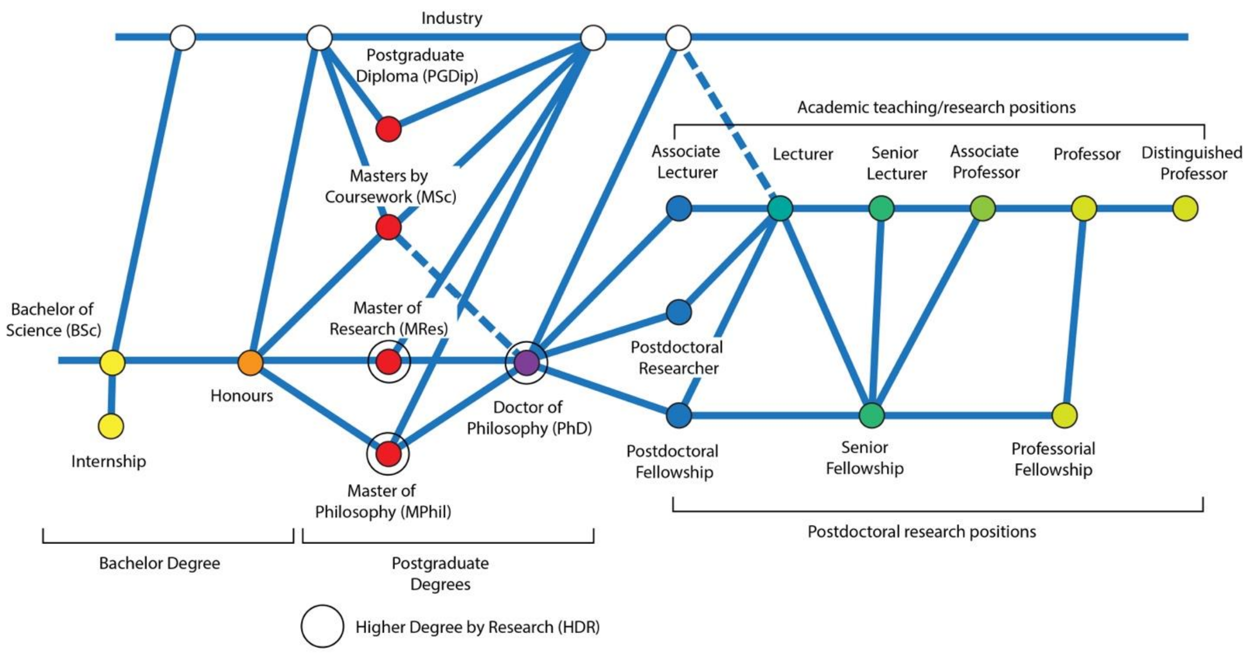
The Honours program includes advanced coursework in selected disciplines and completion of a supervised research project. A major part of the Honours year (~75 %) involves supervised research on a specific topic. This includes undertaking original research and preparation of a thesis, review of current literature, and presentation of seminars on the results of the research. These components are used as the basis for grading of Honours degrees.

What is Honours like?

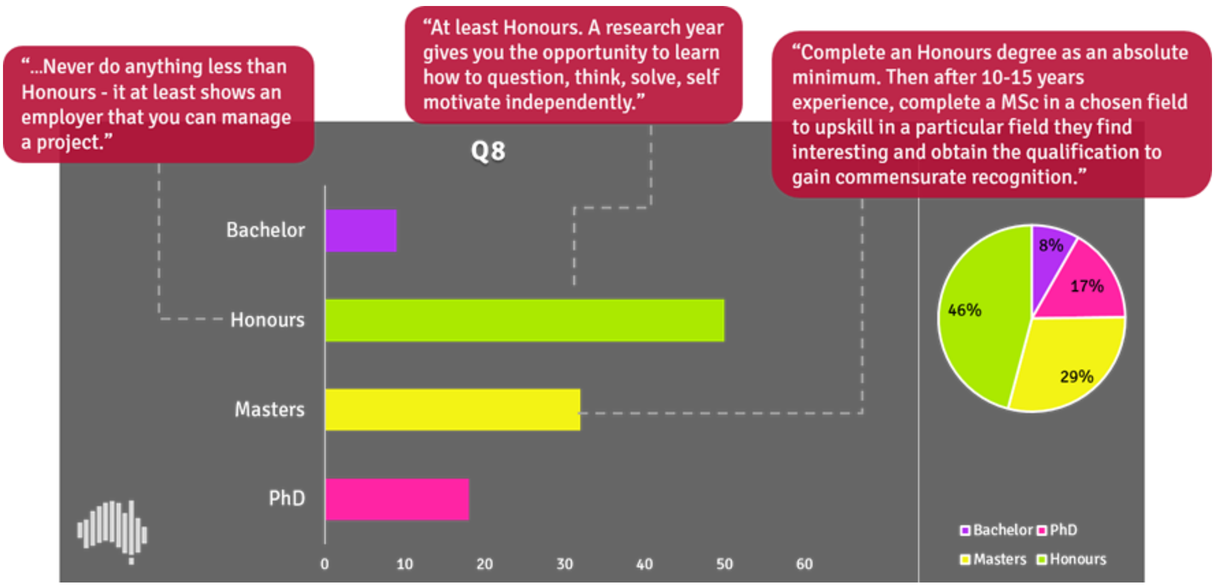
Honours is a different experience from rest of your Bachelor degree. You will dedicate your time to a research project, learning new skills, and work collaboratively with your supervisors and research group. It will be the first time that you are responsible for the outcome of your own scientific work. You will experience all the advantages and challenges that this entails. You will need to be self-directed. Honours students also engage in all the aspects of the social life of the School and you may form friendships and professional relationships that could last a lifetime.

How can Honours help my career pathway?

The Honours degree will give you a thorough training in scientific methods and a detailed insight into the scientific processes in the area of research that you pursue. The scientific approach to problem solving, maturity and self-discipline gained during the Honours year will equip you for a wide variety of careers. After completing the Honours year, students may elect to continue their research project and upgrade their qualification to a Master by Research (MRes) in Earth and Planetary Sciences by undergoing a further year of research. Alternatively, Honours graduates could enrol in MPhil or PhD programs directly. The analytical and transferable research skills that our students acquire have led other Honours graduates into a range of careers in many different fields.



Industry Expectations*: "What level of study (i.e., Bachelor, Honours, Masters, and/or PhD) would you recommend and why?"



Taken from the AIG National Graduate Group Geoscience Survey 2017:

[*https://www.aig.org.au/blog/2017/01/27/part-three-of-a-three-part-series-what-the-industry-wants-results-from-the-aig-national-graduate-group-geoscience-survey/*](https://www.aig.org.au/blog/2017/01/27/part-three-of-a-three-part-series-what-the-industry-wants-results-from-the-aig-national-graduate-group-geoscience-survey/)

Optional upgrade from Honours to Master of Research (MRes)

After you have completed your Honours degree, you may wish to upgrade your qualification to Master of Research (MRes) by undertaking one additional year of research, effectively by extending your Honours research project. This is option offered by Curtin designed to provide an opportunity for Honours students to receive a Masters-level qualification in just two years after graduation from a Bachelor degree, maximise outcomes of research projects, and enable students to increase their career prospects in a multitude of ways. Upon successful completion of the additional research year, you will forfeit your Honours qualification and receive MRes in Earth and Planetary Sciences. However, Honours remains an exit option for those who convert to MRes but choose to exit early. A limited number of scholarships for the additional year of study will be available to students who wish to pursue the Honours to MRes conversion option.

What are the Honours admission requirements?

A Completion of a recognised Bachelor degree majoring in an Earth and Planetary Sciences discipline.

…and…

B Course weighted average (CWA) of at least 65% (Curtin graduates). Graduates with less than 65% may apply separately for consideration by the Head of School. Applicants from other recognised tertiary institutions must be able to demonstrate an academic standard equivalent to that required for Curtin graduates and must submit a certified copy of their undergraduate academic record and a statement of completion of the degree (when available from their university).

…and…

C A viable research project.

…and…

D A willing and able supervisory team.

How do I choose an Honours project?

This prospectus includes a list of Honours research projects offered by supervisors for 2025. You are also encouraged to talk with academic staff because the listed projects may not reflect all the projects available. It is recommended that you consider the preferred field in geosciences in which you would like to do a project and then get in contact with the supervisors who supervise projects in this field. You may also want to talk with current Honours students to find out what Honours is like from a student perspective.

Considerations in choosing an Honours Project

There is a general perception that your choice of Honours project will fix you to a certain career path. This is not the case; keep in mind that employers are looking for confident and capable people who have successfully tackled and completed a challenging project and professional coursework. You are most likely to be successful during

Honours if you choose a research project that interests and motivates you.

If you are interested in continuing into research, or if during your Honours year you begin to enjoy the research experience, you may feel that your choice of project commits, or has committed you to a specialized area. However, the problem solving and other transferable skills that you will learn, and the confidence gained from completing your Honours project means that you are well equipped to change direction to take advantages of new opportunities. The University's scholarship page has more details on postgraduate research.

