

# **MinEx CRC Annual Report**

1 July 2019–30 June 2020

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## 3. Written Annual Report

### 3.1. Executive Summary

The second year of operations of MinEx CRC has been successful and extremely productive, despite the ongoing challenges of the Covid-19 pandemic.

MinEx is now halfway through Phase 1 of the first of three, 3-year research phases of a 10-year funding agreement. In 2019-20, MinEx CRC met all eight Commonwealth milestones and 137 of its 139 quarterly milestones. The nine principle projects are all progressing exceptionally well, with an additional four projects added during the past year, at the request of industry partners, to augment our existing research projects. These new projects are a result of an additional \$1.58M committed to research by the MinEx CRC Opportunity Fund following recommendations by the MinEx CRC Science Advisory Committee to the Board, and an additional \$2.12M of cash and in-kind contributions from MinEx CRC Participants.

MinEx CRC continues to have stable and diverse Board, governance and staff, and continues with a robust balance sheet. Seventy-five researchers are currently undertaking research. Ongoing and meaningful collaboration between the Participant research institutes, government survey organisations (GSOs), mining companies and Mining Equipment and Technology Services (METS) companies has also continued. Whilst there was one Participant who withdrew during the reporting period, there was a net gain of three Affiliates, with 39 participants at year-end.

MinEx CRC is on target to achieve its Education and Training outputs, with 16 PhD and four MSc students currently enrolled, on track to the 50 planned HDR completions. Publications from our research projects have commenced. No commercialising activities have been undertaken to date but MinEx CRC currently holds nine patent families, three design families and three trademark registrations.

Research in the past year has included substantial laboratory work as well as field trials and deployments on various test sites, exploration locations and at mine sites across Australia. A MinEx CRC researcher was also the recipient of a University award.

Communications have been strongly emphasised in the past year. Communication highlights included the first MinEx CRC Annual Conference with 175 delegates, and a Project Integration Workshop with 66 attendees. Eleven videos were published on MinEx CRC TV, 122 press articles generated, with ~6,000 visitors and ~31,000 page views on the MinEx CRC website.

Research is ongoing, and continued support from our Participants and the Federal Government will see MinEx CRC not only achieve but exceed its ambitious program goals, including research, education and ultimately commercialisation.

Andrew Bailey

**Chief Executive Officer  
MinEx CRC**

## 3.2. Achievements

The following summarises key achievements of MinEx CRC in the year 1 July 2019 — 30 June 2020.

### Work Health and Safety:

- There were no reportable incidents on MinEx CRC Projects during the reporting period.

### Head Office and Staff

- Caroline Tiddy (University of South Australia), Education and Training Program Coordinator was nominated for a Women in Innovation Award, September 2019.
- Masood Mostofi (Curtin University) Project 1 Leader and the Curtin Drilling Mechanics Team were recipients of the 2019 Emerging Research Team Award, June 2020.
- Monique Stagg (University of South Australia) was appointed in July 2019 as an Administration Officer (Part Time).
- MinEx CRC continues to base its WA Head Office at the Australian Resources Research Centre, a joint facility shared by CSIRO, Curtin University, Natural Resources and Energy Australia, University of WA, National Geosequestrian Laboratory and the Pawsey Supercomputer Centre.
- The South Australian based headquarters of MinEx CRC is at the Future Industries Institute, University of South Australia.

### Participants and Affiliates

- MinEx CRC currently has 17 Major Mining, Mining Equipment and Technology Services (METS) and Geological Survey Participants.
- MinEx CRC currently has 7 Research Participants and 15 Affiliates.

### Education and Training

- As of 30 June 2020, MinEx CRC had 16 PhD, and 4 MSc students enrolled.
- Version 2 of the Postgraduate Booklet has been published.

### Research Management

- Project 20: Hydraulic Drilling Fluid Processing System (HPS) lead by Shane Fox (University of South Australia) commenced in November 2019.
- Project 20.1: Centrifuge Optimisation for Fluid Management in Coiled Tubing drilling lead by Masood Mostofi (Curtin University) commenced in January 2020.
- Project 20.2: Hydraulic Drilling Fluid Processing System Accelerator and Fines Sampling Research lead by Ben Van der Hoek (University of South Australia) commenced in January 2020.

