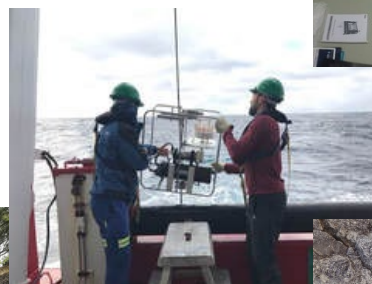
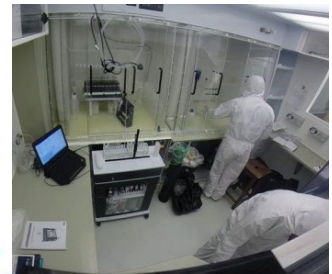
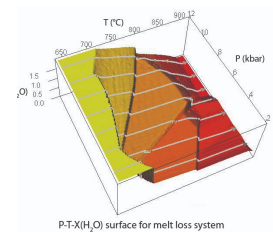
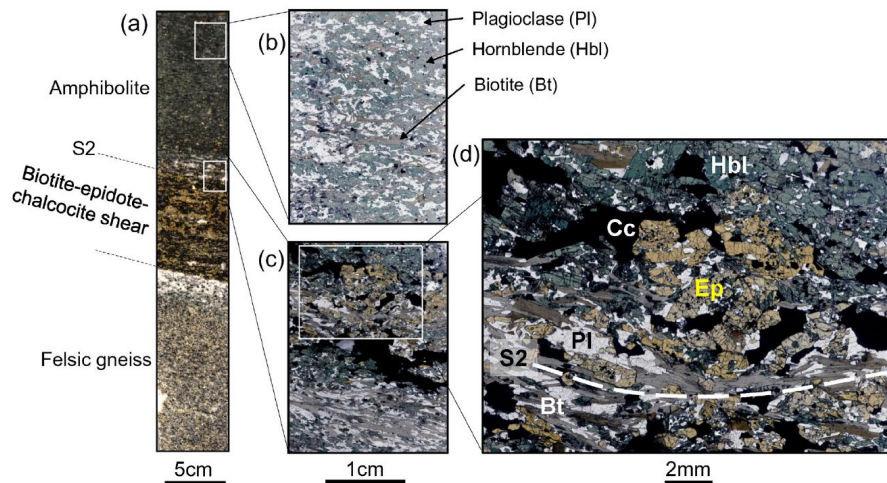


# Department of Earth Sciences Research portfolio



# The Department of Earth Sciences

- Applied Geology
- SARCHI chair Experimental Petrology
- Environmental Geochemistry
- TracEx laboratory

# Structural Geology



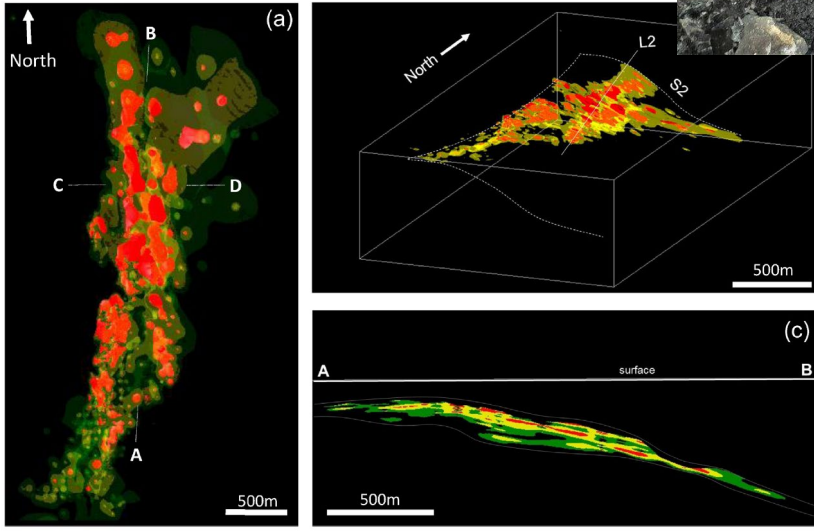
Prof Alex Kisters  
 akisters@sun.ac.za

## RESEARCH Focus

- Crustal deformation of rocks
- Magmas and crustal rheologies
- Structural controls of fluid migration
- Regional-scale tectonics



