QUT Earth and Atmospheric Sciences
Potential student research projects
Research in Earth and Atmospheric Sciences at QUT

Our school specialises in understanding fundamental chemical and physical processes that operate across the physical spheres of Earth. We're motivated by the need to solve current global challenges, such as the state of the atmosphere, greenhouse gases, energy and resource sustainability, and future planetary habitability.

Why do a research degree in Earth & Atmospheric Sciences?

Our core research focus is on the physical spheres of Earth: the lithosphere, atmosphere and hydrosphere. We investigate how these physical spheres have evolved over Earth's history and, through geospatial science, we observe and understand these spheres today and their interactions with all life.

We have a particular research focus on:
- natural resources
- Earth observation
- atmospheric composition and change
- air quality and pollution
- natural hazards
- climate
- environmental science challenges (including reef restoration and energy).

Earth is our main laboratory and learning-ground for extra-terrestrial ventures. We conduct our research with access to QUT’s state-of-the-art instruments and facilities, including those based within the Central Analytical Research Facility (CARF)
Testimonials

Make a difference, explore the world
‘My research focuses on aerosol particles in the atmosphere and how they affect clouds and the climate.

QUT has given me many opportunities for exciting field work that will contribute to improving climate modelling. This photo was taken on board the Research Vessel (RV) Investigator at about 65 degrees south at the start of the Antarctic sea ice’.

Luke Cravigan, QUT Postdoctoral Research Fellow (Atmospheric science)

Help ecosystems thrive
'I study the limestone sediments from algae skeletons to investigate processes in reef ecosystems. The results could help us to better predict how marine ecosystems might respond to environmental change.

QUT has connected me with a wide network of global collaborators and real-world experiences. This photo was taken during fieldwork on Moreton Bay where we trialled a method for imaging sediments below the seafloor’.

Mardi McNeil, QUT PhD researcher (Earth science)
Research in Earth and Atmospheric Sciences at QUT

How to apply for a research degree

Read our guide to applying for a research degree at QUT, including scholarship information and faculty-specific steps you’ll need to take as part of your application:

How to apply for a research degree

Have questions about applying?

Our Higher Degree Research support team can answer your questions about applying for a research degree at QUT:

• Call: 3138 7200
• Email: hdr@qut.edu.au

Support for our research students

Our Graduate Research Education and Development (GRE+D) program is here to support your learning and skills development at all stages of your research degree.

Find out more about GRE+D
CHARLOTTE ALLEN

CONTACT
PHONE: +61 7 3138 0177
EMAIL: cm.allen@qut.edu.au
OFFICE: GP, P Block, Rm. 739

POSITION
Director of QUT’s Central Analytical Facility in the Institute for Future Environment, and Research Fellow in School of Earth and Atmospheric Sciences

RESEARCH
Earth and Atmospheric sciences prosper by combinations of good field work, sample collection and advancement in analytical techniques. My interests are generally mineral to outcrop scale. What rock information can we squeeze from mineral data?

Research student projects available 2021:
• Equilibrium among trace minerals in common igneous rocks: apatite+zircon+titanite. How can we determine what sets of minerals crystallized together? This relies on dating and trace element composition (PhD, Masters)
• Separating the inseparable: Zr and Hf. Hf was element X in the periodic table for a long time because separating it from Zr is difficult in the laboratory. Nature, on the other hand can do it, how? The main driver in siliceous systems, zircon, is relatively well understood but what controls these elements in more mafic systems? (PhD, Masters)

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/cm.allen

SCOTT BRYAN

CONTACT
PHONE: +61 7 3138 4827
EMAIL: scott.bryan@qut.edu.au
OFFICE: GP, R Block, Rm 204

POSITION
Associate Professor
School of Earth & Atmospheric Sciences

RESEARCH
I study volcanoes and the different ways volcanism has impacted our planet – its evolution, its atmosphere and our environment. Volcanoes are one of the most powerful agents of change on our planet, from creating the continents we live on to changing the climate and extinguishing life.

Research student projects available 2021:
• Petrological evolution during back-arc basin formation: the East Manus Basin, PNG (PhD)
• Volcanology and Petrology of pumice raft-producing eruptions from Tonga (MSc/PhD)
• Temporal-compositional trends in long-lava flows: the 600,000 year old Coalstoun Lakes eruption, Southeast Queensland (MSc).

