

MINERAL ENDOWMENT: Formation and Exploration of Mineral Deposits

THEME COORDINATOR:
Richard Lilly

The conference brings together approximately 100 presentations within the theme Mineral Endowment: Formation and Exploration of Mineral Deposits; Their Tectonic and Geochemical Environment and Significance as part of a full program on Uncover Earth's Past to Discover Our Future. 360 papers and 135 posters will be presented over four days from June 26 – June 30.

Presentations come from Australasian university students and researchers, Australasian government organisations including Geoscience Australia, and CSIRO, and leading industry explorers, miners and their service companies.

Mineral Endowment is a significant part of the 2016 AESC, and forms one of six themes of the conference. Additionally, two of the five symposia of the conference are directly related to the Mineral Endowment theme.



Mineral Endowment:

Formation and Exploration of Mineral Deposit; Their Tectonic and Geochemical Environment and Significance

Earth's Environment:

Past to Present

Tectonics of the Planet:

Craton and Continental Formation and Evolution, Ocean Plate Tectonics, Plate Margin and Plate Interior Tectonism

Deep Earth Geodynamics:

Core, Asthenosphere and Lithosphere Dynamics, Coupling the Dynamic Deep Earth with Surface Tectonics

Geoscience and Society

Education, Integration and Translation of Earth Sciences for Societal Benefit

The Earth Science of Energy

From Hydrocarbons to Renewables

SYMPOSIA

The 40th Anniversary of Olympic Dam Symposium

UNCOVER Symposium:

The future of under cover exploration

AuScope 10 Year Anniversary Symposium

Early-Mid Career Geoscientist Symposium

Sprigg Symposium:

Earth's Evolving Climate



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26 - 30 June 2016 – Adelaide Convention Centre

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New Technologies in Mineral Exploration

The decline in economically significant mineral deposits and increase in global demand for metals over the last ~20 years signifies that we need to be innovative with the way we undergo mineral exploration. The major hindrance to discovery is primarily viewed as deposits exposed at the Earth's surface having mostly being discovered, forcing exploration into deeper, buried environments. Exploration through cover is significantly more costly,

slower and challenging compared to surface exploration. Samples that give critical information can only be returned through expensive drilling practices, and all sample media (cover and basement) needs to be utilised in a manner that will return maximum information. This session will present recent technological advances and case studies that will enable successful mineral exploration through deep, barren cover rocks.

KEYNOTE

Robert Hough: Detection of mineral system signatures through cover - A bigger picture

Sandra Occhipinti:

Translating mineral systems analyses into a sensible workflow for ground selection and targeting

Tim Munday:

Uncovering the depths in minerals exploration - Advancing geophysics is a critical element to this goal

Agnieszka Zuber:

Gold sensing at ppb level with optical methods

Soren Soe:

New drilling technologies in mineral exploration productivity

James Cleverley:

Material classification in a connected world

Deposit to camp scale ore systems

Most exploration activities are at deposit- to camp-scale. This session intends to reveal near-ore to far-field signals of and vectors towards mineralisation to help increase exploration success rate and efficiency. The session will focus on the transition between different styles of mineralisation with genetic links, spatial zonation at various scales (meters to 10s of kilometres; within a deposit or

between genetically linked deposits), zoning patterns in all possible geological features (e.g., mineralogy, texture, whole rock geochemistry, mineral chemistry, spectral features, isotope compositions, etc.), zonation at various paragenesis stages, and ore genesis to ensure the validity of the spatial zoning patterns.

Matt McGloin:

The origins of Palaeoproterozoic tungsten (and copper) mineralisation in the eastern Aileron Province, Arunta Region, central Australia

Michael Gazley:

Redox gradients, [and ore footprints: Mineralogical variability and geochemical insights into the Cloncurry District mineral system

Richard Lilly:

Geochemical evolution of the mafic volcanic sequences in the Cloncurry District, Queensland: Implications for crustal accretion and prospectivity

Adrian Fabris:

Regional to deposit scale geochemical and spectral footprints of the ~1.6 Ga thermal event in the eastern Gawler Craton - a case study from the Punt Hill region, South Australia

Alistair White:

Distinguishing local- and regional-scale metasomatic systems



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Integrating structure and geochemistry

How far do fluids migrate due to dynamic processes such as earthquakes or earthquake swarms, and how does this affect their chemistry? What is the impact of rapid fluid removal from rocks undergoing prograde metamorphism? What are permeability changes at different levels in the crust during an earthquake cycle? Can we distinguish mineral zonation arising from fault-related fluid pulsing,

relative to crystal-fluid interface effects? These questions and others like them are the topic of this session, and will bring together structural geologists and geochemists to share the latest insights of their respective fields, and explore the implications that each discipline has for the other.