*Gold-quartz-sulphide veins in Barberton*



*3D modelling of subsurface Cu ore body in Namibia*

## APPLICATION OF RESEARCH

- Mining and mineral exploration
- Resource geology

Structural geology, tectonics, economic geology, crustal deformation



Dr Ryan Tucker  
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# Evolution of Life in Earth's History



## RESEARCH Focus

- Sedimentology & Stratigraphy
  - Addressing issues in the global to local correlation of Mesozoic strata and entombed fossil assemblages
- Geochronology
  - Utilizing chemical tracers to better understand
    - patterns within the fossil record
    - Timing and patterns of basin development and environmental evolution
- Vertebrate Palaeontology
  - Addressing issues in global to local biogeographical and temporal rates of evolution across time and space



A) Newly discovered assemblage of Enantiornithine birds from the Late Cretaceous, Brazil  
B) Excavation of a newly discovered fossil egg-nest from the mid-Cretaceous, Utah, USA

## Recent Application of Research: Utah, USA-based project

- Refined temporal and stratigraphic context for the Mussentuchit Member of the Cedar Mountain Formation suggest species data may best be interpreted as representing at least two temporally distinct paleoassemblages highlighted by distinct paleoenvironmental signals.
- To date, eco-evolutionary dynamics in the ascent of tyrannosauroids to top predator roles have been obscured by a 70-million-year gap in the North American fossil record. Here we report a new tyrannosauroid from the Cenomanian-aged, Mussentuchit Mbr., Cedar Mountain Fm., Utah, extending the continental lineage by ~15 million years.

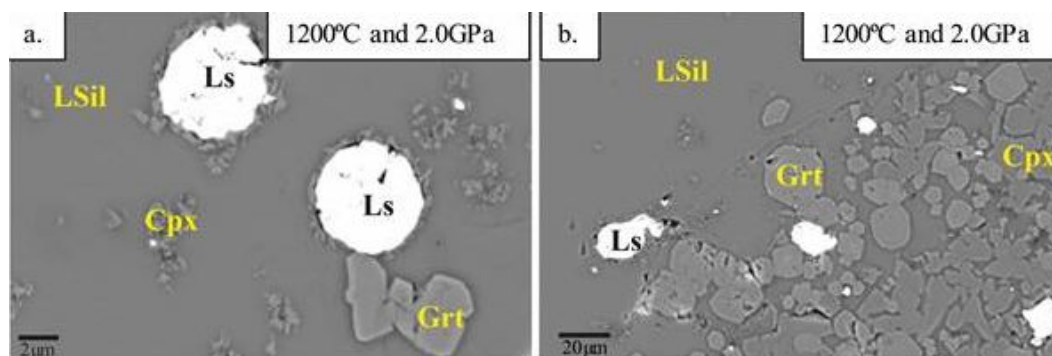
# Petrology & Experimental Petrology



Prof Gary Stevens  
SARChI chair  
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## RESEARCH Focus

- Studies of the geodynamic and chemical evolution of Earth's young crust and the nature of the tectonic processes relevant to this crust
- S-type granite petrogenesis and the partial melting of metapelitic/psammitic rocks
- Experimental investigations using autoclaves, of the partial melting behaviour of silicate and sulphide rocks and minerals in Earth's crust and upper mantle



*BSE images of run products from experiments investigating the partial melting of sulphide-bearing metasomatised mantle.*

## APPLICATION OF RESEARCH

- The research provides information on how the chemical structure of the continental crust was achieved and what the tectonic processes were that shaped the crust. This has application on exploration for new minable reserves. Experimental investigations of sulphide systems have direct application in understanding grade enrichment in massive sulphide deposits.

