Virtual GESSS 2020 Program

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Welcome

Welcome to Virtual Geological Society of Australia Earth Science Student Symposium 2020 (Virtual GESSS). We are pleased to have you join us via zoom from around Australia for a week of presentations that will showcase the best of Australia's student research. GESSS is a national program of symposia and an initiative of the Geological Society of Australia. Student conferences organised by students for students nationally.

Virtual GESSS was formed in response to the COVID pandemic when the GSA recognised that face to face GESSS may not be possible. Virtual GESSS is an alternative to divisional GESSS events for 2020. It is the flagship event for the GSA during Earth Science Week. Virtual GESSS is a week of afternoon/evening sessions. The sessions will be approximately 2 hours of student and recent graduate presentations followed by a 20-30-minute INTRA GSA networking session.

Each state participating in Virtual GESSS has formed a committee of students to plan, curate and host that state's Virtual GESSS session. The committees are supported by the National Working Group that is made up of Verity Normington (Governing Councillor), Sue Fletcher (CEO) and Tim Holland (Membership Officer).

As a committee we are extremely proud to have organised this symposium for you and hope you enjoy this showcase of new research in Australia

Thank you,

Virtual GESSS 2020 National Working Group and Divisional Committees

Earth Science Week 2020

This year's Earth Science Week will be held from October 11 - 17, 2020 and will celebrate the theme "Earth Materials in Our Lives." The theme focuses on the ways that Earth materials impact humans - and the ways human activity impacts these materials - in the 21st century.

Earth Science Week, celebrated each October, reaches over 50 million people annually with activities, materials, and information about the geosciences. Twenty years since its inception, Earth Science Week remains the largest international education campaign dedicated exclusively to promoting awareness of the importance of the geosciences and stewardship of the planet.

Our Sponsor: CSIRO

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) are Australia's national science research agency. At CSIRO, they solve the greatest challenges using innovative science and technology. They do this by using science to solve real issues to unlock and shape a better future for our community, our economy, our planet. CSIRO are committed to growing Australia's pipeline of STEMM talent through promoting STEMM capability, development and education for students and early-career researchers, allowing the nation to remain innovative and competitive in science.

The Virtual GESSS committees thank CSIRO for their commitment to supporting student Earth Science research in Australia.

Program

Due to Virtual GESSS being streamed across several different time zones, the program will be based on the time zone of the divisional session of the day. There is a time zone converter in the appendix to help you know what time to dial in.

Monday 12 October – Queensland (2.00 - 4.30pm AEST)

Tuesday 13 October – Tasmania (5.00 -7.30pm AEDT)

Wednesday 14 October – ACT and New South Wales (5.00 -7.30pm AEDT)

Thursday 15 October – Professional Development (3.00 – 5.30pm AEDT)

Friday 16 October – Western Australia (3.00 – 5.30pm AWST)

Virtual GESSS Code of Conduct

Virtual GESSS is dedicated to providing a harassment-free event experience for everyone, regardless of age, gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, nationality, race or religion. We expect our attendees to contribute to a professional and respectful atmosphere. All attendees, speakers, and organisers are required to comply with the Virtual GESSS Code of Conduct both at the symposium and during symposium-related activities. Organisers and volunteers will enforce this code throughout the event to ensure a safe, inclusive and welcoming environment for everyone.

Virtual Symposium guidelines

- No Screen-shotting or screen-recording at any point of the symposium without the expressed permission from speakers
- No spam in chat windows, including reposting the same word/content repeatedly to disrupt the conversation in addition to zero tolerance for unacceptable conduct (see below)
- During a presentation please ensure you are muted if you are not presenting
- You can keep your video on during the presentations if you like
- Ask questions and make comments through the comments section, hosts will then use these during the Q&A component of the sessions

Expected conduct
All participants, including attendees, speakers, and organisers are expected to:

- Treat each other with respect and consideration, valuing a diversity of views and opinions
- Behave in a professional manner
- Communicate openly, critiquing ideas rather than individuals
- Be kind to others, do not insult or put down other attendees
- Be polite and respectful in online chats
- Ask for explicit consent from the speaker and organiser prior to publishing presentation recordings or video clips on any kind of media or platform (e.g scientific publications, social media or conference websites). Posting (a few) slides (or parts thereof) on social media (e.g. Twitter, Facebook, Instagram etc) helps promote scientific discussion and is permitted unless the speaker indicates at the beginning of their talk that they are not comfortable with that

Unacceptable behaviour
Inappropriate behaviour and harassment of symposium participants in any form will not be tolerated. These include but are not limited to:

- Offensive verbal comments related to gender, age, sexual orientation, disability, physical appearance, body size, race, national origin or religion
- Inappropriate use of sexual language, nudity and/or sexual images in public spaces or in presentations
- Deliberate intimidation, stalking, following, bullying, discrimination, photography or recording without consent
- Sustained disruption of talks or other contents
- Unwelcome sexual attention
- Trolling
- Sharing connection information to the platform with non-registered people. When connecting to the platform, all attendees should use their own name, and not attempt to misrepresent themselves in any way
- Copying, redistributing or using data from presentations without permission from the authors
- Unauthorised access or malicious changes to the conference website, conference hosting tools or any related systems

Enforcement
Participants asked to stop any inappropriate behaviour are expected to comply immediately. Anyone violating these rules may receive a written warning or be asked to leave the event at the sole discretion of the organisers. Depending on the severity of the behaviour further action may be taken as explained in the GSA Code of Conduct.

Reporting an incident or misconduct

If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact Tim at info@gsa.org.au. Any reports will be handled in the strictest confidence.

These guidelines are based on the GSA's Code of Conduct, Geek Feminism wiki – conference anti-harassment page as well as guidelines and code of conduct's from AGU, Goldschmidt and CSIRO Future of Meetings Symposium.

GSA's Code of Conduct

1. GSA members are expected to act in a courteous and respectful manner at all times.

2. The GSA and its members promote equality of opportunity, regardless of age, race, nationality, gender, sexuality, religion, disability, ethnicity, marital status, political affiliation or culture.

3. GSA will not tolerate any form of harassment or bullying, which is defined as repeated and unreasonable behaviour directed towards its members, staff or any other person participating in a GSA-based activity. This includes (but is not limited to): abusive or offensive language or comments, aggressive and intimidating behaviour, belittling or humiliating comments, practical jokes or initiation rituals and unjustified criticism or complaint.

4. Communication will be fair and open and should be appropriate for people of many different backgrounds.

5. Conflicts will be resolved in a fair and objective manner to produce an effective solution.

6. When undertaking any GSA-related activity, GSA members will not compromise the safety, welfare or health of the community or themselves.

7. When undertaking any GSA-related activity, GSA members are expected to seek permission for access to sites from relevant landowners and/or caretakers, including Traditional Owners where appropriate and/or applicable.

8. When undertaking any GSA-related activity, GSA members will endeavour to be respectful of the heritage values of geological field sites and will avoid and/or limit sampling accordingly. Special consideration should be given to the preservation of geoheritage and geotourism sites, and Aboriginal Heritage Register sites (refer to relevant state or government pages, where appropriate).

The GSA Code of Conduct is available in full including the outcomes of failure to meet the code by contacting the GSA Business Office.

Queensland - Monday 12 October

Schedule (AEST)

Time	Presenter	Title
14:00-14:05	Welcome - GSA President Jo Parr	
14:05-14:10	CSIRO Welcome – Yulia Uvarova (CSIRO)	
14:10-14:15	Welcome sessional host – Keegan McGuffie	
14:15-14:30	Emily Conn (University of Queensland)	*Mapping sedimentation rates offshore New Zealand*
14:30-14:45	Thomas Ray Jones (University of Queensland)	*Bacterially accelerated weathering and mineral carbonation of kimberlite; and other exciting things happing at the UQ geomicrobiology lab*
14:45-15:00	Siyumini Perera (University of Queensland)	*Signature of siliceous biomineralizing microorganisms during their initial phase of diversification*
15:00-15:15	Tianjiao Yu (University of Queensland)	*The effect of Igneous Intrusion on the Mineral Matter in Coal, Moatize Bain, Mozambique*
15:15-15:20	Intermission	
15:20- 15:35	Pooya S. Salehi Naini (Shahid Beheshti University)	*The Bidester High Sulfidation Epithermal Prospect, Southeast Iran*
15:35-15:50	Alice MacDonald (University of Queensland)	*Trace element partitioning between sector zoned clinopyroxene and trachybasaltic melts at increasing undercooling conditions*
15:50-16:05	Mia Maria Pique (University of Queensland)	*Hazard preparation for explosive volcanism: ash-time series analysis of Reventador volcano, Ecuador Andes*
16:05-16:20	Vanessa K. Zepeda (Queensland University of Technology)	*Investigating the Origin of Organic Matter in Archean Chert*
16:20-16:25	Closing Remarks – Keegan McGuffie	
16:25-16:45	INTRA GSA co-hosted by Governing Council and sessional hosts	

Social Media

Please remember to follow GESSSQ on Social Media

Website: https://gesssq.org/
Facebook: https://www.facebook.com/GESSSQ
Twitter: https://twitter.com/gesssq

Don't forget to use and follow the **Hashtags** #VirtualGESSS #GESSSQ

Queensland Committee

Keegan McGuffie (University of Queensland) – Co-chair & Communications
Emily Conn (University of Queensland) – Vice/Co-Chair & Facebook
Tianjiao Yu (University of Queensland) – Secretary
Mathew Vermaak (University of Queensland) – All-rounder & Communications
Joan Esterle (University of Queensland) – Abstract Coordinator
Alison Troup (University of Queensland) – Abstract Coordinator

Queensland - Monday 12 October

Keegan McGuffie

The University of Queensland

Science Leader, UQGS Treasurer

GESSSQ Co-Chair

Research Interests:

- Earth Observation Science
- Hydrogeology
- Geophysics

I'm graduating this semester with a Bachelor of Science - Geology & Geography from UQ. My research has focused on using satellite imagery to map and classify the lakes on K'gari. My passion lies in pushing the boundaries of geographic & geologic understanding from above and below ground sources. I would love to see more physical geography and earth sciences taught in our schooling systems and am keen to get involved with initiatives supporting this.

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LinkedIn: www.linkedin.com/in/keegan-mcguffie/

Tianjiao Yu

The University of Queensland

GESSSQ Secretary

Research Interests:

- Clay Mineralogy
- Sedimentary Basins
- Paleoclimate

I am a currently in Honours year in a Bachelor of Environmental Science at UQ, majoring in Earth Resources. My honours project focuses on the mineralogical changes in a Cenozoic strata from the Bowen Basin. I am very curious about any story happened on our planet and my passion brings me to geoscience fields.

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Instagram: https://www.instagram.com/tian_jiao_yu/

Queensland - Monday 12 October

Joan Esterle

The University of Queensland

GESSSQ committee member

Research Interests:

- Coal geoscience and petrology
- Applied basin analysis
- Problem solving for geotechnical assessment, coal processing and utilisation

My Vale UQ Coal Geosciences research group is varied, underpinned by using a fundamental understanding of sedimentary environments, palaeoclimate and tectonic history within coal and coal-bearing basins to predict changes in coal quality, hydrocarbon charge, ground behaviour during mining and material behaviour during mining, processing and utilisation.

https://sees.uq.edu.au/profile/9083/joan-esterle

https://www.facebook.com/groups/Coalresearchteamuq

Alison Troup

The University of Queensland/DNRME
PhD Candidate/Senior Geoscientist
Abstracts co-ordinator

Research Interests:

- Sedimentology
- Petroleum Geology
- Basin Analysis

My research with DNRME has focused on understanding the petroleum potential in Queensland, with a particular focus on source rocks and unconventional petroleum systems. This has led me to my PhD work, which will look at the Powell Depression in the southern Galilee Basin as a region that has been overlooked in previous work, but that by analogue, should have a petroleum system.

ResearchGate: https://www.researchgate.net/profile/Alison_Troup

Twitter: @alisontroup

LinkedIn: https://www.linkedin.com/in/alison-troup/

Instagram: @havecamerawillsnap

Queensland - Monday 12 October

Abstracts

MAPPING SEDIMENTATION RATES OFFSHORE NEW ZEALAND

Emily Conn[1]

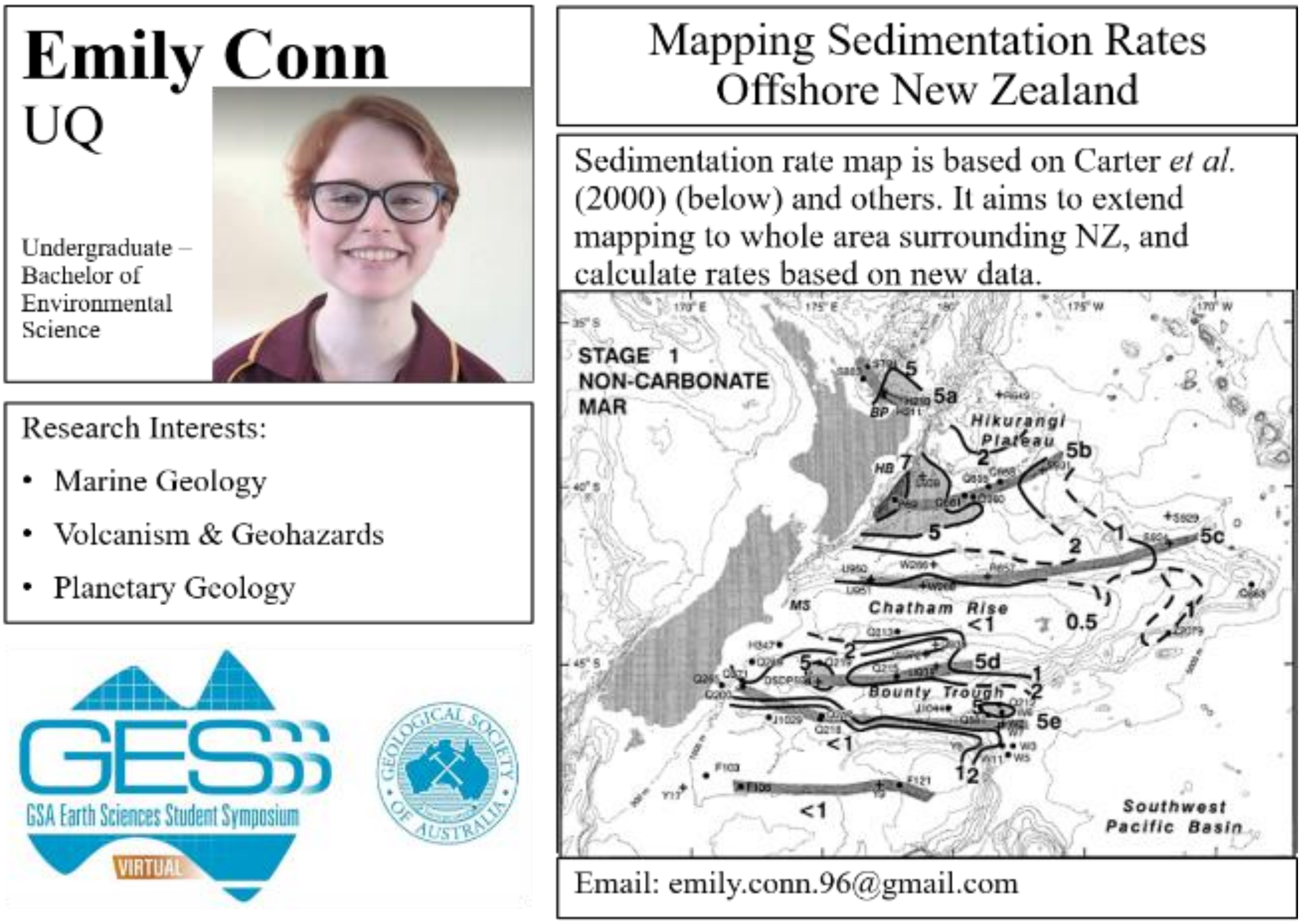
[1]The University of Queensland

This research project aims to map the modern sedimentation rates (or rate of linear sediment accumulation) on the seafloor of the continental slope and deep oceans surrounding New Zealand. I have developed a comprehensive database of recently published radiocarbon and tephra ages from sediment cores around New Zealand. Marine sedimentation rates show clear spatial and temporal patterns, as a function of climate, sea level, terrigenous sediment flux and provenance, tectonics, volcanism, biological productivity, bathymetry and oceanography.

As marine sedimentation impacts marine organisms, commercial fishing, ocean infrastructure and environmental management legislation, the database and sedimentation map can be used by academics, industry professionals and government legislators to help manage the marine environment.

Keywords: sedimentation, marine, New Zealand, modern

Research Supervisors: Dr Helen Bostock and Dr Derya Guerer



Queensland - Monday 12 October

BACTERIALLY ACCELERATED WEATHERING AND MINERAL CARBONATION OF KIMBERLITE; AND OTHER EXCITING THINGS HAPPING AT THE UQ GEOMICROBIOLOGY LAB

Thomas Ray Jones[1]

[1]School of Earth and Environmental Sciences, University of Queensland

The roles of microbes within the mining and environmental industries has increased significantly in recent decades, and with an increasing expectation on these companies to lower their carbon footprint, biotechnological methods that enhance extraction and processing may provide novel approaches. Understanding microbe-mineral interactions occurring between biofilms and ultra-mafic mine tailings may provide strategies to accelerate mineral bio-weathering and microbial carbonate precipitation within mine-scale kimberlite waste rock

Microorganisms have the ability to enhance mineral weathering, impacting the environments they inhabit via the extraction of nutrients from their surroundings. Physiological processes that enhance weathering include the formation of organic and inorganic acids that work to break down minerals, as well as the production of bicarbonate ions, which buffers pH. Kimberlite waste rock deposits provide an excellent natural laboratory to study large-scale weathering, mineral carbonation reactions that sequester atmospheric CO_2, and the bacterially driven interactions associated. The aim of the present study is to promote weathering and mineral carbonation within tailings material from the Venetia diamond mine, Limpopo, ZAF, via the inoculation of a native microbial consortia.

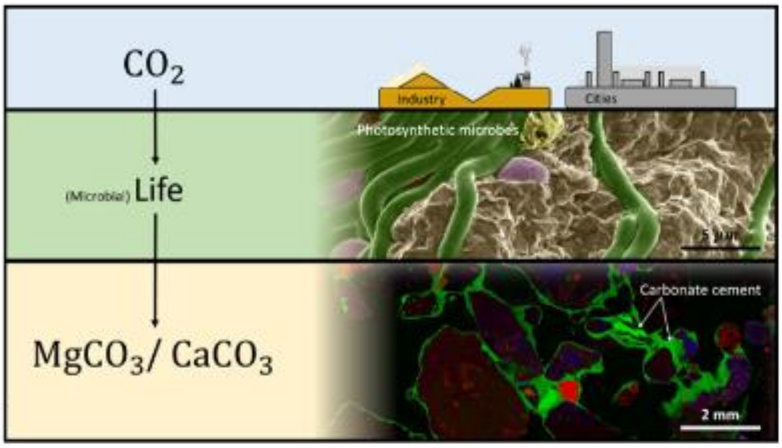
Thomas Ray Jones

SEES UQ
PhD student

Vale - UQ
Geomicrobiology Laboratory

The biological history of kimberlite weathering.

A glimpse of the unseen microbe → mineral interactions driving carbon sequestration within kimberlite tailings.



Research Interests:

- Geomicrobiology
- Carbon Sequestration
- Industrial Bio-Tech

ORCid

www.mendeley.com/profiles/thomas-ray-jones/

www.linkedin.com/in/thomasrayjones-geomicrobiology

Queensland - Monday 12 October

SIGNATURE OF SILICEOUS BIOMINERALIZING MICROORGANISMS DURING THEIR INITIAL PHASE OF DIVERSIFICATION

Siyumini Perera[1]

[1]School of Earth & Environmental Sciences, The University of Queensland, St. Lucia, 4072, Queensland, Australia
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Radiolarians were the only siliceous microorganisms that existed in the oceans before diatoms become the primary silica-fixers in the Mesozoic. They first appeared during the early Cambrian and diversified at a slow pace leaving a rather weak and intermittent fossil record until the latest Cambrian. Simultaneously, along with the rest of the marine biota, radiolarians entered a rapid diversification phase that is well recorded for the majority of the marine life during the Ordovician. The pulse of diversification seen in radiolarians during this phase remains enigmatic in comparison to other well-documented marine clades. This is most likely due to the limited amount of qualitative and quantitative radiolarian data that exist for much of the Lower Paleozoic, especially for the Ordovician. Many taxa recognized in Ordovician sections are poorly preserved and lack detailed and precise taxonomic descriptions. The present research first addresses gaps that exist in the radiolarian fossil record through Ordovician time. New data will be used alongside with previously published information to reconstruct the pattern of the initial diversification pulse of radiolarians using statistical methods tailored to treatment of sporadic and sparse fossil data.

