THE UNIVERSITY
of ADELAIDE

MINERALS AND MINING CAPABILITY

Institute for Mineral and Energy Resources

adelaide.edu.au/imer

WELCOME

Just as the minerals sector is central to our nation's identity and prosperity, so it is to the University of Adelaide.

Through our world-class research and development expertise, we've supported and strengthened Australian mining since 1889; and we will continue to act as a catalyst for its success well into the future.

As you'll see in these pages, our relevant expertise and experience—coordinated and focused through our Institute for Mineral and Energy Resources—encompasses every aspect of the minerals value chain.

You will also see evidenced here the high value we place on industry collaboration. We believe strong, productive partnerships are essential, both to address the sector's biggest challenges and maximise its greatest opportunities.

An exciting tomorrow is there for the making—more efficient, more productive and environmentally sustainable. We would welcome the chance to shape it with you.

Regards,

Professor Peter Høj
Vice-Chancellor and President
The University of Adelaide

Contents

MEET OUR TEAM

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DELIVERING EXPERTISE ACROSS THE ENTIRE MINERALS VALUE CHAIN

OFF-EARTH RESOURCES
Advanced remote sensing
Robotic vision and machine learning
Space engineering
In situ resource utilisation
Mapping and interpreting planetary surfaces

EXPLORATION
Geometallurgy
Machine learning
Magnetotellurics
Resource modelling

EXTRACTION
Drill and blast
Advanced sensing
Machine learning
Radionuclide monitoring

PROCESSING
Mill to refinery
Integrated grinding and flotation circuits
Blend strategies
Radionuclide removal

SOCIAL LICENCE
Community engagement
Environmental sustainability

MINE PLANNING
Smart data integration
Cyber security
Infrastructure design
Renewably powered operations

LOAD AND HAUL
Safe transport
Network stability

EXPORT
Economic and market analysis
Legal expertise

ENERGY
Hydrogen production and storage
Solar thermal mineral processing
Mine electrification

STOCKPILING
Run of mine
Crushed ore
Belt sensing

LEGACY AND CLOSURE
Environmental sustainability
Community engagement
Radionuclide removal
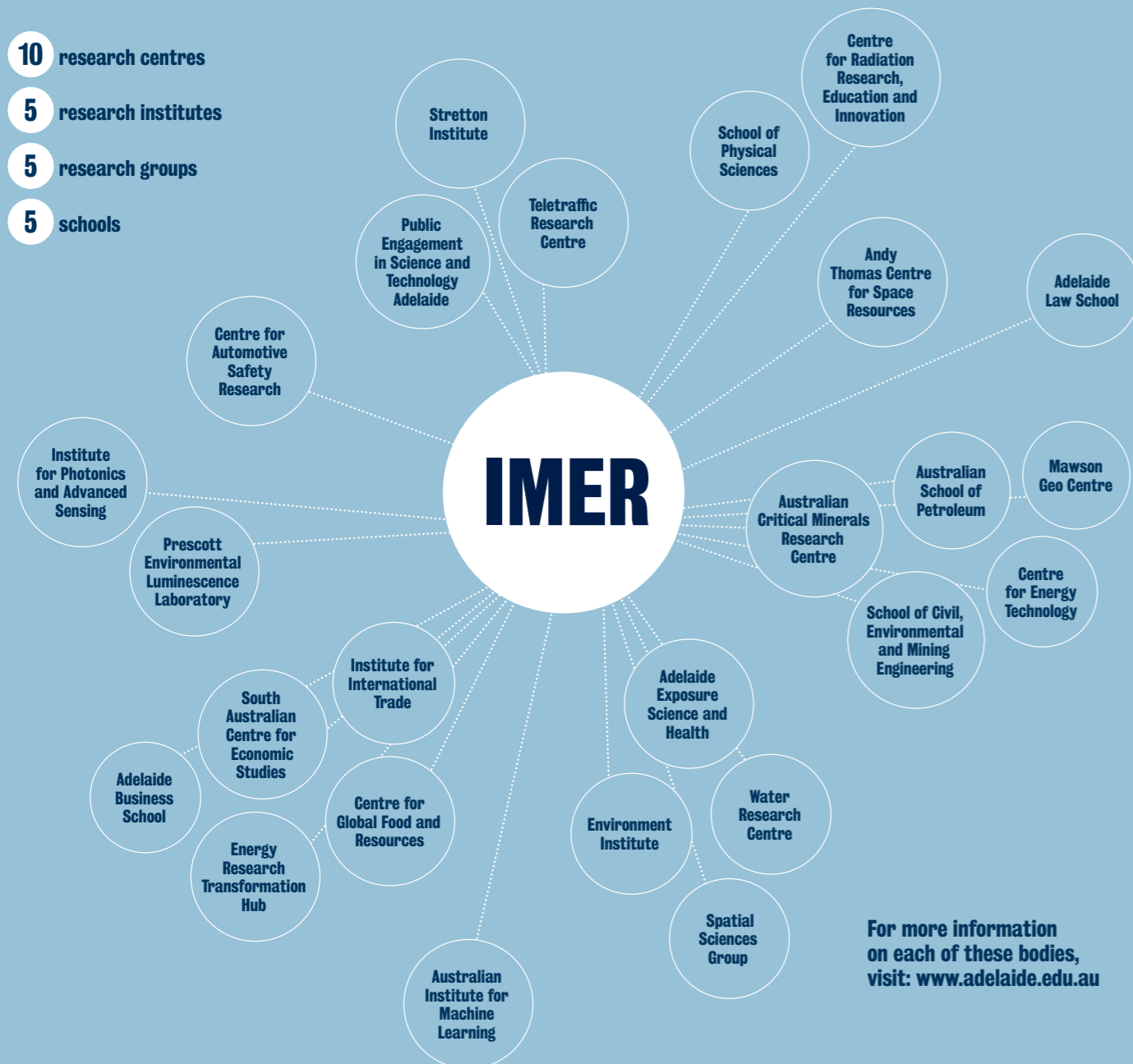
ONE POINT OF CONTACT
ENDLESS POSSIBILITIES

The Institute for Mineral and Energy Resources (IMER) is your commercial conduit to the University of Adelaide's full spectrum of world-class, mining-related expertise.