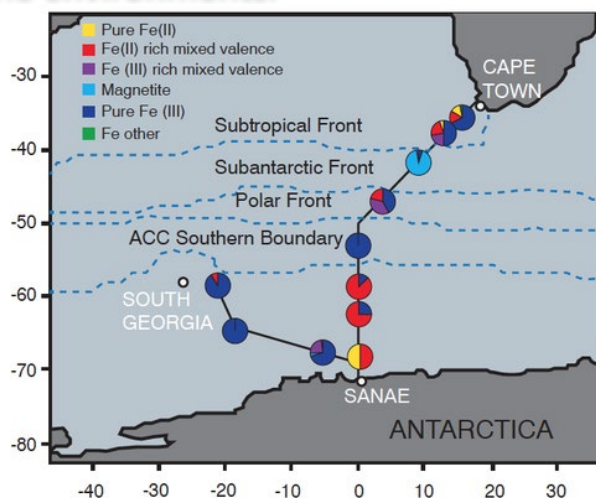


# Marine & Environmental Biogeochemistry

Prof AN Roychoudhury  
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## RESEARCH Focus

- Speciation and distribution of bioactive trace metals in the Southern Ocean
- Nano-particles in the ocean environment
- The Centre for Trace and Experimental Biogeochemistry, a centre within the Department of Earth Sciences at Stellenbosch University, aims to gain an improved understanding on biogeochemical cycling of bioactive trace elements in marine environments.



*Fe speciation in marine nanoparticles. The pie charts show the relative contribution of Fe species, as defined by their spectral features, in the solid-phase Fe pool at each site.*

## APPLICATION OF RESEARCH

- Capability to measure ultra-low concentrations (picomolar level) of ions in water samples.
- Measurement and application of stable isotopes of Carbon, Hydrogen and Oxygen to environmental processes
- Global carbon cycle, Ocean acidification and impact
- Pollution of water resources and acid mine drainage
- Microbially mediated reactions in early diagenetic processes and their application to remediation of waste

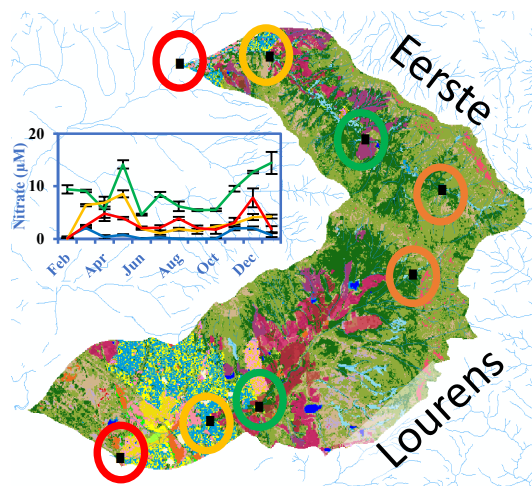
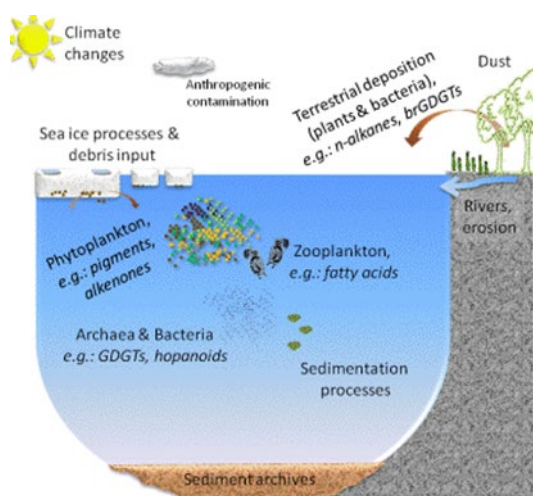
# Modern and past environments



Dr Susanne Fietz  
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## RESEARCH Focus

- Nutrient and pollutant retention in local streams
- Impact of trace metals on algal growth, primary production and CO<sub>2</sub> drawdown in the Southern Ocean
- Extent of air pollution in the Western Cape and impact on human health and the coastal marine environment
- Climate reconstruction over past 100k years