If you are thinking about doing Honours, it is a good idea to talk to current and past Honours students; they will give you frank and helpful advice.

Discuss project options further before you decide

Interested students are encouraged to discuss their research interests with academic staff (including the Honours Coordinator) to ascertain what research projects are or may become available for next year. Research projects that emerge after the production of this prospectus are also advertised via the Honours Coordinator. If you have interests other than the projects currently available, it may be possible to arrange a research project suited to your interests, but you must consult with appropriate staff.

Every endeavour is made to ensure that Honours research projects are fully funded, either through industry sponsorship or research grant support. ***Funding for projects and logistical support should be discussed with project supervisors.***

It is sensible to identify at least three to four projects of interest in the prospectus and then arrange to meet with the supervisor(s) to discuss in more detail. Remember that the supervisors mentioned in this prospectus will not expect you to have a great deal of knowledge about their particular fields of research, so do not feel intimidated. It is also worth remembering that different supervisors have different ways of assigning projects. Some may use the first-in, first-served approach, while others may consider all enquiries before offering a particular project, make sure that you leave a contact number in case another student also expresses and interest.

For the most part, students who are clear that they want to do Honours will have chosen a project in early December. However, other students may still find great projects up until January. Late breaking projects are not necessarily second rate since a lot of the funding (Research councils, government agencies and industry) that will be used to support the various projects may not be finalized until late December or January. If you are unsure of what projects to do, it is advisable to start talking to supervisors that you would like to work with. It may also be the case that there are other potential projects that are not listed in this prospectus. In addition, if you have a good idea to explore - bring it to our attention, by all means. it is advisable to get in early and confirm your preferred project as soon as possible.

How do I apply?

Follow these four steps…

Step 1

Discuss a project that interests you with the supervisor(s).
Consider which discipline(s) is of most interest to you, and consider which academic staff supervisor with whom you would like to work. Discussion is highly recommended to help you decide if a project is suitable for you, and to help supervisors allocate projects.

Step 2

Complete and lodge an Expression of Interest form before 27th November.
The form is available on page 13 of this prospectus. An '*Expression of Interest*' is not a commitment to embarking on Honours but is designed to assist the academic staff with planning for the forthcoming year, including arranging research projects, if required. Scan the signed form and email it directly to the Earth and Planetary Sciences Honours Major Coordinator Aaron Cavosies aaron.cavosie@curtin.edu.au

Step 3

Complete an Application for Admission online
The Expression of Interest form is not an application. You will need to apply for the Honours degree formally via Curtin's online system. Honours is separate to an undergraduate degree. The Earth and Planetary Sciences Honours course is called "MJRH-EPSCI v.1 Earth and Planetary Sciences Honours Major (BSc) (Honours)" and details can be found in the Curtin Courses Handbook at: https://handbook.curtin.edu.au/courses/course-ug-earth-and-planetary-sciences-honours-major-bsc-honours--mjrh-epsciv1
It is a 'major' subject of "BH-SCNCE v.2 Bachelor of Science (Science) (Honours)". Further information about the degree structure and admission details can be found at: https://handbook.curtin.edu.au/courses/course-ug-bachelor-of-science-science-honours--bh-scncev4

Please note that part-time enrolment is NOT available for MJRH-EPSCI v.1 Earth and Planetary Sciences Honours Major (BSc) (Honours).

Step 4 Your admission will be subject to you meeting the minimum criteria and having a project allocated to you. Therefore, you will be notified after the release of the final results of your Bachelor degree.

Are there any scholarships or bursaries available for Honours students?

Scholarships may be available to full-time Curtin Honours students (see below). Also check https://scholarships.curtin.edu.au or contact the scholarships office via email at scholarships@curtin.edu.au

Australian Institute of Geoscientists (AIG) Bursary

Amount	$1000-3000	**Conditions**	Recipients must be a current AIG member. Full time students are eligible for free membership
Number offered	See website		
Application deadline	2024: Aug 1		
More details	http://aig.org.au		

Western Australian branch of the Petroleum Exploration Society of Australia (PESA WA)

Amount	$400 (in 2019)	**Conditions**	1. Enrolled as a third year, higher undergraduate or post-graduate student in a geology or geophysics program at UWA or Curtin University 2. Must be a current PESA member. Membership is free for students
Number offered	One in 2019		
Application deadline	Usually Sept/Oct		
More details	**www.pesa.com.au**		

Australian Energy Producers Tony Noon Memorial Scholarship

Amount	Up to $3,000	**Conditions**	1. Honours, Masters or PhD student attending an Australian university in the year of application and must be an Australian citizen or resident
Number offered	According to merit		
Application deadline	End Sept		
More details	**https://energyproducers.au/about/about-us/scholarships/**		

West Australian Mining Club Scholarship

Amount	$10,000	**Conditions**	See website
Number offered	Usually one		
Application deadline	Not listed yet		
More details	**www.waminingclub.asn.au**		

CSIRO Next Generation Graduates Honours Scholarship

Amount	Up to $15,000	**Conditions**	Must be Australian citizen or permanent resident. 10,000 for stipend, and 5,000 for training.
Number offered			
Application deadline	See website		
More details	**https://www.csiro.au/en/work-with-us/funding-programs/funding/next-generation-graduates-programs/nextgen-scholarship-information**		

AINSE Pathway Honours Scholarship

Amount	Up to $5,000	**Conditions**	Awarded to a student doing work involving the use of an ANSTO facility or AINSE-sponsored work.
Number offered	Usually one per year		
Application deadline	Dec 1 2024		
More details	**https://www.ainse.edu.au/pathway/**		

Reg Dowson Mining Geology Honours Scholarship

Amount	$3,000	**Conditions**	Awarded to a student doing an Honours project in Earth and Planetary Sciences of relevance to the mining industry.
Number offered	Usually one per year		
Application deadline	Typically ~March each year		
More details	https://scholarships.curtin.edu.au/scholarships/scholarship.cfm?id=2823.0		

Who does what in the School of Earth and Planetary Sciences?

Research interests of academic staff

Dr Amir Allahvirdizadeh Satellite positioning, geodesy

Prof David Antoine Earth observation from space; satellite remote sensing, with focus on oceans and coastal areas and ecosystems.

Dr Mehrooz Aspandiar Regolith geology and geochemistry; weathering & landscape processes; clay mineralogy; exploration geochemistry.

Prof Joseph Awange Environmental geoinformatics, mathematical geosciences

Dr Milo Barham Integrated sedimentological, geochronological, geochemical and palaeontological studies to reconstruct Earth surface processes and evolution.

Dr. Dave Belton Laser scanning, photogrammetry

Prof Gretchen Benedix Chemistry, mineralogy, and petrology of meteorites; evolution of asteroids and other planets; understanding the ambient conditions of the early solar system; formation of terrestrial planets.

Prof Phil Bland Planetary Science, early evolution of the solar system, characterization of meteorites, tracking meteorite falls.

Dr Alison Blyth Palaeontology, isotope geochemistry of fossils, palaeo-environmental geoscience.

Katelyn Boase Geomicrobiology

Dr Michael Carson Exploration Geophysics

Dr Aaron Cavosie Planetary science; impact cratering; shocked minerals; dating meteorite impacts; Martian meteorites; early Earth processes; accessory phase geochronology; oxygen isotopes; igneous petrology.

Dr. Sten Claessens Geodesy, gravimetry

Prof Chris Clark Metamorphic geology & geochronology: High-temperature metamorphism; thermal and thermodynamic modelling, geochronology and tectonics.

Olivia Collet Exploration geophysics

A/Prof Marco Coolen Molecular palaeoecology; geomicrobiology; palaeoclimatology; microbial activity in hydrocarbon reservoirs.

Dr. Hadrien Devillepoix Astrophysics, meteoritics

A/Prof Ashraf Dewan Environmental geoinformatics, climate change

Dr Navdeep Dhami Organic geochemistry, geomicrobiologist, bio-activated materials.

Dr Luc Doucet Geodynamic reconstructions.

Dr Maximilian Droellner Detrital geochronology, isotope geochemistry, sedimentary provenance analysis

Dr Alec Duncan Marine acoustics, sonar

Prof Ahmed El-Mowafy Satellite positioning, engineering surveying

Prof Chris Elders Petroleum geoscience, structural and stratigraphic evolution of sedimentary basins, seismic interpretation, fault growth, linkage, and reactivation.

Dr Amy Elson Organic geochemistry.

Prof Christine Erbe Underwater sound (ambient, anthropogenic & biological), sound propagation, signal processing and noise effects on marine fauna.

Prof Katy Evans Metamorphic rocks - blueschist, eclogite, ultramafic. Geothermal - fieldwork and chemical modelling.

Prof Noreen Evans Laser ablation ICPMS applications in geological, environmental and biological sciences; (U-Th)/He thermochronology and isotope geochemistry; meteorite impact dynamics and related geochemistry/geochronology.

Dr. Mick Filmer Geodesy, remote sensing

Prof Ian Fitzsimons Metamorphic geology: Mineralogy and petrology of metamorphic rocks; metamorphic mineral assemblages, structure and tectonics.