At the pilot stage, before merging the new data, the database compiled for this research consists of published data from the uppermost Cambrian to Upper Ordovician. The range-through data from this collection, are assessed using three diversity indices including total diversity, in-bin-diversity and normalized diversity, where the stratigraphic bins considered are the Ordovician stage slices. The normalized diversity curve is the most accurate diversity index compared to the rest and potentially minimizes the sampling bias caused by the number of studies carried out per stratigraphic bin. Results demonstrate that radiolarians commenced their rapid ascending trend of diversification with the onset of the Cambrian explosion before having two diversity peaks in the late Floian (Fl3) and middle Darriwilian (Dw2). Rates of diversification collapsed significantly by the end of Darriwilian and continued to plummet through to the end of Ordovician. However, this plunging signal may be an artefact partially attributable to the limited number of detailed studies conducted for the uppermost Ordovician and highlights the necessity for more work in future. Although the middle Darriwilian peak is congruent with many reported taxa, the first diversity peak in the Floian corresponds only with that of conodonts, graptolites and acritarchs. Synchronizing with the diversity peaks, the origination rates were at their highest during the Early Ordovician and continued to drop towards the end of the Late Ordovician. Since diversification is actually a speciation event, the data lend support to the hypothesis that the occurrence of the major diversity pulse of radiolarians occurred in the Early Ordovician.

Queensland - Monday 12 October

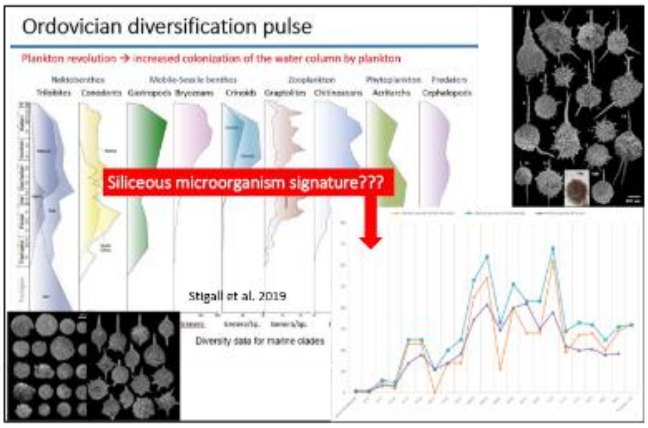
Siyumini Perera
The University of Queensland

PhD candidate

Signature of siliceous biomineralizing microorganisms during their initial phase of diversification

Research Interests:

- Micropalaeontology
- Ordovician palaeo-biodiversity
- Micro-Computed Tomography



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Queensland - Monday 12 October

THE EFFECT OF IGNEOUS INTRUSION ON THE MINERAL MATTER IN COAL, MOATIZE BAIN, MOZAMBIQUE

Tianjiao Yu[1]

[1]The School of Earth and Environmental Sciences, The University of Queensland

Coal is constituted by organic (macerals) and inorganic components (minerals). The inorganic matter as non-reactive component normally contributes no value to the coking coal, and displaces more useful organic matter to reduce the percentage of fixed carbon of the coal, which can affect the degree of organic metamorphism of a coal to reduce coal quality. The minerals in coal come from different origins, such as terrigenous material input, seawater invasion, volcanic ash fall; and minerals in coal can be altered after deposition, for example, fluids from igneous intrusion, descending and ascending groundwater, and other hydrothermal fluids. Igneous intrusion is one of the most important geological features to affect pre-existing sediments and structure underground, especially for coal seams. Igneous intrusion can thermally alter coal with high temperature, and also able to add or remove elements of the mineral matter by hydrothermal fluids in coal. Thus, the alternation of coal and its mineralogy by magmatic intrusions affects the safety, economic viability and productivity of many coal mines, and study the effect of igneous intrusions on the inorganic constituents in the coal may help to answer some questions of the coal seams in the study site, Moatize Basin, Mozambique. Before the study the coal seam in this site has been known that it has been altered, but not clear how dyke has altered the coal seam.

Therefore, to answers these questions, the identification of mineral species changes and the modes of occurrences through the increasing distance of dyke is used to understand the mineralogy. It is assumed that the mineral species increase as the dyke is approached, and hydrothermal fluid is the main reason to change mineral matter in these coal samples, due to add or remove elements. The result of the study shows that the dyke altered the minerals in all of the samples in the seam due to the offshoot on the roof of the coal seam, which shows a contribution of high temperature and hydrothermal fluids affected the mineralogy in the coal. The Si-rich fluids delivered epigenetic quartz, and Ca-, Mg-, Fe-rich fluids to form carbonates minerals, and the late fluid deposited pyrite in fracture and pores. The fluids also removed elements from minerals, siderite was altered and removed Fe ions, and be replaced by ankerite or ferroan dolomite. Interaction between gas and mineral material can form new minerals, such as kaolinite transfer to chamosite or illite, carbonated formed by CO_2.

Queensland - Monday 12 October

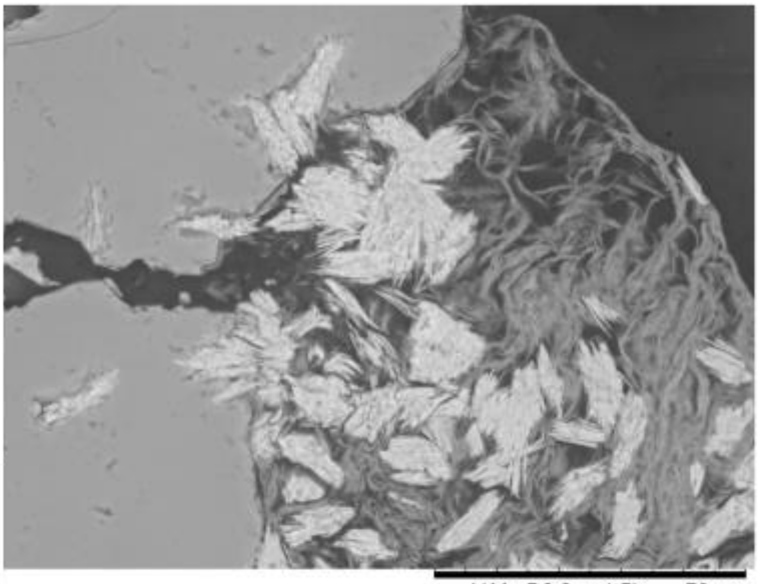
Tianjiao Yu

The School of Earth and Environmental Sciences, The University of Queensland

Research Interests:

- Clay Mineralogy
- Sedimentary Basins
- Paleoclimate

The effect of Igneous Intrusion on the Mineral Matter in Coal, Moatize Bain, Mozambique



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Queensland - Monday 12 October

THE BIDESTER HIGH SULFIDATION EPITHERMAL PROSPECT, SOUTHEAST IRAN

Pooya S. Salehi Naini[1]

[1]Shahid Beheshti University

The East Iran flysch zone (EIFZ), also known as Sistan suture (Tirrul, 1983), extends for over 800 km in N-S direction in east Iran. The development of the EIFZ is closely associated with the evolution of a Neotethyan oceanic basin, between the Lut Block and the Afghan Block in Upper Mesozoic-Early Cenozoic, and the subsequent continental collision in Paleogene. The study area lies in the southern section of the EIFZ, ~ 25 km to the northwest of the Quaternary Taftan summit. The two areas were targeted following a regional exploration program that called Kharestan and Bidester locality. Hydrothermal alteration-mineralization in Bidester is developed in Neogene andesitic-dacitic lava flows. The prospect was targeted following a regional exploration program using stream sediment geochemistry and lithogeochemistry during 2015-2018. The geological setting, the alteration assemblages typical of advanced argillic, and subsurface data from drill cores and geophysics suggest a link with porphyry systems at deeper levels. Detailed exploration is in progress, including geological mapping, systematic sampling across trenches in hydrothermally altered rocks, and diamond drilling, for ore assay. At the top of the homogenous Andesite to the bottom, argillic alteration, advanced argillic and fresh host rock respectively are visible, that with them clay minerals such as Alunite, Pyrophylite and Diaspore implying a zonation of alteration according to the High-Sulfidation gold deposits. The Vuggy texture is common and resulted from host rock alteration, and gold mineralization is considerable at this occurrence.

Pooya S. Salehi Naini
Shahid Beheshti University
PhD Candidate

The Bidester High Sulfidation Epithermal Prospect, Southeast Iran

Research Interests:

- Epithermal and Porphyry Systems
- Isotopic and Fluid Inclusion Studies
- Tectonic and Geodynamic

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Queensland - Monday 12 October

TRACE ELEMENT PARTITIONING BETWEEN SECTOR ZONED CLINOPYROXENE AND TRACHYBASALTIC MELTS AT INCREASING UNDERCOOLING CONDITIONS

Alice MacDonald[1], Teresa Ubide[1], Matteo Masotta[2], Silvio Mollo[3], Alessio Pontesilli[4]

[1]The University of Queensland, Australia (*correspondence: alice.macdonald@uq.edu.au)
[2]University of Pisa, Italy
[3]Sapienza University of Rome, Italy
[4]Otago University, New Zealand

Clinopyroxene chemistry is increasingly being utilised to investigate magmatic processes, due to its ability to record an extensive history of physiochemical changes in the host magma. However, clinopyroxene chemistry is not only influenced by pressure, temperature, and magma composition, but also by kinetic effects that may generate compositional zoning, such as sector zoning**.** Previous experimental work has highlighted the role of undercooling ($\Delta T = T_{liquidus} - T_{system}$) on the morphology and major element chemistry of sector-zoned clinopyroxene, however the spatial distribution of trace elements in clinopyroxene remains relatively underexplored.

Here we present trace element data measured using laser ablation ICP-MS mapping techniques from experimentally produced clinopyroxene crystals. Experiments were produced by inducing a range of undercooling conditions (ΔT = 23 - 173°C) on a starting composition of primitive trachybasalt from the Mt Etna volcano (Italy) at a constant pressure of 400 MPa.

Our results indicate that the partition coefficients of incompatible HFSEs and REEs are positively correlated with undercooling, associated with an increase in Al. Clinopyroxene crystals show different styles of zoning across the entire range of undercooling conditions, where zones enriched in Al are also enriched in HFSEs and REEs. At low degrees of undercooling (delta T < 40 °C), clinopyroxene is sector zoned with distinct Al-poor hourglass and Al-rich prism sectors. At moderate undercooling (75 - 123°C), skeletal morphologies dominate as crystal growth transitions from interface controlled to diffusion limited. These crystals are comprised of Al-rich skeletons and Al-poor overgrowths. At very high undercooling (123-175°C), clinopyroxene is primarily dendritic, with subtle Al zoning.

The overall correlation between Al and trace element composition is attributed to charge-balancing mechanisms. Highly charged cations are favourably incorporated into the M1 and M2 sites with increasing Al, to compensate for the substitution of Si^{2+} for Al^{3} in the tetrahedral site.

Modelling of lattice strain parameters for 3+ cations in the M2 site (REEs + Y) illustrates that the maximum partition coefficient, D_o, is strongly correlated with undercooling. The remaining parameters, r_o and E, remain constant across our dataset.

The application of our trace element calibrations to natural samples from Mt Etna supports the growing conception that sector zoning in clinopyroxene is related to low-moderate degrees of undercooling. Our new experimental data could bring crucial new insights into magmatic processes which occur in the lead up to volcanic eruptions, including magma mixing, the exsolution of volatiles and decompression.

Queensland - Monday 12 October

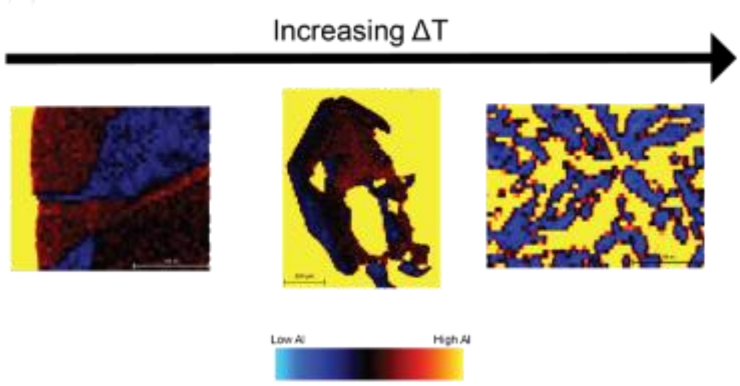
Alice MacDonald

School of Earth and Environment Sciences, UQ
PhD Candidate

Research Interests:

- Volcanology
- Experimental Petrology
- Geochemistry

Trace element partitioning between sector zoned clinopyroxene and trachybasaltic melts at increasing undercooling conditions



Queensland - Monday 12 October

HAZARD PREPARATION FOR EXPLOSIVE VOLCANISM: ASH-TIME SERIES ANALYSIS OF REVENTADOR VOLCANO, ECUADOR ANDES

Mia Maria Pique[1], Elizabeth Gaunt[2], Charles Langmuir[3], Michael Ort[4], Teresa Ubide[1]

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Time-series analysis of volcanic ash provides a window into volcanic styles and hazards. The Reventador volcano, a 3,562-m tall stratovolcano located in the eastern Andes of Ecuador, has major socio-economic impacts for Ecuador since breaking a 26-year long quiescence on 3 November 2002. The 2002 VEI-4 reawakening erupted a 17 km high eruption column that lasted a few hours, produced nine pyroclastic flows that reached nine km eastward, and two days later lava flows flowed from its crater. Since 2002, Reventador has erupted basalt to andesite products, including mm to m-sized pyroclasts. The volcano destroyed its crater in 2002 and rebuilt it in less than five years. Close volcano monitoring has provided a unique ash sample set that can provide a better understanding of magma ascent and eruption dynamics.

This work focuses on Reventador ash collected from two key locations ("Lava 4" and "LavCAM"), east of the two primary active craters, from 2014 to 2019. Ash samples were sieved, washed and examined with an optical binocular microscope to categorize the particles into different components. Scanning electron microscopy with energy-dispersive x-ray spectroscopy (SEM-EDS) was used to investigate the textural detail of ash grains and obtain semi-quantitative chemical data on mineral phases. Geochemical analysis was undertaken via laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS).

Since 2014, Reventador ash included 76 vol.% dense juvenile black andesite with increasing phenocryst content over time (up to 8-26 vol.% in 2017-19). Texturally, the ash shows blocky fragments and step fractures, suggesting phreatomagmatic eruptions or explosions at depth. The ash can be either vesicular (18%) or more commonly dense (non-vesicular; 82%). The dominance of dense ash suggests efficient degassing prior to eruption. Compositionally, the ash became more evolved from 2014 to 2018 (61-65 wt.% SiO_2) and returned to more primitive compositions in 2019 (62 wt.% SiO_2), correlating with an increase in the abundance of dense juvenile fragments. The increase in phenocryst content over time may represent enhanced early crystal growth within the magma or increased magma transport capacity. These results suggest that Reventador may be experiencing well-mixed eruptions subjected to effective degassing, with explosions at depth, and small variations in magma composition and explosivity with time. Results from this study will be combined with geophysical and visual observational data to help monitor the eruptive dynamic story of Reventador.

Queensland - Monday 12 October

INVESTIGATING THE ORIGIN OF ORGANIC MATTER IN ARCHEAN CHERT

Vanessa K. Zepeda[1]

[1]Queensland University of Technology, Science and Engineering Faculty, School of Earth and Atmospheric Sciences

The origin of organic matter from the 3.43 billion-year-old Strelley Pool Formation (SPF), Pilbara Craton, Western Australia has been heavily debated. The region has an extensive history of diverse hydrothermalism induced by thrusting granitoid complexes which underlie the protocontinent. In consequence, hundreds of siliceous chert dike systems rich in carbonaceous material cross-cut Archean sedimentary rocks. Hydrothermal systems have the potential to synthesize organic molecules abiotically by a process called Fischer Tropsch Synthesis, particularly in the presence of certain metal catalysts. Conversely, a recently proposed hydrothermal pump hypothesis suggests that organic matter in anoxic waters could have been incorporated and redistributed to significant depths due to the higher geothermal gradients in hydrothermal systems. Differentiating between abiotic and biotic sources becomes increasingly difficult because both methods induce fractionation effects on ^{13}C that are significantly depleted. The author aims to address the questions regarding the origin of organic matter in the SPF by exploring the distribution of metal catalysts that could stimulate abiotic synthesis, as well as utilizing fine-scale geological and geochemical techniques to form paleoenvironmental interpretations of the ancient hydrothermal system. Developing new investigative methods and corroborative lines of evidence from ancient systems like the SPF is likely to yield new insights into the origin and early evolution of life on Earth, as well as other bodies in our solar system such as Mars.

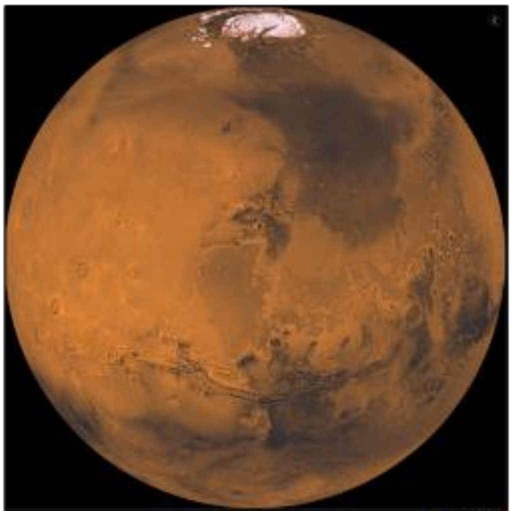
Vanessa K. Zepeda
QUT
PhD Student

Virtual GESSS Presentation title:

Investigating the Origin of Organic Matter in Archean Chert

Research Interests:

- Astrobiology
- Paleoenvironmental Reconstructions
- Earth Systems as Mars Analogs



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Tasmania - Tuesday, 13 October

Schedule (AEDT)

Time	Presenter	Title
17:00-17:10	Welcome – Hannah Moore	
17:10-17:22	Thomas Schaap (University of Tasmania)	*Plate tectonic reconstructions of the Early Palaeozoic Lachlan Orogen*
17:22-17:34	Andrea Davies (University of Tasmania)	*Polymetallic nodule geochemistry: the interplay between sedimentology and oceanography in the SW Pacific Ocean*
17:34-17:46	Carlos Diaz Castro (SolGold/University of Tasmania)	*The Cascabel Cu-Au-Ag porphyry cluster in northern Ecuador*
17:46- 17:58	Acacia Clark (University of Tasmania)	*Transitions in eruptive style during the 2012 deep submarine silicic eruption of Havre Volcano, Kermadec Arc, New Zealand*
17:58-18:10	Umer Habib (University of Tasmania)	*Provenance of Late Cambrian-Ordovician sedimentary rocks in Western, North-Eastern Tasmania and Southern Victoria. Constraints from U/Pb dating, Zircon geochemistry and εHf isotope*
18:10-18:15	Intermission	
18:15-18:27	Harris J. Anderson (University of Tasmania)	*Biological responses to millennial-scale temperature and terrigenous flux variability in the Southwest Pacific Ocean*
18:27-18:39	Hannah Moore (University of Tasmania)	*Shallow conduit and vent processes involved in the 1886 basaltic Plinian eruption at Tarawera, New Zealand*
18:39-18:54	Eliza Fisher, Wei Xuen Heng (University of Tasmania)	*An enduring problem: a multidisciplinary approach to characterise acid and metalliferous drainage at endurance mine, NE Tasmania*
18:54-19:06	Max Hohl (University of Tasmania)	*Using Trace Element Chemistry of Magnetite as an Indicator Mineral in Iron-Oxide Copper Gold Deposits*
19:06-19:10	Closing Remarks – Hannah Moore	
19:10-19:30	INTRA GSA	

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Tasmania - Tuesday, 13 October

Tasmania Committee

Olivia Wilson

University of Tasmania
Honours Student

Virtual GESSS TAS committee member

Research Interests:

- Hydrogeology
- Environmental geochemistry
- Legacy mine site remediation

I am an honours student at the University of Tasmania. I am researching the hydrogeology and environmental geochemistry of an abandoned mine site in north east Tasmania, in collaboration with a geophysics student and sediment geochemistry student. I am passionate about rectifying environmental degradation caused by legacy mining activities and the impacts on local communities.

