



**THE UNIVERSITY  
OF QUEENSLAND**  
A U S T R A L I A

**Earth Sciences**  
**School of Physical Sciences**

**Postgraduate Research Programs**

## **Postgraduate Research Programs**

Page 3

Postgraduate program – Available Projects

Page 5

Research Programs

## Postgraduate Program – Available Projects

PROJECT	SCOPE	DISCIPLINES	SUPERVISOR
<b>Environmental Earth and Marine Science</b>			
Reconstructing cyclone history by U-series dating of transported coral blocks on Heron Reef, Great Barrier Reef	Hons	Field and lab based; geochemistry, marine geology	<a href="#">Dr J Zhao</a> <a href="#">Dr D Neil</a> <a href="#">Dr J Pandolfi</a>
Reconstructing past climate changes in the wet tropics over the past 300 ka using speleothems in a cave from Mt Etna, central Queensland	Hons	Field and lab based; geochemistry, marine geology	<a href="#">Dr J Zhao</a> <a href="#">Dr S Hocknull</a> <a href="#">Assoc Prof S Golding</a>
Constraining the causes of mortality in Holocene corals and their role in community persistence	Hons	Field and lab based; geochemistry, marine geology	<a href="#">Dr J Zhao</a> <a href="#">Dr J Pandolfi</a>
Silicon, oxygen and strontium isotope studies of silcrete formation in Australia: implications for the global Si-cycle, palaeoclimatic interpretation and metals exploration	PhD/Mast	Geochemistry, geochronology, economic geology	<a href="#">Assoc Prof S Golding</a>
Environmental impact in the Moreton Bay area	PhD/Mast	Geochemistry, mainly lab-based	<a href="#">Dr M Gasparon</a>
Metal adsorption-desorption processes in uncontaminated and contaminated sediments and soils	PhD	Geochemistry, mainly lab-based	<a href="#">Dr M Gasparon</a>
An integrated microscopical & analytical study of Archaen microbiota and its response to early Earth environments - relevance to origin of life	PhD	Field and lab based; experimental, organic petrology, organic geochemistry, mineral-organic relationship investigation, electron microscopy, microanalysis	<a href="#">Assoc Prof S Golding</a> <a href="#">Dr M Glikson</a>
Gas storage analogue studies in coal and coal measure systems/ CO <sub>2</sub> sequestration	PhD (x 2)	Geochemistry, coal geology, modelling	<a href="#">Assoc Prof J Esterle</a> <a href="#">Dr T Payenburg (Adelaide)</a>
<b>Isotope Analysis, Trace Element Geochemistry and Geochronology</b>			
Source signature, timing and emplacement history of Middle to Late Triassic plutonic and volcanic suites of SE Qld	Mast/PhD	Petrology, geochemistry, geochronology	<a href="#">Dr K Knesel</a> <a href="#">Dr P Vasconcelos</a>

Mantle/crustal signature and timing of Late Triassic mineralisation across the NEFB in SE Qld	Mast/PhD	Petrology, isotopic geochemistry, geochronology, economic geology	<a href="#">Dr K Knesel</a> <a href="#">Dr P Vasconcelos</a>
Fluid characterisation in mesothermal gold deposits in SE Qld	PhD	Fluid inclusion studies geochemistry, geochronology, economic geology	<a href="#">Dr P Vasconcelos</a>
Thermal history and fluid flow studies in the well mineralised Proterozoic Lawn Hill Platform of northern Australia	PhD	Clay mineralogy, organic reflectance, fluid inclusion and isotope geochemistry approach	<a href="#">Assoc Prof S Golding</a>
Hydrothermal mineralisation in banded iron formations: fluid characterisation and timing	PhD	Fluid inclusion thermometry and geochemistry, geochronology, economic geology	<a href="#">Dr P Vasconcelos</a>

New staff appointments and collaborative arrangements mean that other new projects may be available. Please contact project supervisors or staff members in your area of interest for detailed information about available projects.