### Research Highlights

- The first field trials of the iDrill drill rig recording system in Q4 2019 in collaboration with MinEx CRC Participant McKay Drilling at an operational drill site in the Pilbara iron-ore province of Western Australia.
- The Dynamic Loop experimental facility at Curtin University was commissioned in Q2 2020 and conducted the first series of experiments to test our online fluid monitoring system and automated dosing system.
- The Project 2 team modified their research schedule to bring forward project milestones aimed at achieving 1000m reach. Engineering calculations have been completed for the 1000m capable CT Rig, based on the modification of the existing RoXplorer® platform to carry and drill with 1000m of coiled tubing.

- Design completed of a Selective Interval Coring System for Coiled Tubing (CT) drilling based on a modified core barrel (provided in-kind by project Participant Epiroc) in combination with a MinEX CRC downhole motor.
- A downhole positioning module provided in-kind by MinEx CRC Participant Wassara has been electronically integrated into the beta-version of the MinEx CRC smart bottom hole assembly.
- Advanced stage of design of the hydraulic processing system for CT drilling with the build expected to commence in Q4 2020 in advance of field trials in Q1 2021.
- Significant progress in the design and laboratory testing of our downhole laser-induced breakdown spectrometer (LIBS) prototype during the reporting period. Experiments focused on the effect of drilling fluids on the LIBS spectrum and the efficiency of optical transmission through drilling fluids.
- A sensor development pathway has been finalised for downhole logging-while-drilling tools – confirming that our priority will be to complete field trials of a total count gamma (TCG) tool by the end of 2021. We designed and built our prototype slim line TCG sensor and completed a series of preliminary tests incorporating newly developed baseline code for real-time data processing and display.
- Conducted field deployments of optic fibre distributed acoustic sensing for seismic acquisition at a Queensland coal mine operated by MinEx CRC Participant Anglo-American (including borehole seismic acquisition) and over the hyper-saline Lake Carey in Western Australia, in collaboration with MinEx CRC Participant HiSeis and Affiliate Matsa Resources.
- Proof-of-concept codes that automate the conversion of digital geological maps into 3D geological models developed. In collaboration with MinEx CRC Participant MRIWA, we used the new codes to build a 3D model of the entire Hamersley Basin by stitching together twenty-four models built from Geological Survey of Western Australia (GSWA) maps and constrained by the GSWA drilling database.
- Web portal built to allow the mineral exploration community to easily access, visualise, analyse and share exploration data collected during the National Drilling Initiative (NDI). The portal can be accessed via the MinEx CRC webpage ([minexcrc.com.au](http://minexcrc.com.au)) to deliver NDI data in an efficient and accessible manner to the widest possible audience.
- Pre-drilling research in the East Tennant NDI campaign identified a large volume of pre-1850Ma metasedimentary rocks intruded by a bimodal igneous suite at ~1850Ma with deformation and IOCG-style alteration continuing to ~1845Ma. These rocks are of comparable age and event history to the host rocks of IOCG mineralization in the Tennant Creek Inlier providing evidence that the mineralized rocks continue undercover into the NDI campaign area.
- Pre-drilling mineral systems analysis and prospectivity mapping over the East Tennant NDI campaign area using both knowledge-driven (weights-of-evidence) and data-driven (machine learning) approaches completed. The prospectivity mapping was used to help prioritise drill targets for the East Tennant NDI campaign.

### **Communications**

- MinEx CRC's first Annual Conference: Frontier Exploration. Events were held over the period 12-14 November 2019 in Perth, WA. 175 delegates attended the conference (66 % from industry/end-user organisations and 34 % from research organisations). 85% of Participant organisations and 52% of Affiliate organisations were represented.
- Project Integration Workshop held 29 April 2020 with 66 attendees.
- Eleven videos published on MinEx CRC TV.
- 122 press articles generated.
- ~6,000 visitors and ~31,000 page views.

### 3.3. Risks & Impediments

MinEx CRC recognizes that it operates in an uncertain environment in which identification and management of risk and mitigation of impediments are essential to our success. Risk management has been built into MinEx CRC structures and reporting requirements from project to Board level. The Board Audit and Risk Committee provides oversight on risks that may impact MinEx CRC's ability to achieve our vision.