We operate at the sector's international forefront, focusing our University's finest, multidisciplinary talent. Our size, capability and experience equip us to take on collaborative projects of any scale or complexity. We can absorb high levels of risk.

And we're fiercely committed to ensuring our work has positive impact—for our partners, our community and our planet.

25 CONTRIBUTING ENTITIES

- **10** research centres
- **5** research institutes
- **5** research groups
- **5** schools

IMER

- Stretton Institute
- Centre for Radiation Research, Education and Innovation
- School of Physical Sciences
- Teletraffic Research Centre
- Public Engagement in Science and Technology Adelaide
- Andy Thomas Centre for Space Resources
- Adelaide Law School
- Centre for Automotive Safety Research
- Institute for Photonics and Advanced Sensing
- Australian Critical Minerals Research Centre
- Australian School of Petroleum
- Mawson Geo Centre
- Prescott Environmental Luminescence Laboratory
- Centre for Energy Technology
- School of Civil, Environmental and Mining Engineering
- Institute for International Trade
- Adelaide Exposure Science and Health
- South Australian Centre for Economic Studies
- Adelaide Business School
- Centre for Global Food and Resources
- Environment Institute
- Water Research Centre
- Energy Research Transformation Hub
- Spatial Sciences Group
- Australian Institute for Machine Learning

For more information on each of these bodies, visit: www.adelaide.edu.au

2020 PERFORMANCE
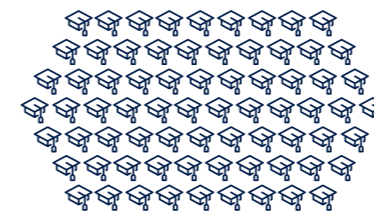
$12.7m
TOTAL FUNDING

80 STUDENT MEMBERS

190 TOTAL IMER MEMBERS

7 INDUSTRY AWARDS

12 RESEARCH LEADERS

70 PHD COMPLETIONS

8 MASTER'S COMPLETIONS

1036 RESEARCH PUBLICATIONS

FULL-SPECTRUM SMART INTEGRATION

IMER has led Australia in the development of fully integrated, AI-driven resource value chains. We can help you incorporate or enhance self-learning extraction-and-processing control systems to extract more value from complex resources—faster, safer and at lower cost.

Responding to industry need

With discoveries of conventional, easily extracted resources dwindling, the long-term trend is towards lower-grade, highly heterogeneous deposits, in hard-to-reach locations.

Such complex deposits vary in size, difficulty of extraction, the amount of energy or water needed to liberate the minerals, and many other factors. This variability demands the capacity to adapt operational inputs rapidly, precisely and safely—every step of the way—to deliver materials with the right attributes at the right time, without undue cost.

AI-driven data integration delivers that outcome.

Multiple industry collaborations

At IMER we have a long history of coordinating University of Adelaide teams in industry–research collaborations to refine our world-class AI-integration work in the real world.

Geovision CRC (2017–20)

In the recently completed Geovision Cooperative Research Centre project we partnered with global drilling giant Boart Longyear and South Australian specialist software company SRA Information Technology to allow generation of geological information in close to real time, directly at the drill site.

Multiple sensors at the drill site delivered different types of digital information that could be correlated using data fusion and interpreted using machine learning. This in turn identified key factors, including drillcore lithology and composition. Such data facilitates rapid decision making and real-time adjustments, without the need for traditional drillcore logging/assay processes, which can take days or weeks.

Orica blast models

We've been working with Australia-based multinational commercial explosives and blasting systems specialist Orica since 2017 to apply digitally integrated AI to their blast models. This smart feedback loop constantly adjusts settings to ensure the desired level of fragmentation and prevent dilution.

Integrated Mining Consortium

We're collaborating with BHP, OZ Minerals and others on mining and processing control platforms in the Integrated Mining Consortium, part of the Premier's Research and Industry Fund Research Consortium Program (see inset).

Australian Institute of Machine Learning

The University of Adelaide's Australian Institute of Machine Learning (AIML) is the largest machine learning and computer vision group in the nation—and a key IMER collaborator. Established in early 2018, AIML has over 100 members and boasts outstanding research expertise, state-of-the-art facilities and global recognition.

The institute's specialised staff are highly experienced in tailoring R&D proposals to help organisations better compete in an AI-enabled economy, with past project partners including the likes of Bayer, Facebook, Google, Microsoft and Canon.

MOVING INDUSTRY FORWARD

Key areas of focus

AIML's talented researchers can work with you to provide practical solutions in areas such as:

- identifying patterns in large, complex data sources
- predicting future behaviour of people and systems
- optimising complex systems
- automating the interpretation of video and imagery
- producing computer vision and robotics applications
- natural language processing
- visual question answering
- AI innovation strategies.

Integrated Mining Consortium: Premier's Research and Industry Fund Research Consortia Program

Launched in 2018, the Integrated Mining Consortium—led by IMER and including BHP and OZ Minerals—is developing, trialling and commercialising technologies and techniques to integrate every step of the mining value chain.

Anticipated industry benefits

Each step will 'talk' to the others. This will bring much increased operational efficiency; higher extraction rates from complex ores; and, ultimately, greater profitability.

Key areas of focus

Machine learning and AI: to target resource attributes with unparalleled precision; optimise downstream processing; and rapidly deliver feedback to operators, so that they can alter the mine plan 'on the fly'.

VR and AR modelling, simulation and digital twins: providing key tools for decision-makers to analyse and predict mining operations and plant performance in near real time.

Advanced data analytics: finding new ways to collect data all along the mining chain; and feeding it backwards and forwards to provide real-time knowledge of the orebody, enabling appropriate mine plan and operational adjustments.