Dr. Lucy Forman-Amel Extraterrestrial geology, meteoritics

Dr Denis Fougerouse Ore deposit geology, microstructural geology, mineral chemistry.

A/Prof Alexander Gavrilov Marine acoustics, oceanography

Dr Paul Greenwood Environmental and organic geochemistry, molecular organics, stable isotopes, sediments, soils, and water.

Prof Kliti Grice Organic geochemistry; organic matter stable isotopes, molecular biochemistry, climate change, hydrologic and atmospheric processes, hydrocarbons.

Prof Boris Gurevich Rock physics

Prof Brett Harris Exploration geophysics, hydrogeology

Dr Mike Hartnady Geochronology, metamorphism, structural geology, and tectonics.

Dr. Joshua Hedgepeth Extraterrestrial geophysics

A/Prof Petra Helmholz Photogrammetry, geomatics

Dr Alex Holman Organic geochemistry, molecular and isotope geochemisirty, mass extinctions, fossils.

Dr. Robert Howie Space systems, planetary science

Roman Isaenkov Exploration seismology, marine geophysics

Dr. Ivana Ivanova Spatial data quality, geoinformatics

Prof Tim Johnson Metamorphic geology: high-temperature metamorphism and partial melting, thermodynamic modeling, Early Earth processes.

Dr Eriita Jones Planetary Science, multi- and hyperspectral satellite remote sensing, water resources on extra-terrestrial bodies.

Prof Fred Jourdan $^{40}Ar/^{39}Ar$ geochronology & isotope geochemistry: Large igneous provinces & meteorite impacts, their relationship to mass extinction & climate change.

Prof Chris Kirkland Geochronology, tectonics.

Dr. Uwe Kirscher Paleomagnetism

Dr Ben Knight Computational geodynamics

Dr Juan Li Remote sensing

Dr Janne Liebmann Stable isotopes, geochronology

Dr Yebo Liu Paleomagnetism, paleogeography

A/Prof Katarina Miljkovic Comparative planetology, structure and evolution of planetary crusts, planetary resources, Impact cratering mechanics, numerical simulations of cratering.

Prof Alex Nemchin Geochemistry of early Solar System, lunar science, geochronology.

Dr Hoang Nguyen Exploration geophysics

Dr Paul Nguyen Hong Duc Marine acoustics.

Dr Hugo Olierook Geochronology, Geochemistry, Tectonics, Basin analysis, Economic Geology.

Dr Richard Palmer Computer science, photogrammetry

Dr Chandanlal Parida Biological oceanography

Dr Iain Parnum Marin acoustics, marine geophysics

Prof Roman Pevzner Exploration seismology

Dr Sergei Pisarevsky Palaeomagnetism, geochronology and tectonics; Evolution and palaeogeography of Proterozoic Supercontinents.

Dr Steven Poropat Organic geochemistry.

Dr Kai Rankenburg Isotope geochemistry, geochronology.

Prof Steve Reddy Structural geology & tectonics. Mineral and rock deformation. Microstructure and nanoscale geochemistry.

Dr Will Rickard Microanalysis techniques, scanning and transmission electron microscopy.

A/Prof Todd Robinson Geoinformatics, Remote sensing

Dr Rob Seggie Sedimentology, Sedimentary Basins, Petroleum systems.

Dr Ellie Sansom Planetary science, fireball tracking, meteoroid and meteorite science.

Dr Alan Scarlett Biogeochemistsry, analytical geochemistry

Dr Bettina Schaefer Organic geochemistry

Lyn Schofield Photogrammetry

Pavel Shashkin Seismology

Dr Evgeny Sidenko Marine geophysics

Dr Greg Smith 3D modeling of sedimentary basins for petroleum exploration, seismic interpretation, well log analysis, petrophysical properties of petroleum systems.

Dr Christopher Taylor Paleoecology

Dr Konstantin Tertyshnikov Seismology

A/Prof Svetlana Tessalina Re-Os and Sm-Nd isotope geochemistry & geochronology; application to evolution of the lithosphere and mineral deposits.

A/Prof Nick Timms: Tectonic and shock deformation of rocks and minerals, meteorite, lunar and planetary science; structural geology; geological field mapping; evolution of sedimentary basins; ore deposits.

Dr Cristina Tollefsen Underwater acoustics, physical oceanography

Dr Martin Towner Tracking meteorite falls, digital camera network guru, meteorite search and recovery.

Prof Kate Trinajstic Vertebrate palaeontology, biostratigraphy and evolution; geochemistry to identify fossil biomarkers and palaeoecology.

Lewis Trotter Geographic information systems

Dr Stephanie Vialle Experimental geophysics, rock physics

Dr Bruno Vieira Ribeiro Metamorphic petrology, isotope geochemistry.

Dr Chong Wei Marine geophysics, bioacoustics

Dr Daniel Wilkes Underwater acoustics

A/Prof Dom Wolff-Boenisch Aqueous geochemistry, Environmental Geology

List of Honours projects for 2025

1. Dynamics of particulate matter at two WA coastal sites, as quantified from field and satellite observations (David Antoine, Mick Fimler)
2. Interrogating sedimentary systems using novel integrated detrital mineral characterisation (Milo Barham, Taryn Scharf, Chris Kirkland)
3. Origin of unusual, giant, gem-quality detrital zircon grains in placer deposits from Myanmar (Burma) (Aaron Cavosie, Axel Schmitt)
4. Shock deformation at Brazilian asteroid strikes Vargeão Dome and Vista Alegre: Mars analogue sites (Aaron Cavosie, Lucy Forman, Morgan Cox)
5. Whale localisation in 2D: case studies (Cristina Tollefsen, Christine Erbe)
6. Stable carbon isotopes of amino acids in fossils (Kliti Grice, Alex Holman, Paul Greenwood)
7. Depositional environment and biomarkers of Bolivian Trilobites (Kliti Grice, Paul Greenwood, Alex Holman)
8. Cross-calibrating Orbital Evapotranspiration Datasets For Western Australian Forest and Agricultural Ecosystems (Eriita Jones, Joseph Awange, Baden Myers)
9. Charting Shadows Over The Surface of Mars (Eriita Jones, Katarina Miljkovic)
10. Quantum Diamond Microscopy of Mt Weld Carbonatites (Uwe Kirscher, Denis Fougerouse, Luc Doucet, Arthuer Vicentini)
11. Magnetic remanence measurements to improve geophysical understanding for mineral exploration (Uwe Kirscher, Yebo Liu, Cam Adams)
12. Geochronology and volatile emissions of Makira Island, Ontong Java large igneous province (Hugo Olierook, Luc Doucet, Hijas Hameed)
13. Meteorites: Planetary Story Tellers (Ellie Sansom, Lucy Forman)
14. Timing and evolution of placer gold in Pilbara (Svetlana Tessaline, Denis Fougerouse, Neal McNaughton, Lena Hancock)
15. Textural analysis of lunar rocks from Apollo samples (Nick Timms, Alexander Nemchin)
16. Volcanic centre(s) of the Bunbury Basalt and the breakup of Gondwana (Yebo Liu, Uwe Kirscher, Zheng-Xiang Li)
17. Fossil snakes of Western Australia (Stephen Poropat, Kliti Grice, Alison Blyth, Kailah Thorn)

Expression of Interest – Earth and Planetary Sciences Honours Major

This Expression of Interest is NOT an application for admission to Honours. You must also apply for MJRH-EPSCI Earth and Planetary Sciences Honours Major (BSc) (Honours) online via Curtin separately.

Contact details

Full Name ____

Preferred contact email ____

Preferred contact phone ____

Academic Qualifications

Institution* ____

Degree title ____

Completion anticipated this year ☐

Completed prior to this year ☐   Date completed ___________________________________

Curtin Student ID (if relevant) ____

If available: Course Weighted Average (or equivalent) ______________________________

*If you are/were not enrolled at Curtin, please provide a copy of your full academic record and confirmation of completion of a degree as soon as it is available from your University.

Project Preferences

First Preference Project Title ____

Principal Supervisor ____

I have discussed this project with the supervisor(s) ☐

Student signature _____________________________________ date ____________________

Potential Supervisor signature _____________________________ date ____________________

If applicable:

Second Preference Project Title ____

Principal Supervisor ____

I have discussed this project with the supervisor(s) ☐

Student signature _____________________________________ date ____________________

Potential Supervisor signature _____________________________ date ____________________

**Please scan the signed form and email it directly to the Earth and Planetary Sciences Honours Major Coordinator Aaron Cavosie, at: aaron.cavosie@curtin.edu.au

Dynamics of particulate matter at two WA coastal sites, as quantified from field and satellite observations

AREA OF RESEARCH

Earth observation from space (Satellite remote sensing), dynamics of coastal environments and ecosystems, marine bio-optics.