Covid-19 has undoubtedly been the top risk to MinEx CRC in the past year, but to date, the effect on MinEx CRC has been relatively minor. Risk registers have been reviewed to ensure that Covid-19 is adequately addressed.

Specific steps to address the Covid-19 risks have included:

- Ensuring the safety of staff, including predominantly working from home and emphasis on available help, together with the MinEx CRC Employee Assistance Program.
- Research partners follow safety and working guidelines from their respective institutions.
- Budget re-forecasts to account for reduced travel spend in the past year, and some outsourcing of specific tasks, as well as the possibility of more intense fieldwork in 2021.
- Social distancing has resulted in reduced laboratory efficiency and increased administrative processes to ensure a continued safe operating environment.
- Numerous students are at moderately high risk due to fieldwork and sampling restrictions.
- Some project milestones have been altered, but there is no material risk to Project or Commonwealth milestones.

The top 10 areas of risk that may impact on the achievement of outputs or ability to achieve outcomes in MinEx CRC are summarised below. The strategies adopted to address the risks are listed as controls which are in place and mitigating factors which exist.

RISK AREA	RISK ISSUES	CONTROLS IN PLACE	MITIGATING FACTORS
<b>CAPABILITY</b>	<b>Crisis Management</b> Business Continuity and crisis management. Failure to develop and implement suitable strategies including management of Covid19 risks	* Risk Register process and Management controls * Approved Crisis Communications plan	* Experienced Board and Management Team * Initial Crisis Management Plan
<b>MARKETS</b>	<b>Public Image</b> Damage to Public Image or reputation	* Monitor ongoing compliance with legal and contractual requirements * Communications Strategy * Key Management focus	* Experienced Board * Crisis Management Plan
<b>RESEARCH</b>	<b>Failure to Execute NDI Drilling</b> a) Lack of required drilling equipment, including Coil Tube Drill accessibility b) Community and Land access issues c) Drilling Program Failure d) Integration of the Drilling Campaign with the Research Projects	* Drill equipment and CT long-lead items in the current workflow * Proactive approach adopted for ground access * Expert drilling advice being utilised * Structure and process in place to maximise integration	* Experienced personnel and learnings between states. * Process has commenced promptly and regularly monitored

<b>MARKETS</b>	<b>Loss of CRC Contributions from:</b> a) CRC Department b) Industry, Research and other Participants	* Maintain strong relationships with all parties * Continue to report progress to Stakeholders * 35% of Participant funds payable in years 1 & 2	* Spread of Contributions from Participants * Rare for CRC funds to be reduced
<b>RESEARCH</b>	<b>Research Outcomes not Achieved</b> Research staff are not capable of achieving project outcomes, including due to Covid-19 restrictions	* Regular monitoring of research project outcomes and staff performance	* Track record of staff achieving research outcomes, * Modification of Milestones and work practices
<b>CAPABILITY</b>	<b>OHSE Performance</b> Failure to develop policies and achieve satisfactory OHSE performance and comply with legal obligations	* OHSE Policy and reporting regime in place * Detailed OHSE Risk Assessment completed for 2020 NDI drilling campaigns	* Apart from Drilling Campaigns most CRC activities are relatively low risk
<b>FINANCE &amp; COMPLIANCE</b>	<b>Cash Management and Fraud</b> a) Loss of funds or income due to fraud c) Loss of funds or income due to poor debtor management b) Loss of funds or income due to low investment returns	* Best practice fraud prevention in place * Low-risk investment policy * Rigorous debtor management and small number of Debtors & Invoices	* Spread of funds across accounts & low-risk Banks * Conservative investment policy
<b>FINANCE &amp; COMPLIANCE</b>	<b>Head Office Budget</b> Insufficient funds to meet necessary Head Office budget expenses	* Regular monitoring of CRC Life of Centre budget* Ongoing monitoring of expenses to maximise the potential for savings	* Potential to earn interest income and fees to offset the shortfall * Potential to reduce expenditure in latter years of the CRC
<b>RESEARCH</b>	<b>Research Portfolio Failure to:</b> a) Meet industry requirements b) Maximise outcomes from Opportunity Fund	* Project agreements with Milestones & budgets * Ongoing Project reporting & tracking * Project review panels include Participants	Diversification of research portfolio across sectors, researchers and Participants
<b>CAPABILITY</b>	<b>Education Program</b> Unsatisfactory implementation of the Education Program, failure to achieve objectives and milestones Impact of Covid-19 on students and international travel	* Objectives and milestones are monitored – ongoing * Education Committee in place with approved strategy, business plan and action items * Monitoring of high-risk students	* Successful commencement in implementing an Education program