KEYNOTE

Nicholas Oliver: Combined slow and rapid mineral precipitation in lode gold and IOCG deposits

Andy Tomkins:

Regional brines in the Mt Isa Inlier: Unavoidable phase separation and consequences for fluid chemistry and crustal structure

Steven Micklethwaite:

Geo-tipping point: Impact of a humble carbonate on microfracture, gold remobilisation and the generation of a world-class deposit

Brendan Duffy:

Understanding the distribution and structural setting of mineralization from principle component analysis of portable X-Ray Fluorescence geochemistry: new insights from an old friend

Jonathan Berthiaume:

Geometry and evolution of deformation bands and their impacts on uranium-rich fluid flow in sedimentary basins

The Australian 1.5–1.6 Ga environment

This session brings together researchers from a wide range of specialities in order to discuss one of the most significant ore-forming events in Earth's history. The Gawler, Curnamona and Mount Isa cratons share significant links between

geodynamics and ore-deposit genesis during the period 1.5-1.6 Ga. Multi-disciplinary comparison between these areas will assist in the identification of key drivers for mineralisation and will have implications for regional prospectivity.

KEYNOTE

Peter Betts: Tectonic switches during the Palaeo-Mesoproterozoic transition: implications for mineral systems

Pat Williams: New geological and geochronological constraints on the origin of the Prominent Hill hematitic IOCG deposit, Gawler Craton, South Australia

Adrian Fabris:

Mineral systems of the southern margin of the Gawler Range Volcanics - Outcomes of the Mineral Systems Drilling Program, South Australia

Garry Davidson:

The Gap Zone mineralisation (Prominent Hill IOCG deposit, South Australia): A zoned system in carbonate wallrocks that was produced when orogenic pyrite vein stockworks reacted with copper-bearing sulfate-rich fluids containing isotopically heavy sulfur



Hyperspectral applications in economic geology

New technology has led to rapid developments in the application of mineral spectroscopy as an effective tool across the exploration to mine value chain. This new technology has the capacity to record and analyse hundreds of thousands of continuous measurements every day, leading to the creation of high resolution datasets. Geologists can maximise the benefit of this growing data bank of rich resources (collected from the surface by satellites and aircraft or from drill-core by hyperspectral scanners) by identifying mineral assemblages and spectral parameters that can be used as vectors for miner-

alisation and visualisation in three dimensions. This session will be supported by the National Virtual Core Library community which comprises all State and Territory Geological Surveys, their downstream users and CSIRO. The use of automated hyperspectral and imaging technologies as applied to extracting value from drill samples (core, chips, pulps, etc) will be covered. New users of hyperspectral data will have the opportunity to learn about these new techniques, whilst existing users will be able to share their experiences across diverse geological environments.

KEYNOTE

Alan Mauger: Alteration at the Olympic Dam IOCG-U Deposit – Insights into distal to proximal feldspar chemistry from infrared reflectance spectroscopy

Simon van der Wielen: Regional 3D Mineral Maps from Hylogger Data – examples from eastern Gawler Craton

Martin Wells: Reflectance spectroscopic characterisation of mineral alteration footprints associated with sediment-hosted gold mineralisation at Mt Olympus (Ashburton Basin, Western Australia)

Tony Hill: HyLogging unconventional petroleum core from the Cooper Basin, South Australia

Carsten Laukamp: Advances in mineral spectroscopy for rapid resource characterisation – examples from South American base metal deposits

Heta Lampinen: Relationship of geochemistry and hyperspectral mineralogy to parent lithology and the degree of weathering in regolith

Groundwater in mineral exploration and mining

This session will highlight the use of novel techniques, including hydrochemical methods, in mineral exploration, and present research into the impact of mining on groundwater systems (groundwater flow, groundwater contamination and remediation, and subsidence).

KEYNOTE

David Gray: Hydrogeochemistry in Australia: Challenges and Possibilities

Tim Munday: Working with the minerals industry in facilitating outback water solutions for remote parts of South Australia: The Goyder Long-Term Outback Water Solutions (G-FLOWS) Eyre Peninsula Project.