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Tasmania - Tuesday, 13 October

Rhiannon Jones

University of Tasmania
PhD student
Virtual GESSS TAS committee member

Research Interests:

- Porphyry deposits
- Mineral exploration
- Geochemistry

My research is based on understanding the significance of the phyllic alteration zone at the Northparkes porphyry Cu-Au deposits in New South Wales. My project is focused on characterising different styles of phyllic alteration and determining their relationship with grade. My research aims to develop vectoring and fertility indicators within the phyllic alteration zone and enhance tools in porphyry exploration.

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Hannah Moore

University of Tasmania
PhD student

Virtual GESSS TAS committee member

Research Interests:

- Volcanology
- Petrology
- Field Geology

My PhD research involves improving our understanding of the shallow conduit and vent processes involved in the 1886 basaltic Plinian eruption of Tarawera, New Zealand. My favourite part of this research is the fieldwork, where I get to climb volcanoes, collect samples and enjoy nature! Communicating science is one of my passions, so I am super excited to help young geoscientists showcase their research through GESSS!

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Tasmania - Tuesday, 13 October

Abstracts

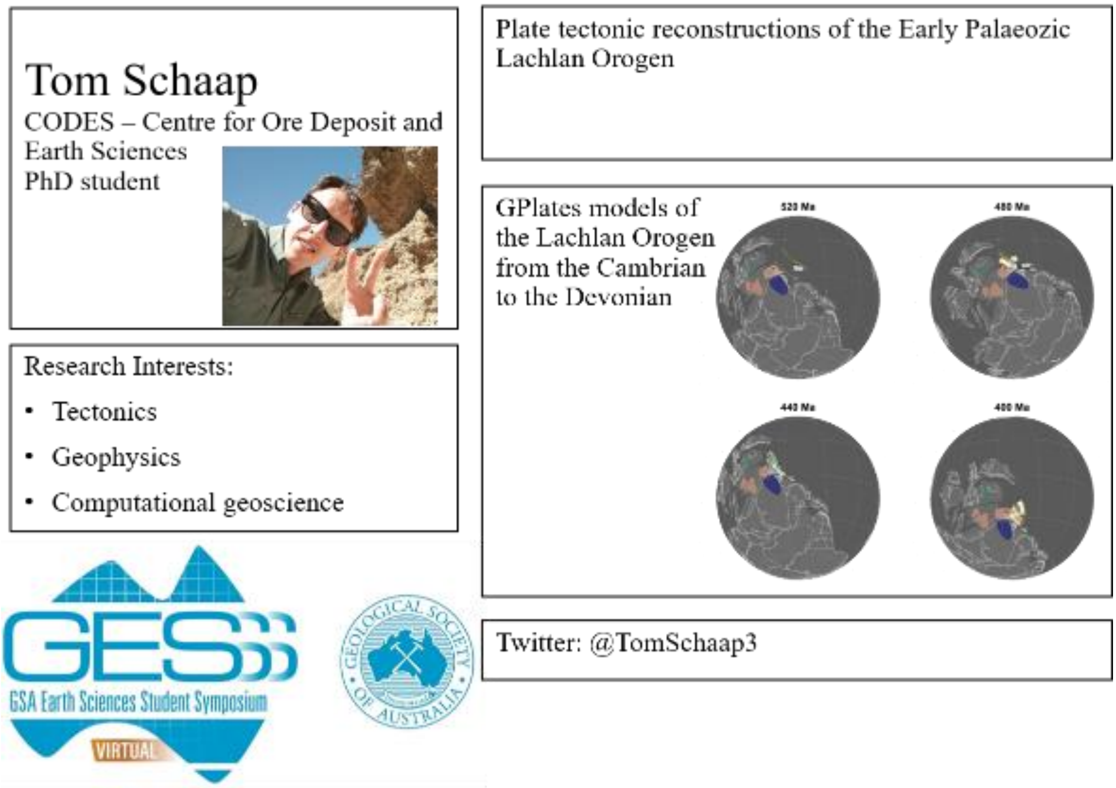
PLATE TECTONIC RECONSTRUCTIONS OF THE EARLY PALAEOZIC LACHLAN OROGEN

Thomas Schaap[1], Sebastien Meffre[1], Jo Whittaker[2], Matthew Cracknell[1], Michael Roach[1]

[1]Centre for Ore Deposit and Earth Sciences, University of Tasmania
[2]Institute for Marine and Antarctic Studies, University of Tasmania

The Lachlan Orogen is a diverse region of deformed geology representing a complex history of tectonic processes on the margin of Gondwana during the Early Palaeozoic. It is now present in South-Eastern Australia, with correlates in Tasmania, Antarctica, and Zealandia. This study aims to reconstruct the tectonic evolution of the Lachlan Orogen between the Cambrian and the Devonian using multiple lines of evidence, including mapping, geophysics, geochemistry and geochronology, combined using *GPlates* software. This modelling technique has been used to (i) retrodeform the shortening of the Devonian Tabberabberan Orogeny, (ii) reconstruct and assess a hypothesis invoking an orogen-wide Silurian-Devonian double-hinged orocline, (iii) evaluate several theories regarding the geodynamics of the Ordovician Benambran Orogeny, and the evolution porphyry Cu-Au deposit-hosting Macquarie Arc, and (iv) reconstruct the conditions in which the Ross, Tyennan, and Delamerian orogenies occurred and ultimately instigated the rest of the region's tectonic evolution. Multiple working hypotheses from previous authors have been tested by this method, some of which have been rejected, but most have been modified or combined with different ideas to produce an all-encompassing reconstruction model with its own unique set of strengths and flaws. This method has also demonstrated novel ways in which spatial data can be reconstructed and assessed within the palaegeographic and geodynamic context from which it originates. An example is the reconstruction of a porphyry Cu-Au mineralisation potential map across the Macquarie Arc. Reuniting the disparate volcanic belts of this once-singular arc during the Ordovician shows a distinct band of high mineralisation potential.

Keywords: Tectonics, Geophysics, Gondwana, Geodynamics



Tasmania - Tuesday, 13 October

POLYMETALLIC NODULE GEOCHEMISTRY: THE INTERPLAY BETWEEN SEDIMENTOLOGY AND OCEANOGRAPHY IN THE SW PACIFIC OCEAN

Andrea Mary Lola Davies[1,3], Monica R. Handler[1], Richard J. Wysoczanski[2] & Helen C. Bostock[2]

[1] SGEES, Victoria University of Wellington, New Zealand.
[2] National Institute of Water & Atmosphere Research, Wellington, New Zealand.
[3] Present affiliation: Institute for Marine and Antarctic Studies, University of Tasmania, Battery Point, Tasmania, Australia.
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Polymetallic nodules are authigenic marine sediments that form slowly over millions of years from the precipitation of iron and manganese (hydroxy)oxides from seawater and sediment pore waters. These deposits, commonly enriched in metals such as copper, nickel, and cobalt, and the rare earth elements, are of interest both as long-lived records of changing oceanic environmental conditions, and as potential economic resources. The incorporation of trace elements and metals into polymetallic nodules reflects their growth mechanism and environmental conditions, and their chemistry is thus dependent on the sedimentology and oceanography of the region in which they are forming.

This study presents the chemical composition of the outermost rims of 77 polymetallic nodules and associated sediment from locations in the Campbell Nodule Field, Tasman Sea and Southern Ocean. Although the sample locations lie several thousand kilometres apart, they are all overlain by Lower Circumpolar Deep Water, but with varying water depth, current velocity, and sediment type. The Campbell Plateau nodule field is sampled across two transects perpendicular to the Subantarctic Slope with varying degrees of influence from the Deep Western Boundary Current across the transects, whereas samples from the Tasman Sea represent a more quiescent environment.

Nodule and sediment trace element data and sediment grainsize data provide insights into nodule growth mechanisms in the Southwest Pacific Ocean. Whilst the nodules overall are dominated by hydrogenetic growth mechanisms, the Southern Ocean and Tasman Sea nodules define distinctive trace element signatures that can be attributed to hydrogenetic (seawater) and diagenetic (sediment pore water) growth mechanisms, respectively. The Campbell Nodule Field transects show systematic variations in mixed hydrogenetic-diagenetic contributions, with increased diagenetic influence with greater distance from the Subantarctic Slope. This reflects variations in the underlying sediments (grainsize, geochemistry, and calcium carbonate content), which in turn is influenced by the regional oceanography of the sites.

Key words: Polymetallic nodules; Geochemistry; Marine sedimentology; Southwest Pacific Ocean.

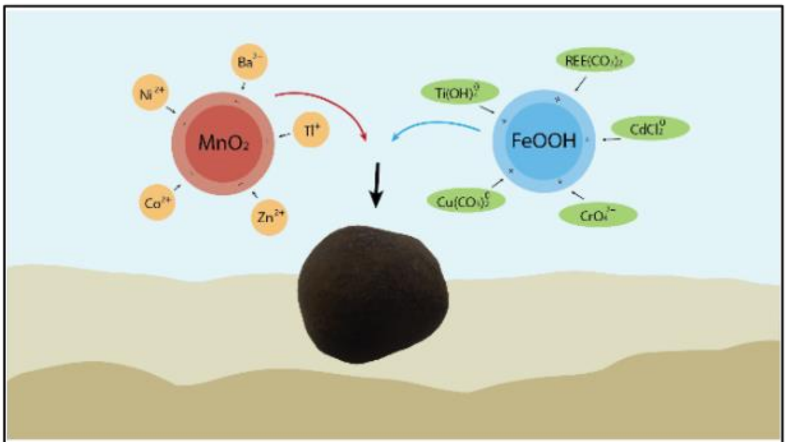
Tasmania - Tuesday, 13 October

Andrea Davies
UTAS-IMAS
PhD Student

Polymetallic nodule geochemistry: the interplay between sedimentology and oceanography in the SW Pacific Ocean

Research Interests:

- Marine geochemistry
- Biogeochemistry
- Analytical chemistry



Simplified electrochemical model showing adsorption of dissolved trace metal species onto oppositely charged Fe and Mn oxyhydr(oxide) colloids, and precipitation onto a ferromanganese nodule surface. Adapted from Hein et al. (2013).

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Tasmania - Tuesday, 13 October

THE CASCABEL Cu-Au-Ag PORPHYRY CLUSTER IN NORTHERN ECUADOR

Carlos Diaz Castro[1,2], David Cooke[2], Santiago Vaca[1], Steve Garwin[1]

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[2] Centre of Excellence in Ore Deposits, University of Tasmania, Tasmania, Australia.
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Cascabel is located within the northern Western Cordillera of Ecuador, near the overlap between Eocene and Miocene metallogenic belts of northern Andean Cordillera of South America. The Cascabel district hosts several Cu-Au(-Ag) porphyry prospects within its concession area. Cascabel regional geology consists of Cretaceous locally calcareous siltstones and minor sandstones that are overlain by a Tertiary sequence dominated by andesitic volcaniclastic packages and volcano-sedimentary rocks. The volcanic packages are characterized by porphyritic andesitic breccias, crystal tuffs, lapilli tuffs, and aphanitic and vesicular lavas. Eocene diorites, quartzdiorites and tonalites have intruded the volcano-sedimentary sequence as plutons, stocks and dykes. The volcanic and volcano-sedimentary host-rocks at Cascabel are interpreted to have been part of the submarine to transitional emergent Paleocene to late Eocene Macuchi Formation, based on the volcano-sedimentary facies recognized in drill core and U-Pb zircon geochronological data.

The discovery of the porphyry copper-gold-silver mineralization at Cascabel is a direct result of target acquisition in a prospective geological setting within an underexplored region. The applications of Anaconda mapping-style in regional exploration and drill core logging to identified major intrusion stages and vein paragenesis in surface and subsurface, soil and rock-chip geochemical anomalies and geophysical surveys (magnetics) have facilitated the identification of several Cu-Au(-Ag) porphyry prospects at Cascabel. Three main mineralized corridors interpreted by topography combined with regional mapping and aerial photography and associated with major fault-trends have been defined at Cascabel. These corridors show northwest-, north-northwest- and northeast-trending and are controlling the hydrothermal alteration zoning and the emplacement of mineralization in fractures and porphyry-style veinlets, which demonstrate than Cascabel hosts several significant Cu-Au(-Ag) porphyry prospects, where the principals are Alpala, Aguinaga and Tandayama – America. The early recognition of a large and structurally controlled, hydrothermal alteration domains allowed for the exploration of porphyry-style mineralization in an under-explored area in northern Ecuador. The altered zoning patterns interpreted in Cascabel are typically of those expressed by many porphyry systems.

New crystallization ages obtained at Cascabel indicate multi-phase intrusive activity over a period of ~4.5 million years. Re-Os geochronological data highlights that mineralization occurred in a narrow time interval, in the late-Eocene, associated with the emplacement and crystallization of the QD10 quartz diorite dykes, which are interpreted as the source of the mineralization at Alpala.

The intrusive rocks at Cascabel range from sub-alkaline basalt to rhyolite in composition. They have negative correlation of SiO_2 with CaO, Fe_2O_3 and TiO_2, consistent with fractional crystallization and have characteristic flat primitive mantle-normalized REE profiles with a negative Nb anomaly. Their REE concentrations are consistent with a magmatic arc origin. The main mineralized intrusions (QD10 dykes) illustrate distinctive positive Eu anomalies that provide evidence for oxidized hydrous magmas that underwent plagioclase fractionation.

Keywords: metallogenic-belt, fractional crystallization.

Tasmania - Tuesday, 13 October

Carlos Diaz Castro

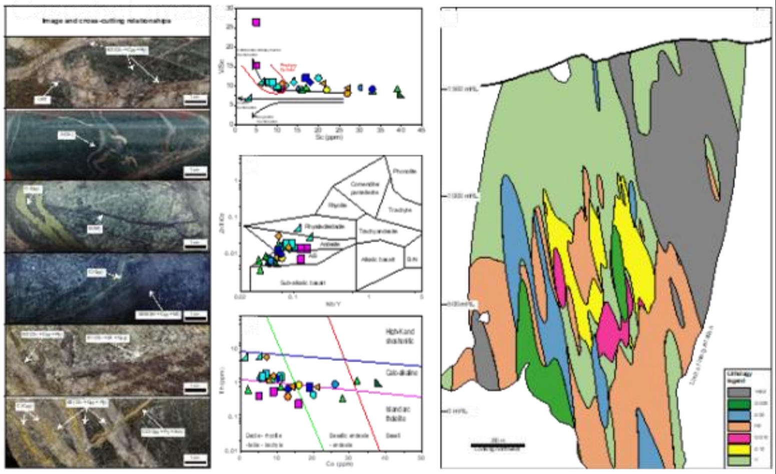
CODES - University of Tasmania

MSc
Economic Geology student

Research Interests:

- Economic geology
- Geochemistry
- Mining exploration

The Cascabel Cu-Au-Ag porphyry cluster in northern Ecuador



LinkedIn: Carlos Diaz Castro

Tasmania - Tuesday, 13 October

TRANSITIONS IN ERUPTIVE STYLE DURING THE 2012 DEEP SUBMARINE SILICIC ERUPTION OF HAVRE VOLCANO, KERMADEC ARC, NEW ZEALAND

Acacia Clark[1], Rebecca Carey[1], and Martin Jutzeler[1]

[1]University of Tasmania

Submarine eruptions are poorly understood compared to subaerial counterparts due to challenges accessing and observing them. The 2012 silicic submarine eruption of Havre Volcano in the Kermadec Arc was the largest deep ocean eruption (~900 – 1220 meters below sea level) ever recorded.
The eruption was complex with at least 14 different eruptive vents. The main vent transitioned in eruption style during the event. The current eruption framework describes the onset of magma disruption on the seafloor at high (107 kgs-1) eruption rates, which produced a large pumice raft (~1 km3) accompanied with a giant pumice seafloor deposit. This phase transitioned to an intermediate phase of unknown intensity that produced an ash-lapilli-block (ALB) deposit proximal to the vent. The final eruptive phase was low intensity (104 kgs-1) effusive magma emplacement that produced a 250 m-high dome complex (Dome OP) over the vent. Previous studies have focused on microtextures of these main phases to understand shallow conduit processes.
We have identified lobe deposits around Dome OP which stratigraphically sit above the ALB deposit but were emplaced prior to the end of the effusive phase. These deposits represent a transitional phase between high to low eruption rates. Detailed microtextural studies were conducted on two representative clasts from in-situ Dome OP together with two clasts from surrounding lobe deposits to quantify crystallinity, vesicle number density and vesicle volume distribution.
Microlites of the same crystal types and habits are present in lobe deposits and in-situ Dome OP clasts, where they are most abundant. Clasts from lobe deposits have elongated vesicles with round edges and in-situ Dome clasts have elongated and flattened vesicles. Vesicle number density is higher in the lobe deposits and lower in the in-situ Dome clasts. Rounded vapor-phase cristobalite is present in the lobe deposits and in-situ Dome O clasts, whereas in-situ Dome P clasts contain an abundance of oblong cristobalite crystals that exist entirely within the groundmass. No discernible correlation could be made between vesicle size and cristobalite crystal size. Silicic submarine domes are morphologically and texturally similar to subaerial domes, indicating hydrostatic pressure has a minor role in outgassing and emplacement processes of lava domes.

Keywords: submarine volcanism, Havre 2012 eruption, microtextural analysis, transition in eruption style

Tasmania - Tuesday, 13 October

Acacia Clark

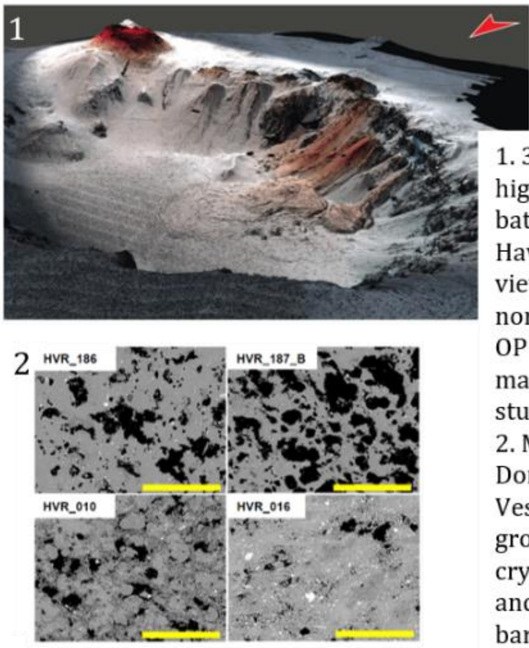
University of Tasmania
Prospective PhD Student

Research Interests:

- Physical volcanology
- Transitions between 'wet' and 'dry' eruptions
- Submarine volcanic processes
- Hazard monitoring and mitigation
- Lava dome emplacement, stability and collapse

Virtual GESSS Presentation title:

Transitions in Eruptive Style During the 2012 Deep Submarine Silicic Eruption of Havre Volcano, Kermadec Arc, New Zealand



1. 3D rendered high resolution bathymetry map of Havre caldera viewed from the northwest. Dome OP (top left) is the main focus of this study.
2. Microtextures of Dome OP samples. Vesicles are black, groundmass and crystals are grey and white. Scale bar is 200μm.

Twitter: @Acacia_Volc

Tasmania - Tuesday, 13 October

PROVENANCE OF LATE CAMBRIAN-ORDOVICIAN SEDIMENTARY ROCKS IN WESTERN, NORTH-EASTERN TASMANIA AND SOUTHERN VICTORIA. CONSTRAINTS FROM U/Pb DATING, ZIRCON GEOCHEMISTRY AND *εHf* ISOTOPE

Sebastien Meffre[1], Umer Habib[1], Sitthinon Kultaksayos[1], Ron Berry[1]

[1]Centre of Ore-Deposit Geology and Earth Sciences, University of Tasmania, Australia
Email address. umer.habib@utas.edu.au

The Late Cambrian to Early Ordovician sedimentary sequences in Western, North-Eastern Tasmania and South Victoria were deposited in contrasting environment of deposition and sedimentary sources. In this study we constrain the provenance of these rocks using U-Pb zircon ages, zircon geochemistry, and zircon *εHf* isotope data. The In western Tasmania the detrital zircon U-Pb ages span from 2800 to 476 Ma including some major Precambrian age peaks at 1800 and 1500 Ma which are consistent with the metamorphic sources of Tyennan and Rocky Cape groups. A recent study shows that these Precambrian ages are widespread in ancient sediments deposited in the Nuna Supercontinent and thought to be derived from granitoids in Laurentia (North America) and Baltica. The zircon geochemistry indicates that the 500 Ma detrital zircon age peak for late Cambrian rocks (Owen group) is most likely to have been derived from a proximal source i.e. Mt Read Volcanics. However, Th/U ratios from Ordovician rocks in north east and western Tasmania (Pioneer and Lefroy) and South Victoria (Diggers Marlstone) implies that these do not come from western Tasmania but were derived from the Gondwana a very large fan system which transported sediments to Australia from the Trans-African Orogen in the Early Palaeozoic.