### 3.4. Performance against activities

MinEx CRC is addressing the industry problem of the threat of declining mineral discovery in Australia through new technologies of drilling and data, and the application of technologies in field operations. More specifically, MinEx CRC is committed to delivering outcomes of:

- new technologies for improving the efficiency and productivity of mineral exploration drilling, including a next-generation Coiled Tube drill rig with extended depth range, steering capability and sample quality comparable with diamond drilling;
- new technologies for acquisition of geochemical and geophysical data while drilling and incorporation of those data into automated, constantly updating 3D models, and;
- a \$20M drilling program (the NDI) to deliver an unprecedented density of samples and data from as yet unexplored regions of Australia and provide a testbed for novel drilling, sampling and analytical technologies.

During our first full year of operations, MinEx CRC commenced nine principal projects and committed to a series of drilling campaigns to deliver the three goals listed above. The second full year of MinEx CRC operations saw the nine principle projects all progressing exceptionally well, with the research outcomes achieved to date outlined in section 3.5. In addition, four new projects were added at the request of industry partners.

Preparation for our drilling campaigns in the East Tennant and South Nicholson areas of the Northern Territory was near complete and at the end of the reporting period, and we were awaiting final clearances for field operations to commence, notwithstanding Covid-19 restrictions.

The MinEx CRC goals are encapsulated in the Commonwealth Milestones and underlying quarterly milestones. All eight Commonwealth and 137 of the 139 quarterly milestones were met. All individual projects are monitored by industry-chaired project review panels (PRP's) and, in all 36 PRP meetings covering the nine principle projects, the respective chairs of the meetings were satisfied that the projects being reviewed met the criteria set.

In our opening two years of operation, MinEx CRC research has been focused on the lower stages of technology readiness level with no commercialisation yet undertaken. Patent investigations in two distinct fields of research have commenced, indicating that our industry partners, including the high-value Mining Equipment, Technology and Services (METS) sector will ultimately benefit through commercialisation of this valuable and ongoing research.



*MinEx CRC Project 20 Leader Shane Fox (left) and Program 1 Leader Soren Soe (right).*



## 3.5. Research

MinEx CRC continued its nine Phase 1 research projects and commenced four new projects during the financial year 2019-2020. Phase 1 is the first of three, 3-year research phases. The four new projects commenced are resourced by a combination of cash from the MinEx CRC Opportunity Fund and cash and in-kind contributions from MinEx CRC Participants. Three projects are aligned with Phase 1, Project 2 (vis Projects 20, 20.1 and 20.2) with the aim of improving fluid and sample management for Coiled Tubing (CT) drilling and bringing forward development of an integrated Hydraulic Processing System (HPS) to enable field deployment of the CT drilling platform.

All eight Commonwealth Milestones due in the reporting period were met. For the past year, 70 quarterly milestones were created to monitor progress in our original nine research projects. Fourteen existing quarterly milestones were made redundant and replaced by these new milestones. An additional 38 quarterly milestones were created as part of project agreements for Projects 20, 20.1 and 20.2 which commenced during the reporting period, as detailed further in section 3.5.

On 30 June 2020 MinEx CRC achieved 137 of the 139 revised quarterly project milestones due. MinEx CRC achieved one milestone before the due date and were ahead of schedule on a further 19 milestones. All ten (of 37 then due) milestones that were behind schedule on 30 June 2019 (close of the previous reported period) were achieved in the second half of 2019. The two milestones that were behind schedule at 30 June, were 90% and 80% complete respectively and both due for completion in Q3 2020. Cumulative progress against all Phase 1 project milestones was 56.5% compared to a target of 49.4%.