## Potential Industrial APPLICATION OF RESEARCH

- Collaboration with SU Biotechnology for the advance of commercial approaches for remediation strategies
- Use of organic molecules in petroleum industry

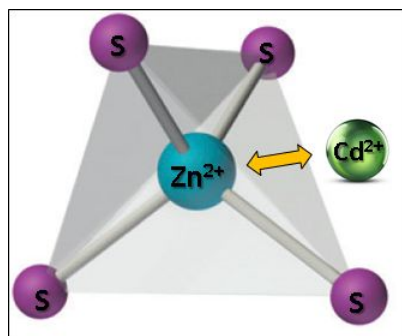


# Economic Geology

Dr Bjorn von der Heyden  
 bvon@sun.ac.za

## RESEARCH Focus

- Geology and geochemistry of African orogenic gold deposits.
- Across-disciplinary research into the effects of trace element substituents on sulphide mineral beneficiation.
- Use of X-ray spectroscopic techniques towards advancing fundamental and molecular-scale understanding in ore geology research.



## APPLICATION OF RESEARCH

- The ultimate goal of ore geology research is to improve on the existing exploration models such that we can ensure a sustained supply of resources for future generations.
- Better understanding of the mineralogical controls on minerals beneficiation will result in more efficient beneficiation strategies utilized by the 'Mine of the Future'.



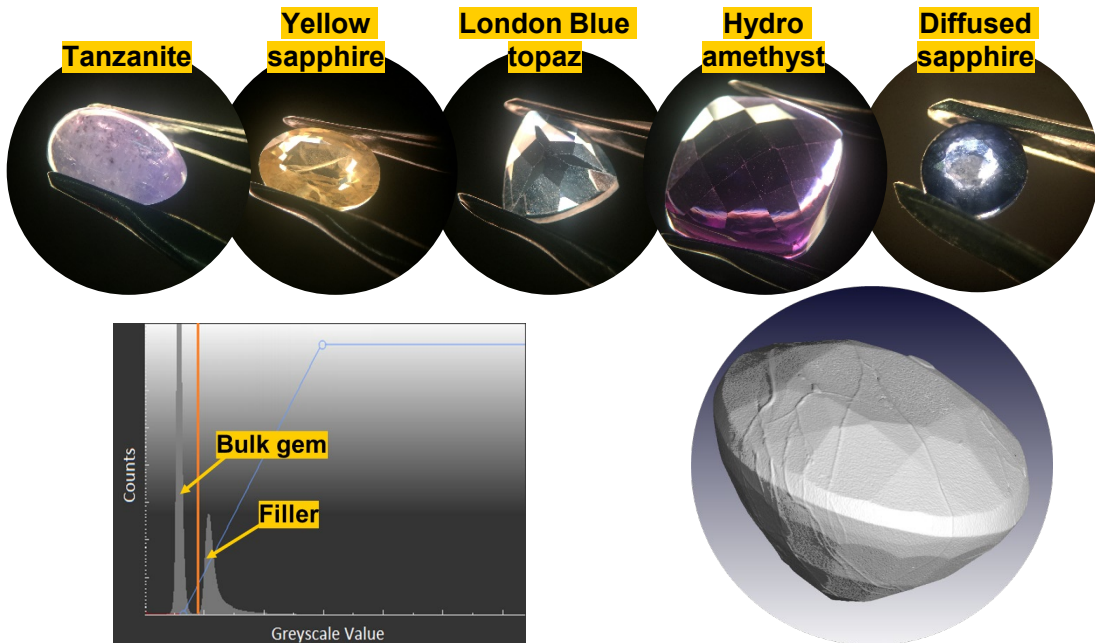
# X-ray micro Computed Tomography



Dr René Heyn  
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## RESEARCH Focus

- Use of X-ray micro Computed Tomography (microCT) scanning as a qualitative and quantitative analytical tool in the fields of gemmology and economic geology



Top: Photographs of various coloured gemstones under magnification. Bottom left: Diagram showing the quantitative values of the gem and filler material. Bottom right: Image of a 3D mesh files created on the exterior surface of a glass-filled ruby.