Nathan Reid: Can drilling fluids be used as a mineral exploration sampling medium?

Robert Thorne: Regional hydrogeochemistry of the Capricorn Orogen, Western Australia

Ian Brandes de Roos: Sedimentary basins for geothermal energy: the Montgomery House example



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Exposing the Nullabor basement

The Eucla-Gawler deep crustal seismic reflection line (13GA-EG1) and magnetotelluric (MT) surveys were conducted across the Nullabor Plain of Western and South Australia to investigate the lithospheric architecture of hidden basement provinces under deep cover. The 870 km long west to east transect stretches from the eastern margin of the Yilgarn Craton and Albany-Fraser Orogen in Western Australia, across the Madura and Coompana Provinces and the South Australian border, and through to the Eastern Gawler Craton where it links with the GOMA seismic line at Tarcoola. The seismic and MT surveys are a na-

tional collaboration between Geoscience Australia (GA), the Geological Survey of Western Australia (GSWA), the Geological Survey of South Australia (GSSA) and AusScope Earth Imaging (part of the National Collaborative Research Infrastructure Strategy). Additional new information from these key hidden basement provinces include regional magnetic and gravity data, and mineral exploration and stratigraphic drilling, all providing important constraints on 3D architecture and 4D evolution interpretations, which will be presented in a series of talks by the collaborators (GSWA, GSSA, GA, and ANU).

KEYNOTE

Rian Dutch: What lies beneath the Nullabor Plain? Insights into the geology of the Coompana Province from deep crustal seismic reflection profile 13GA-EG1

Catherine Spaggiari: Insights on crustal architecture and evolution of the Madura Province, Western Australia, from deep crustal seismic reflection data.

Geoff Fraser: Geochronological constraints from the Coompana Province, with implications for geological relationships with the Gawler Craton, Musgrave Province and Madura Province

Brian Kennett: The nature of the lithosphere in the vicinity of the Eucla-Gawler reflection seismic line

Stephan Thiel: Linking Western and South Australia: Insights from magnetotelluric profiling

Exploration through cover

The continued demand for world-class ore discoveries and the decreasing chance of finding exposed ore deposits increases the need to explore for potentially buried mineralisation in areas of thick overburden and cover sequences. This session highlights develop-

ments of new geochemical and biogeochemical sampling methods designed to measure the surface geochemical expressions of buried and blind mineralisation in a range of regolith settings, and our continued advancement in geochemical exploration in covered terrains.

Steve Hill: Taking Exploration Geochemistry to greater depths towards 4D landscape geochemistry of Australia's cover

Ravi Anand: Detection of buried mineralisation and lithology through transported cover in Australia

Mel Lintern: Calcrete sampling for gold from the Albany-Fraser Province, Australia

Caroline Forbes: Exploration for iron oxide-copper-gold deposits using monazite chemistry

Walid Salama: Gold in silcrete as a new vector to volcanic-hosted massive sulphide mineralisation



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Non-traditional isotopes in high and low T

New stable isotope tracers of heavy metals (Cr, Fe, Ni, Cu, Zn, Mo, Cd, Hg), alkaline earth metals (Ca, Mg, Sr, Ba) and lighter elements (Li, B, Cl) are being increasingly used to solve problems relevant to the origin and evolution of ore deposits and the earth system over geological time, as well as for practical applications involving min-

eral exploration and isotope tracing of metal contaminants in the environment. This session includes presentations on the use of non-traditional isotopes to advance our knowledge and understanding of ore forming processes, earth system evolution and geochemical pathways of metals in both high- and low-temperature environments.

Yulia Uvarova:

Non-traditional isotopes applied to mineral exploration and grade estimation

Zhu Zhiyong:

Iron isotope behaviour during mineralization and K-feldspar alteration: A case study of two types of gold deposits from the Jiaodong Peninsula, East China



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PLEANARY SPEAKER:
RICH GOLDFARB

(Colorado School of Mines; China School of Geosciences, Beijing):
Gold Deposits In Metamorphic Rocks: Why Are We Getting More Confused?

FIELDTRIPS AND WORKSHOPS:

- IOCGs – Where it all began.
The Moonta-Wararoo region of the eastern Gawler Craton
- Orogenic Gold Deposits: Geology, Geochemistry, Exploration Criteria, and Global Patterns
- HyLogger™ Workshop: Learn the value of objective spectral results applied directly to core during manual logging and see the wealth of information available in the digital data

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