A measure of research outcomes is a comparison to the MinEx CRC Commonwealth and Project Milestones, which have been detailed below. The key research outcomes for each project are detailed after this.

### Commonwealth Milestones

There were eight research performance Commonwealth Milestones due in the reporting period. All milestones have been met, and reports have been made available to Participants on the MinEx CRC SharePoint site, as follows:

RP1.1.1 Due on 31 December 2019: Complete state-of-the-art review and road map of drilling optimisation and automation.

Richard, T., and Mostofi, M. (2020). Drilling optimization and automation road map. Commonwealth Milestone Report, Project 1: Drilling Optimisation and Automation. MinEx CRC Report 2020/012, 51p. (Submitted January 2020)

RP1.2.1 Due on 31 December 2019: Delivered scoping study on technologies to enable hardrock Coiled Tubing drilling to 1000m, including sample integrity, positioning and steering systems and engineering for extended reach.

van der Hoek, B., Fox, S., Addinell, S., Chen, G., Chang, H. and Soe, S. (2020). Scoping study on technologies to enable hardrock Coiled Tubing drilling to 1000m, including sample integrity, positioning and steering systems and engineering for extended reach. Commonwealth Milestone Report, Project 2: Coiled Tubing Drilling for Definition of Mineral Deposits. MinEx CRC Report 2020/70, 156p. (February 2020).

RP2.2.1 Due on 31 December 2019: Delivered state-of-the-art review of potential geosteering techniques and road map for delivering appropriate tools within the timeframe of MinEx CRC.

Harris, B., Carson, M., Nguyen, H. and Pethick, A. (2020) State-of-the-art review of potential geosteering techniques and road map for delivering appropriate tools within the timeframe of MinEx CRC. Commonwealth Milestone Report, Project 4: Petrophysics for Mineral Discovery During Drilling. MinEx CRC Report 2020/08, 17p. (February 2020).

RP2.3.1 Due on 31 December 2019: 3D virtual mine (based on existing mine site) as the framework for prediction of seismic response, optimal survey design, processing and imaging workflows completed.

Bona, A. and Pevzner, R. (2020). 3D virtual mine (based on existing mine site) as the framework for prediction of seismic response, optimal survey design, processing and imaging workflows. Commonwealth Milestone Report, Project 5: Seismic in the Drilling Workflow. MinEx CRC Report 2020/11, 14p. (February 2020)

RP2.3.1 Due on 31 December 2019: Design completed for real-time 3D geological modelling workflow.

Jessell, M., Lindsay, M. and Giraud, J. (2020) Design completed for real-time 3D geological modelling workflow. Commonwealth Milestone Report, Project 6: Automated 3D Geological Modelling. MinEx CRC Report 2020/69, 54p. (January 2020)

RP3.1.1 Due on 31 December 2019: Design specifications and work plan for drilling data management and delivery platform compatible with the state, territory and national systems completed.

Thomas, M. and van der Wielen, S. (2019). Design specifications and work plan for drilling data management and delivery platform compatible with state, territory and national systems. Commonwealth Milestone Report, Project 7: Maximising the Value of Data and Drilling Through Cover. MinEx CRC Report 2020/71, 11p. (October 2019)

RP3.2.1 Due on 31 December 2019: Define workflows, protocols and standards for NDI data acquisition, storage, sharing, reporting and delivery completed.

Morrissey, L. and Roach, I. (2019). Define workflows, protocols and standards for NDI data acquisition, storage, sharing, reporting and delivery. Commonwealth Milestone Report, Project 8: Geological Architecture and Evolution. MinEx CRC Report 2019/68, 17p. (November 2019)

