4. APPLIED GEOSCIENCES IN THE 21st CENTURY – INNOVATION, TECHNOLOGY AND THE FUTURE		Chris Woodfull cwoodfull@srk.com.au
SubTHEME	**DESCRIPTION**	**CHAMPIONS**
4.1 Geohazards, risk and mitigation	This subTHEME is dedicated to recent advances in Geo- hazards and Geo-risk. The topics to be covered include, but are not limited to, hazard mapping, risk assessment and design of mitigations against landslides (submarine or terrestrial), debris flows, rock fall, tsunami and earthquakes. Contributions on climate-related hazards (e.g. methane burst) will also be considered. The Geo-risk theme will extend methods to manage uncertainties related to natural variability of Geomaterials.	Olivier Buzzi (Newcastle University) **olivier.buzzi@newcastle.edu.au** Anna Giacomini (Newcastle University) **anna.giacomini@newcastle.edu.au**
4.2 Mining geology and geometallurgy	Mining geology and geometallurgy are key activities in the resources value-chain and critical in optimising the extraction and processing of all mineral assets. Although often identified separately they are interlinked functions that reflect the need for consideration of and interaction with downstream users of the resource to maximise benefits for all. This symposium will present keynotes and case studies showcasing the current technology advances that assist with optimising the extraction and treatments processes through detailed investigation, assessment, modelling and monitoring of the resource and its physical and chemical properties.	Jill Terry (BHP) Dale Sims (Dale Sims Consulting) **dalesims@tpg.com.au** Chris Banasik
4.3 Engineering geology – from underpinning our civil infrastructure to mine closure risk and mitigation	Now, more than ever, the world needs efficient infrastructure and resource solutions. Be it civil or mining, our operating environments are becoming more constrained: transportation corridors require clever solutions for infrastructure to offer greater efficiency and capacity with reduced social and environmental impact; urban areas must be re-designed to accommodate a greater population density; water storage and utilities must offer greater certainty under increased demand; emerging renewable energy sources require a new generation of affordable foundation options and mines are subject to ever increasing scrutiny from regulators, approvers and the public. To deliver on these expectations, engineering geologists must now create ground models in more challenging environments, to support the design of the next generation of high performance infrastructure. Papers in this subTHEME will showcase excellence in engineering geology through its application to the next generation of infrastructure and mining projects.	Stephen Fityus (Newcastle University) **stephen.fityus@newcastle.edu.au**

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4.4 Geoscience and its impact on land use and productivity	With increasing global population and urbanisation leading to increased demand and competition for both living and non-living natural resources, it is important that all available information is used to inform decisions around land-use and infrastructure planning. Geoscientific and geospatial data are a fundamental dataset that should inform the planning and operation of infrastructure and land use planning on a global, national and local scale.	Adam Lewis (Geoscience Australia) **Adam.Lewis@ga.gov.au** Paul Dale (NSW Dept. of Industry) **paul.dale@industry.nsw.gov.au**
4.4.1 Understanding the Surface	Surface landforms, soils, water availability and consequently, effective use of these natural resources are fundamentally controlled by subsurface geology. With new and developing technologies, we are able to more accurately and efficiently map and characterise the composition and nature of the surface of the planet. This session will feature recent advances in the application of remote sensing technologies in geology, geography, environmental science and agriculture, including Digital Earth Australia and its applications; the use of remote sensing to map surface chemistry; applications of advances in Lidar capture; interferometric SAR studies; and the monitoring, attribution and projection of land surface changes.	Trevor Dhu (Geoscience Australia) **Trevor.Dhu@ga.gov.au** Simon Costello (Geoscience Australia) **Simon.Costello@ga.gov.au**
4.4.2 The Geoscience of Where	The science of accurately measuring and understanding the temporal variation of the shape and orientation of the Earth and features on Earth, and the associated technologies used to understand the globe and creatively structure information according to location, are driving innovation and productivity across society. In the 21st century, new technologies and techniques allow us to measure Earth's properties with unprecedented accuracy and precision, opening up new applications in this field. This session will include presentations on the science and applications of geodesy, including cutting edge developments in positioning and implementation of a dynamic datum; advances in the way Geospatial Information is spatially referenced to the Earth through discrete global gridding systems; and developments in geospatial and positioning infrastructures.	Gary Johnston (Geoscience Australia) **Gary.Johnston@ga.gov.au** Simon Costello (Geoscience Australia) **Simon.Costello@ga.gov.au**