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/scott.bryan
POSITION
Postdoctoral Research Fellow

RESEARCH
My research focus is aerosol particles in the atmosphere and how these particles influence clouds and climate. Aerosols are important for cloud formation because every cloud droplet requires an aerosol seed on which to condense. Cloud and aerosol processes are the major contributor to uncertainty in global climate projections and are important for predictions of sea surface temperature and coral bleaching. My work involves examining aerosol properties from research voyages over the Southern Ocean and the Great Barrier Reef. The ultimate aims are to improve climate models and to assess the potential for aerosols to ameliorate coral bleaching events.

Research student projects available 2021:
• Measuring the water uptake of artificially generated sea spray particles (BSc Hons).
• Modelling open ocean sea spray aerosol emissions (BSc Hons).

LUKE CRAVIGAN

CONTACT
EMAIL: luke.cravigan@qut.edu.au
OFFICE: GP, E Block, 209 Rm.

POSITION
Adjunct Professor/Research Fellow

RESEARCH
I study Earth’s oldest environments in order to learn about the origin, early evolution and geobiology of microbial ecosystems. These environments are preserved in rocks that are billions of years old in Western Australia, South Africa, North America and elsewhere. I’m particularly interested in major changes that have occurred to habitable environments throughout deep time, both on Earth and elsewhere in our solar system.

This work has led to international collaborations involving robotic exploration of the Moon and Mars, including upcoming NASA rover missions.

Research student projects available 2021:
• Paleobiology of Earth’s oldest lake and river systems (field geology background essential). Results will assist with interpretation of data returned by the Perseverance Rover (PhD) (Masters).
• Identifying minerals on Mars using novel x-ray diffraction (BSc Hons) (Masters).
• Dating Pleistocene rock art using secondary ion mass spectrometry (BSc Hons) (Masters).

DAVID FLANNERY

CONTACT
PHONE: +61 7 3138 1615
EMAIL: david.Flannery@qut.edu.au
OFFICE: GP, Block, Rm. 307

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/david.flannery
OLIVER GADEDE

CONTACT
PHONE: +61 7 3138 2535
EMAIL: oliver.gaede@qut.edu.au
OFFICE: GP, Block R, Rm. 325

POSITION
Lecturer, School of Earth & Atmospheric Sciences

RESEARCH
I have always gained strong motivation from applied research that has an impact beyond the world of academia. I develop geophysical methods and create knowledge that helps us utilize new resources in an environmentally safe and economic fashion. My work has relevance for the groundwater, geothermal energy, gas and CO2 sequestration industries. I am an expert in the Finite Element Method and constitutive modelling and specialise in anisotropic media, damage mechanics and coupled processes. Current research includes petrophysical characterisation of Great Artesian Basin aquifers, coupled processes in rock mechanics as well as numerical geomechanics.

Research student projects available 2021:
• Uncertainty Quantification of Petrophysical Models (PhD)
• Nanoscale Characterisation of Rocks with SAXS (PhD)
• Geomechanics in Compressive Stress Regimes (MSc)

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/oliver.gaede

PATRICK HAYMAN

CONTACT
PHONE: +61 7 3138 5259
EMAIL: patrick.hayman@qut.edu.au
OFFICE: GP, R-321

POSITION
Lecturer, School of Earth & Atmospheric Sciences

RESEARCH
Volcanoes play a critical role in ore formation, acting as a transport agent (diamond), heat engine/metal source (copper, lead, zinc, gold), or preferred host rock (e.g., gold). My research focusses on volcanic systems and their complex relationship to ore deposits. With active projects in West Australia, NSW and West Africa, my current research focusses on two main themes:
• Ancient (>2.1 billion year old) volcanic provinces that formed during periods of extreme mineral enrichment, to inform on both early earth tectonics and mineral exploration
• Individual volcanoes to inform on local controls on mineralisation.

Research student projects available 2021:
• Differentiated mafic sills and the controls on fertility for orogenic gold (BSc Hons, MSc, PhD)
• Mapping the >2.72 Ga basement in the Kalgoorlie and Kurnalpi Terrane, Western Australia (PhD)
• Archean stratigraphy and basin architecture of the Eastern Goldfields Superterrane, WA (BSc Hons, MSc, PhD)

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/patrick.hayman
POSITION
Senior Lecturer – School of Earth and Atmospheric Sciences

RESEARCH
I study the production and behaviour of atmospheric aerosols from systems such as the human respiratory tract and the marine environment. I am particularly interested in the interactions that occur within and between particles and the atmosphere. My work is especially concerned with how such interactions can alter the survival and transport of bacteria, viruses and pollutants. I am constantly developing new instrumentation and techniques to facilitate this work and particular enjoy pursuing new initiatives of this kind.