# Research Programs

## Geochemistry, geochronology and isotope systems

Geochronology/Thermochronology	Paulo, Sue, Kurt
--------------------------------	------------------

In preparation

Trace Element Geochemistry	Massimo, Kurt, Paulo
----------------------------	----------------------

The ability to generate precise and accurate geochemical analyses is the backbone of UQ Earth Sciences, and Earth Sciences staff are involved with research in various aspects of geochemistry. These include the origin and evolution of melts in volcanic systems (Knesel, Gasparon), the geochemistry of water-rock interactions in surficial environments (Vasconcelos, Gasparon), the origin of supergene and hypogene mineral deposits (Vasconcelos), and the temporal and spatial distribution of trace elements in geological archives and in the environment (Gasparon). Current research projects are based in Australia and Overseas (Andes, Antarctica, Brazil, Indonesia, Europe), in cooperation with Government agencies and mining companies.

UQ Earth Sciences houses state-of-the-art laboratories and instruments for [sample preparation](#) and analysis of all kinds of Earth materials, and including rocks, minerals, soils, waters, and environmental matrices such as plant matter, atmospheric dust, and sludges. Equipment available for geochemical analysis include an Inductively-Coupled Plasma Mass Spectrometer (ICP-MS, Thermo X7) and an Inductively-Coupled Plasma Optical Emission Spectrometer (ICP-OES, Perkin Elmer OPTIMA 3300 DV) [[Trace Element Geochemistry Laboratory](#)].

Stable Isotope Geochemistry	Sue, John P, Paulo
-----------------------------	--------------------

The stable light isotopes (H, O, C, N and S) are used extensively in Earth Systems research because these elements are ideally distributed in the atmosphere, hydrosphere, biosphere and geosphere and fractionated by geological and biological processes. The Earth Sciences [stable isotope laboratories](#) are at the forefront of natural resource and climate change research and a major provider of stable isotope analyses for the minerals and energy industries. We develop and use stable isotope geochemistry techniques to reconstruct Earth history and understand modern environments including the Great Barrier Reef in Queensland and coral reefs worldwide. We also investigate how the early biosphere interacted with its planetary and Solar System environment using the isotopic records of carbon, oxygen and sulfur in ancient sedimentary materials.

## Environmental and Marine Studies

Environmental Geochemistry	Massimo, Paulo, Sue
----------------------------	---------------------

Research in Environmental Geochemistry at UQ Earth Sciences focuses on the origin and distribution of trace metals in natural and impacted environments. Current research projects include the assessment of baseline levels of trace metals and arsenic at abandoned mine sites of the New England Fold Belt and in pristine lakes of East Antarctica (Gasparon). Specific strengths of UQ Earth Sciences staff include expertise in the modelling of fluid-rock reactions and interactions in surficial environments, and analysis of trace metals at ultra-trace levels in waters and in environmental matrices such as lichens and mosses (Gasparon) and soil mechanics and soil-water interactions ( [Hydrogeology and Geoecology group](#)).

Another field of research in Environmental Geochemistry is the study of recent and past climate history - trace element and isotopic fingerprinting in marine and lacustrine sediments, peat deposits, and weathering profiles (Gasparon, Vasconcelos).

Surficial Processes and Landscape Evolution	Paulo, Sue, Massimo, Thomas
---	-----------------------------

In preparation

Marine Geology and Geochemistry	John J, John P
---------------------------------	----------------

Research in Marine Geology is concerned with the origin and morphology of ocean basins and margins, sources and composition of marine sediments, effects of waves and currents, sea level processes and effects of sea level change, marine productivity and benthic organisms, imprint of climatic zonation on marine sediments, stratigraphy of deep-sea sediments, and resources from the ocean floor. Projects include studying the effect of sea level change on marine diversity and productivity in Papua New Guinea, and the development of tropical carbonate systems along continental shelves, for example, by studying carbonate platforms in the waters around Australia. Some projects are concerned with the composition of marine sediments in nearby basins and the link to the origin and morphology of the nearby ocean margins. Another focus of research is change in marine productivity caused by anthropogenic impacts in coastal areas.