Automation and robotics: for huge safety gains and cost savings, everywhere from robotic drills, to automated grinding and flotation circuits, and self-driving trucks.

Sensing and monitoring: to precisely identify variability in mineralogy, grade, hardness, lithology and grain size, and communicate this information along the chain.

MOVING INDUSTRY FORWARD

Our Geovision collaboration involved a truly transdisciplinary team of researchers developing visionary mineral exploration ideas for real-world implementation at the interface between earth science, computing and engineering. The group worked closely with METS providers to seek new techniques that can, potentially, provide game-changing solutions that enhance Australia's leading role in the sector.

SOCIAL LICENCE

Obtaining and maintaining legitimate social licence is not only essential for individual mining projects, but a fantastic opportunity to strengthen the entire sector's future. IMER can help you make it happen.

Backed by robust social science

IMER can connect you with the University of Adelaide's world-class social science researchers, who bring a wealth of knowledge and experience in rigorous community engagement surrounding complex issues relating to science, technology and the environment.

With a focus on engagement rather than communication, we will conduct robust, culturally sensitive social science research to determine your situation-specific basis for social licence, identifying all possible drivers and potential impediments.

We will then help you formulate and execute a strategic way forward.

Programs tailored to your objectives

Our approach to obtaining and maintaining social licence can be shaped to achieve any objective(s), including to:

- assess community concerns and help build community confidence regarding a proposed project's short- and long-term impacts—social, cultural, environmental and economic
- build collaborative relationships with previously negatively impacted communities or stakeholders
- address concerns raised by stakeholders, and establish bases for mutual understanding
- strengthen links between government, industry, academia and the community
- lay solid foundations for future collaborations/projects in the region
- help identify, and create, win-win pathways to a low-carbon economy.

ENVIRONMENTAL SUSTAINABILITY

Ensuring our environment's ongoing health is not only a vital component of securing social licence, but of maintaining life on Earth. From preserving unique flora and fauna, to protecting groundwater, human habitability and entire ecosystems, IMER can guide your responsible custodianship of it all.

Monitoring and management at all scales

The University of Adelaide is internationally renowned for its capability in all scales of spatial imaging and environmental management, from unmanned aircraft to satellites and spatial big-data analysis.

Coordinated by IMER, we can use remote sensing, geographic information systems, ecological modelling and multi-objective decision support systems to help you understand and manage any environment of interest—natural or managed, terrestrial, aquatic or marine. Our strengths and experience include monitoring and assessing:

- spatial variations in landscapes, establishing what's occurring where and why
- biodiversity and landscape composition
- land, habitat, vegetation, soil and water condition
- environmental change over time.

We're also highly capable in the areas of:

- natural resource and wildlife management planning and decision support
- environmental and resource mapping.

Optimising our most precious resource: water

The University of Adelaide is widely recognised for its multidisciplinary expertise in water and water systems management, and IMER is highly experienced in focusing this for the minerals sector. We're able to develop bespoke technology and applied scientific solutions to optimise—both environmentally and commercially—your water use, supply and treatment. This could involve:

- water supply and distribution system planning, design and operation
- risk analysis and system resilience assessments
- rainfall runoff modelling

- tracing water pathways—including using four-dimensional magnetotellurics (4DMT)—nutrient pollution and recharge
- predicting and modelling water demand and availability
- predicting and testing water quality in source and distribution systems
- soil settlement prediction and microbiology studies
- river health prediction and management
- stream mesocosm experimentation
- water management guidelines for mineral extraction and processing, dams and reservoirs
- wastewater treatment, contaminant removal and transport
- environmental remediation.

Protecting your people's health

IMER can assemble a specialist team of qualified, experienced professionals to assess your workforce's occupational and environmental exposure to chemical, physical and biological hazards. Our experience sector-relevant expertise includes:

- community exposure studies and health impact assessments
- environmental health risk assessments (i.e. air, water, soil, food and consumer goods)
- hazardous chemicals audits and risk assessments
- heat-stress surveys
- indoor air quality investigations
- lighting surveys
- noise assessment and control
- ultrafine particles (i.e. dust, mist, fumes, gases)
- vapour intrusion assessments
- ventilation assessments.

As a matter of course, our detailed reports also include practical recommendations for improvement.

We're now able to pinpoint the age, origin and interconnectivity of your site's groundwater —and how it has moved through space and time—using state-of-the-art atom trap analysis. This technology can also be used to determine gas tightness for underground storage.

Hydrogen Australia: Cooperative Research Centre (CRC) bid

The University of Adelaide, through IMER, is leading the Hydrogen CRC bid, which brings together key stakeholders to build a national hydrogen production capability that will progressively make hydrogen an affordable energy source for Australian industry, including the mining sector.

Anticipated industry benefits

The CRC will help Australia become a leading global player in the hydrogen industry. It will accelerate hydrogen's commercialisation by:

- growing domestic demand
- driving production
- building export capabilities.

Key areas of focus

The Hydrogen CRC will drive innovation in hydrogen:

- production
- storage
- distribution
- utilisation.

It will also lead workforce upskilling to facilitate the transition to a hydrogen economy. A dedicated education and training program will utilise 7.5% of the CRC's budget for delivering applied programs, vocational skills development and community education.

Further information

To learn more, or to join the Hydrogen CRC bid, contact:

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MOVING INDUSTRY FORWARD

EXPLORATION

In 2020, The Australian recognised the University of Adelaide as the nation's number one research institution for geochemistry and mineralogy, and IMER Deputy Director Professor Nigel Cook as Australia's leading individual authority in the field. To discover more out there, first explore here.

World-leading critical minerals expertise

IMER's research in critical minerals is end-to-end, from prospectivity analyses through to resource definition, extraction waste utilisation and environment, mineral processing, supply chain economics and export.

Our Australian Critical Minerals Research Centre, launched in 2020, is the go-to group for multidisciplinary research programs—the only one of its kind in Australia, and one of only a few worldwide.