4.4.3 Geoscience data delivery – current methods and future plans	This symposium is intended as an opportunity for State and Territory Geological Surveys, CSIRO, research organisations, and anyone else to demonstrate how their data is currently made more widely available, why those methods were chosen, what limitations there are to current practices, and what new ideas for data delivery might be under discussion (if they are willing to share). While the Convener's background and work focus is in stratigraphy and fundamental geological data, this session is intended to allow the inclusion of discussion on all kinds of data relevant to the collaborative geoscience projects undertaken in the 21st century.	Cathy Brown (Geoscience Australia) **Cathy.Brown@ga.gov.au**
4.5 Exploration technology: future trends and adoption challenges	Technology has already had a critical role to play in minerals, and as the industry's efforts shift to undercover exploration, existing technologies need to evolve and new approaches need to develop. Ranging from drilling techniques to sensors and data analytics, in this subTHEME we will showcase new technologies under development and being introduced, as well as exploring the challenges and industry change required for adoption into the exploration life cycle to occur.	Michelle Carey (IMDEX Ltd) **michelle.carey@imdexlimited.com** Caroline Tiddy (University of South Australia) Kevin Cassidy (Barerock Geological Services)
4.6 Mathematics, modelling, AI, robotics and machine learning applied to the acquisition and interpretation of large or complex geoscience data sets	Automation in the resources industry is being driven by a need for increased safety, efficiency and productivity, as well as reducing negative environmental impacts. This session will present recent advances in automation for the geosciences as well as overviews of the current state of research and development in this field. Areas of interest will include: • Autonomous mining, haulage and drilling • Managing large and complex geoscientific digital datasets and physical collections • Interpreting large and complex geoscientific data sets (eg. using spatial statistics, machine learning, complex systems, fractal methods) • Improved 3D geology modelling software: more geologically realistic, faster to generate, better integration of data • Understanding uncertainty in predictive geosciences	June Hill (CSIRO) **june.hill@csiro.au** Gavin Yeates (Gavin Yeates Consulting) Dale Sims (Dale Sims Consulting) Angela Riganti (Geological Survey of Western Australia)

SubTHEME	DESCRIPTION	CHAMPIONS
4.7 The National Virtual Core Library	The characterisation of mineral assemblages is amongst the first steps for describing and analysing mineral systems. The identification of lithologies and alteration footprints usually starts with time consuming core logging next to drill rigs or in drill core sheds across the world. Notwithstanding the geological expertise, the results of visual core logging can be very subjective and are difficult to use for decision making, let alone in a quantitative way for resource characterisation. Numerous drill core sensing technologies have been developed over the past decade that provide objective drill core information. The Symposium is organized by the National Virtual Core Library (NVCL),which is part of AuScope's national earth science infrastructure program (http://www.auscope.org.au/nvcl). The prime objective of the NVCL has been to provide access, via the internet, to the vast resource of geological information from the upper 1 – 2km of our Earth's crust that is stored in drill core libraries and core sheds across Australia. The NVCL has driven the development of hyperspectral drill core sensing technologies and delivery of the drill core data to the research community and resources sector via AuScope's data infrastructure and Discovery Portal (http://www.auscope.org.au/auscope-grid/), and comprises close to 1000km of hyperspectral drill core data from various geological environments and mineral deposit types across the Australian continent with continuing acquisition. This Symposium invites contributions that (1) demonstrate the integration of geochemical, petrophysical and mineralogical drill core data, (2) further routine textural analysis, and (3) Showcase the latest developments of new drill core sensing technologies.	Georgina Gordon (Geological Survey of South Australia) **Georgina.Gordon@sa.gov.au** Carsten Laukamp (CSIRO)