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Prof. David Antoine	david.antoine@curtin.edu.au
Co-Supervisor	Dr. Mick Filmer	mick.filmer@curtin.edu.au

RESEARCH PROJECT

WA coastal waters are important areas for economic activities such as aquaculture, fisheries and tourism. These areas are however subject to many influences that can lead to rapid and intense changes of water quality. Here, water quality is described through the load of particulate matter, of either biological or mineral origins.

This particle load can be quantified from measurements of the water optical properties, in particular the so-called particulate backscattering coefficient, denoted b_{bp}. As part of a collaboration with the oyster aquaculture industry, a site in the Kimberley (“Cone Bay”) and a site in the Pilbara (“Foam passage” near Karratha) were equipped with moored buoys fitted with optical instrumentation recording b_{bp} and other environment parameters. What is proposed here is to analyse the two 8-month measurements time series (hourly data) to identify the dominant scales of temporal variability, in particular with respect to tidal cycles. Preliminary analyses show correlation with tidal constituents, so a key question is how changes of the particle load are physically related to tides.

The b_{bp} data will also be compared to their values as derived from satellite remote sensing observations, to assess whether the satellite observations provide an accurate representation of the variability of particle load on the 2 sites. Data from the European Copernicus Sentinel2/MSI sensor[1] will be processed through the ACOLITE software[2].

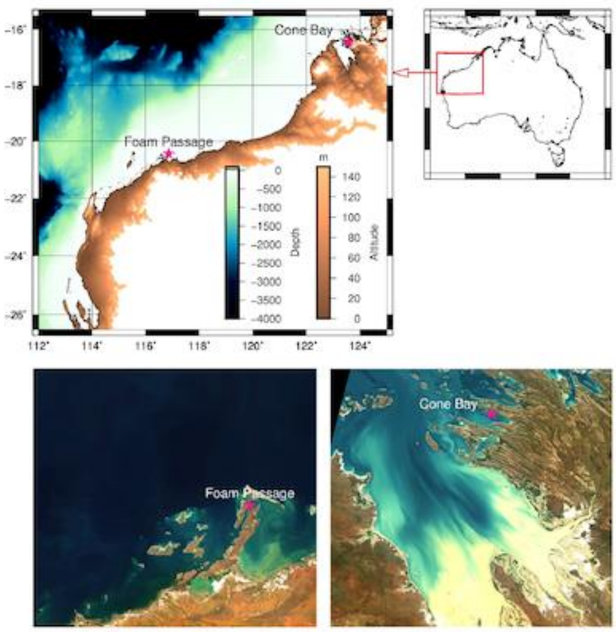


Figure: map of WA showing the location of the 2 study sites (pink stars). The 2 bottom images give some details of the two areas around the sites (Copernicus Sentinel2/MSI satellite sensor)

SUPPORT

The field data sets are available from a research project previously funded by the SmartSAT CRC, and the satellite data are freely available from the Copernicus programme. The satellite data processing software is also available and is run on Linux platforms. Programming ability is expected (e.g., Python or low-level language).

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1 https://sentiwiki.copernicus.eu/web/s2-mission

2 https://odnature.naturalsciences.be/remsem/software-and-data/acolite

Interrogating sedimentary systems using novel integrated detrital mineral characterisation

AREA OF RESEARCH
Sedimentology, Economic geology, Geochronology, Geochemistry, Image analysis

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Milo Barham	milo.barham@curtin.edu.au
Co-Supervisor	Taryn Scharf	t.scharf@curtin.edu.au
Co-Supervisor	Chris Kirkland	c.kirkland@curtin.edu.au

RESEARCH PROJECT
Detrital minerals retain important information about source region geological histories and sediment routing that are essential for larger scale understanding of geological processes through deep time and the evolution of our habitable planet. As well as being excellent archives of geological information, detrital heavy minerals are economic in their own right, in particular zircon, rutile and increasingly, rare earth element bearing monazite.

Significant untapped opportunities remain in terms of developing novel tools in understanding sedimentary systems and aspects of Earth history through integrated geochronological, geochemical and grain morphological analyses of detrital minerals. Furthermore, such developments have applications in understanding reservoir connectivity for aquifer, hydrocarbon and carbon capture research, distal footprint mapping of ore bodies in regolith and mineral system analysis for placer deposits. Australia is a world leader in heavy mineral sands but uncertainties remain with respect to the controls on mineral sand sourcing, accumulation and upgrading and ultimate preservation.

Depending on the candidate, this work will involve applying advanced grain fingerprinting (e.g., newly developed grain shape analysis and laser ablation-based mass spectrometry) techniques to specific minerals. Fieldwork and industry engagement are possible.

SUPPORT
Where relevant the project will be supported by the Timescales of Mineral Systems Group, working on legacy material from projects with Iluka in addition to potential new sampling.

Figure: Happy Prof. and students in a mineral sands mine. Heavy minerals highlight beach facies.

Curtin University
TIMESCALES OF MINERAL SYSTEMS

Origin of unusual, giant, gem-quality detrital zircon grains in placer deposits from Myanmar (Burma)

AREA OF RESEARCH
Petrology; geochemistry; zircon; gemstones; microstructure; metamorphism; tectonics

SUPERVISORS / RESEARCH GROUP: Space Science and Technology Centre
Principal Supervisor: Dr Aaron Cavosie. Email: aaron.cavosie@curtin.edu.au
Co-supervisor: Dr. Axel Schmitt. Email: axel.schmitt@curtin.edu.au

RESEARCH PROJECT
Detrital gemstones from placer deposits in the jungles of the Mogok area of Myanmar are world-renowned, and include pink spinel, ruby, forsterite, and other gems. Among these are some of the most geochemically unusual zircons ever reported, many of which are used as standards for geochemical analysis. Zircon is a common mineral in granitoids and other rocks types, and while the crystallization age of zircon varies according to the local geologic setting, the geochemistry (O, Hf, TE) of most crustal zircons are broadly similar. Placer zircons from Mogok are unzoned, come in a wide range of colors, and preserve some of the highest oxygen isotope ratios ever reported. These observations suggest that the zircons originated from a range of different host rocks, including some that are likely unusual (non-igneous), including metamorphic rocks such as marble or skarn.

Objectives of this project are to use geochemical methods to constrain the provenance of a suite of detrital zircon grains acquired from a private gem dealer who visited artisanal mines in Mogok in March 2020. The project involves scanning electron microscopy (SEM) and laser ablation inductively coupled plasma mass spectrometry (LAICPMS) to detect if chemical zonation is present, as well as to quantify the age and trace element abundance of the different populations. The project will also involve oxygen isotope analysis using secondary ion mass spectrometry (SIMS) to correlate oxygen isotope ratios with age and trace element data. Collectively, the data will be used to constrain which source rock in the complex tectonic collision zone of Myanmar are the likeliest source rocks for the gemstones. These materials will also be evaluated for use as in-house zircon standards.

Left. Example of some of the gem-quality detrital zircons from placer deposits in Myanmar. Note the different colors and also different degrees of sedimentary abrasion, ranging from nearly euhedral to fully rounded. Scale bar increments are mm. These are seriously big honkin' zircons.

SUPPORT. Analytical costs will be covered by the supervisor's subscriptions and other John de Laeter Centre facilities.

Shock deformation at Brazilian asteroid strikes Vargeão Dome and Vista Alegre: Mars analogue sites

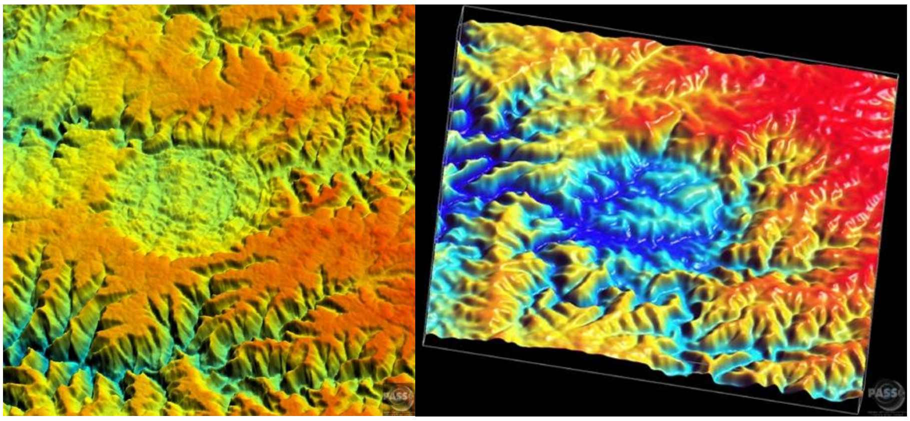
AREA OF RESEARCH

Planetary science; impact cratering; petrology; microstructure

SUPERVISORS / RESEARCH GROUP: Space Science and Technology Centre

Principal Supervisor: Dr Aaron Cavosie. Email: aaron.cavosie@curtin.edu.au
Co-supervisor: Dr Lucy Forman Email: lucy.forman@curtin.edu.au
Co-Supervisor: Dr Morgan Cox Email: morgan.cox@bhp.com

RESEARCH PROJECT



Two Brazilian impact structures. Left: Vargeão Dome impact structure (SRTM topography with shaded relief). Right: Vista Alegre impact structure (DEM). Images from Earth Impact Database.