Geobiology of Past and Present Coral Reefs	John P, John J, Geoff
--	-----------------------

The global decline of coral reefs has been attributed to a short list of human disturbances including fishing, land-based sources of pollution, and global climate change. Recent findings from sites distributed throughout the tropical world point to the immense importance of understanding historical events when attempting to tease out factors that have or may influence present coral reef biodiversity. This program incorporates data from large spatial and temporal scales to uncover the major past and predicted future influences of natural processes, human impacts, and climate change on the sustainability of coral reefs. Research areas include the historical ecology of reefs worldwide, palaeoecology of Quaternary reefs of Papua New Guinea, and the Neogene evolutionary history of Indo-Pacific reef species and populations.

Palaeoclimatology and Global Change	John P, John J
-------------------------------------	----------------

Paleoclimatology is concerned with the generation and interpretation of paleoclimatic data sets for geological time periods. It aims at understanding long-term climate change and variability. Paleoclimate data can, for example, be obtained from modern and ancient carbonates of both marine and continental origin, laminated sediment deposits, tree rings, dunes, past shorelines and glacier outlines. At UQ, we focus on looking at paleoclimate variability in Australia and overseas, for example, in Papua New Guinea, Turkey, the European Alps, New Zealand, and locations in North and South America.

Paleoclimate research in Australia and Papua New Guinea, for example, includes several research projects in coral reefs, where we look at past sea level changes in response to climate change, and how coral reefs have responded to paleoclimatic changes in the past. Our key location for such research is, of course, the Great Barrier Reef in Queensland.

Hydrogeology and Geoecology	Thomas, Massimo, Peter
-----------------------------	------------------------

Water in the environment is investigated by the disciplines of Hydrogeology and Geoecology. Hydrogeology deals with saturated or unsaturated water flow in the porous system of soils or underground and investigates the interaction of water fluxes and element fluxes in the pores. The understanding of these processes (e.g. exchange reactions, hydraulic transport of chemicals, influence of chemistry on hydraulic properties, geochemistry), is the basis for the identification of environmental risks.

Geoecology deals with the biotic as well as the abiotic environment. Parameters and processes of water flow are investigated, which determine the hydrological cycle in the soil-plant-atmosphere continuum. Knowledge of processes and properties of specific locations (climate, vegetation, soil) can be applied to the management of the environment. This includes issues like salinity, development of capping systems and rehabilitation of mined sites, and environmental problems associated with mining. Both Hydrogeology and Geoecology use various tools for field and laboratory data acquisition and modelling procedures to understand and predict environmental systems.

Quantitative Palaeoecology and Palaeobiology	John P, John J, Geoff
--	-----------------------

The development of new techniques in analytical palaeobiology has provided exciting tools with which to explore the evolutionary and ecological framework of the marine biota. When coupled with state-of-the art analytical geochemistry, the relationship between this framework and changes in the natural environment can be explored. A number of projects can be developed through the use of this powerful framework to provide insight into the long-term evolutionary and ecological dynamics of marine species and populations. Research areas include the evolutionary and extinction dynamics of the *Montastraea 'annularis'* species group, individualistic versus 'community unity' models for the maintenance of species diversity in ecological communities, and the evolutionary ecology of marine invertebrates using high-resolution stratigraphic sequences.

### **Fossils fuels, ore geology, and exploration**

Ore Geology	Paulo, Sue, Ross, Noel
-------------	------------------------

Ore deposit research focuses on the processes leading to the formation of hypogene and supergene mineralisation in rocks of all ages. We use geochemical and fluid inclusion facilities to establish the thermal and fluid flow histories of mineralized terranes and the regional and local controls on mineralization [[Stable Isotope Geochemistry Laboratory](#), [UQAGES](#)]. The emphasis is on fluid and metal sources, the precise timing of magmatic, structural and hydrothermal events and characterisation of ore and alteration mineralogy for genetic modelling and as an exploration vector. Major current project focuses are sediment-hosted base metal sulfide mineralisation in northern Australia, porphyry and related skarn and epithermal mineralisation in east Asia, Papua New Guinea and west South America, orogenic gold deposits in Australia and Brazil and the interplay of hypogene and supergene processes in the formation of the iron ores of Western Australia and Brazil.