Deep mineral source discovery

IMER has developed a way to locate the origins of mineral systems deep under the Earth's crust.

The approach involves using magnetotelluric (MT) technology to record data about the Earth's magnetic field in a particular location over time, which is then translated into a 3D image of the deep Earth there. This image can then be searched for tell-tale indicators of ancient fluid paths, indicating the likely location of mineral deposits.

Known as DeepMT and supported by seismic techniques, the method was perfected by studying the area deep under known, world-class mineral deposits in South Australia's Olympic Domain.

Helping to map Australia's lithosphere

IMER's magnetotellurics (MT) expertise is also evidenced by our leading role in AusLAMP: the Australian Lithospheric Architecture Magnetotelluric Project.

AusLAMP is providing the first whole-country, 3D picture of the lithosphere—Earth's rigid upper plate—underneath Australia. It's informing deep, under-cover resources exploration, and providing valuable insight into our geological hazards and history.

Our researchers, working closely with the South Australian Government Geological Survey, have been responsible for all South Australian data stations, as well as some in New South Wales and Western Australia. The project launched in 2018 and is expected to be completed in 2023.

Extracting basins' deepest secrets

IMER researchers are studying mineral-rich basins to better understand:

- how fluids move in them
- how hydrocarbons are trapped in them
- the 'footprints' left by mineral deposits.

Critical Minerals for Australia 2030: ARC Centre of Excellence bid

The University of Adelaide, through IMER, is leading the Critical Minerals for Australia 2030 Centre of Excellence (CoE) bid. The bid involves a consortium of six leading Australian universities, partner organisations including Geoscience Australia, ANSTO Minerals and CSIRO Minerals, federal and state government agencies, and leaders across the critical minerals sector in Australia and overseas.

Anticipated industry benefits

The Critical Minerals CoE will help realise Australia's enormous potential to become a global leader in geopolitically secure critical minerals (CM) supply. In doing so, our nation will play a vital role in helping the world transition to a low-carbon society, with metal and non-metal CM being essential components in diverse advanced energy technology and defence applications.

Key areas of focus

We will address CM across the full mining value chain, including:

- fundamental geochemistry
- geological controls on deposit formation
- innovation in CM exploration
- identification of new, extractable resources within existing ores and wastes
- CM geometallurgy
- processing and purification challenges
- game-changing methodologies for CM concentration and recovery
- CM markets and economics
- human, social and environmental dimensions of CM exploitation
- researcher training and community engagement.

Further information

To learn more, or to join the Critical Minerals for Australia 2030 CoE bid, contact:

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Proposed Centre Director
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The University is partnering with Corning SA to conduct continuous-flow metal purification from real and mimicked asteroid materials, by means of solvent extraction; and with Space Tango and Alpha Space to explore in-space pharmaceutical manufacturing using space resources. For the latter, two experiments are currently* underway at the International Space Station—one inside and one out.

Using a combination of techniques, including tectonic geography, traditional geochemical tools, novel isotope proxies and modern sedimentary processes, the work is enabling significantly more accurate predictions of what resources might be found in unexplored basins.

Expanding understanding of South Australia's world-class IOCG deposits

IMER facilitated the University of Adelaide's lead role in the FOX project (2015-20), which investigated: the trace element geochemistry and mineralogy of iron oxides (hematite and magnetite); and what they can reveal about the formation and exploitation of iron-oxide-copper-gold (IOCG) orebodies, and other resources in which iron-oxides are major components.

Nanoscale characterisation and development of robust new isotope geochronometers have allowed valuable insights into these hitherto understudied minerals, and have broad potential in exploration, ore processing and the environmentally sustainable disposal of mine waste.

FOX was funded by BHP Olympic Dam and the Government of South Australia Mining and Petroleum Services Centre of Excellence.

Applied geoscience projects for Mount Isa Mines

IMER leads the Academics With Exploration: Studies Of Mount Isa and the Eastern Succession (A.W.E.S.O.M.E.S.) research group, which is conducting a series of industry-funded applied geoscience projects for Mount Isa Mines (MIM). The group's relevant research themes include:

- Exploration through cover—establishing innovative geochemical exploration techniques, including the use of a soil gas technique and biogeochemistry to generate new drill targets.
- Deposit-scale characterisation—conducting detailed geological, geochemical and geophysical modelling and structural studies of current ore bodies (Mount Isa copper and Ernest Henry IOCG) and advanced exploration targets to maximise near-mine and brown-fields exploration targeting.

Seven Sisters Consortium: lunar exploration mission

The University of Adelaide is partnering with Fleet Space Technologies in Australia's Seven Sisters consortium. Supporting NASA's Artemis Program, the consortium will send nanosatellites and exploration sensors to the Moon in 2023 to search for abundant, accessible water and resources. OZ Minerals, the University of NSW, Unearthed, Tyvak Australia and Fugro are also involved.

Anticipated industry benefits

The mission will develop and prove hardware and space systems to enable efficient off-Earth exploration. Linked student education and experience opportunities will also help to motivate and prepare the next generation of industry professionals.

Key areas of focus

Our involvement will centre around the development of large arrays of wireless sensors for remote heat-flow mapping.

We will also contribute to the Seven Sisters Explorers Program, providing Australian STEM students and graduates with the incredible opportunity to join the mission. 'Explorers' will take part in terrestrial geoscience missions, cutting-edge analysis and inspirational space engineering programs.

- District-scale ore systems—studying temporal and spatial variations in ore systems, and their implications for improved district and regional exploration targeting and ground evaluation.
- Production challenges—identifying key geological and metallurgical questions to overcome technical challenges across MIM's business units.

Leading off-Earth capability

IMER can connect you with the University of Adelaide's world-class expertise in sustainable off-Earth resource exploration, extraction and processing. Our significant strengths in the area include:

- in situ resource utilisation
- new materials and catalysts
- space engineering
- energy production, deep mining and mineral processing
- renewable, sustainable and future energy technologies
- mapping and interpreting planetary surfaces
- process intensification technologies, such as continuous micro-flow
- machine learning, artificial intelligence and robotic vision
- advanced optical sensing.