Earth's impact cratering record consists of only ~200 impact structures. Of these, many have not been studied in detail. In September 2019 we had the good fortune to collect new sample suites of rocks from two Brazilian impact structures: Vargeao Dome (~12 km diameter), and Vista Alegre (~9.5 km diameter). While both sites are recognized as confirmed impact structures, few studies have been conducted on them, and thus little is known about their history of shock deformation, or the impact conditions recorded in preserved rocks. Both of these sites involve basaltic target rocks, and thus serve as Martin analogue sites for impact cratering. In this project, you will use a combination of petrographic observations and scanning electron microscopy (SEM) techniques to document mineral deformation and transformations in various impactites (shocked rocks and impact melts) from both impact structures. This project will involve looking for the unique 'tell tale' signs of damage to minerals (shock deformation) that is caused by high-pressure shock waves. You will also investigate if suitable U-Pb geochronology targets are present. If shock-recrystallized minerals are identified, we will laboratories in the John de Laeter Centre at Curtin to conduct analyses to determine the age of formation of these impact structures using U-Pb geochronology. All of the proposed work represents potential new discoveries and is of broad interest and relevant to Mars exploration.

SUPPORT

Analytical costs will be covered by the supervisor's subscriptions to relevant John de Laeter Centre facilities.

Whale localisation in 2D: case studies

AREA OF RESEARCH
Marine Science / Acoustics

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

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Co-Supervisor	Christine Erbe	c.erbe@curtin.edu.au

RESEARCH PROJECT
Underwater sound is one of the most effective means of studying marine mammal behaviour. Whales, for example, can be tracked by detecting their vocalisations on a hydrophone. With a directional hydrophone, the relative bearing to the vocalising animal(s) can be estimated and more information can be gleaned about their behaviour.

Directional Frequency Analysis and Recording (DIFAR) sonobuoys were deployed off the western coast of Australia in June 2022 to monitor for marine mammal presence. In addition to its omnidirectional recording capabilities, DIFAR sonobuoy data can be processed to provide bearings to sounds relative to the sonobuoy location. On several occasions, pygmy blue whale and minke whale acoustic observations were detected on different bearings, suggesting spatially separated whales (or groups of whales). The bearings to the detected animals changed during the two-hour observation period, indicating relative motion among the animals. In addition, several as-yet unidentified downsweep calls were recorded.

In this project, the student will combine acoustic propagation modelling with estimates of whale vocalisation source level to produce a 2-D map of likely whale position(s) during the observation period. The results could allow for new understanding the migratory behaviour of pygmy blue and minke whales on a timescale of hours.

SUPPORT
The acoustic dataset has already been collected and processed, and the acoustic propagation model is straightforward to install and run. Regular supervision and mentorship is offered.

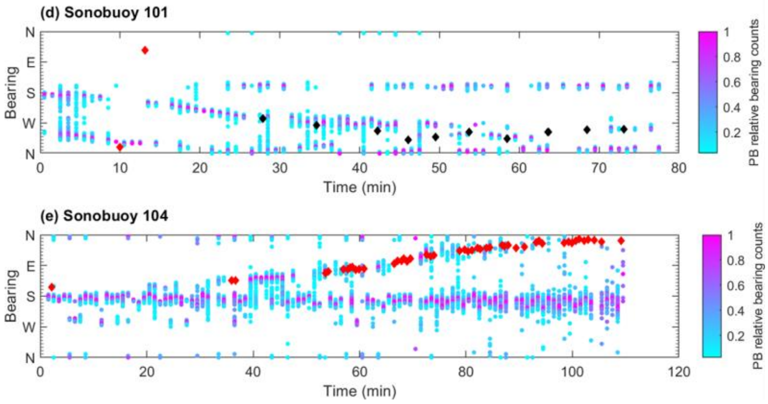

Figure: Bearings to vocalising pygmy blue whales (pink/blue), unidentified downsweeps (red diamonds), and minke whales (black diamonds) for two sonobuoys in the dataset.

Stable carbon isotopes of amino acids in fossils

AREA OF RESEARCH
Isotope Geochemistry; Organic Geochemistry

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Prof. Kliti Grice	k.grice@curtin.edu.au
Co-Supervisor	Dr Alex Holman	a.holman@curtin.edu.au
Co-Supervisor	Dr Paul Greenwood	p.greenwood@exchange.curtin.edu.au

RESEARCH PROJECT
Compound-specific stable isotope analysis (CSIA) is a powerful analytical tool which provides information on source, biosynthetic pathways, and alteration processes of organic molecules in complex mixtures. CSIA has traditionally been performed using gas chromatographic separation, limiting the target analytes to volatile, non-polar molecules. The recent development of liquid chromatography – isotope ratio mass spectrometry (LC-irMS) has expanded the analytical range of CSIA to large or polar compounds that are not amenable to GC separation, including amino acids and sugars. The WA Organic & Isotope Geochemistry Centre has recently been awarded an ARC LIEF grant to purchase an LC-irMS facility, and this project will apply this new technique to the analysis of amino acids in exceptionally preserved fossils.

In the majority of fossils, hard body parts such as bones and teeth are mineralised and soft tissues are degraded with little if any organic preservation. In ideal conditions, however, the degradation of organic matter appears to have paused early in the fossilisation process, contributing to the prolonged preservation of soft tissues. These conditions include anoxic and/or sulfidic conditions, and the rapid encapsulation of deceased organisms in microbially-formed concretions. Such fossils can act as 'time capsules', with preserved biomolecules giving insights into the development and evolution of life. In this project, organic matter from exceptionally preserved fossils (e.g. the Late Pleistocene megafauna of Lake Callabonna, South Australia) will be extracted and analysed, and stable carbon isotopes of amino acids will be measured by LC-irMS. This will provide important information on the diet and trophic levels of the organisms, and the palaeoenvironment in which they lived and died.

SUPPORT
This project will be funded through an ARC Laureate awarded to Prof Kliti Grice (FL210100103: *Interpreting the molecular record in extraordinarily preserved fossils*). The LC-irMS facility was funded through an ARC LIEF (LE240100109: *Compound specific isotopes of polar organic molecules in complex mixtures*).

Figure: A reconstruction of *Diprotodon optatum*, the largest known marsupial. Fossils from Lake Callabonna, including *Diprotodon*, are available for analysis at WA-OIGC. Illustration: Anne Musser, Australian Museum.

Depositional environment and biomarkers of Bolivian Trilobites

AREA OF RESEARCH Evolutionary Science, Organic Geochemistry

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

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Associate Supervisor	Alex Holman	a.holman@curtin.edu.au

RESEARCH PROJECT

Trilobites are burrowing bilaterean organisms that evolved about 520 mya and widely populated the planet for 270 million years from the Early Cambrian until the end Permian. They are believed to have been important ecosystem engineers, with their robust burrowing activity punctuating previously impermeable microbial mats. Early benthic animals had not been able to penetrate the mats which acted as an effective oxic-anoxic boundary on the sea floor (McIlroy & Logan 1999). Breakthrough and subsequent bioturbation of this barrier was a key aspect of Steven Gould and Niles Eldredge theory of Punctuated Equilibria (1972); and is also believed to have contributed to the transition from stable Neoproterozoic type substrates to unconsolidated soft substrates of the Cambrian.

Several exceptionally preserved Trilobite fossils have been acquired from a famous Bolivian deposit (specimen shown right). Isolated fossils and the host sediment will be separately subject to detailed organic geochemical appraisal (i.e., molecular and isotope analysis of solvent and thermally extracted fractions; including by gas chromatography, organic mass spectrometry, isotope ratio mass spectrometry; analytical pyrolysis).

The aims of the project are:

i) Molecular evidence of benthic/microbial mat features which would implicitly link trilobites to the impervious ecosystem divide they are thought to have successfully breached.
ii) Identify biomarker compounds unique to the trilobite fossil– i.e., present in the trilobite sample, but not the background sediment – thus providing new biochemical information about these enigmatic animals. Biomarkers are organic compounds retaining a structural (or stable isotopic) link to their source organism. Biomarkers are a valuable complement to macro fossils (e.g., animal skeleton), each contributing to our understanding of the ever expanding evolutionary framework for life on our planet.

Refs:

McIlroy, D. Logan (1999) The impact of bioturbation on infaunal ecology and evolution during the Proterozoic-Cambrian transition. Palaois 14, 58-72.
Gould, S.J., Eldredge, N. (1972)Punctuated Equilibria, Harvard University Press

SUPPORT: Grice ARC-Laureate Fellowship grant (**FL210100103**).