In western Tasmania, a change of provenance is recorded in the Middle-Late Ordovician Pioneer Sandstone which uncomfortably overlies the Owen Group. This sandstone contains mostly 500 Ma detrital zircons with very small 600 1200 and 1800 Ma populations. This pattern resembles Ordovician Sandstone from mainland Australia, but the population of 500 Ma is higher, suggesting that the provenance of Pioneer Sandstone may be from the global Gondwana-wide population combined with a Mt Read Volcanics and/or Cambrian magmatic arcs in Victoria or Antarctica.

In addition to standard analysis of detrital zircons, we apply multivariate statistics to co-relate different U/Pb ages to quantify the difference among different samples from various localities. Our analysis demonstrates that the detrital ages for Owen, Pioneer, Lefroy and Waratah Bay rocks have a proximal source for Precambrian zircons deposited by west directed paleocurrents. Tectonically these sediments deposited in an extension environment which was developed by rifting during late Cambrian.

Keywords: Western Tasmania, U-Pb dating, Tectonic configuration, Palaeozoic

Tasmania - Tuesday, 13 October

BIOLOGICAL RESPONSES TO MILLENNIAL-SCALE TEMPERATURE AND TERRIGENOUS FLUX VARIABILITY IN THE SOUTHWEST PACIFIC OCEAN

Harris J. Anderson[1], Joel B. Pedro[1,2], Helen C. Bostock[3,4], Zanna Chase[1], Taryn L. Noble[1].

[1] Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia.
[2]Australian Antarctic Division, Kingston, Tasmania, Australia.
[3]School of Earth and Environmental Sciences, University of Queensland, Brisbane, Queensland, Australia.
[4]National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand.

Southern Ocean temperature estimates during the last glacial period (Marine Isotope Stage 3 – MIS-3) identify warming events on millennial-timescales (0.2 – 1.5°C) that coincide with atmospheric events observed in Antarctic ice cores (1 - 3°C). Although there are a number of temperature records during this period in the Southern Ocean there are relatively few records that assess the relationship between temperature and productivity during MIS-3, and fewer still using ^{230}Th-normalised fluxes. We present the first record of Thorium-normalised export production and terrigenous material flux from the South Pacific sector of the Southern Ocean that spans MIS-3. We determined the Th-normalised flux of terrigenous material and continentally derived dust by trace metal analysis, and identified this flux to be anti-phased with millennial-scale warming in the South Pacific sector of the Southern Ocean. We compare paleo-productivity proxies with temperature estimates and the flux of terrigenous material to assess the effects of these variables on export production flux. Export production fluxes correspond closely to the changes in terrigenous fluxes, suggesting that export production increases during the colder periods of the last glacial. However, our paleo-productivity fluxes are anti-phased with the flux of carbonate, which align with increases in temperature and decreases in bottom water oxygenation, which may be indicative of preservation effects on export production flux and burial. Export production flux observations are consistent with the Southern Atlantic sector of the Southern Ocean, where influx of dust and biologically available iron are proposed as the drivers of increased export production. We propose a similar mechanism for the increases in export production identified in the South Pacific despite preservation effects.

Keywords: Paleoclimate, export production, trace metals, Southern Ocean

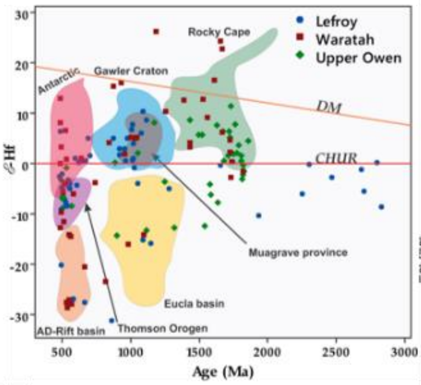
Tasmania - Tuesday, 13 October

Umer Habib
CODES, UTAS
PhD candidate

Research Interests:

- Geochronology
- Structure geology
- Soil Mechanics, foundation modelling

Provenance of Late Cambrian-Ordovician sedimentary rocks in Western, North-Eastern Tasmania and Southern Victoria. Constraints from U/Pb dating, Zircon geochemistry and *εHf* isotope



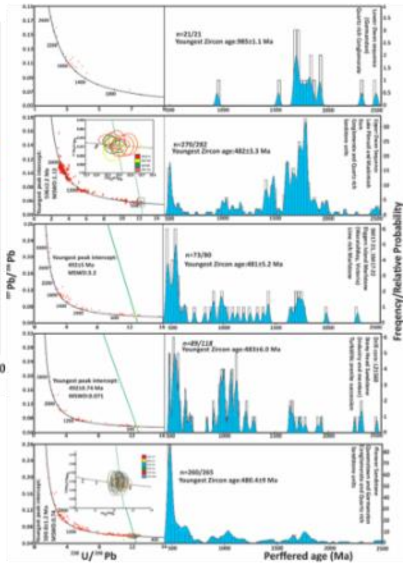


Figure 1. Left: εHf isotope plot for Waratah, Lefroy and Owen group Ordovician rocks. Coloured polygons display different probable sources for these sediments. Right: Kernel density estimate graph with mean Concordia plots on their left while inset shows the peak intercepts for Owen and Pioneer rocks.

Tasmania - Tuesday, 13 October

SHALLOW CONDUIT AND VENT PROCESSES IN THE 1886 BASALTIC PLINIAN ERUPTION AT TARAWERA, NEW ZEALAND

Hannah Moore[1], Rebecca Carey[1], Martin Jutzeler[1]

[1]School of Natural Sciences and CODES, University of Tasmania, Tasmania, Australia

The 1886 eruption of Tarawera, New Zealand, is one of four known examples of basaltic Plinian eruptions. During the climactic phase, high Plinian eruption columns were produced at four vents along an 8-km-long fissure and were simultaneously accompanied by numerous low-intensity phases at separate vents along the same fissure on Mt Tarawera and beyond into Rotomahana.

We present a detailed re-examination of microtextures from proximal and medial suites of clasts. Clasts from the margins of the high Plinian plumes were deposited adjacent to the fissure in beds with widespread dispersal ($t_{1/2}$ of 100s m), whereas clasts derived from low-intensity eruptions were deposited in beds with localised dispersal ($t_{1/2}$ 10s m).

Clast vesicle number densities (VNDs) are similar between all sample locations (in the order of 10^6–10^7 cm^{-3}), vesicle shapes are generally polylobate, and high microlite content (66–89%) is ubiquitous. This evidence suggests that factors related to the external environment (e.g. vent wall collapse) could be more important than previously recognised.
All clasts have a significant secondary bubble population <10µm of different abundances (referred to here as tiny voids) which either represent (1) a late-stage nucleation event, (2) magma contraction during crystallisation, or (3) devitrification of glass due to volatile gases. Investigation into the mechanisms that formed such voids may elucidate shallow conduit processes which contributed to the different eruption styles at Tarawera. We suggest that for the case of the 1886 Tarawera eruption, VNDs need to be carefully interpreted; for some clasts (particularly the dense clasts), the process which formed the tiny voids which have 'overprinted' the original ascent signature and thus VND is not a proxy for decompression rate.

This research furthers our understanding of a poorly understood and hazardous end-member of basaltic volcanism. Improved knowledge of the conditions that promote powerful eruption of basaltic magma is crucial for volcanologists and to provide better short-term forecasts of eruption onset to emergency managers and hence mitigate hazardous situations.

Keywords: Tarawera, basalt, Plinian eruption, microtextural analysis

Tasmania - Tuesday, 13 October

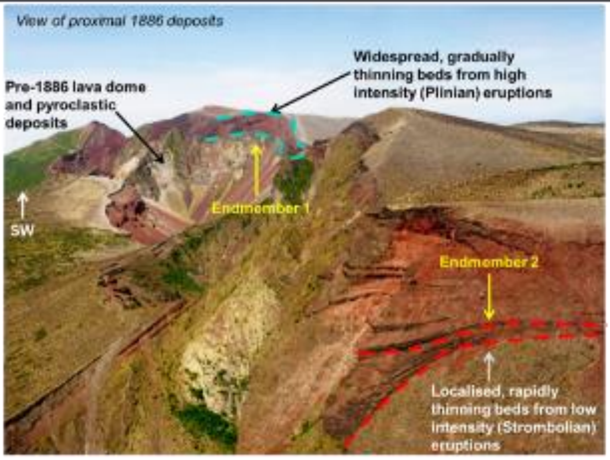
Hannah Moore

CODES – Centre for Ore Deposit and Earth Sciences
PhD student

Shallow Conduit and Vent Processes in the 1886 Basaltic Plinian Eruption at Tarawera, New Zealand

Research Interests:

- Volcanology
- Petrology
- Field Geology



Annotated photo of the 1886 eruptive fissure at Tarawera

Email: Hannah.Moore@utas.edu.au

Supervisory Team: Dr Rebecca Carey (UTAS)
Dr Martin Jutzeler (UTAS)

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Twitter: @HannahCMoore

Tasmania - Tuesday, 13 October

AN ENDURING PROBLEM: A MULTIDISCIPLINARY APPROACH TO CHARACTERISE ACID AND METALLIFEROUS DRAINAGE AT ENDURANCE MINE, NE TASMANIA

Eliza Fisher[1], Wei Xuen Heng[1]

[1]University of Tasmania

The legacy Endurance Mine, an abandoned alluvial tin mine in northeast Tasmania, provides an opportunity to evaluate the production of acid and metalliferous drainage (AMD) in quartz-rich gravel tailings. Almost four decades after mine closure, and despite low observed pyrite content (< 1 wt. %), AMD generated at the Endurance tailings site continues to negatively impact rehabilitation success and the local environment. Three Earth Sciences honours projects at the University of Tasmania aim to embody a collaborative, multidisciplinary approach to mine waste characterisation and rehabilitation using hydrological, geochemical and geophysical methods. Due to the heterogenous nature of mine waste materials, research shows that a combination of disciplines is necessary to effectively characterise a tailings repository. These concurrent studies provide a unique opportunity for integration of results and a more holistic understanding of the Endurance legacy mine site.

Eliza Fisher's thesis focuses on tailings and lake sediment geochemistry across the Endurance site. Her project has completed a bathymetric survey of Blue Lake, the largest of the three acidic (pH 2.7–4) pit-lakes to study depositional processes and pinpoint the deepest section of at 16.5 meters depth for sediment coring. Lake sediment cores were also collected from Middle Lake and Ruby Lagoon, the latter which is a collection pond for acid and metalliferous drainage. Horizons in the lake sediment cores will be analysed using integrated ICP-MS, XRD and SEM/MLA techniques to characterise the bulk geochemistry, mineralogy and trace metal hosts in the sediments. As the redox and pH sensitivity of authigenic metal-bearing minerals in sub-aqueous environments has implications for metal mobility, the geochemical analysis of these sediment will help to inform suitable remediation techniques.

To better understand the source and pathway of contamination at the former mine site, nine piezometers have been installed for Olivia Wilson's hydrogeological survey. Surface and groundwater samples collected across the site demonstrate low pH (2.97-5.56), high conductivity, and elevated levels of metals (Al, Fe, Pb, Zn). Shake flask tests have been completed on various tailings materials to assess the solubility of mineral phases when interacting with surface and groundwaters. Analyses will lead to a combined understanding of sources of acid and metalliferous drainage at the legacy tailings site and the fate and transport of metals of concern to the downstream environment.

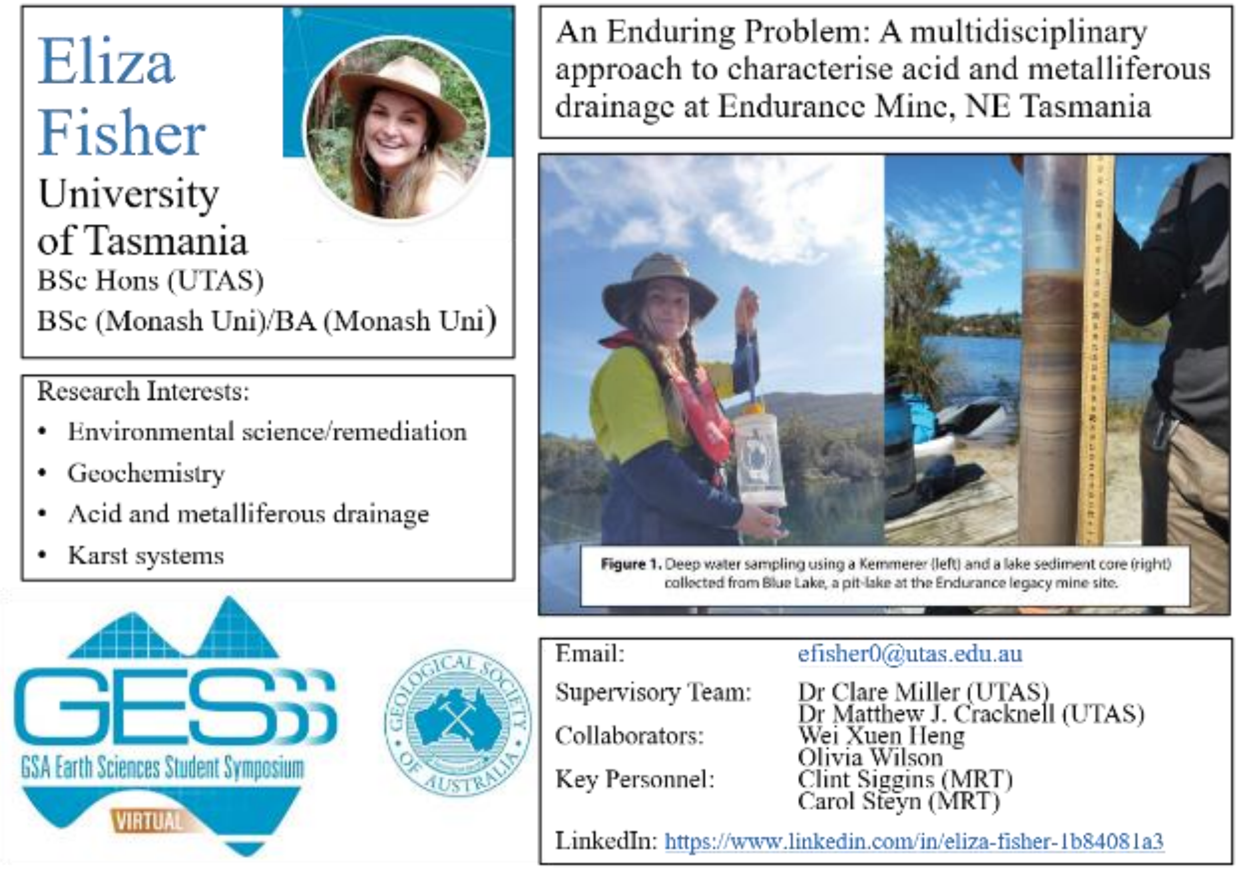
Wei Xuen Heng's project focuses on the collecting geophysical observations of the historic tailings landscape using Electromagnetics (EM), Ground Penetrating Radar (GPR), Electrical resistivity imaging (ERI), near-surface seismic and radiometrics. These geophysical methods were used to image the thickness and internal structure of the Endurance tailings site. ERI and seismic methods have helped in estimating the thickness of surface tailings, saturated sediments, and granitic basement. GPR has proven to be a rapid way for defining the depth-to-basement, position of saturated sediments and highlighting the presence of dipping structures within 10 meters of the surface. In addition, this study compared electrical and elastic properties of the near-surface tailings layer based on the integration of inverted models and found that granite has > 2000 m/s P-wave velocity and > 100 Ohm/m resistivity values. These geophysical models are being cross-referenced with observations from the hydrogeological and geochemical surveys, which has the potential to provide an insight into basement topography for on-going hydrological and geochemical studies for future rehabilitation.

Tasmania - Tuesday, 13 October

The permeable nature of the tailings material, combined with low water pH and high levels of aluminium, present challenges to passive remediation techniques. The collaborative effort of these three honours projects have implications for future remediation approaches at Endurance, which will inform remediation projects in high Al concentration environments across the tin fields of Tasmania's northeast.

Supervisory Team: Dr Clare Miller, Dr Matthew J. Cracknell
Key Personnel: Clint Siggins (MRT), Carol Steyn (MRT)
Collaborators: Eliza Fisher, Wei Xuen Heng, Olivia Wilson – Honours Theses

Keywords: Remediation, acid mine drainage, geochemistry, geophysics



Tasmania - Tuesday, 13 October

Wei Xuen Heng
University of Tasmania
Honours Student

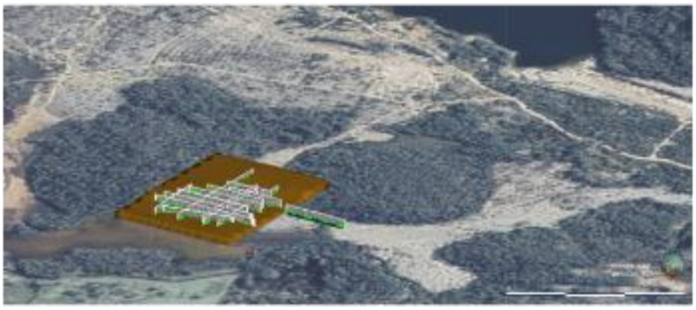
Research Interests:

- Near-surface geophysics
- Mine waste
- Acid mine drainage

Virtual GESSS Presentation title

An Enduring Problem: A multidisciplinary approach to characterise acid and metalliferous drainage at Endurance Mine, NE Tasmania

Caption: Pre-mining basement model derived from GPR sections.



LinkedIn: linkedin.com/in/weixuenheng/

Tasmania - Tuesday, 13 October

USING TRACE ELEMENT CHEMISTRY OF MAGNETITE AS AN INDICATOR MINERAL IN IRON-OXIDE COPPER GOLD DEPOSITS

Max Hohl[1]

[1]University of Tasmania

Iron Oxide – Coper – Gold (IOCG) deposits classify a group of hydrothermal ore deposits that are defined by large scale potassic and sodic alteration followed by iron alteration. IOCG style ore deposits occur worldwide and host globally significant amounts of copper, gold, and uranium. While the extent of the barren alteration often reaches multiple kilometers identifying fertile systems remains challenging. Trace element chemistry of minerals commonly present in the alteration halo can be used as tool to discriminate fertile from barren hydrothermal systems.

Magnetite is commonly present in the widespread alteration footprint surrounding the ore body. Due to magnetites inverse spinel crystal structure its trace element chemistry is well understood. Incorporation of trace elements in magnetite follows physicochemical parameters reflecting the formation temperature and prevailing redox conditions during magnetite formation. This led to numerous applications as fingerprint mineral for various and ore deposits and distinct hydrothermal settings.

Subject of this study is the Starra Au-Cu system in the eastern part of the Mount Isa Inlier in Northwest Queensland (Australia). Along a circa 6 kilometers long interval five previously mined ore bodies comprise the Starra Au-Cu system. The ore bodies are emplaced within magnetite-hematite dominated ironstones along the Starra shear at the contact between the Answer Slate to the west and the Staveley Formation to the east. Magnetite dominated iron oxide alteration along the Starra shear form a strong magnetic anomaly, which can be followed for more than 20 kilometres. This extensive iron oxide feature represents an ideal locality to define a chemical fingerprint of the mineralized zone and to study the variation of magnetites trace element chemistry with increasing distance to the ore bodies. One controlling factor on the Au precipitation and chalcopyrite formation in IOCG systems is the oxygen fugacity fO_2 of the hydrothermal fluid. Gold carrying chloride complexes are stable under high fO_2 conditions. For the Starra Au-Cu system the genetic model argues that oxidized fluids were reduced by magnetite dominated ironstones, which led to unstable chloride complexes and precipitation of Au. Vanadium and Cr concentrations in magnetite are commonly interpreted to reflect fO_2 conditions. Magnetite from the Starra system that is heavily overprinted by hematite shows low V concentration indicating low fO_2, while magnetite associated with later stages of the hydrothermal system show high V concentration indicating more reduced conditions. Indispensable for using magnetite as a proxy in mineralized hydrothermal systems is to better understand the effect of hydrothermal alteration on its trace element chemistry.

Characterizing the mineral chemistry of magnetite and thus evolution of the hydrothermal fluids will lead to a better understanding of the ore formation processes within the Starra Au-Cu deposit, and in a broader sense to a more efficient exploration method in mineralized hydrothermal settings.