Correct at time of printing.

EXTRACTION

In addition to the smart-integration aspects of extraction discussed earlier, IMER is also building new minerals-recovery knowledge in other key areas to help the industry adapt and thrive.

Fracture and flow modelling for hard-rock in situ recovery

IMER's researchers have developed effective algorithms and methods to create a realistic fracture and flow model for hard-rock in situ reservoirs. This modelling enables miners to predict and plan:

- how fractures will behave
- how fluids will flow into and out of fractures and target mineral zones
- where to inject fluids and where to recover them
- how to avoid pumped-in chemicals leaking into the environment outside the ore body.

This innovation will ultimately enable the design of entire in situ recovery mine sites.

Chasing uranium and other non-target ore system components

Led by the University of Adelaide, through IMER, the Research Hub for Australian Copper-Uranium (2015-20) was established by the Australian Research Council to address the distribution of radionuclides (RN) in South Australian copper ores. Drawing on cross-disciplinary expertise at four Australian universities, the team:

- identified why removal of these non-target components from concentrates has proven so challenging in the past
- developed innovative approaches to measuring RN activity and concentration
- visualised RN distributions at different scales
- designed and optimised innovative, game-changing strategies for RN removal from concentrates
- engineered fibre-based liquid sensors for monitoring RN concentrations in chemically challenging environments, such as flotation cells and leach tanks.

The results, coupled with a fundamental understanding of RN behaviour in processing circuits and laboratory experiments to back up empirical data, will guide innovative methods of reducing RN activity in final concentrates, without losing valuable commodities. Different multi-stage hydrometallurgical treatments are currently being appraised, with bespoke treatment options based on activity, ore grade, feasibility and cost-effectiveness.

Copper for Tomorrow: Cooperative Research Centre bid

The University of Adelaide, through IMER, is partnering with the University of South Australia as the lead research organisations in the Copper for Tomorrow Cooperative Research Centre (CRC) bid. The CRC's objective is to help Australia meet the world's coming massive increase in copper demand to facilitate a global transition to renewable energy.

Anticipated industry benefits

The CRC will develop mining and processing solutions across the copper value chain to provide a step change in both the economics and sustainability of copper production.

Key areas of focus

We will make the leaps in innovation required to mine known lower-grade, complex copper ores using less energy and water, and producing less waste.

Further information

To learn more, or to join the Copper for Tomorrow CRC bid, contact:

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CRREI Deputy Director Professor Nigel Spooner has considerable rescue archaeology experience within the resources sector, dating culturally significant Indigenous Australian sites.

Radiation research, education and innovation

The University of Adelaide, through IMER, hosts and leads the Centre for Radiation Research, Education and Innovation (CRREI), a collaboration between industry, government, researchers and the community.

The centre's main goal is to improve the competitiveness, productivity and sustainability of Australian industries that deal with radiation-related issues, including the mining sector. Our contributed expertise includes:

- discovering new processes to remove non-target metals from copper concentrates, so that ores can be added to typical global pool smelter feeds
- ensuring new methods are scalable, cost-effective and robust enough to be suitable for operating plant conditions
- creating and applying highly sensitive radiation sensor technologies, including real-time process control optical fibre sensors and spatially resolved localisation of alpha-particle-emitting radionuclides
- radiation-related education and training for mining industry professionals to ensure a highly skilled workforce
- providing a high-throughput commercial radioanalytical facility meeting the needs of mining and mineral processing industries.

Globally significant deposits at Olympic Dam, Prominent Hill, Wirrda Well and Carrapateena are already benefiting from CRREI's work.

PROCESSING

IMER is also playing a leading role in advancing Australia's ability to sustainably add value to its mineral ore—and enjoy significant economic and employment gains as a result.

Heavy Industry Low-carbon Transition (HILT) Cooperative Research Centre bid

Through IMER, the University of Adelaide is a Core Partner in the proposed HILT Cooperative Research Centre (CRC), with IMER Deputy Director Professor Gus Nathan nominated as HILT Research Director.

Also involving many other leading organisations in the sector, including Alcoa, Boral, Fortescue and Adelaide Brighton Cement, the CRC will enable our heavy industry sector to compete in the low-carbon global economy for carbon-neutral materials, such as:

- 'green' iron
- alumina
- cement
- other processed minerals.

HILT's focus will be on developing technologies and methods that overcome barriers to the low-carbon transition, including the unacceptable risks of untested innovations that could jeopardise equipment, production and/or worker safety.

Australian Research Council (ARC) Graphene Enabled Industry Transformation Hub

Again through IMER, the University of Adelaide administers the ARC Graphene Enabled Industry Transformation Hub, a major partnership between universities and industry partners to develop a sustainable graphene-based industry in Australia.

Our researchers have outstanding knowledge in graphene production and functionalisation, and have contributed strongly to the hub's growing IP portfolio. Now including six patents (PCT stage), five licensing technologies, and a broad range of new products and devices under development (technical readiness TRL 3-4), this output spans conductive inks, protective coatings, advanced environmental remediation, sensors and energy storage.

Several technologies have been licensed to industry partners, with one industry partner (Spark Technologies) recently listing on the ASX.

EnviroCopper Cooperative Research Centre Project (CRC-P)

IMER is part of the EnviroCopper CRC-P, assessing the potential to recover stranded mineral deposits in the historic Kapunda, South Australia copper-gold mine area using minimally invasive mining. The team also includes Environmental Copper Recovery, Thor Mining, Terramin Exploration, Mining3 and the CSIRO.

Anticipated industry benefits

By creating a 3D hydrogeological model of the site, the CRC-P team is devising an innovative new approach for environmentally low-impact in situ recovery of copper and gold, likely to generate strong social licence. Once demonstrated, the approach could be extended to similar deposits around Australia and the world.