## APPLICATION OF RESEARCH

- The application of microCT as a qualitative and quantitative supplementary analytical tool for future use in the heavy minerals industry to make a meaningful contribution to mining and beneficiation operations in the heavy minerals industry.
- MicroCT can provide an additional and complementing service for the gemstone industry in providing a non-destructive routine analysis for coloured gemstones to characterize and present a unique “fingerprint” identification.

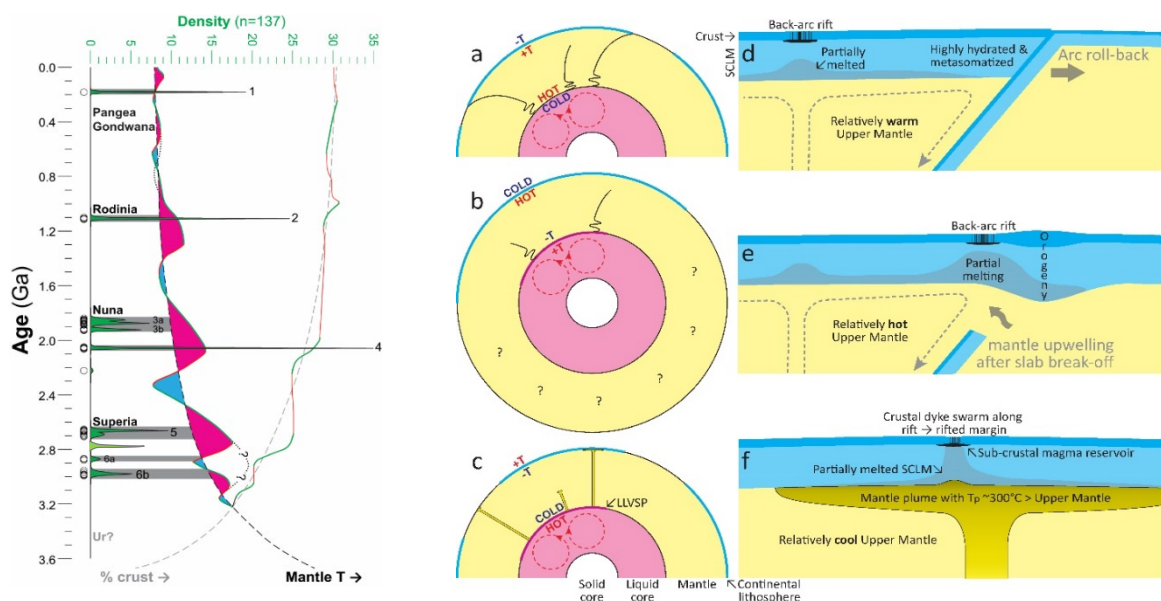


# Large igneous provinces

Dr Martin Klausen  
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## RESEARCH Focus

- Large igneous provinces (LIPs) through space and time
- More specifically, Precambrian giant mafic dyke swarms and Phanerozoic volcanic rifted margins across southern Africa and Greenland



Left: Temporal LIP distribution across the Kaapvaal craton. Middle: Supercontinent cycle of amalgamation to breakup. Right: LIP petrogenesis along back-arcs and during breakup

## APPLICATION OF RESEARCH

- Based on a solid foundation of field relationships, thin section petrography, and bulk rock geochemistry
- Including U-Pb dating of extracted baddeleyites through the University of Lund (Sweden)
- Understand LIP magma formation in the Earth's mantle, differentiation and emplacement in/onto the Earth's crust.
- Merge coeval LIP fragments on different cratons into ancient supercontinent reconstructions.
- Discriminate between different LIP-types, e.g., formed during supercontinental amalgamation or breakup.
- Basic research that assist the targeting of LIP-associated mineral resources