Keywords: IOCG systems; Mineral Exploration; Laser-ICP-MS; Magnetite

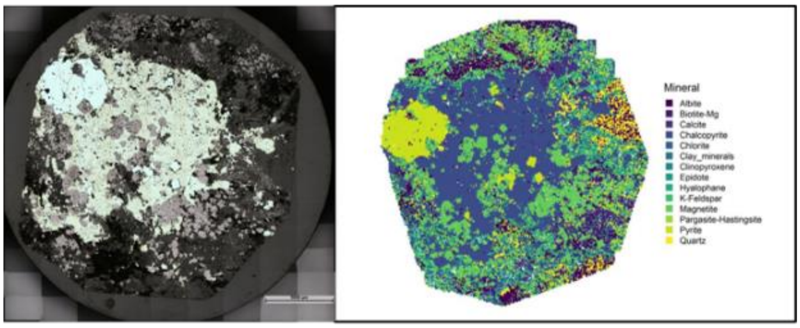
Tasmania - Tuesday, 13 October

Max Hohl

CODES – Centre of Ore Deposits and Earth Science, University of Tasmania, Private Bag 79, Hobart, Tasmania 7001, Australia

PhD - Student

Using Trace Element Chemistry of Magnetite as an Indicator Mineral in Iron-Oxide Copper Gold Deposits



Research Interests:

- Mineral Chemistry
- Ore Deposits
- Machine Learning

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ACT/NSW - Wednesday, 14 October

Schedule (AEDT)

Time	Presenter	Title
17:00-17:10	Welcome – Amber Jarrett	
17:10-17:35	Abdulwaheed Ògúnsàmì (Australian National University)	*Keynote: Offshore rig to High-pressure lab: The journey to the Bush Capital*
17:35-17:50	Caleb Bishop (Australian National University)	*Tracing the early evolution of Archaeplastida throughout the Cryogenian glaciations*
17:50-18:05	Mahdiyeh Razeghi (Australian National University)	*Keynote: PhD Students and Mental Health*
18:05-18:10	Intermission	
18:10-18:25	Cait Stuart (Macquarie University)	*The recognition of former melt flux through shear zones*
18:25-18:40	Jemima E. Jeffree (Australian National University)	*Remote sensing of on-farm water storage in the Murray-Darling Basin*
18:40-19:05	Michael Anenberg (Australian National University)	*Keynote: What happens after the PhD?*
19:05-19:10	Closing Remarks – Amber Jarrett	
19:10-19:30	INTRA GSA co-hosted by Governing Council and sessional hosts	

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ACT/NSW - Wednesday, 14 October

Australian Capital Territory Committee

Dr Amber Jarrett
Geoscience Australia

Geochemist

Virtual GESSS ACT chair

Research Interests:

- Geochemistry
- Stable isotopes
- Basin redox
- Early life

I am a geochemist, working with the Onshore Energy Systems team at Geoscience Australia since 2014. I am interested in basin hosted resource potential, petroleum systems, organic-inorganic geochemistry, isotopes, Proterozoic biomarkers and early life.

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ResearchGate: https://www.researchgate.net/profile/Amber_Jarrett

LinkedIn: https://www.linkedin.com/in/amber-jarrett-4a501323/

Caleb Bishop
Australia National University

PhD Candidate
Virtual GESSS ACT committee member

Research Interests:

- Precambrian biomarkers
- Paleoredox
- Sedimentology

The primary conduct of my research is in the field of paleobiogeochemistry. My research focuses on the interactions between exogenic earth processes and the proliferation of complex life in the Neoproterozoic. Specifically, this work involves investigations into basin development, sedimentary provenance, nutrient cycling, redox conditions, aquatic temperatures, biomarker distributions and the rise of eukaryotic life to ecological dominance.

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Research Gate: https://www.researchgate.net/profile/Caleb_Bishop2

ACT/NSW - Wednesday, 14 October

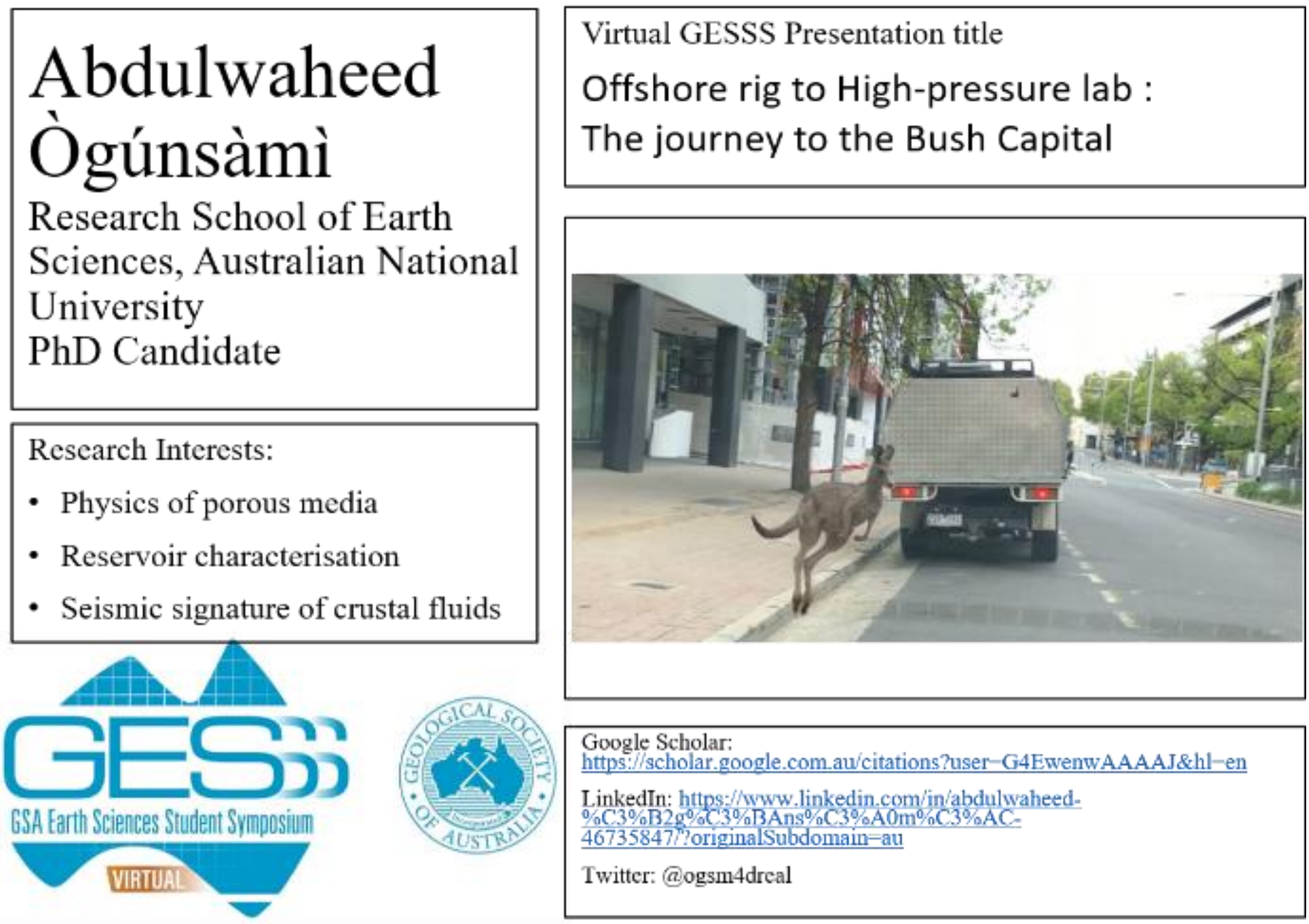
Abstracts

OFFSHORE RIG TO HIGH-PRESSURE LAB: THE JOURNEY TO THE BUSH CAPITAL

Abdulwaheed Ògúnsàmì[1]

[1]Research School of Earth Sciences, Australia National University, ACT 2601, Australia

In this keynote presentation, I provide an overview of my journey from the industry back to university to pursue a PhD in rock physics. I highlight some of the findings of my on-going PhD work on how I torture glass to milk rock. While it may appear that PhD Work-life balance does not exist, I illustrate useful tips I wish I knew when I started. In particular, as a PhD student with young children but luckily with previous industry experience, these trips have proven very helpful in managing stress and future career uncertainties.



ACT/NSW - Wednesday, 14 October

TRACING THE EARLY EVOLUTION OF ARCHAEPLASTIDA THROUGHOUT THE CRYOGENIAN GLACIATIONS

Caleb M.B. Bishop[1], Rose Y. Zhang[1], Peter W. Haines[2], Janet M. Hope[1], Jochen J. Brocks[1]

[1]Research School of Earth Sciences, Australia National University, ACT 2601, Australia
[2]Geological Survey of Western Australia, WA 6892, Australia
E-mail address: Caleb.Bishop@anu.edu.au

The ecological transition from a biosphere dominated by bacteria to one dominated by eukaryotes marks a major turning point in the success of metazoan life. Specifically, the early emergence and proliferation of Chlorophyta green algae is held responsible for instating a more efficient biological pump to the deep ocean which breached oxygen and nutrient thresholds that had since prevented the proliferation of large eukaryotic organisms. Bacterial and eukaryotic biomarkers have been used to trace this ecological transition, ascribing it to the Cryogenian Snowball Earth events. A solitary sample from the South Oman Salt Basin posits a Cryogenian 'rise of algae', suggesting the proliferation of Chlorophytes occurred during the interglacial period (ca. 659-645 Ma). However thermally immature, syngenetic biomarker distributions from the Marinoan Wahlgu Formation in the central Officer Basin, Western Australia, are here found to display unanimous typical primitive Tonian signatures, evincing a reappraisal on our understanding of the 'rise of algae' to an early Ediacaran timeline at the earliest. Such alters our present understanding on what initially drove the proliferation of early Archaeplastida and ultimately metazoan life as a whole. A revised age for the rise of Chlorophyta is proposed at ~622 Ma ago in post-glacial Ediacaran oceans.

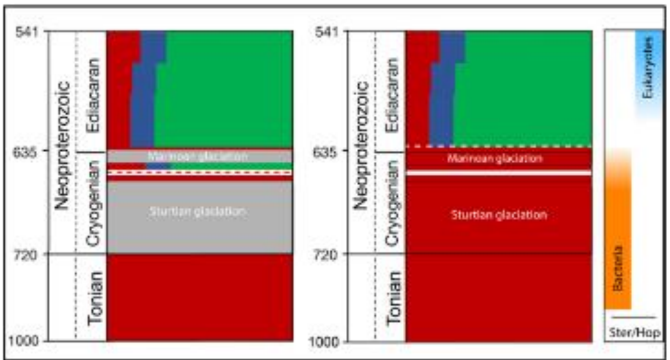
Keywords: Biomarker, Neoproterozoic, Cryogenian, Paleobiogeochemistry, Eukaryotes, Archaeplastida, Snowball Earth.

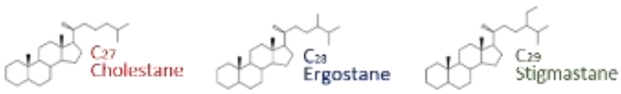
Caleb Bishop
Research School of Earth Sciences,
Australia National University
PhD Candidate

Research Interests:

- Neoproterozoic biomarkers
- Paleoredox
- Sedimentology

Tracing the early evolution of Archaeplastida throughout the Cryogenian glaciations





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Research Gate:
https://www.researchgate.net/profile/Caleb_Bishop2

ACT/NSW - Wednesday, 14 October

PhD STUDENTS AND MENTAL HEALTH

Mahdiyeh Razeghi[1]

[1]Research School of Earth Sciences, Australia National University, ACT 2601, Australia

Mental health has been a significant issue among post-graduate students for a long time. Most of both students and institutions have ignored this important matter which can be due to lack of knowledge and/or judgmental reactions. Toxic supervision, losing work-life balance, and feeling unvalued could be the reasons which lead a student to struggle with the mental health. Institutions can play a significant role by providing counselling services, check students' progress, and make a confidential space for students to speak up. Students also need to not only try to keep mentally and physically fit (by routine exercise and seeking help), but also keep the passion, take responsibility of the project, and accept failure as an inevitable step of the research.

Mahdiyeh Razeghi
Research School of Earth Sciences,
Australian National University,
Canberra, Australia
Postdoctoral Fellow

Research Interests:

- GRACE
- GNSS
- Geodesy

PhD Students and Mental Health

Mental health has been a significant issue among post-graduate students for a long time. Most of both students and institutions have ignored this important matter which can be due to lack of knowledge and/or judgmental reactions. Toxic supervision, losing work-life balance, and feeling unvalued could be the reasons which lead a student to struggle with the mental health. Institutions can play a significant role by providing counselling services, check students' progress, and make a confidential space for students to speak up. Students also need to not only try to keep mentally and physically fit (by routine exercise and seeking help), but also keep the passion, take responsibility of the project, and accept failure as an inevitable step of the research.

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ACT/NSW - Wednesday, 14 October

THE RECOGNITION OF FORMER MELT FLUX THROUGH SHEAR ZONES

Catherine Stuart[1*], Sandra Piazolo[1,2], Nathan Daczko[1]

[1]ARC Centre of Excellence for Core to Crust Fluid Systems and GEMOC, Department of Earth and Planetary Sciences, Macquarie University, Sydney, NSW, 2109, Australia
[2]School of Earth and Environment, University of Leeds, Leeds, UK
*now at the Geological Survey of NSW

Shear zones are pathways used by melt as it migrates through the crust. However, identification of shear zones as former pathways is usually limited to cases where the interpreted volume of melt preserved in the shear zone is over 10%. This study examines shear zones in the Pembroke Granulite, an otherwise low-strain outcrop of volcanic arc lower crust exposed in Fiordland, New Zealand. Rare leucosome and coarse-grained peritectic garnet within the shear zones suggest partial melting was occurring during deformation. At an outcrop scale the shear zones display compositional banding, flaser-shaped mineral grains and closely-spaced foliation planes typical of high-strain deformation. In contrast, the shear zones lack microstructures typical of high-strain deformation and instead display microstructures typical of equilibrium such as straight grain boundaries, 120° triple junctions and subhedral grain shapes.

This study identifies and characterises five key microstructures that indicate melt was present during deformation: (1) small dihedral angles of interstitial phases; (2) extremely elongate interstitial grains; (3) small aggregates of quartz grains with xenomorphic plagioclase grains connected in three dimensions; (4) fine-grained, K-feldspar bearing, multiphase aggregates with or without augite rims; and (5) mm- to cm-scale felsic dykelets. These five microstructures are proposed as a tool that may be used to recognise shear zones that have been used as pathways for melt migration.

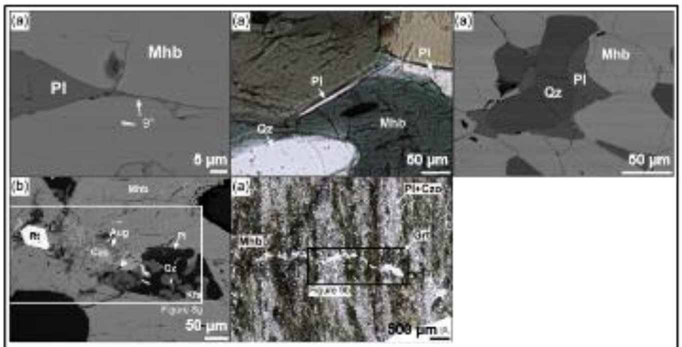
Keywords: melt migration, shear zones, strain localisation, porous melt flow

Cait Stuart
Geological Survey of NSW
Graduate Geoscientist

Research Interests:

- Melt-rock interaction
- Melt migration
- Structural geology
- Field geology

The recognition of former melt flux through shear zones



Microstructures used to identify former melt presence (clockwise from top left): small dihedral angles; elongate interstitial grains; small aggregates of quartz with xenomorphic plagioclase; mm- to cm-scale felsic dykelets; and fine-grained multiphase aggregates

Google Scholar: https://scholar.google.com/citations?user=BAmh4OkAAAAJ&hl=en
Personal Webpage: https://www.researchgate.net/profile/Cait_Stuart
Twitter: @RockDrCait
LinkedIn: https://www.linkedin.com/in/cait-stuart/

ACT/NSW - Wednesday, 14 October

REMOTE SENSING OF ON-FARM WATER STORAGE IN THE MURRAY-DARLING BASIN

Jemima E. Jeffree[1], Mahdiyeh Razeghi[1], Paul Tregoning[1]

[1]Research School of Earth Sciences, Australian National University, 2601, Australia
E-mail address: u6955431@anu.edu.au

Water consumption in the Murray Darling Basin is regulated. These regulations are difficult to manage due to minimal monitoring of both river water extraction and overland flow capture. Current water extraction meters are of low accuracy and are often tampered with, as well as being sparsely distributed across the basin. Although the number of meters and accuracy of meters is currently being increased across New South Wales, this lack of widespread, reliable information leads to difficulty enforcing water restrictions.

Satellite altimetry has the potential to be used to improve monitoring by measuring changes in dam surface elevation. Changes in dam surface elevation reflect changes in dam water storage, which can reflect the volume of water taken from a river or captured from overland flow. Three satellites altimeters currently in orbit have sufficiently high spacial resolution to potentially be used to monitor small dams: ATLAS on ICESat2 (lidar), GEDI on the ISS (lidar) and SRAL on Sentinel 3. Previous studies monitoring lakes, reservoirs and rivers suggest that all three altimeters have an accuracy of 2-50cm, and that the lidar altimeters are more accurate than radar altimeters when measuring the surface elevation of smaller water bodies.

A preliminary trial to measure the dam height of government dams, where the water volume is known from gauges, suggests that radar and lidar data can give complementary data to improve compliance monitoring. A time series of satellite measurements of the water surface elevation of Burrinjuck Dam suggests that different satellites have different biases, and that lidar measurements are more accurate than radar measurements.

Keywords: Geodesy, ICESAT2, sentinel-3, GEDI, lidar, radar

ACT/NSW - Wednesday, 14 October

Jemima E. Jeffree
Research School of Earth Sciences,
Australian National University

Remote sensing of on-farm water storage in the Murray-Darling Basin

Research Interests:

- Geodesy
- Lidar
- Radar

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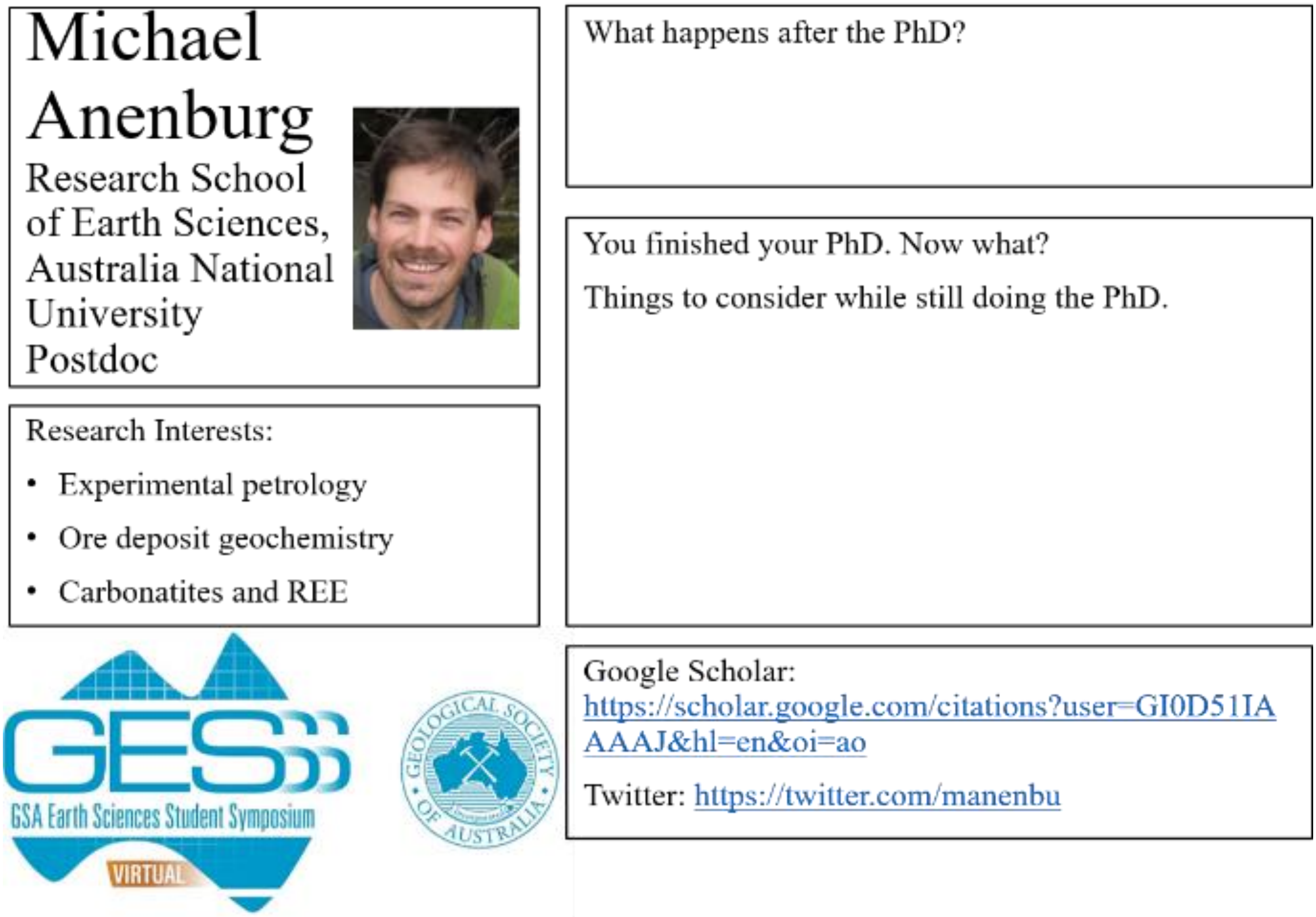
ACT/NSW - Wednesday, 14 October

WHAT HAPPENS AFTER THE PhD?