Key areas of focus

IMER's contributed expertise includes:

- geomechanical and geological modelling
- geophysical site characterisation.

TRANSPORT AND INFRASTRUCTURE

When it comes to site construction, function and security, IMER can put you in touch with some of the most innovative and in-demand experts in the nation—from structural resilience and vehicle safety, to ICT stability.

Addressing acid mine drainage

Coordinated through IMER, University of Adelaide chemical and structural engineers are working to help the mining industry predict and avoid the effects of acid mine drainage.

A particularly informative project we conducted recently was for Newcrest Mining, modelling the rate and behaviour of pyrite oxidation, the driving force behind not only acid mine drainage, but also spontaneous combustion in stockpiles.

Designing and monitoring better tailings dams

Our researchers are working with mining software and hardware company Maptek to integrate numerical modelling into their laser monitoring tool for tailings dams, an innovation that will facilitate improved dam design and security.

Enabling safer transport

IMER can connect you with the University of Adelaide's world-class Centre for Automotive Safety Research (CASR). CASR has significant experience working with the resources sector, including for Santos and BHP. They're able to provide expert guidance on:

- vehicle fleet safety
- after-market vehicle modifications
- floor pan protection and foreign object penetration testing
- strategic approaches to private road network management and maintenance
- crash investigation training
- general road safety.

Enhancing, stabilising and securing digital networks

The University of Adelaide's expertise in cyber security and network stability is nationally and internationally recognised. We regularly collaborate with industry leaders, such as Intel, AMD and OpenSSL, and work closely with Australian defence agencies, including the Defence Science and Technology (DST) group and Australian Signals Directorate.

Accessing this pool of talent, IMER can help you:

- design and improve state-of-the-art telecommunications systems, such as mobile ad-hoc networks, through traffic and other performance analyses
- enhance stability in your telecommunications and other complex networked systems
- conduct advanced systems modelling, measurement and analysis, including for complex systems with multiple interacting components

- efficiently collect, use and protect commercially sensitive or confidential data
- ensure the security of critical services in the absence of operating-system control, and under device constraints
- identify the source(s) of any data leaks.

Bygen: improving access to high-quality activated carbon

Activated carbon is a valuable resource for the mining sector, playing an important role in site air and water purification, as well as precious metal refining and gold extraction.

IMER can connect you with the University of Adelaide's significant expertise in this area through start-up company Bygen Pty Ltd. A spin-out from the University's Chemical Engineering department founded in collaboration with research commercialisation incubator Innovyz, Bygen has developed revolutionary new technology for the sustainable production of high-quality activated carbon.

Their innovative approach requires significantly less energy and infrastructure than legacy methods, and is powered by cheap and abundant agricultural waste, rather than the traditional coal, hardwood or coconut husk.

Advanced and functional construction materials

Research at the University of Adelaide, led by Dr Han Fang, is exploring the development and use of: advanced and functional construction materials, including high-strength steel, ultra-high-performance concrete, geopolymer concrete, shape memory alloys and conductive concrete; and sustainable, self-sensing and resilient structures.

Anticipated industry benefits

For the mining industry, Dr Fang's work will enable the construction of infrastructure that is less vulnerable to corrosion and requires less maintenance—delivering fewer operational interruptions and significant cost savings.

Her work has already led to industry research and development in the use of functional materials for the monitoring and control of offshore oil and gas infrastructures.

Key areas of focus

- Sustainable and flexibly formed high-strength-steel polygonal structures.
- Constitutive models for predicting advanced and functional materials' mechanical, thermal or coupled properties.
- Advanced and functional material life cycle performance prediction.
- Structural adaptability to climate change.

MOVING INDUSTRY FORWARD

The University of Adelaide is a member of the Canberra-based national Cyber Security Cooperative Research Centre (CRC). Our Professor Ali Babar leads the CRC's Platform and Architecture for Cyber Security as a Service research theme.

ECONOMIC AND MARKET ANALYSIS

IMER can connect you with the University of Adelaide's outstanding pool of economic expertise. However large or small the venture, however complex the issues you face, we can help you move forward with a sound strategy and commercial confidence.

Vast mining industry experience

The University's economists have conducted numerous analyses and appraisals of various mining industry organisations, projects and policy decisions, to assess their actual or likely:

- gross economic contribution
- employment creation and skills requirements
- growth opportunities and constraints
- value-added production impacts
- energy sector modelling
- domestic and international energy market analysis
- whole economy modelling (computerised general equilibrium), including greenhouse gas emissions and hydrogen production
- environmental and social impact assessments
- analysis of the national and industry-sector implications of changes in global trade policy (including border carbon adjustment).

Some of our current and past projects include:

- Hydrogen 2050: Four exploratory scenarios for Australia (in progress, prepared as part of the Future Fuels CRC)
- Advancing Hydrogen: Learning from 19 plans to advance hydrogen from across the globe (2020, prepared as part of the Future Fuels CRC)
- Economic Impact of Olympic Dam Operations and Sustainment Investment Activities in South Australia (2017, prepared for BHP)

The University has conducted a number of studies into innovation, science and technology, and has developed a framework for understanding innovation's role and process. Informing this work, one of our team previously served as the UK representative to the OECD Innovation and Technology Working Group.

- Economic Impact of Metal Ores and Coal Production on the South Australian Economy, (2014, prepared for the SA Chamber of Mines and Energy)
- Gross Economic Impact of the Proposed Angas Zinc Mine on the Strathalbyn Economy (2006)
- Skills and HR Audit: Heavy Industry Sector of the Upper Spencer Gulf Region (2005, report prepared for Global Maintenance Upper Spencer Gulf).