Cross-calibrating Orbital Evapotranspiration Datasets For Western Australian Forest and Agricultural Ecosystems

AREA OF RESEARCH
Remote sensing; Earth Observation; Physics; Planetary Science; Spatial Science

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

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Co-Supervisor	Joseph Awange	Joseph.Awange@curtin.edu.au
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RESEARCH PROJECT
Evapotranspiration (ET) provides a measure of the total loss of water from the surface through the combined processes of evaporation (from soil or vegetation surfaces) and transpiration (from plants). High frequency, high resolution accurate monitoring of the evapotranspiration of Australian ecosystems is essential for knowledge of their water use over time and for sustainable management of water resources such as irrigation inputs and groundwater. A new model has been developed to provide daily 10 metre per pixel evapotranspiration products however it has not been validated over Western Australian environments. In the absence of field monitoring data, this project aims to understand the potential accuracy of this model by comparing it to other evapotranspiration products and any similar datasets with known error values.

The student will implement a state-of-the-art satellite remote sensing model to derive evapotranspiration products from a range of sensors at different spatial and temporal resolutions over Western Australian ecosystems. The student will use GIS spatial datasets, and open-source evapotranspiration products such as CMRSET, IRRISAT, and NASA's ECOSTRESS to compare to their given model. They will be supported in developing some statistical modelling, spatial analysis, basic coding skills.

SUPPORT
Regular supervision and mentoring is offered.

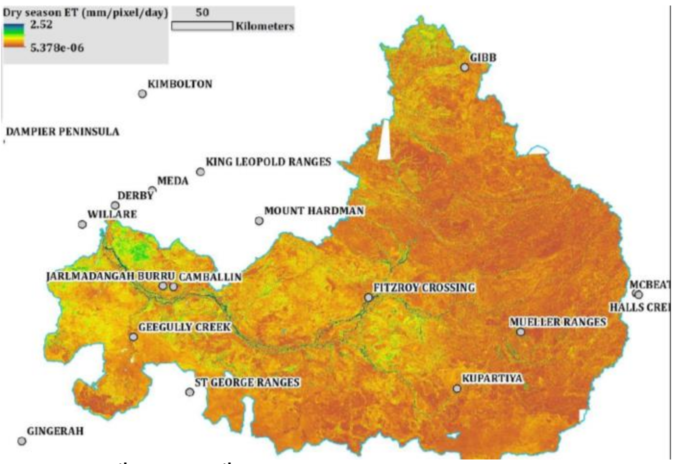

Figure: Mosaic of dry season (24th and 26th July) evapotranspiration in mm/pixel/day in the catchment area of the Fitzroy river, Western Australia.

Charting Shadows Over The Surface of Mars

AREA OF RESEARCH
Planetary Science; Remote sensing; Physics; Spatial Science; Impact Craters

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Dr Eriita Jones	Eriita.Jones@curtin.edu.au
Co-Supervisor	A/Prof Katarine Miljkovic	Katarina.miljkovic@curtin.edu.au

RESEARCH PROJECT
Finding low latitude sources of accessible water ice on Mars is of great importance for future human exploration of the planet and in-situ resource utilisation, and for habitability. However, because of the pressures and temperatures, water ice is only stable on Mars at the surface at high latitudes. At low latitudes water ice is known to occur in some locations in the subsurface regolith – from recent meteorite impacts and unusual hydrogen concentrations – however once exposed to the atmosphere it immediately sublimes back to the gas phase. The role of shadows in reducing the temperature of the surface and promoting ice stability in deep impact craters near the equator, has not been investigated in detail. This project will aim to understand the origin and stability of observed water deposits, as well as identify further locations where water ice may be available at low latitudes where it is accessible near the surface.

The student will utilise Mars global elevation maps and impact craters datasets, in conjunction with a shadow length model to chart the length of time that crater floors experience shadow across Mars. They will utilise a GIS to derive maps and will be supported to develop basic coding language, statistical analysis and mathematical modelling skills.

SUPPORT
Regular supervision and mentoring is offered.

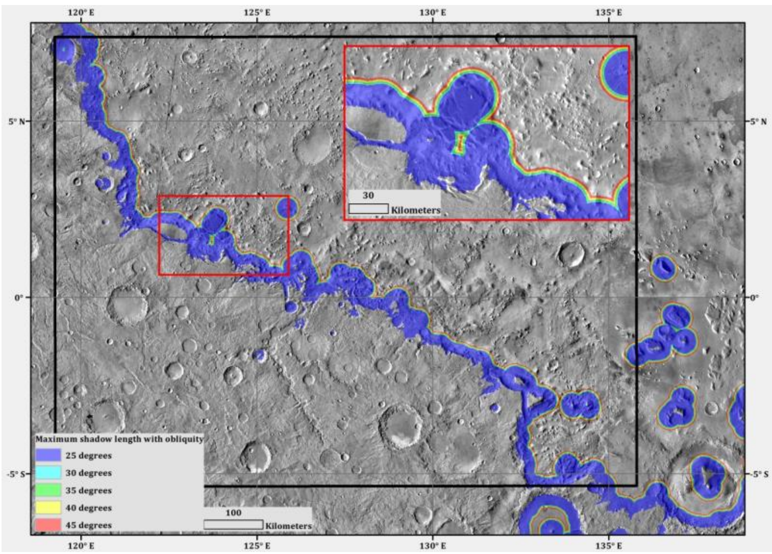

Figure: The extent of shadows cast by the dichotomy on Mars, a significant elevation change separating northern and southern terrain and causing a potentially extensive low temperature anomaly across the low elevation terrain when it falls into shadow.

Quantum Diamond Microscopy of Mt Weld Carbonatites

AREA OF RESEARCH
Paleomagnetism, Ore Deposits, Mineralogy, Geochronology

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

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RESEARCH PROJECT
The Mount Weld deposit of Western Australia is one of the world's richest Rare Earth Element (REE) deposits. Even though the location of the Yilgarn Craton during the formation of the Mount Weld deposit is largely unconstrained, its origination has been linked to large plume events in the Bushveld Craton, South Africa. More direct knowledge about the paleogeographic relationships of plumes and large-scale mineral deposits could improve success rates of identification of new deposits significantly. This project investigates the possibilities of paleomagnetic studies on mineral deposits using the newly established Quantum Diamond Microscope at Curtin University. The student will use the microscope to create remanence maps and hence localize the paleomagnetic signal in the various carbonatite rocks and by doing so support the obtained paleomagnetic data as being of primary origin. If successful, this approach would represent a major step forward in using metamorphic rocks with importance for resources for paleogeographic reconstructions.
During the project the student will be:

- Using a Kappabridge and a variable field translation balance to obtain magnetic hysteresis loops, isothermal remanence magnetization acquisition curves and thermomagnetic curves to characterize magnetic carriers.
- Assist with demagnetization experiments to obtain paleomagnetic directions from carbonatite and dolerite dyke samples of Mt Weld using a 2-G cryogenic squid magnetometer.
- Using the newly installed Quantum Diamond Microscope to create remanence images of selected samples at various demagnetization steps.
- Results will be used to relate the paleogeographic position of the Mt Weld deposit and investigate its relationship with the Bushveld Craton.

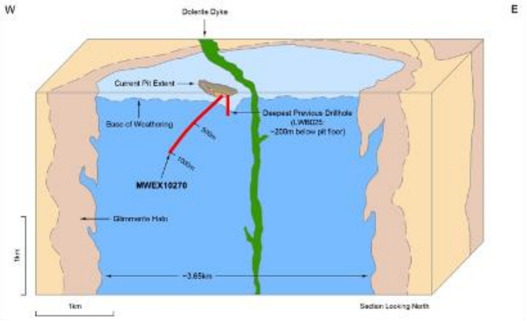

Figure: Sketch map of the Mt Weld REE deposit with a cross-cutting dolerite dyke (left). Newly purchased Quantum Diamond Microscope (right).

SUPPORT

The paleomagnetic measurements will be supported by the Western Australian Palaeomagnetic Facility. Samples and analytical support will be provided by a MRIWA project of Denis Fougerouse.

Magnetic remanence measurements to improve geophysical understanding for mineral exploration

AREA OF RESEARCH
Geophysics, Paleomagnetism, Petrophysics

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS
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Co-Supervisor yebo.liu@curtin.edu.au
Associate Supervisor Cam.Adams@csiro.au

RESEARCH PROJECT
Geophysical modelling of the subsurface using aeromagnetic data is a commonly used exploration technique that is used to interpret location, depth, and geometry of rocks that may be associated with economic mineralisation. This is a crucial set of information, particularly as drilling costs continue to increase as exploration moves further undercover and to more remote regions. It is long known that the measured magnetic anomalies are a superposition of induced and remanent rock magnetisations. While the induced magnetisation can be related to the present-day magnetic field, the remanent magnetisation is often related to the recorded magnetisation direction during formation and/or important alteration events. Remanent magnetisation is far more difficult to obtain than induced magnetisation and is therefore not regularly done within the mineral exploration industry. There are recent examples where remanence directions are interpreted to play an important role in the success of mineral exploration – in some instances drilling has missed mineralisation (and source magnetic bodies) entirely.

This project is 'hands-on', and the student-researcher will become familiar with petrophysical equipment, petrophysical data, and geophysical contexts. Diamond drill cores from a State Government and/or an industry partner will be investigated and used to understand broader geophysical implications (including sources and vectors of magnetism) that is needed to reliably interpret aeromagnetic data and improve mineral exploration. Analyses will be made at the WA Palaeomagnetic Facility, Curtin University and the Rock Characterisation Research Laboratory, ARRC, CSIRO.