Michael Anenberg[1]

[1]Postdoctoral fellow, Research School of Earth Science, ANU

You finished your PhD. Now what? In this presentation we will discuss the final stages of a PhD program, things to consider while still doing the PhD and some personal reflections of a postdoctoral fellow.



Professional Development Thursday 15 October

Schedule (AEDT)

Time	Presenter	Title
15:00-15:10	Welcome – GSA President's Welcome – Jo Parr	
15:10-15:15	Ignacio González-Álvarez	*Introduction to "Pathways to work for the CSIRO" panel*
15:15-15:30	Renee Birchall; Morgan Williams; Jessica Stromberg; Siyu (Shirley) Hu; Shane Mulè (CSIRO)	*Overview of CSIRO Panellists*
15:30-15:50		*Panel Discussion*
15:50-16:00	Intermission	
16:00-16:20	Kate Selway (Macquarie University)	*Communicating Science Outside of Publications*
16:20-16:40	Anita Andrew (Australian Journal of Earth Sciences)	*Publishing your research and discoverability*
16:40-17:00	Thomas Schapp (University of Tasmania)	*Gold at the End of the Rainbow: How your choice of colour can impact data interpretation*
17:00-17:20	Marina Costelloe (Geoscience Australia)	*Why Mentors Matter*
17:20-17:30	Closing Remarks – Jo Parr	

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Email: info@gsa.org.au

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Professional Development Thursday 15 October

National Working Group

Dr Verity Normington

Geological Society of Australia

National Secretary, Governing Council

Research Interests:

- Sedimentary Basins
- Regolith
- Science Communication

I'm a geologist with experience in sedimentary basins. I'm a Superstar of STEM who is passionate about supporting early career geoscientists and increasing STEM and diversity awareness within the science community and to the general public. I whole-heartedly believe in "you can't be what you can't see" and believe that the work I do can help to solve the issue of reduced STEM participate especially by girls and young women.

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Instagram: https://www.instagram.com/obsessedgeo/?hl=en

Ms Sue Fletcher

Geological Society of Australia
Chief Executive Officer

I work for the Geological Society of Australia. In my role I am responsible for publishing, membership, communications, events, supplier relationships and overall Association management.

I have a background in publishing, event management and finance.

Special Interests:

- AESC field trips
- Supporting members communicate their research

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Professional Development Thursday 15 October

Dr Tim Holland

Geological Society of Australia
Membership Officer

Research Interests:

- Devonian and Carboniferous Fish
- Australian Cretaceous Dinosaurs
- Cretaceous Pliosaurs

I work for the Geological Society of Australia, with a focus on membership, communications and events, including Virtual GESSS.

I have a background in Vertebrate Palaeontology, having worked, conducted research and collected fossils in Victoria and Queensland.

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https://www.facebook.com/Geological-Society-of-Australia-266952990958/

https://scholar.google.com.au/citations?user=Kfl04yMAAAAJ&hl=en

Professional Development Thursday 15 October

CSIRO Panellists

Renee Birchall
CSIRO
Mineral Resources

Experimental Scientist/Team Leader

Research Interests:

- Orogenic gold systems
- SEM mineral mapping
- Mineral exploration

I am the Hydrothermal Footprints Team Leader in CSIRO Mineral Resources' (CMR) Discovery Program and have expertise working in gold systems. I joined CMR in 2015 from industry where I worked in gold mining and exploration across Western Australia. At CMR I apply SEM mineral mapping to gold and copper mineralising systems, with a focus on developing and implementing workflows for the exploration and mining industry. I am also actively involved in the STEMM Professionals in Schools program and the Pride@CSIRO network.

Personal Webpage:
https://people-my.csiro.au/b/r/renee-birchall

LinkedIn:
https://www.linkedin.com/in/reneebirchall/

Morgan Williams
CSIRO
Mineral Resources

Postdoctoral Fellow

Research Interests:

- Data-driven geochemistry; applying data science and machine learning to geochemical problems
- Metasomatism, stable isotopes and microanalysis
- Research software engineering

I am a postdoctoral fellow within CSIRO Mineral Resources' Geoscience Analytics and Ore Deposit Petrology teams. I integrate domain knowledge with new approaches and tools to interrogate large datasets and develop open software for geoscientists. I'm passionate about making these tools and approaches accessible and enabling others to develop practical digital skills. My research currently focuses on automated classification and tectonic discrimination using lithogeochemistry, with applications to magmatic nickel deposits and IOCG systems.

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GitHub:	morganjwilliams
Personal Webpage:	fluids.rocks

Professional Development Thursday 15 October

Jessica Stromberg

CSIRO
Mineral Resources

Research Scientist

Research Interests:

- Ore deposit geochemistry
- Hyperspectral mineralogy
- Mineral Exploration

I am an ore deposit geologist who applies the combined use of lab and field-based spectroscopic and geochemical techniques for mineral exploration. I am working on several projects including MinEx CRC Project 3 and the NVCL. I am also a strong believer in the importance of increasing diversity and the representation of untapped populations in the geosciences and am actively involved in the CMR D&I Committee, the Pride@CSIRO network, QueersInScience, and the AAS National Committee for the Earth Sciences.

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Siyu (Shirley) Hu

CSIRO
Research Scientist

Research Interests:

- Modern seafloor hydrothermal system
- Microbe-metal interactions in extreme environments
- General ore body characterisation

I'm interested in utilizing a combination of advanced analytical techniques (e.g. XRD, Desktop XRF element mapping, Synchrotron-based XRF, LA-ICP-MS, EBSD, NanoSIMS and TEM) to understand the ore-forming processes through multiple scales. I'm particularly attracted by the modern seafloor hydrothermal systems and the life behaviors in such extreme environments.

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https://scholar.google.com.au/citations?user=u3bVebYAAAAJ&hl=en

LinkedIn: https://www.linkedin.com/in/siyu-shirley-hu-177824b5/

Professional Development Thursday 15 October

Shane Mulè
CSIRO
Research Scientist / Team Leader

Research Interests:

- Geophysics
- Groundwater
- Mineral Exploration

My research at CSIRO is focussed on applying geophysics to assist with characterising the subsurface primarily for groundwater and mineral exploration applications. My work involves the development of geophysical acquisition, processing, modelling and interpretation methods. I am an advocate for cross disciplinary collaboration and thus work across multiple teams comprised of a variety of geoscience specialists and application engineers.

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Professional Development Thursday 15 October

Abstracts

COMMUNICATING SCIENCE OUTSIDE OF PUBLICATIONS

Kate Selway[1]

[1]Macquarie University, ARC Future Fellow

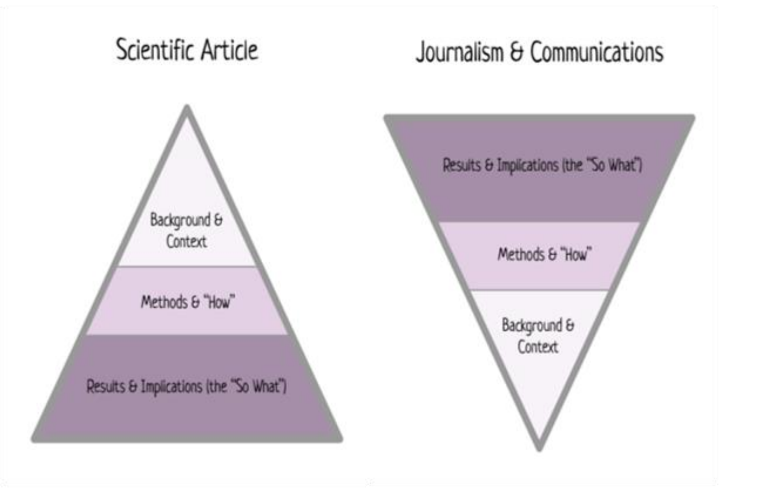
Our science can have so much more impact through avenues other than publications, whether that be in getting funding, building community support, or educating the public. Despite this, we often do not think very much about how to communicate our science to all those people who will never read our papers. In this presentation, I will talk about the benefits of communicating science outside of publications and give some pointers on how to do this most effectively.

Kate Selway
Macquarie Uni
ARC Future Fellow

Research Interests:

- Mantle composition
- Solid Earth – ice sheet interactions
- Magnetotellurics

Communicating Science Outside of Publications



Google Scholar: https://scholar.google.com/citations?hl=en&user=Mt7VgAsAAAAJ
Personal Webpage: https://kateselway.wordpress.com/
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LinkedIn: https://au.linkedin.com/in/kate-selway-001883b0

Professional Development Thursday 15 October

PUBLISHING YOUR RESEARCH AND DISCOVERABILITY

Anita Andrew[1]

[1]Editor-in-Chief, Australian Journal of Earth Sciences (ajes.editor@gsa.org.au)

You have some exciting results that you want to share with the world. Unless results are shared, the research is of limited value and the best way to share your research with a global audience is to publish in a peer-reviewed journal. The publishing world is dominated by large publishing houses that allow wide-distribution and promotion but demand the highest standards.

Writing your manuscript is the beginning of the journey to acceptance and sharing your results. The selection of your preferred publication is essential as each journal has different styles and criteria. Your paper may be rejected without review if it is not appropriate for the chosen journal or not written in the correct style. Read the instructions to authors to save time and disappointment.

With your manuscript submitted and accepted for review, the editor will send it out for peer-review. When reviews have been received, the editor will make a decision and send this back to the authors. Authors will be asked to address reviewers' concerns and make necessary amendments before resubmission and reassessment by the editor and possibly another round of reviews. After final acceptance of the manuscript, the files are edited and sent to the publisher for typesetting. When proofs are corrected the paper may be published on-line and later in a hard copy; the details will vary between journals.

In this changing world of journal publishing, issues of discoverability, accessibility, and effective impact are important to authors. Open access, data accessibility, online publication, marketing, profile raising and best practice on social media empower authors to raise awareness of their research and increase their impact.

Professional Development Thursday 15 October

GOLD AT THE END OF THE RAINBOW: HOW YOUR CHOICE OF COLOUR CAN IMPACT DATA INTERPRETATION

Thomas Schaap[1]

[1]Centre for Ore Deposit and Earth Sciences (CODES) - University of Tasmania

In a modern world where geoscientists are analysing ever more complicated and nuanced data, good data visualisation is increasingly important in our quest to build knowledge. Good data visualisation should allow us to express large volumes of data without compromising our ability to understand its structure, nor without introducing artefacts which create bias. A common data format in geoscience which suffers from poor visualisation technique is the coloured raster grid. These data show the distribution of a continuous variable across a data space using a colour ramp which corresponds to the value range. Common examples of this format might include gravity and magnetics data, or mineral chemistry maps. For many years, these data have been presented using poorly chosen colour ramps which do not honestly reflect their structure. The most common, and arguably the worst offender, is the rainbow colour ramp, which inherently contains alternating and uneven bands of bright and dark colours. These colour ramps are not uniformly perceived by the human eye, such that when they are projected on data, some structures which fall on certain value ranges are apparently exaggerated, while others become obscured. Geoscientists should instead focus on presenting data using perceptually uniform colour ramps. These show consistent gradation in lightness and colour such that only the structures inherent within the dataset itself are shown, without dishonest exaggeration or obscurity. This talk will discuss ways to intelligently present coloured raster data in ways which are both precise and attractive to present.

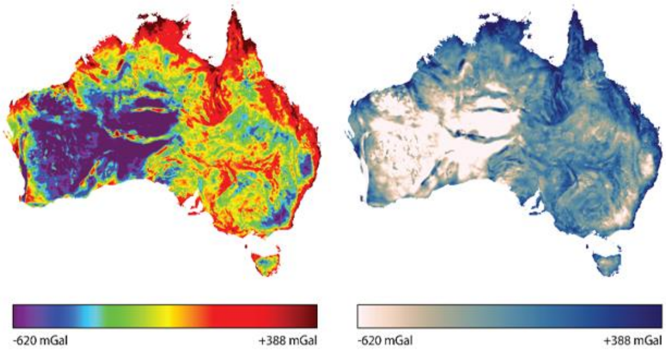
Tom Schaap
CODES – Centre for Ore Deposit and Earth Sciences
PhD student

Research Interests:

- Tectonics
- Geophysics
- Computational geoscience

Gold at the End of the Rainbow: How your choice of colour can impact data interpretation

Comparison between typical rainbow colour map and a perceptually uniform colour map on gravity data



Twitter: @TomSchaap3

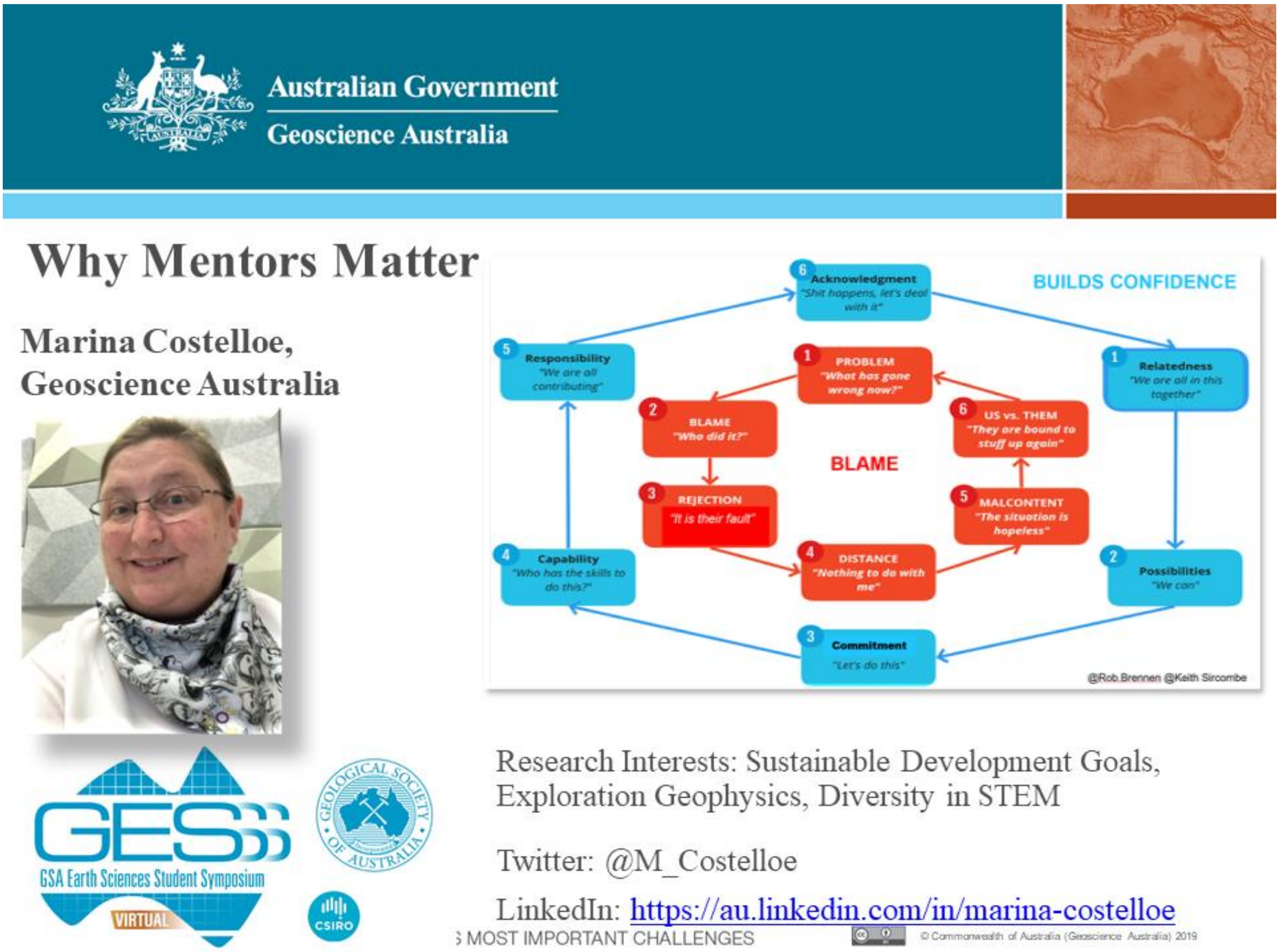
Professional Development Thursday 15 October

WHY MENTORS MATTER

Marina Costelloe[1]

[1]Acting Branch Head, Mineral Systems Branch, Geoscience Australia

Building on her experience as an ASEG President, STEM ambassador, and senior manager with Geoscience Australia, this talk is aimed at geoscientists at any stage in their career and will cover shared challenges, what we need to do more of (get a mentor), and less of (going it alone), where to go to for help (again find a mentor) and how you can make the most of 2020.



Western Australia Friday, 16 October

Schedule (AWST)

Time	Presenter	Title
15:00-15:10	Welcome – Ken Orr and Raiza Quintero	
15:10-15:22	John Fairweather (Curtin University)	*Using pXRF to Fingerprint Artefacts in Dampier Archipelago, Western Australia*
15:22-15:34	Madison Tripp (Curtin University)	*Molecular and isotopic insights into ancient dietary information within exceptionally preserved coprolites in Mazon Creek (Carboniferous) carbonate concretions*
15:34-15:46	Joanna Heeb (Curtin University)	*Hydrating anhydrite under stress: Implications for the mobility of rock salt in the subsurface*
15:46-15:58	Morgan Cox (Curtin University)	*How to confirm a suspected impact crater on Earth*
15:58-16:10	Razia Quintero (Curtin University)	*The Australian Impact Cratering Record: Updates and Recent Discoveries*
16:10-16:15	Intermission	
16:15-16:27	Andrea Rajšić (Curtin University)	*Detectability of Impacts on Mars*
16:27-16:39	Tanja Neidhart (Curtin University)	*Crater Clusters on Mars: Morphology and Updated Statistics*
16:39-16:51	Patrick Shober (Curtin University)	*Close Encounters of Asteroid and Comet Debris*
16:51-17:03	Seamus Anderson (Curtin University)	*Characterization of the Murrili (H5) Ordinary Chondrite: The third meteorite recovered by the Desert Fireball Network.*
17:03-17:10	Closing Remarks – Ken Orr and Raiza Quintero	
17:10-17:40	INTRA GSA, includes Award Presentations thanks to CSIRO awarded by Dr Ignacio González-Álvarez	

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Facebook: https://www.facebook.com/GESSS.WA

Instagram: https://www.instagram.com/gesss.wa/?hl=en

Don't forget to use and follow the **Hashtags** #VirtualGESSS #GESSSWA

Western Australia Friday, 16 October

Western Australia Committee

Raiza R. Quintero

Space Science & Technology Centre, Curtin University

PhD Candidate
Virtual GESSS Co-chair

Research Interests:

- Impact cratering on Earth
- Isotope geochemistry
- Science outreach

My PhD consists of studying meteorite impact craters and their relationship to economic deposits. I'm currently focusing on both exposed and buried impact craters in Western Australia. I'm passionate about field geology, geochemistry, and impact cratering, among other things. I also enjoy teaching, and especially love doing science outreach. Prior to landing in Australia I spent ca. 8 years working as a petroleum systems geologist at BP-America.

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Instagram: @femme.geologist

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Ken Orr

Curtin University

PhD Candidate

Co-Chair

Research Interests:

- Planetary Science
- Martian Meteorites
- Remote Sensing

The aim of my PhD is to determine the geology of the Martian surface by combining laboratory-based analysis of Martian meteorites with Martian orbiting satellites and surface rovers. By combining geology and geochemistry with remote sensing (infrared spectroscopy) I hope to constrain the locations of the source craters of the Martian meteorites.