Valuable government insight

We also have considerable experience working with government in the minerals sector, providing critical complementary insight. Some recent project examples include:

- Potential Economic Contribution of South Australia's Energy and Mining Sectors (2020, SA Department for Energy and Mining)
- Future Grid Cluster: Economic and Investment Models for Future Grids (2013-17, CSIRO Flagship Collaborative Research Program Cluster)

- Economic Modelling Platform for Domestic Energy Markets (2013, Department of Industry, Science, Energy and Resources)
- Impacts on Eyre Peninsula Councils of the Mining Sector (2013, SA Local Government Authority)
- Social Assessment Framework for the Resources Sector (2012, SA Department for Manufacturing, Innovation, Trade, Resources and Energy).

Statistical modelling and assessment tools

In addition to major project work, we're experienced in developing statistical models and assessment tools for various operational purposes, including:

- quantifying hydrogen's potential impact in achieving greenhouse gas emission reduction targets
- policy analysis
- program administration
- performance monitoring.

LEGAL EXPERTISE

IMER provides access to the University's significant talent in contract law, mining and energy law, and international energy law. To determine where you're going, it's always wise to know where you stand.

Research in mining and petroleum law

Our research in mining and petroleum law is focused on the industries' environmental regulation. Areas of particular interest include:

- examination of international environmental standards
- the development of bilateral and regional principles to harmonise civil liability and compensation regimes.

Research in energy and natural resources law

Our research here includes renewable energy law, petroleum regulation and environmental law, and has focused on overcoming legal barriers to the development of renewable energy. Work of note includes:

- examining the general instruments required to encourage renewable energy generation in Australia
- conducting critical analyses of the states' planning systems in relation to off- and onshore wind energy.
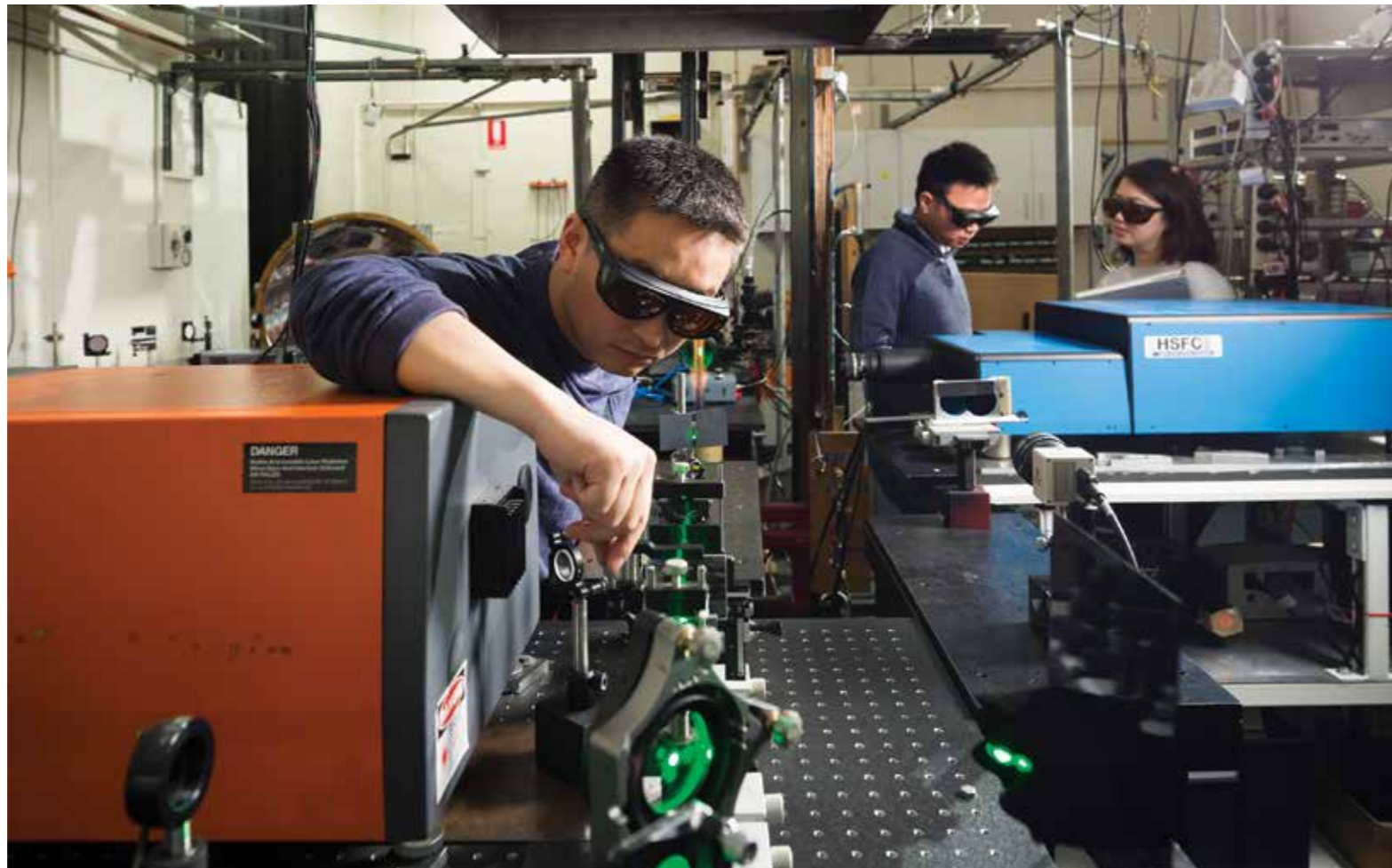
ARC Training Centre for Integrated Operations for Complex Resources

The University of Adelaide, through IMER, hosts and manages the ARC Training Centre for Integrated Operations for Complex Resources (IOCR). The IOCR centre works with a number of industry partners to guide and support the innovative research being undertaken at our University, the University of South Australia and Curtin University.

Anticipated industry benefits

The centre is delivering vital tools to enable the widespread adoption of automated, integrated and optimised mining. This includes:

- advanced sensing
- data analytics and integration
- artificial intelligence.

By bringing together end-users, translation partners and researchers, we're driving productivity in mining, growing competitiveness in the METS sector, and building skills and capacity for end-user-focused research.