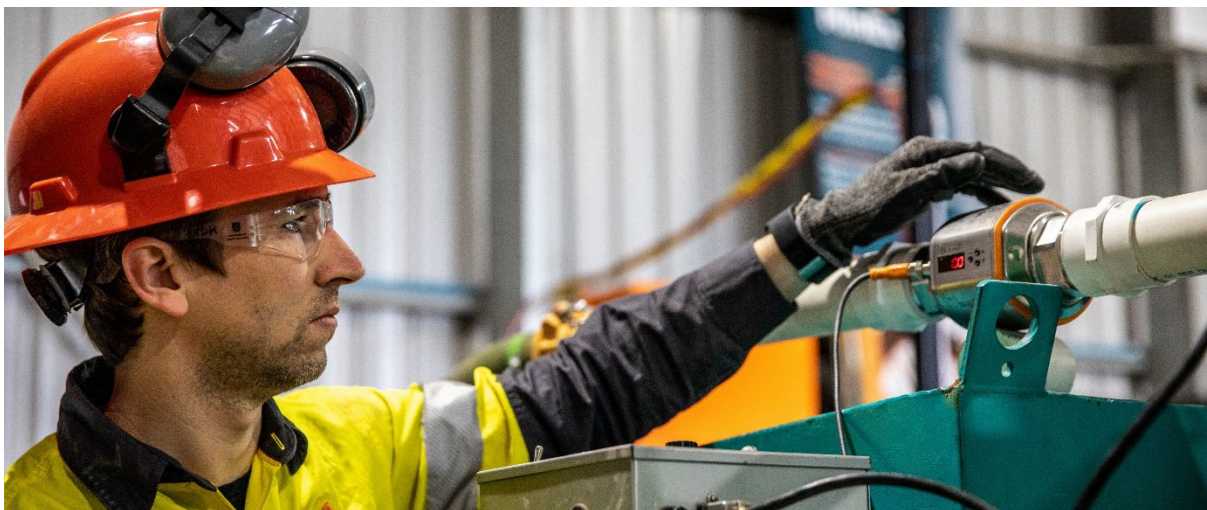
RP3.3.1 Due on 30 June 2020: State-of-the-Art review of mineral prospectivity assessment techniques completed. Defined workflows for Mineral Systems Analysis in Phase I NDI case study areas and recommended additional sampling and analytical techniques if required completed.

Otto, A., Metelka, V., Cole, D., Talebi, H., Haynes, M., Spinks, S., McGee, L. and Hong, W. (2020). State-of-the-art review of mineral prospectivity assessment techniques. Commonwealth Milestone Report, Project 9: Targeting Mineral Systems in Covered Terranes. MinEx CRC Report 2020/21, 22p. (July 2020)

## **Project Milestones**

At the close of 2019, All research projects were reviewed in consultation with Participants, and updated project milestones were approved by the relevant Project Review Panels (PRPs). Seventy new quarterly milestones were created to monitor progress in our original nine research projects during the calendar year 2020. Fourteen existing quarterly milestones were made redundant and replaced by these new milestones. An additional 38 quarterly milestones were created as part of project agreements for Projects 20, 20.1 and 20.2, which commenced during the reporting period

As of 30 June 2020, we had achieved 137 of the 139 revised quarterly project milestones that were due (Table 1). One milestone was achieved before the due date and were ahead of schedule on a further 19 milestones. All ten (of 37 then due) milestones that were behind schedule on 30 June 2019 (close of the previous reported period) were achieved in the second half of 2019. The two milestones that were behind schedule at 30 June, were 90% and 80% complete respectively and both due for completion in Q3 2020. Cumulative progress against all Phase 1 project milestones was 56.5% compared to a target of 49.4%.