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Western Australia Friday, 16 October

Andrea Rajšić
PhD student
Abstract coordinater

Research Interests:

- Numerical modelling
- Impact cratering
- Mars

I come from Belgrade University in Serbia where I did her Bachelor and Master thesis in Tectonics and Structural Geology.

I am currently working on Marsquakes. My project is closely related to the new NASA's InSight Mission. With the seismic signals from impacts on Mars and numerical modelling I am trying to better understand uppermost layers of Martian crust.

Sean Makin
Curtin University
MRes Candidate
Abstracts

Research Interests:

- Phase-equilibria modelling
- Petrochronology
- Fluid–rock interaction

My work focuses around the *P–T–t* evolution of a large scale crustal structure key to the current tectonostratigraphy of the Scandinavian Calendonides. I also have broad interests in various petrochronology and phase-equilibria problems.

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Western Australia Friday, 16 October

Abstracts

USING pXRF TO FINGERPRINT ARTEFACTS IN DAMPIER ARCHIPELAGO, WESTERN AUSTRALIA

John Hugh Fairweather[1], Jo McDonald[2]

[1]Space Science and Technology Centre, Curtin University.
[2]Centre for Rock Art Research + Management, University of Western Australia.

The Dampier Archipelago (Murujuga) is a series of 42 islands located in northwest Western Australia, that boasts both industrial and cultural significance. The region is geologically noteworthy with its incredibly slow erosion rates (0.2mm/1000 years), 50m high boulder piles, and dykes scattered across the landscape. The region is archaeologically significant due to its >1 million rock-art engravings, stone material culture, and 40,000 years of occupational history. To this day the area still holds a deep cultural and spiritual connection to the Aboriginal people, currently the region is going through the process of becoming a world heritage listed site. Understanding how past human communities traversed and occupied landscape is achieved by looking at what remains of their material culture, i.e. stone artefacts/tools. Stone artefacts are quarried and knapped from bedrock, thus they both share the same geochemical characteristics. Comparing the artefact and bedrock geochemistry we can discern where the artefact was sourced from and determine if the artefacts are local or foreign to where it was found/excavated. A geological assessment was conducted at the Burrup Peninsula, Enderby, Dolphin, and Rosemary Islands, which entailed petrological and geochemical analysis on the bedrock. Artefacts found and excavated at these sites were analysed using a Niton pXRF device, chosen as it was a non-destructive way to gather geochemical information. 10 different bedrock types were identified across the sites, a multi-correspondence and statistical analysis on the geochemical data showed that the elements Zr, Ti, Rb, and Sr can be used to fingerprint a stone back to one of the 10 rock types. The Zr-Ti relationship proved most useful in discriminating samples. 160 artefacts were analysed and fingerprinted to a source location. We were able to highlight that ~80% of the artefacts were locally sourced, within 1km of the site, even during the vast environmental changes throughout the last glacial maximum and rising sea levels. Sites such as Deep Gorge on the Burrup Peninsular showed non-locally sourced artefacts, with ~60% linked to a foreign bedrock. The pXRF analysis also indicated and corrected observational errors made in the past when determining rock types. A secondary study was completed, to determine the impact of the thick weathered rinds the surfaces of the bedrocks and artefacts, and how that affected the precision of using pXRF. When a sample was particularly weathered, we observed a ±30% difference in the elemental abundances when compared to the inner fresh surface. Indicating an emphasis to analyse the freshest and cleanest surface possible.

Keywords: Artefacts, pXRF, Non-destructive, Archaeology

Western Australia Friday, 16 October

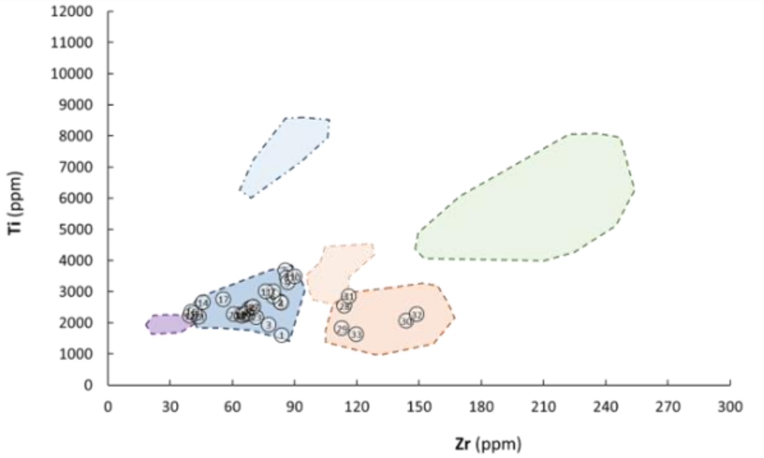
John Fairweather

BSc (Hons)
Space Science and Technology Centre, Curtin University;
Centre for Rock Art Research and Management, UWA.

Research Interests:

- Archaeology, stone material/artefacts
- Space Science, with a focus on the Moon

Using pXRF to Fingerprint Artefacts in Dampier Archipelago, Western Australia



The Ti– Zr distribution of analysed artefacts, Enderby Island site–02. The coloured fields represent the Ti– Zr ranges of identified rock types.

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Western Australia Friday, 16 October

MOLECULAR AND ISOTOPIC INSIGHTS INTO ANCIENT DIETARY INFORMATION WITHIN EXCEPTIONALLY PRESERVED COPROLITES IN MAZON CREEK (CARBONIFEROUS) CARBONATE CONCRETIONS

Madison Tripp[1], Paul Mayer[2], Scott Lidgard[2] and Kliti Grice[1]

[1] Western Australian Organic and Isotope Geochemistry Centre, Curtin University, Perth, Western Australia 6845
[2] Field Museum of Natural History, 1400 S. Lake Shore Drive, Chicago, Illinois 60605, USA

Soft-tissue preservation of fossils is rare; it can be found to occur throughout geological history in unusual circumstances, including those which are associated with carbonate concretions. Rapid formation of carbonate concretions encapsulating organic matter can result in the exceptional preservation of fine morphological details of fossils as well as biomarkers or even intact biolipids, providing biological information on a molecular level. For example, the Carboniferous Mazon Creek locality (306 Ma) is a renowned Konservat Lagerstätten, consisting of one of the most diverse assemblages of soft tissue fossils of flora and fauna, preserved within siderite concretions. These concretions have also been found to contain exceptionally preserved coprolite fossils in three dimensions. Coprolites can offer a unique insight into diets of extinct organisms, and have been shown to be a powerful tool for examining environmental inputs into ancient diets at specific localities.

This study focuses on investigating coprolite fossils from Mazon Creek using a biomarker approach, in order to obtain clues on diets of animals living in the Carboniferous and to determine the extent to which diet can be interpreted from ancient coprolites using extracted biomarkers and their stable isotopic composition.

Two coprolites encased within carbonate concretions were studied here; a portion of one half of each concretion was used in extractions. The coprolites were separated from the surrounding concretionary matrix in which they were preserved, extracted with organic solvents and analysed *via* gas chromatography-mass spectrometry (GC-MS) to investigate their biomarker distributions. The sterane distribution of the coprolite fossils compared to their matrix showed notable differences, including an unusually high relative abundance of the C_{27} ααα 20*R* cholestane isomer, which can be interpreted as being a dietary biomarker from the coprolite itself. Sterane biomarkers within coprolite concretions have been proven to be able to be used to interpret key components of the diet or an unknown organism, such as whether it can be classified as a carnivore, herbivore or omnivore. A lack of C_{29} sterane biomarkers, typically understood to be of higher plant origin, and high abundance of C_{27} sterane biomarkers suggests this coprolite may be from a carnivore. Carbon isotopes were also able to be measured for this biomarker compared to other saturated biomarkers, showing a unique distribution and demonstrating that the isotopic study of biomarkers is a powerful tool for differentiating the sources of different biomarkers in complex fossil samples.

Keywords: Biomarkers, Stable carbon isotopes, Carboniferous, Carbonate concretions

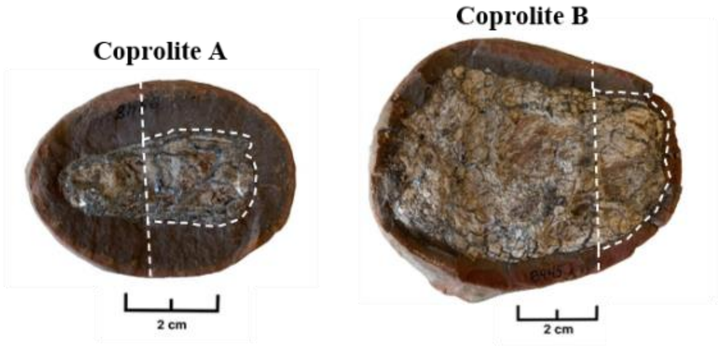
Western Australia Friday, 16 October

Madison Tripp
WA-OIGC, Curtin University
PhD Candidate

Molecular and isotopic insights into ancient dietary information within exceptionally preserved coprolites in Mazon Creek (Carboniferous) carbonate concretions

Research Interests:

- Exceptional preservation of fossils and biomolecules
- Carbonate concretions
- Mazon Creek fossil flora and fauna



Coprolites A and B studied. Regions enclosed within the dotted lines show the portions of each concretion which were analysed.

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Western Australia Friday, 16 October

HYDRATING ANHYDRITE UNDER STRESS: IMPLICATIONS FOR THE MOBILITY OF ROCK SALT IN THE SUBSURFACE

Johanna Heeb[1,2], David Healy[2], Enrique Gomez-Rivas[2], Nick Timms[1], Chris Elders[1]

[1]School of Earth and Planetary Sciences, Curtin University, Perth, Western Australia
[2]School of Geosciences, University of Aberdeen, United Kingdom; email: Johanna.Heeb@postgrad.curtin.edu.au

The focus of the study is on influence of stress on the experimental hydration of natural anhydrite rock and the accommodated changes in rock composition, microstructural features, and stress-strain behaviour. Anhydrite, along with halite and gypsum, is one of the three evaporitic phases that predominantly form rock salt deposits. The modal composition of rock salt initially depends on the composition of the precipitating source aqueous solution and the natural precipitation sequence of evaporate minerals. Secondary phase transitions of evaporites via (de)hydration processes are very common if water is available and of importance for a variety of scientific fields, as well as the mining industry (oil and gas, general cave stability, storage of nuclear/hazardous/hydrocarbonic substances). Previous hydration experiments have focused on the effects of temperature, particle size of anhydrite powders, activators, nucleation and ratio of solid to liquid, as well as swelling properties. There have been various dehydration and compression tests, as well as hydration experiments with anhydrite powder, brine solutions and elevated temperatures but real rocks are known to experience conditions that fall outside this range, especially with respect to stress conditions. Further, time is a limiting factor that explains that experimental hydration of natural anhydrite bulk samples und der stress and accommodating microstructures is understudied.

A combination of the established phase diagram that describes P and T conditions achievable in the lab with the knowledge about activators enabled us to test the effects of stress, strain rate and fluid pressure on hydration reactions under dynamic conditions i.e. under imposed stress. We conducted triaxial dry, 'wet' and hydrostatic compaction tests with and without failure using a triaxial rock deformation apparatus from Sanchez Technologies to investigate hydration in bulk aggregates under stress conditions on two different types of natural anhydrite-dominated rocks, differing in texture, grain size and mineral composition. Characterization of the samples before and, where possible, after triaxial experiments was conducted via optical microscopy and scanning electron microscopy (SEM) for backscattered electron (BSE) imaging, energy-dispersive x-ray spectroscopy (EDS) and electron backscatter diffraction (EBSD) analysis.

Keywords: Experimental hydration; Evaporites; Differential stress; Hydration microstructures

Western Australia Friday, 16 October

Johanna Heeb

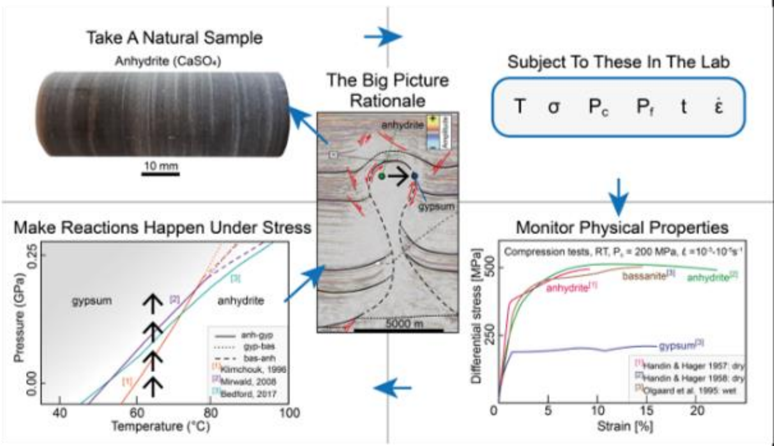
Curtin University & University of Aberdeen

PhD Candidate

Research Interests:

- Deformation behaviour of evaporites
- Hydration under stress
- Seismic velocity anisotropy linked to microstructures

Hydrating anhydrite under stress: Implications for the mobility of rock salt in the subsurface



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Western Australia Friday, 16 October

HOW TO CONFIRM A SUSPECTED IMPACT CRATER ON EARTH

Morgan Cox[1]

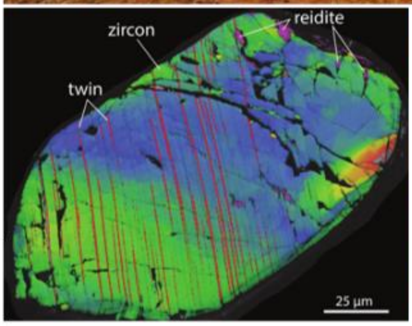
[1]School of Earth and Planetary Science, Curtin University

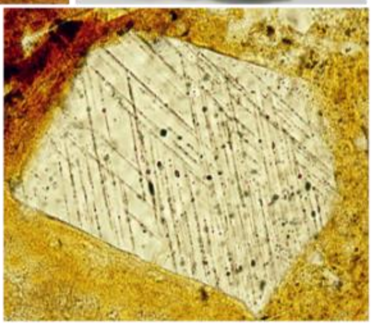
Impact cratering is a significant geological process throughout the solar system. From planet forming processes to reworking of planetary surfaces, impact cratering has played a major role in development of characterising what our solar system looks like today. On Earth, shocked minerals, shatter cones and meteoritic anomalies provide diagnostic criteria used in confirming an impact event (French, 1989; French and Koeberl, 2010). Understanding the response of shock deformation in target rocks, along with formation and interpretation of impact modelling is crucial in order to characterise and comprehend crustal behaviour when a meteorite impacts Earth. Here we present an overview on how to confirm an impact structure on Earth, and the significance of identifying diagnostic evidence of hyper-velocity impacts.

Keywords: Impact craters, Shatter cones, Shocked minerals

Morgan Cox
Curtin University
PhD candidate

How to confirm a suspected impact crater on Earth.





Research Interests:

- Shock Deformation
- EBSD
- Impact cratering

Google Scholar: Morgan A Cox

Western Australia Friday, 16 October

THE AUSTRALIAN IMPACT CRATERING RECORD: UPDATES AND RECENT DISCOVERIES

Raiza R. Quintero[1], Aaron J. Cavosie[1], Morgan A. Cox[1], Katarina Miljcovik[1], and Allison Dugdale[2]

[1]Space Science and Technology Centre (SSTC), School of Earth and Planetary Sciences, Curtin University, Australia
[2]School of Earth and Planetary Sciences, Curtin University, Perth, WA 6102, Australia
Email address: r.quinteromendez@postgrad.curtin.edu.au

The study of meteorite impact craters and impact structures adds to our understanding of the solar system, early Earth history, mass extinctions, and large mineral deposits. About 190 structures have been confirmed as impact structures globally (Earth Impact Database, 2020). There are currently 31 confirmed structures of impact origin in Australia, 27 of which are currently listed in the Earth Impact Database. The four additional impact structures in our compilation are the Cleanskin, Hickman, Raeside and Yallalie structures. Additionally, more than 48 additional structures are suspected to have formed due to asteroid impact, but await confirmation. Many discoveries have been made in Australia over the last 15 years, further expanding the cratering record, and providing new insights into a variety of impact-related processes such as shock deformation, phase transitions in accessory minerals, new impact age determinations, studies of oblique impacts, and more. We focus principally on summarizing discoveries made over the last 15 years. Highlights since then include confirmation of five new Australian impact structures, identification of Earth's oldest recognized impact structure, shock deformation in accessory minerals, discovery of the high-pressure phase reidite in Australia, links between impact craters and ore deposits, and the first generation of numerical hydrocode models for some Australian craters.

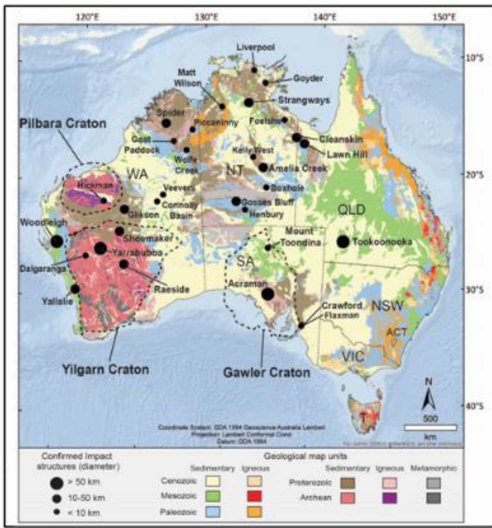
Keywords: Impact crater; Impact structure; Australia impact record

Raiza R. Quintero

Space Science & Technology Centre, Curtin University

PhD Candidate

The Australian impact cratering record: updates and recent discoveries



Map of the 31 confirmed Australian impact structures overlain on surface geology. Geological map and craton outlines modified from Raymond et al. (2012).

Research Interests:

- Impact cratering on Earth
- Isotope geochemistry
- Science outreach

Google Scholar, search: Raiza R. Quintero
Instagram: @femme.geologist
LinkedIn: linkedin.com/in/raizaquintero

Western Australia Friday, 16 October

DETECTABILITY OF IMPACTS ON MARS

Andrea Rajšić[1], Katarina Miljković[1], Gareth S. Collins[2], Kai Wünnemann[3], Mark A. Wieczorek[4], Natalia Wójcicka[2] and Ingrid J. Daubar[5]

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[2]Imperial College London, UK
[3]Museum für Naturkunde, Berlin, Germany
[4]Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Laboratoire Lagrange, France
[5]Brown University, Providence, RI, USA.
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Meteoroid bombardment is one of the sources of seismic activity on planetary bodies. The very first seismometer operating on the surface of another planet was successfully deployed by the NASA InSight (Interior Exploration using Seismic Investigations, Geodesy and Heat Transport) mission to Mars. It gives us an opportunity to investigate the seismicity of Mars, including impact-induced seismic activity. This work investigated the seismic efficiency associated with small meteorite impacts on Mars, using numerical methods in targets analogue to the Martian surface. The Martian crust was simulated as non-porous bedrock (0% porosity) or regolith with different porosities (25%, 44% and 65%).

Keywords: Mars, Numerical modelling, Regolith, Impact cratering

Andrea Rajšić
PhD student
Curtin University

Research Interests:

- Numerical modelling
- Impact cratering
- Mars

Crater clusters on Mars:
Morphology and updated statistics

I come from Belgrade University in Serbia where I did my Bachelor and Masters thesis in Tectonics and Structural Geology. I am currently working on Marsquakes.

My project is closely related to the new NASA's InSight Mission. With the seismic signals from impacts on Mars and numerical modelling I am trying to better understand uppermost layers of Martian crust.

Western Australia Friday, 16 October

CRATER CLUSTERS ON MARS: MORPHOLOGY AND UPDATED STATISTICS

Tanja Neidhart[1], Jonas Eschenfelder[2], Ingrid J. Daubar[3], Katarina Miljković[1], Elenanor K. Sansom[1], Gareth S. Collins[2], Annabelle Gao[3] and Danial Wexler[3]

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Since 2006, an increasing number of new impact craters on Mars have been detected which formed in the last decades. These impact sites were first seen as dark spots in lower resolution images that formed during the impact process through the removal of bright surface material. At present, 1067 of these impact sites have been detected. About 57% of these impacts are clusters that formed due to fragmentation of the impactor in the atmosphere. The aim of the study is to get more information about the characteristics of crater clusters. We used images from HiRISE (High Resolution Imaging Science Experiment) having a pixel scale of 0.25 m/pixel. Craters were measured using ArcMap (ArcGIS) software with the CraterTools add-in. Best fit ellipses and impact angles were calculated as described in Daubar et al., 2019. The MOLA (Mars Orbiter Laster Altimeter) elevation map was used to determine the elevations of crater cluster sites. We will report the characteristics and properties of about half of these new clusters that have been measured in detail so far: the number of craters in the cluster, their diameters and location, their dispersion, the best fit ellipse, the impact angle and elevation of the impact site. Dispersion is measured as the standard deviation of distances between each possible combination of pairs of craters. The number of craters in the clusters ranges from 2 to 465 and the effective diameters from 1.7 m to 33.8 m. Dispersion is between 2.0 m and 721.0 m and impact angles from vertical range from 34.5° to 89.5°. Correlations between these properties will also be presented. Studying these properties of crater clusters also informs us about fragmentation processes in the atmosphere, characteristics of the impactors and the impact process itself.