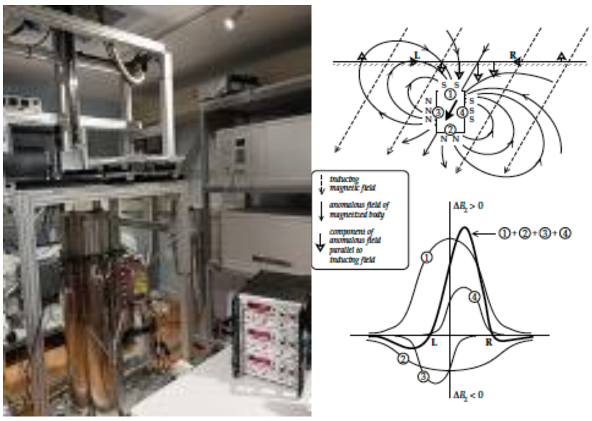

Figure: Left: WA Superconducting Rock Magnetometer for automated alternating field demagnetization and measurement of 99 samples. Right: Simplified principle of magnetic surveying where 'only' induced magnetisation is considered.

SUPPORT
The student-researcher will be supervised by experienced geophysicists and will have access to state-of-the-art facilities, including the West Australian Paleomagnetic Facilities (i.e., paleomagnetic and petrographic analyses), Curtin and the Rock Characterisation Research Laboratory, ARRC, CSIRO (i.e., other petrophysical and some geochemical analyses, as required). An industry or State-Government partner will be consulted, and suitable rocks (with mineral explorations context) sourced for this study. The student-researcher will be directly involved with the partner throughout the project. Measurement costs for the project will be provided by both laboratories.

Geochronology and volatile emissions of Makira Island, Ontong Java large igneous province

AREA OF RESEARCH
Petrography, Geochemistry, Geochronology

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Hugo Olierook	hugo.olierook@curtin.edu.au
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RESEARCH PROJECT
Environmental crises have had detrimental effects on Earth's biota and climate. The vast majority of these crises were caused by large igneous provinces, which emitted truly gigantic volumes of mafic rocks, volatiles and metals into the atmosphere and oceans in geologically short periods of time.

The very largest of these large igneous provinces, Ontong Java in the southwestern Pacific Ocean, did not cause a mass extinction but may have two global oceanic anoxia events at c. 120 and 94 Ma. However, Ontong Java remains one of the least well understood large igneous provinces, principally because it is almost wholly submerged. The only emerged portions exist on Malaita and Santa Isabel, two of the Solomon Islands, and even those remain poorly constrained due to the challenging terrain and politic climate. A third island, Makira, is even more controversial, with multiple models of its formation, including relationships to the Ontong Java large igneous province, but also arc-related magmatic genesis.

You will use a combination of geochronology, whole-rock geochemistry and volatile emission quantification to evaluate the nature of the mafic rocks on Makira Island. As part of the project, you will need to conduct 'fieldwork', involving travelling to the capital to collect samples housed by the Ministry of Minerals, Energy and Rural Electrification. Depending on the findings of the project, there is the potential to also the potential to be involved in other aspects of the Ontong Java large igneous province, including on Malaita and Santa Isabel.

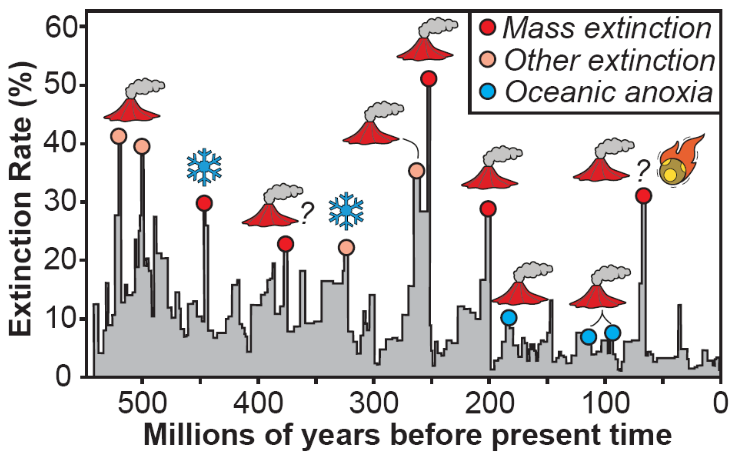

Figure: Earth's crises and their causes, with volcanoes representing eruptions of large igneous province.

SUPPORT
Funding is provided through Olierook's DECRA, including for fieldwork and analytical data acquisition

Meteorites: Planetary Story Tellers

AREA OF RESEARCH
Planetary Science, Geochemistry, Structural geology

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Dr. Ellie Sansom	Eleanor.sansom@curtin.edu.au
Co-Supervisor	Dr. Lucy Forman	lucy.forman@curtin.edu.au

RESEARCH PROJECT
Meteorites provide a comprehensive snapshot of processes that have occurred within our early solar system, and the conditions under which they formed. We analyse meteorites using a multitude of different techniques; light microscopy, electron microscopy, geochemical experiments and imaging to name a few. These extraterrestrial samples are the key to understanding the history of our solar system, and we can use them to build a geological map of our neighbourhood to better understand how the Earth and other planets came to be, and have evolved over time.

Using meteorites collected by the Desert Fireball Network based here at Curtin, the WA Museum, and international collections, this project will delve into the geochemistry and structural analysis of meteorites from Mars, Vesta, and the asteroid belt. The deliverables possible via this project include classification, relative dating, analysis of meteorite origins, and reconstruction of meteorite evolution. During this project, there will also be the opportunity to travel to the Nullarbor and take part in searching for meteorites.

Existing structural and geochemical data will be processed and analysed by the candidate to produce a geological history of the rock(s) in the context of our Solar System. Examples of such data in shown in the figure below. Working with experts within the Space Science & Technology Centre, their work will be placed into the wider planetary science field for potential future publication.

SUPPORT
This project is supported by an Australian Research Council Discovery Project called "Expanding the foundations of planetary science", led by Eleanor Sansom.

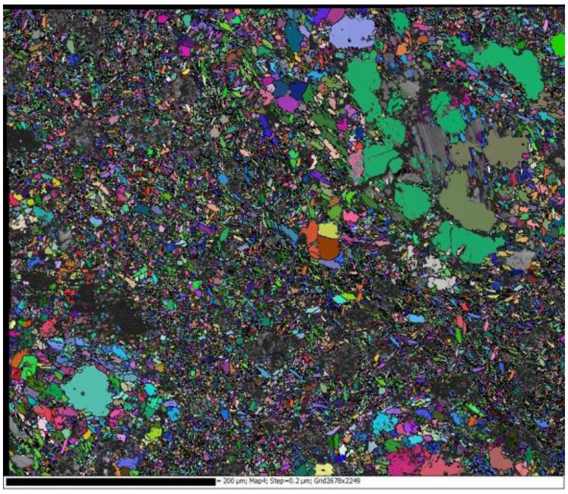

Figure: Crystallographic orientation map of the Allende meteorite, collected using electron backscattered diffraction techniques. Colours correlate to the orientations of the three primary crystallographic axes.

Timing and evolution of placer gold in Pilbara

AREA OF RESEARCH
Geochemistry, Mineralogy, Geochronology, Mineral deposits

SUPERVISORS

Principal Supervisor	Svetlana Tessalina	Svetlana.Tessalina@curtin.edu.au
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Co-Supervisor	Neal McNaughton	N.McNaughton@curtin.edu.au
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PROJECT PARTNERS
. John de Laeter Centre/Curtin University
. Geological Survey of Western Australia

RESEARCH PROJECT
Western Australia is well known by its Archean gold endowment, spanning across the Yilgarn and Pilbara Cratons. The renewed interest into the origin and age of gold mineralisation was recently fuelled by the finding of 'conglomerate gold' in Pilbara sedimentary sequences, with some arguing the similarity with the major Witwatersrand gold event in South Africa. Previous studies of gold mineralisation in WA were based on gold-associated minerals. In this study, we focused on the native gold itself, performing state-of-the-art analysis of Pb and Os isotopes coupled with trace elements, gold nugget morphology, microstructure, and inclusions. We report that the Pb isotope composition of native gold and its galena inclusions can provide valuable information about the timing of gold formation and subsequent evolution history (Tessalina et al., 2023). In this project, we are going to investigate selected gold nuggets from the Pilbara Craton with the aim to establish the formation age and subsequent evolution of placer gold nuggets.
The John de Laeter Centre at Curtin University collaborate with the Geological Survey of Western Australia to constrain the timing and the source(s) of Western Australian gold mineralization, by applying the Triton™ Thermo-Ionisation Mass Spectrometer (TIMS) to determine the Pb-Pb and Re-Os radiogenic isotope systematics for a selection of native gold specimens. The study will use specimens provided by GSWA that represent a range of geological settings, ages and types of gold deposits, and for which mineralogy and trace element chemistry have already been determined. Specimens will include placer gold occurrences from the Pilbara Craton. Where it is possible, micro-samples of internal and rim material will be extracted, using micro-drilling to avoid mineral inclusions. Each sample will be totally dissolved and separated into four aliquots for analyses of (i) Re-Os isotopes; (ii) Pb-Pb isotopes. Field work is not required.