Research student projects available 2021:
• Electrodynamic Paul Trap Development - Micro-droplet charging and entrapment for bioaerosol research
• Viral infection transmission - airborne versus droplets & fomites
• Optimising the efficiency of layered masks and respirators
• Microplastic pollutants - airborne dispersal from the oceans
• Ultrasonic mesh nebuliser optimisation for bioaerosol research
• Deliquesence/efflorescence – time dependence
• Moisture exchange in human respiratory aerosols

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/g.johnson

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POSITION
Professor (Petrology)

RESEARCH
My main interest is in how our planet has changed and continues to change with time. Over its long history, Earth has seen key episodes of dramatic change, which have left their imprint in the rock record. These include the emergence of land, the build of free oxygen in the atmosphere, global glaciations, etc. My group specialises in developing new chemical tools to better read this fragmental record to inform models of planetary evolution and to decisions about shaping the future of the Earth in the face of the changing atmospheric greenhouse.

Research student projects available 2021:
• To quantify the area of emerged land through time and model the effect of rock weathering on ocean chemistry.
• To experimentally and empirically study very deep (>150 km) and very hot (>1,750°C) melting of the early mantle.
• To use the eastern Australian dust export into the equatorial Pacific as an analogue for the pre-greened Earth’s sedimentary cycle.

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/balz.kamber

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GRAHAM JOHNSON

CONTACT
PHONE: +61 7 3138 4371
EMAIL: g.johnson@qut.edu.au
OFFICE: GP, E Block, Rm 209C.

BALZ KAMBER

CONTACT
PHONE: +61 7 3138 1410
EMAIL: balz.kamber@qut.edu.au
OFFICE: GP, R Block, Rm. 322
BRANKA MILJEVIC

POSITION
Senior Lecturer, School of Earth and Atmospheric Sciences

RESEARCH
I am a chemist by training and my research focus is atmospheric aerosols - tiny particles suspended in the air. These aerosols impact human health and climate, so understanding their sources, properties and evolution in the atmosphere is critical for the development of strategies and policies for improving air quality and public health, as well as for improvement of climate models. I use real time mass spectrometry to investigate chemical composition of aerosols in different environments and coming from different sources. My research involves a lot of fieldwork and has taken me to many interesting places, with the most exciting being Antarctica.

Research student projects available 2021:
• Aerosol precursors in the Southern Ocean and Antarctic sea-ice region during 2018/19 CAMPcANN campaign (Hon/MSc/PhD)
• Atmospheric ageing of bushfire smoke (PhD)
• Sources of ultrafine particles in Australian cities (PhD)
• Chemical Ionisation Mass Spectrometer with an X-ray ionizer – investigation of performance (Hons)
• Online aerosol chemical characterisation by coupling Particle Into Liquid Sampler (PILS) and mass spectrometry (Hons/MSc)

QUT STAFF PROFILE: https://staff.qut.edu.au/staff/b.miljevic

LIDIA MORAWSKA

CONTACT
PHONE: +61 7 3138 2616
EMAIL: l.morawska@qut.edu.au
OFFICE: GP, Block, E, Rm. E512

POSITION
Professor, School of Earth and Atmospheric Sciences
Director, International Laboratory for Air Quality and Health
Co-Director, Australia-China Centre for Air Quality Science and Management

RESEARCH
Conducts fundamental and applied research in the interdisciplinary field of air quality and its impact on human health and the environment, with a specific focus on science of airborne particulate matter. She has been involved at the executive level with a number of relevant national and international professional bodies and has been acting as an advisor to the World Health Organization.

Research student projects available 2021:
• The dynamics of ambient particle nucleation and growth in urban environments
• Ultrafine particles in urban air: concentrations and exposure trends
• Application of novel sensing technologies towards fine scale spatial characterisation of particle and gaseous atmospheric pollutants
• The dynamics of indoor-outdoor pollution interactions during bushfire events
• Analysis of the flow dynamics towards minimisation of indoor concentration of droplets from human expiration

QUT STAFF PROFILE: https://staff.qut.edu.au/staff/l.morawska
POSITION
Lecturer in Earth Science
School of Earth and Atmospheric Sciences

RESEARCH
I am fascinated by how the dynamic planet upon which we live works, how the Earth began, how it subsequently evolved and how it reached its current configuration. I work on integrating field data and geochemical data to address significant research questions in a variety of different settings. These include the formation of Earth’s early crust, the isotopic and chemical evolution of the mantle as recorded in mantle derived melts, chemostratigraphy and zircon provenance analysis, and non-geological fields working with biosecurity on pest provenance.