Fossil Fuels	Joan, Sue
--------------	-----------

The focus of the Fossil Fuel research is on the genesis of coal, seam gas and petroleum through the interplay of basin evolution, sedimentary environments, palaeo-climate and botanical evolution, and the practical impact that these geological factors have on exploration and

discovery, mining conditions and reservoir behaviour. The research strengths are interdisciplinary with core strengths in structural geology, sedimentology, isotope and organic geochemistry, organic petrology, palaeobotany, hydrogeology and geophysics. Exciting research opportunities exist within the department and through interaction with associated research centres, such as resource modelling and geostatistics (BRC), numerical simulation and visualisation of reservoir formation and behaviour (ACcESS), understanding the timing and evolution of resources, prediction of safe mining conditions-ground and gas, and predicting material behaviour during mining and processing (JKMRC). The research has practical applications and projects are conducted with mining and petroleum companies.

Exploration Geophysics	Steve, Peter
------------------------	--------------

The focus of the Fossil Fuel research is on the genesis of coal, seam gas and petroleum through the interplay of basin evolution, sedimentary environments, palaeo-climate and botanical evolution, and the practical impact that these geological factors have on exploration and discovery, mining conditions and reservoir behaviour. The research strengths are interdisciplinary with core strengths in structural geology, sedimentology, isotope and organic geochemistry, organic petrology, palaeobotany, hydrogeology and geophysics. Exciting research opportunities exist within the department and through interaction with associated research centres, such as resource modelling and geostatistics (BRC), numerical simulation and visualisation of reservoir formation and behaviour (ACcESS), understanding the timing and evolution of resources, prediction of safe mining conditions-ground and gas, and predicting material behaviour during mining and processing (JKMRC). The research has practical applications and projects are conducted with mining and petroleum companies.

Structural Geology and Exploration	Gideon Rosenbaum
------------------------------------	------------------

The principal research direction of structural geology at UQ is the linkage between local and regional structures and mineralization, both in space and time. Regional and detailed field structural analysis is allied to research in other DES disciplines and Centres, in particular: geochronology (UQAGES); geochemistry (Petrology and Crustal Evolution Group); basin sedimentology (Fossil Fuels Group); seismic interpretation (Exploration Geophysics Group); and geodynamic modelling at terrane scale (ACcESS). Projects are linked to industry links via ExTec contract research and consulting.

The emphasis is on the architecture and formation of young and old orogenic systems, and the structural controls of mineralisation. It merges at the larger scale with tectonics (crustal extension, contractional orogenesis, etc) and regional metallogenic patterns. Current projects focus on Proterozoic/Archaean terranes in Australia and Brazil, the New England Orogen of eastern Australia, and Tertiary fold-thrust belts, particularly in the Andes.

### Crustal studies and tectonics

Petrology and Crustal Evolution	Kurt, Paulo, Massimo, Gideon
---------------------------------	------------------------------

The origin and evolution of the Earth's crust, which is unique among the terrestrial planets, is linked to plate tectonics and magma generation. As such, the emphasis of our research here at UQ is igneous petrology and tectonics. We combine experimental, field, geochemical, geochronologic and structural approaches in addressing questions that include investigations of plate motions through time; the timing and mechanisms of continental growth; the thermal and tectonic

evolution of mountain belts; feedback mechanisms between melting and crustal deformation; the role of melt generation processes in the chemical differentiation of the crust; elemental recycling at convergent margins, and timescales of storage and crystallization of magmas within the crust. Members of the crustal evolution group have active projects in Australia, Brazil, Chile, India, New Zealand and America.

Volcanology	Kurt, Massimo, Paulo
-------------	----------------------

Volcanic activity can endanger the lives of people and property and may affect weather conditions and possibly trigger climatic change. Most activity involves the explosive ejection or flowage of molten rock and is accompanied by release of gases into the atmosphere. Here at UQ we are using new advances in geochemistry and geochronology to piece together the life history of volcanoes to gain a better understanding of the conditions and processes that lead to eruptions. Elemental, noble gas and radiogenic isotopic compositions of volcanic minerals are used as a kind of petrologic 'DNA', allowing us to fingerprint and track processes through time in an evolving volcanic system. Microscale studies of crystals and their inclusions are used to unravel larger-scale problems, such as the origin of the continents we live on and the quantification of elemental fluxes between Earth's surface and deep interior. The volcanic studies group at UQ travels the world's oceans and continents to unravel the clues volcanoes contained about Earth's past, present and future.