Keywords: Impact craters; Mars; Crater clusters; Impact processes

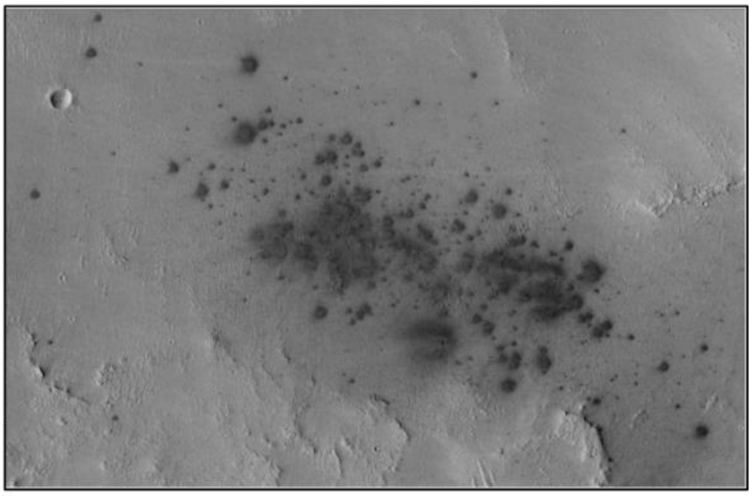
Western Australia Friday, 16 October

Tanja Neidhart
Curtin University
PhD student

Crater clusters on Mars: Morphology and updated statistics

Research Interests:

- Planetary Science
- Impact craters
- Fireballs



Email: tanja.neidhart@postgrad.curtin.edu.au

Western Australia Friday, 16 October

CLOSE ENCOUNTERS OF ASTEROID AND COMET DEBRIS

<u>Patrick M. Shober</u>[1], Trent Jansen-Sturgeon[1], Phil A. Bland[1], Hadrien A. R. Devillepoix[1], Eleanor K. Sansom[1], Martin C. Towner[1], Martin Cupák[1], Robert M. Howie[1], and Benjamin A. D. Hartig[1]

[1]Space Science & Technology Centre, School of Earth and Planetary Sciences, Curtin University, GPO Box U1987, Perth, Western Australia 6845, Australia

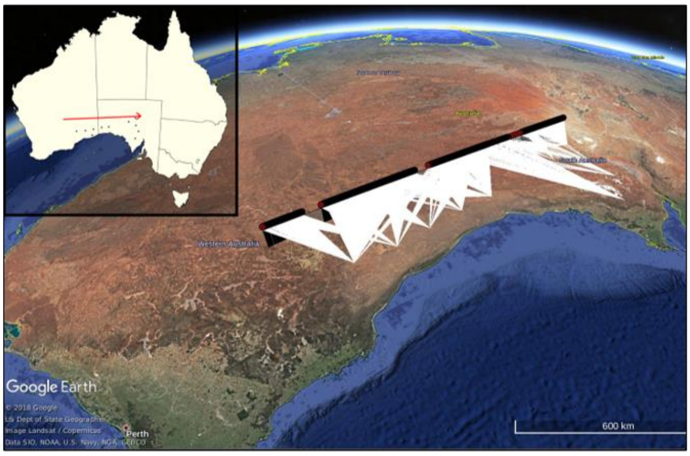
Based on telescopic observations of Jupiter-family comets (JFCs), there is predicted to be a paucity of objects at sub-kilometre sizes. However, several bright fireballs and some meteorites have been tenuously linked to the JFC population, showing metre-scale objects do exist in this region. In 2017, the Desert Fireball Network (DFN) observed a grazing fireball that redirected a meteoroid from an Apollo-type orbit to a JFC-like orbit. Using orbital data collected by the DFN, in this study, we have generated an artificial dataset of close terrestrial encounters that come within 1.5 lunar distances (LD) of the Earth in the size-range of 0.01 − 100 kg. This range of objects is typically too small for telescopic surveys to detect, so using atmospheric impact flux data from fireball observations is currently one of the only ways to characterise these close encounters. Based on this model, we predict that within the considered size-range 2.5 × 108 objects (0.1% of the total flux) from asteroidal orbits (TJ > 3) are annually sent onto JFC-like orbits (2 < TJ < 3), with a steady-state population of about 8 × 1013 objects. Close encounters with the Earth provide another way to transfer material to the JFC region. Additionally, using our model, we found that approximately 1.96 × 107 objects are sent onto Aten-type orbits and ∼ 104 objects are ejected from the Solar System annually via a close encounter with the Earth.

Keywords: Asteroid; Comet; Close encounters

Patrick Shober

Curtin University
Ph.D. Candidate

Close Encounters of Asteroid and Comet Debris



Research Interests:

- orbital dynamics of asteroids/comets
- meteorites/meteoroids
- in-situ resource utilization

Google Scholar: https://scholar.google.com/citations?user=XpOSyfMAAAAJ&hl=en&oi=ao
Personal Webpage: https://www.planetarypat.com/
Twitter: @PlanetaryPat
LinkedIn: www.linkedin.com/in/patrick-shober

Western Australia Friday, 16 October

CHARACTERIZATION OF THE MURRILI (H5) ORDINARY CHONDRITE: THE THIRD METEORITE RECOVERED BY THE DESERT FIREBALL NETWORK

Seamus Anderson[1], Gretchen K. Benedix[1,2], Lucy V. Forman[1], Luke Daly[1,3], Richard C. Greenwood[4], Ian A.Franchi[4], Jon M. Friedrich[5,6], Robert Macke[7], Sean Wiggins[8], Daniel Britt[8,9], Sean M. Cadogan[10], Matthias M.M. Meier[11, 12], Colin Maden[11], Henner Busemann[11], Kees C.Welten[13], Marc W. Caffee[14, 15], Fred Jourdan[1,16], Celia Mayers[1,16], Trudy Kennedy[1,16], Belinda Godel[17], Lionel Esteban[17], Kelly Merigot[18], Alex W.R. Bevan[2], Phil A. Bland[1,2], J. Paxman[1], Martin C. Towner[1], Martin Cupak[1], Ellie K. Sansom[1], Robert Howie[1], Hadrian Devillepoix[1], Trent Jansen-Sturgeon[1], Dean Stuart[19], and Dave Strangway[19]

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Murrili, the third meteorite recovered by the Desert Fireball Network, is analyzed using mineralogy, oxygen isotopes, bulk chemistry, physical properties and cosmogenic radionuclides. The modal mineralogy, bulk chemistry, magnetic susceptibility, physical properties and oxygen isotopes of Murrili point to it being an H5 ordinary chondrite. It is heterogeneously shocked (S2-S5), depending on the method used to determine it, although Murrili is not obviously brecciated in texture. Cosmogenic radionuclides yield a cosmic ray exposure age of 6-8 Ma, and a pre-entry meteoroid size of 15-20 cm in radius. Murrili's fall and subsequent month-long embedment into the salt lake Kati Thanda, significantly altered the whole rock, evident in its Mössbauer spectra, and visual inspection of cut sections. Murrili may have experienced minor, but subsequent impacts after its formation 4475.3 ± 2.3 Ma, which left it heterogeneously shocked.

Keywords: Meteorite; Geochemistry; Asteroid

Western Australia Friday, 16 October

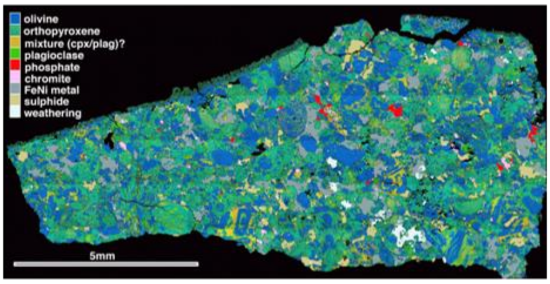
Seamus Anderson
Curtin University
PhD Student

Research Interests:

- Meteoritics
- Machine Learning
- Space Mining

Characterization of the Murrili (H5) Ordinary Chondrite: The third meteorite recovered by the Desert Fireball Network.

The Murrili H5 Ordinary Chondrite the third meteorite recovered by the Desert Fireball Network. Here we explore its detailed geochemical characterization as well as its physical properties and history in the solar system.



Google Scholar:

scholar.google.com/citations?user=2OZ1qikAAAAJ&hl=en&oi=ao

LinkedIn:

linkedin.com/in/seamus-anderson-60410a101/?originalSubdomain=au

Prizes

There will be a prize awarded for best presentation of each session. Prize Presentations will be held on Friday 16th October at the end of the formal Virtual GESSS-WA session. The prize is registration to the Australian Earth Science Convention 2021.

Judging Criteria

Each session will have a different judging panel made up of Governing Councillors and Divisional Committee members. They will be judging presentations on the below points. Please note keynote presentations will not be judged.

Comprehension & Content

- Did the presentation provide an understanding of the background and significance to the research question being addressed, while explaining terminology and avoiding jargon?
- Did the presentation clearly describe the impact and/or results of the research, including conclusions and outcomes or expected outcome (if research is incomplete)?
- Did the presentation follow a clear and logical sequence?
- Was the research topic, research significance, results/impact and the outcome communicated in language appropriate to a non-specialist audience?
- Did the presenter spend adequate time on each element of their presentation - or did they elaborate for too long on one aspect or was the presentation rushed?

Novelty or Challenge of Research Activity

- Was the topic of the presentation novel and/or challenging?
- Were the key results clearly articulated?

Engagement & Communication

- Did the PowerPoint slides enhance the presentation – were they clear, legible, and concise and used appropriately by the speaker?
- Did the oration strike a good balance between clearly communicating the essentials and leaving the audience curious for more information on the study?
- Was the presenter careful not to trivialise or overly generalise their research?
- Did the presenter convey enthusiasm for their research?
- Did the presenter capture and maintain their audience's attention?
- Did the speaker have sufficient stage presence, eye contact and vocal range; maintain a steady pace, and a confident stance?

Judges

The National Working Group and GESSS committees thank all our judges for giving up their time and supporting Virtual GESSS.

Monday

Nick Dyriw
Researcher
Queensland University of Technology
GSA Governing Councillor
GSAQ Division Chair

Mark Pirlo
Geochemist ALS Geochemistry

Honorary Secretary GSA (Queensland Division)

Tuesday

Dr Peter McGoldrick
Adjunct Senior Research Associate
University of Tasmania
GSA National Honorary Treasurer

Associate Professor Sebastien Meffre
Earth Sciences |CODES
University of Tasmania

Wednesday

Dr Sabin Zahirovic
University of Sydney
NSW Division Treasurer

Dr Verity Normington
GSA National Secretary
GSA-ACT Chair

Friday

Dr Verity Normington
GSA National Secretary
GSA-ACT Chair

Dr Ignacio González-Álvarez
Principal Geochemist
CSIRO, Mineral Resources, Discovery Program,
Western Australia

Student and Early Career Opportunities with the Geological Society of Australia

Australian Earth Science Convention 2021

Rapid Fire Session

The National Working Group and GESSS Committee's would like to encourage all participants to consider registering for the **Rapid Fire Session** that will be held as part of the Australian Earth Science Convention (AESC) which will be held between the 9th and 12th of February 2021. This session is an outstanding opportunity for participants to present their science in a friendly but competitive environment. Having a good elevator pitch is a skill many professionals require but rarely have the opportunity to practice.

The Rapid Fire Session is an initiative is designed to enable a large number of Early Career Earth Scientists, across all fields, to participate in a test of their abilities to rapidly and effectively communicate their fields and science to a diverse audience. The Rapid Fire Session is based on the extremely popular and ultra-competitive three-minute thesis competitions that operate at university, national and international levels. Each speaker is allowed three minutes and three slides to communicate the core of their earth science research or work.

Presentations: Each speaker is allowed three minutes and three slides to communicate their research or work in any Earth Science field. Presentations will be pre-recorded, and slides must not have transitions or animations.

Registrations and Eligibility: The competition is open to all Early Career Earth Scientists who have worked in the field for 5 years or less (exclusive of career breaks) as well as Honours, Masters and PhD students. **Abstracts are not required**; however, participants must be registered to attend AESC 2021. Registrants need to submit a talk title and a one to two sentence description of the subject matter.

Prizes: Sponsorship is anticipated to allow the award of a first price sufficient to fund attendance at an overseas conference. We anticipate one prize in the Early Career (5 years or less of working in the field) category and another for students (Hons/MSc/PhD status at a tertiary institution). There may be runner-up prizes as well, depending on the number of participants.

Criteria for Judging Winners: Presentations will be assessed on three key criteria

1. Has the speaker clearly enunciated the scientific question or problem investigated?
2. Was the research undertaken novel or challenging, and were the key results clearly outlined?
3. Quality and effectiveness of the 3 slides presented

Registrations close 30th October via https://www.aesconvention.com.au/rapid-fire-session/.


AESC
australian earth sciences convention
Core to Cosmos
9-12 FEBRUARY 2021
3 minutes
to make an impact
AESC 2021 Virtual Conference
Early Career Earth Scientists
rapidly and effectively communicate your science
NO ABSTRACT REQUIRED
RAPID FIRE PRESENTATIONS
open to early career earth scientists
SUBMISSIONS CLOSE OCTOBER 30 2020
REGISTER AND MORE INFORMATION
https://www.aesconvention.com.au/rapid-fire-session/
@AESC2021
Core to Cosmos
AESC 2021
9-12 FEBRUARY 2021

INTRA GSA

You will notice that there is an INTRA GSA at the end of each session. INTRA GSA is a session where participants and presenters will be able to network, discuss the talks further and get to know each other.

INTRA GSA (Informal NetwoRk cAtchup for GSA Members) are gatherings for all GSA members but especially targeted at members in the Early and Mid-Career stages of their career. GSA members can dial in, have a chat and form networks, share ideas and ask questions. The gatherings are the second Wednesday of every month.

Regular INTRA GSA gatherings are hosted and facilitated by Verity Normington (Governing Council and GSA-NT) and Amber Jarrett (GSA-ACT). INTRA GSA during Virtual GESSS will be hosted by the session hosts.

You can register for regular INTRA GSA here. Don't forget to put it in your calendar.

GSA Divisions, Specialist Groups, and student chapters

Volunteering for the GSA is a rewarding and fulfilling experience. You are able to build your professional and personal network while gaining skills and experience in a wide range of activities. GSA members have reported gaining employment, meeting mentors and creating collaborations through volunteering with the GSA. Volunteers also speak of personal gains such as improved leadership and interpersonal skills as well as gaining new skills such as event organising and management. As an Early Careerist, being able to show that you are an active member in your professional community may also set you apart from other applicants for employment.

If your interesting in becoming involved with the Geological Society, there are a number of opportunities for students and Early Careerist. All GSA divisions and specialist group have a student representative position on their committees. There are also general committee member positions on all committees that can be filled by any member of the GSA no matter their experience level in Earth Science or the GSA.

Next year in-person GESSS will be running again. This is a great opportunity for students and early careerist to get involved in the GSA as well as getting some experience in running a conference.

If you would like to become more active within the GSA please reach out to your Division or Specialist Group Chair, their details can be found at www.gsa.org.au under the 'Divisions' or 'Specialist Group' tabs.

Becoming a GSA member

Not a member of the GSA? Not a problem you can easily join on the website.

The Geological Society of Australia gives members an outstanding opportunity to keep in touch with scientific developments, present the results of their work, and contribute to discussions on vocational and scientific topics. As the premier Australian geoscience society, membership provides an essential network of contacts as well as publications, meetings, events, and opportunities including:

- Access to the *Australian Journal of Earth Science* and a selection of other internationally recognised journals
- Reduced Member registration rates for the biennial convention, selected workshops and symposia
- Subscription to the GSA's popular quarterly magazine *The Australian Geologist*, which covers the broad range of specialist geoscience issues in an entertaining and accessible format

As a member you will be affiliated with your local state or territory division that hold regular meetings both in person and virtually that feature speakers covering a broad range of the latest Earth Science. You will also be able to subscribe to a number of Specialist Groups that cover a broad range of Earth Science specialities. As a member you will also be able to become an Accredited Geoscientist through the Accredited Geoscientist Program. This program enables members, with the relevant level of experience, to be recognised for their expertise.

GESSS-SA

If you would like to see more student presentations GESSS South Australia is being held in person and virtually on the 24th of November.

The Geological Society of Australia Earth Sciences Student Symposium, South Australia (GESSS-SA) is a symposium designed to allow Honours, Masters and PhD students from three South Australian universities (The University of Adelaide, Flinders University and University of South Australia) to come together and present their Earth Sciences related research to the local scientific community.

For more information please visit https://gessssa.wordpress.com/. Registrations are now open at https://www.eventbrite.com.au/e/gesss-south-australia-earth-sciences-student-symposium-tickets-114052532194.

Appendix

Time zone converter

What time does Virtual GESSS start in your state?

Time zone	AEDT (NSW/ACT/TAS)	AEST (Qld)	AWST (WA)	ACDT (SA)	ACST (NT)
Monday	3-5.30 pm	2-4.30 pm (host)	12-2.30 pm	2.30-5 pm	1.30-4 pm
Tuesday	5-7.30 pm (host)	4-6.30 pm	2-4.30 pm	4.30-7 pm	3.30-6 pm
Wednesday	5-7.30 pm (host)	4-6.30 pm	2-4.30 pm	4.30-7 pm	3.30-6 pm
Thursday	3-5.30 pm (host)	2-4.30 pm	12-2.30 pm	2.30-5 pm	1.30-4 pm
Friday	6-8.30 pm	5-7.30 pm	3-5.30 pm (host)	5.30-8 pm	4.30-7 pm

Getting started with Zoom

Where do I download the latest version of Zoom?

You can download the latest version of Zoom from the Zoom Download Centre.

How do I use Zoom on my PC or Mac?

After downloading Zoom, learn how to use the Zoom Desktop Client.

Do you need an account to use Zoom?

A Zoom account is not required if you are strictly joining Zoom Meetings as a participant. If someone invites you to their meeting, you can join as a participant without creating an account. Learn more about joining a Zoom meeting. A Zoom account also allows you to access your personal settings, where you can update your profile at any time.

How do I sign up for Zoom?

You can sign up for a free Zoom account at zoom.us/signup. A basic Zoom license is free.

How do I join a Zoom meeting?

You can join a meeting by clicking the meeting link or going to join.zoom.us and entering in the meeting ID. Learn more about joining a meeting.

How do I join computer/device audio?

On most devices, you can join computer/device audio by clicking Join Audio, Join with Computer Audio, or Audio to access the audio settings. Learn more about connecting your audio.

Can I Use Bluetooth Headset?

Yes, as long as the Bluetooth device is compatible with the computer or mobile device that you are using.

Do I have to have a webcam to join on Zoom?

While you are not required to have a webcam to join a Zoom Meeting or Webinar, you will not be able to transmit video of yourself. You will continue to be able to listen and speak during the meeting, share your screen, and view the webcam video of other participants.

Troubleshooting

My video/camera isn't working.

Read tips on troubleshooting a camera that won't start or show video.

There is echo in my meeting.
Echo can be caused by many things, such as a participant connected to the meeting audio on multiple devices or two participants joined in from the same local. Learn about common causes of audio echo.

Audio isn't working on my mobile device.
Read tips on troubleshooting audio that isn't working on your iOS or Android device.

Tips for Meeting Attendees

- Mute your microphone
  To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- Be mindful of background noise
  When your microphone is not muted, avoid activities that could create additional noise, such as shuffling papers.
- Position your camera properly
  If you choose to use a web camera, be sure it is in a stable position and focused at eye level, if possible. Doing so helps create a more direct sense of engagement with other participants.
- Limit distractions
  You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and muting your smartphone.
- Avoid multi-tasking
  You'll retain the discussion better if you refrain from replying to emails or text messages during the meeting and wait to work on that PowerPoint presentation until after the meeting ends.
- Prepare materials in advance
  If you will be sharing content during the meeting, make sure you have the files and/or links ready to go before the meeting begins.