Figure: Gold nuggets from Marble Bar Sub-basin, Pilbara.

SUPPORT
Funding is provided by Geological Survey of WA.

Textural analysis of lunar rocks from Apollo samples

AREA OF RESEARCH
Lunar science, Petrology, Petrography, Geochemistry, Geochronology.

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

Principal Supervisor	Nick Timms	n.timms@curtin.edu.au
Co-Supervisor	Alexander Nemchin	A.Nemchin@curtin.edu.au

RESEARCH PROJECT
Analysis of lunar rock and soil samples collected by NASA's Apollo missions have led to an unprecedented understanding of the geological history of the Moon since the 1970s. However, there are still many aspects of lunar geology that remain unresolved. This project investigates the mineralogy, petrography, and petrology of lunar rock and soil samples with the aim of developing automated quantitative petrographic methods for interpreting how they formed. For example, the crystal size distribution of minerals in basaltic samples may help distinguish whether they formed from volcanogenic or impact melts. Furthermore, some breccia samples have complicated textures with breccia and many types of lithic clasts, which suggest complex impact histories.
The student may study rocks from various Apollo landing sites. By understanding their geochemistry, mineralogy, and texture, this project aims to constrain how samples fit into lunar volcanic or impact history, identify the potential source region from where they were transported and how they were transported to the Apollo landing sites.

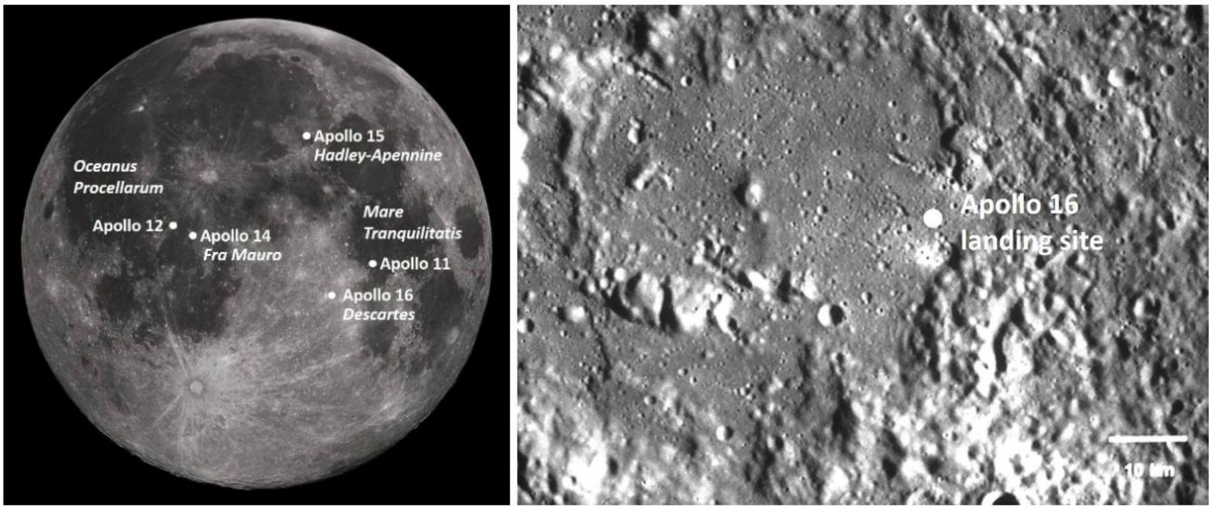

Figure: Left: location of Apollo landing sites. Right: a closeup image of the Apollo 16 landing site. Source: NASA, https://www.nasa.gov/feature/50-years-ago-nasa-selects-landing-site-for-apollo-16

This project will involve collection of quantitative mineralogical and microstructural data via scanning electron microscopy and integration with existing geochronology and geochemistry data. It will provide a student with a unique opportunity to work on lunar samples while developing expertise in analytical techniques that are transferable and applicable across a range of industry and academic research areas.

SUPPORT
This project will be supported by funding from the Space Science and Technology Centre (SSTC) at Curtin University.

Volcanic centre(s) of the Bunbury Basalt and the breakup of Gondwana

AREA OF RESEARCH
Paleomagnetism, Geophysics, Volcanology, Tectonics

SUPERVISORS / RESEARCH GROUP / PROJECT PARTNERS

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Associate Supervisor	Zheng-Xiang Li***	Z.Li@exchange.curtin.edu.au

RESEARCH PROJECT

The aim of this study is to obtain high-quality paleomagnetic data and anisotropy of magnetic susceptibility data from the 137—130 Ma Bunbury Basalt in Western Australia. Based on the data, we hope to be able to shed light on a few questions: a) The location of the volcanic centres from which the lava flows of the Bunbury Basalt erupted; b) Was the Bunbury Basalt formed as the product of a plume head underneath Australia-India or as decompression melt in a passive continental rifting environment; c) The motion of Australia during the Cretaceous and the breakup and Gondwana.

The Bunbury Basalt was paleomagnetically studied in the 70s. However, this study has several shortcomings: a) it predates the modern statistics and instrument were introduced to paleomagnetism; b) it did not separate the paleomagnetic data from different lava flows. c) it involved an insufficient number of samples and analyses.

There will be about 10 days of field work in southwest Australia, from Bunbury to Albany. The student will use a superconducting magnetometer, and a Kappabridge to measure the samples. The expected outcome of this study is a set of high-quality paleomagnetic and AMS data, and one or two publications in peer-reviewed journals.

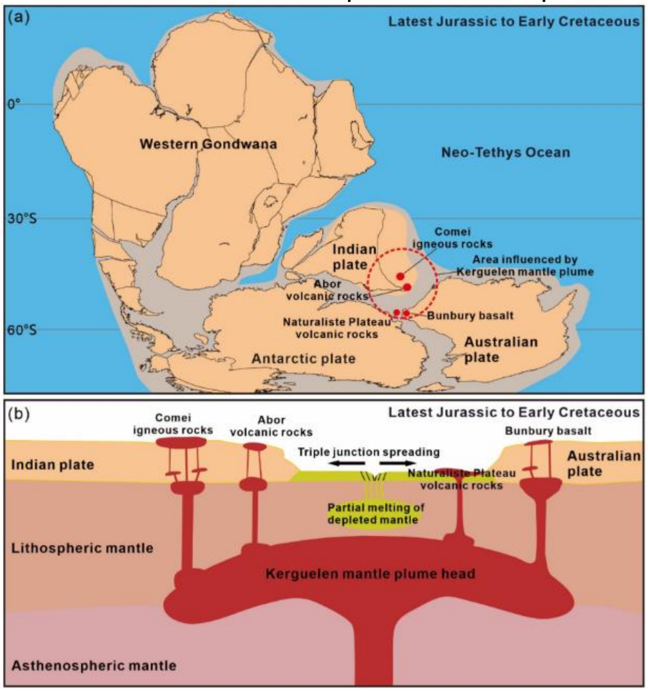

Figure 1 (a) Reconstruction of Gondwana at the latest Jurassic to Early Cretaceous; (b) A schematic model illustrating the relationship between Comei-Bunbury Large Igneous Province and the Kerguelen mantle plume activity. This figure is from Bian, Weiwei, et al. "Paleomagnetic constraints on the link between the Comei-Bunbury large igneous province and the Kerguelen mantle plume." Gondwana Research (2024).

SUPPORT
The paleomagnetic measurements will be supported by the Western Australian Palaeomagnetic Facility. Field trip will be supported by ARC Discover Project awarded to Zheng-Xiang Li

Fossil snakes of Western Australia

AREA OF RESEARCH
Palaeontology, Palaeoecology.

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RESEARCH PROJECT
The aim of this project is to assess the fossil record of snakes (Lepidosauria: Ophidia) in Quaternary cave faunas of southwest of Western Australia. Modern snakes can be classified into two discrete groups that share a common ancestor: Alethiniophidia (including pythons) and Scolecophidia (including colubrids and elapids). Both of these groups are represented in modern Australian faunas, but the Australian fossil record has revealed the presence of a third, now entirely extinct, group called Madtsoiidae, exemplified by the 8-metre-long *Wonambi naracoortensis*.

Quaternary cave faunas in Western Australia remain somewhat of a palaeontological frontier, especially from the perspective of reptiles. Snake remains are known from some caves, yet no fossil snakes have ever been formally described from Western Australia.

The aim of this project is to assess the fossil snake fauna of Western Australia, with a view to better understanding the palaeobiogeography of the represented clades.

The project student will:
(i) Rigorously describe, illustrate, and classify the various fossil snake specimens.
(ii) Assess the palaeobiogeographic significance of each represented group in Western Australia

SUPPORT
Laboratory of WA-OIGC and WA-Museum.