Research student projects available 2021:
• Petrogenesis of Paleoarchean granitoids in the East Pilbara Terrane, the continental crust (PhD, Masters)
• Investigating mid-crustal xenoliths from north Queensland: possible preserved Archean crust (PhD, Masters)
• The interaction of magmas and xenoliths in southeast Queensland Tertiary volcanic (Masters)
• The use of Pb and Sr isotopes and trace elements in tracing the provenance of insect pests (PhD, Masters)

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/david.murphy

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POSITION
Professor and Head of School (acting)
School of Earth and Atmospheric Sciences

RESEARCH
A physicist by training my general interest is in atmospheric sciences with a focus on atmospheric aerosol particles. I study how these particles influence our climate but also how they influence our health. As part of my research I develop new methodologies and instrumentation that would improve our understanding or airborne nanoparticles, what are their origins, fate and how they influence the world around us. Most of the research projects are done though field work either on land or onboard research ships.

Research student projects available 2021:
• Monitoring atmospheric composition over the Great Barrier Reef (Hons, Masters, PhD)
• Aerosol and Cloud Condensation Nuclei in tropical waters of northwest Australia (Hons, Masters).

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/z.ristovski
Senior Lecturer (Structural Geology and Rock Mechanics)

RESEARCH
The physical behaviour of the Earth is controlled by processes covering a vast range of length scales, from the crystal lattice to that of tectonic plates. Chris is passionate about figuring out how these processes interact. He works on the multi-scale coupling of deformation with heat, chemical, and fluid fluxes, combining field studies with micro-analysis, mathematical forward modelling, and laboratory experiments. When Chris doesn’t hunt rocks in the wild, he likes to squeeze digital rocks in supercomputers or real samples at the Synchrotron, examining coupled chemical and structural transformations at the nano- and micro-scale with transmission scattering and fluorescence microscopy.

Research student projects available 2021:
- Unravelling the coupling between chemical reactions, fluid flow and plastic deformation in shear zones – insights from Synchrotron XFM and SAXS/WAXS
- Hi-res XFM trace-elements patterns in calcite veins – what they teach us about fluid flow and deformation in the shallow crust?
- In-situ gypsum dehydration observed with SAXS/WAXS – from sub-nanometre to centimetre scale
- Numerical and physical forward models of strongly strain-softening materials – new numerical approaches and insight into strain localization
- Instabilities due to cross-diffusion waves – a novel view on strain localisation

QUT STAFF PROFILE:
http://staff.qut.edu.au/staff/schrank/

CHRISTOPH SCHRANK

CONTACT
PHONE: +61 7 3138 1583
EMAIL: christoph.schrank@qut.edu.au
OFFICE: GP-R315

I am a geologist who specializes in mitigating the effects of natural hazards. Expertise in volcanic eruptions, large-volume slope collapse and tsunamis has resulted in leading international research programs across six continents and two oceans, wherein I utilises the geological record to forecast and plan for future hazardous events. My current work integrates geological, ecological and engineering technologies to stabilize landslides in southeast Queensland water catchments, securing healthy waterways. This research includes developing a real-time early warning system for rainfall induced slope failure, to be applied to both naturally unstable and engineered slopes, globally.

Research student projects available 2021:
- Reconstructing ancient volcanic and sedimentary successions (BSc Hons) (Masters)
- Developing best practice for stabilising rainfall induced landslides. (Masters)
- Petrology and geochemistry of a newly discovered basalt complex in Borneo (BSc Honours) (Masters)

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/jessica.trofimovs

JESS TROFIMOVS

CONTACT
PHONE: +61 7 3138 2766
EMAIL: jessica.Trofimovs@qut.edu.au
OFFICE: GP, R Block, Rm. 324
POSITION
Associate Professor
School of Earth & Atmospheric Sciences

RESEARCH
I am passionate about fundamental and applied knowledge on natural minerals, particularly clay minerals’ structure and properties, development of their functionality and applications for the real world. These materials hold huge promise for significant applications such as environmental contaminants remediation, energy storage, alleviation of drought, novel building materials etc. Advancement in this research filed will provide practical, cost effective and environmentally friendly solutions to these global issues, I am an experienced scientist in this field with a H-index at 40 and my work has been cited globally for more than 6900 times.

Research student projects available 2021:
• Super Metal Organic Framework-mineral composite material for energy storage
• Environmental contaminant remediation
• Utilisation of Australian natural minerals for novel building products

QUT STAFF PROFILE:
https://staff.qut.edu.au/staff/y.xi