Key areas of focus

- In-house training and industry context for the PhD scholars.
- Producing future leaders in advanced sensors and data analytics for complex resources.
- Contributing to world-leading research that will transform end-user mining operations.
- Translating research outcomes for industry-ready application.

Further information

To learn more, or to join the IOCR centre as an industry partner, contact:

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Director, ARC Training Centre for Integrated Operations for Complex Resources

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t: +61 (0)8 8313 4543

TRAINING AND EDUCATION

World-leading undergraduate and postgraduate degrees. Management and leadership courses. Specialist undercover exploration training. IMER puts the University of Adelaide's peerless suite of educational offerings at your disposal—and workforce-wide professional development within reach.

One world-top-10 subject ranking

- Mineral and Mining Engineering*

Another 6 mining-relevant world-top-50 rankings

- Automation and Control*
- Civil Engineering*
- Computer Science and Engineering*
- Electrical and Electronic Engineering*
- Petroleum Engineering†
- Water Resources*

10 more in the world top 100

- Accounting and Finance^
- Anthropology^
- Chemical Engineering^
- Earth Sciences*
- Energy Science and Engineering*
- Environmental Studies^
- Geology^
- Geophysics^
- Instruments Science and Technology*
- Mathematics^
- Mechanical Engineering*

Academic Ranking of World Universities, 2020
^QS World University Rankings, 2020
†QS World University Rankings, 2021

One of Australia's leading MBAs

The University of Adelaide's highly regarded Adelaide MBA has been rated second of all business school MBAs in the nation, according to the 2019 Australian Financial Review BOSS MBA Rankings. It also has a 5-star ranking from the Graduate Management Association of Australia (2017), Australia's peak body for MBAs.

Multiple international accreditations

Association to Advance Collegiate Schools of Business (AACSB) accreditation

AACSB accreditation is the largest and most recognised specialised accreditation worldwide for undergraduate and postgraduate business programs. AACSB-accredited schools must pass and maintain rigorous quality standards, and have been proven to provide the best in business education worldwide. Less than 5% of business educators globally have achieved this recognition.

Accreditation Council for Entrepreneurial and Engaged Universities (ACEEU) accreditation

Adelaide is the only university in the world to receive dual ACEEU accreditation as being both an Entrepreneurial and an Engaged University**. Additionally, in 2019 we are ranked as Australia's number one university for entrepreneurship education and engagement (Maritz, 2019).

Supporting this standing, we have the longest operating Australian business incubator, ThincLab, and the longest running and most successful entrepreneurship pre-accelerator program, the Australian eChallenge.

*** Correct at time of printing.*

UN Principles for Responsible Management Education (PRME)

The University of Adelaide is a proud Advanced Signatory to the United nations' PRME program. Founded in 2007, PRME aims to raise the profile of sustainability in schools around the world and equip today's business students with the understanding and ability to deliver change tomorrow.

Transformative short courses and executive education

The University of Adelaide delivers an impressive suite of professional and personal development short courses that are practical, work-ready and goals-focused. As professional training experts, we can also meet your team's specific needs with highly customised courses—delivered at your premises or ours. Our extensive range of offerings spans:

- leadership
- strategic and design thinking
- business management
- career and wellbeing
- communication and writing
- customer experience
- digital media and marketing
- presentation skills.

NExUS: National Exploration Undercover School

The University of Adelaide, though IMER, proudly administers NExUS, Australia's prestigious summer school for the next generation of exploration geologists.

Spanning three weeks, this truly world-class intensive training program is available to both existing professionals in the sector, and undergraduate and postgraduate students from any Australian university.

NExUS is funded by the Minerals Council of Australia (MCA) Minerals Tertiary Education Council (MTEC) and supported by industry, government geoscience institutions and academia. For more information, contact:

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GENDER EQUITY

IMER, and the University of Adelaide more broadly, proudly supports women's involvement and advancement in the mining sector.

Contributing to educational scholarships

Through the Unlocking Complex Resources through Lean Processing PRIF Consortium, IMER is helping to fund 'Women in Mining Technology' scholarships at the University of Adelaide and the University of South Australia.

The scholarships are designed to grow the number of talented female students in engineering and technology, and support female students in the completion of their educational goals.

Selected students work together with high-profile academics, postdoctoral research fellows and higher-degree-by-research candidates to address current challenges in the mining industry.

Sponsoring industry events

IMER, through the Unlocking Complex Resources through Lean Processing PRIF Consortium and ARC Training Centre for Integrated Operations for Complex Resources, sponsored the AusIMM International Women's Day Lunch celebrating women in mining.

Held on 9 March 2021 at the Hilton Hotel, Adelaide, the event attracted hundreds of guests.

IMER Deputy Director and Head of the Australian School of Petroleum Dr Kathryn Amos was a state winner and national finalist in the 2020 Dyno Nobel Exceptional Woman in Australian Resources award.

Women in STEM Careers Program

The University's Women in STEM Careers Program provides valuable professional development opportunities for young women studying in areas related to science, technology, engineering or mathematics (STEM). It's also complemented by our Women in STEM Society, which provides a friendly, supportive social network for women and other minority groups working and studying in STEM fields.

Women's Professional Development Network

Supporting women across all professional disciplines, our Women's Professional Development Network is a 'grassroots' professional and personal development group. Participants are predominantly University staff, but membership's open to the entire community. The network conducts events and activities to promote leadership, personal job satisfaction, a positive work attitude and career advancement.

OUR INDUSTRY PARTNERS AND COLLABORATORS

KAURNA ACKNOWLEDGEMENT

We acknowledge and pay our respects to the Kaurna people, the original custodians of the Adelaide Plains and the land on which the University of Adelaide's campuses at North Terrace, Waite, and Roseworthy are built. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs. The University continues to develop respectful and reciprocal relationships with all Indigenous peoples in Australia, and with other Indigenous peoples throughout the world.

FOR FURTHER ENQUIRIES

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