*MinEx CRC Researcher Ben van der Hoek (UniSA) conducting drilling experiments.*

Project Milestone Status by Project as at 30 June 2020																															
Existing milestone		Achieved				Behind Schedule		<div><div></div></div> Target at 30 June 2020																							
New milestone for CY20		Ahead of Schedule				Yet to begin																									
Redundant milestone																															
Proj 01	Due	Proj 02	Due	Proj 20	Due	Proj 20.1	Due	Proj 20.2	Due	Proj 03	Due	Proj 04	Due	Proj 05	Due	Proj 06	Due	Proj 07	Due	Proj 08	Due	Proj 09	Due								
M01	CY19Q1	M01	CY19Q1	M01	CY20Q1	M01	CY20Q2	M01	CY20Q2	M01	CY19Q1	M01	CY19Q1	M01	CY19Q1	M01	CY19Q1	M01	CY19Q1	M01	CY19Q1	M01	CY19Q1								
M02	CY19Q1	M02	CY19Q1	M02	CY20Q1	M02	CY20Q4	M02	CY20Q2	M02	CY19Q2	M02	CY19Q2	M02	CY19Q2	M02	CY19Q1	M02	CY19Q2	M02	CY19Q2	M02	CY19Q1								
M03	CY19Q2	M03	CY19Q1	M03	CY20Q1	M03	CY21Q2	M03	CY20Q2	M03	CY19Q3	M03	CY19Q3	M03	CY19Q2	M03	CY19Q2	M03	CY19Q3	M03	CY19Q2	M03	CY19Q2								
M04	CY19Q2	M04	CY19Q1	M04	CY20Q2	M04	CY21Q3	M04	CY20Q3	M04	CY19Q3	M04	CY19Q3	M04	CY19Q3	M04	CY19Q2	M04	CY19Q3	M04	CY19Q2	M04	CY19Q2								
M05	CY19Q2	M05	CY19Q1	M05	CY20Q2	M05	CY21Q4	M05	CY20Q3	M05	CY19Q4	M05	CY19Q3	M05	CY19Q4	M05	CY19Q3	M05	CY19Q4	M05	CY19Q2	M05	CY19Q3								
M06	CY19Q3	M06	CY19Q2	M06	CY20Q2			M06	CY20Q4	M10	CY20Q1	M06	CY19Q4	M06	CY19Q4	M06	CY19Q4	M06	CY19Q4	M06	CY19Q2	M06	CY19Q3								
M07	CY19Q3	M07	CY19Q2	M07	CY20Q2			M07	CY20Q4	M11	CY20Q1	M07	CY19Q4	M07	CY20Q1	M07	CY20Q1	M07	CY19Q4	M07	CY19Q3	M07	CY19Q4								
M08	CY19Q3	M08	CY19Q3	M08	CY20Q2			M08	CY21Q1	M12	CY20Q2	M08	CY19Q4	M09	CY20Q2	M08	CY20Q2	M08	CY19Q4	M08	CY19Q3	M16	CY20Q1								
M09	CY19Q4	M09	CY19Q3	M09	CY20Q2			M09	CY21Q1	M13	CY20Q2	M09	CY20Q1	M08	CY20Q3	M10	CY20Q3	M09	CY20Q1	M09	CY19Q4	M15	CY20Q2								
M10	CY19Q4	M10	CY19Q3	M10	CY20Q3					M14	CY20Q3	M11	CY20Q1	M12	CY20Q4	M09	CY20Q4	M10	CY20Q2	M10	CY19Q4	M17	CY20Q2								
M11	CY20Q1	M11	CY19Q4	M11	CY20Q3					M15	CY20Q3	M16	CY20Q1	M10	CY21	M11	CY21	M13	CY20Q3	M11	CY19Q4	M18	CY20Q2								
M13	CY20Q1	M12	CY19Q4	M12	CY20Q3					M07	CY20Q4	M17	CY20Q2	M11	CY21	M12	CY21	M14	CY20Q4	M12	CY19Q4	M19	CY20Q3								
M23	CY20Q2	M13	CY19Q4	M13	CY20Q3					M08	CY20Q4	M18	CY20Q2					M11	CY21	M13	CY19Q4	M20	CY20Q3								
M24	CY20Q2	M14	CY19Q4	M14	CY20Q4					M09	CY21	M19	CY20Q2					M12	CY21	M14	CY19Q4	M21	CY20Q4								
M25	CY20Q2	M15	CY19Q4	M15	CY20Q4					M06	Replaced	M20	CY20Q2							M15	CY19Q4	M22	CY20Q4								
M26	CY20Q3	M16	CY19Q4	M16	CY20Q4							M21	CY20Q2							M16	CY19Q4	M23	CY20Q4								
M27	CY20Q3	M28	CY20Q1	M17	CY21Q1							M22	CY20Q2							M17	CY20Q1	M12	CY21								
M28	CY20Q3	M29	CY20Q1	M18	CY21Q1							M10	CY20Q3							M29	CY20Q2	M13	CY21								
M14	CY20Q4	M30	CY20Q1	M19	CY21Q1							M23	CY20Q3							M30	CY20Q2	M14	CY21								
M15	CY20Q4	M31	CY20Q1	M20	CY21Q1							M24	CY20Q3							M31	CY20Q2	M08	Replaced								
M20	CY20Q4	M32	CY20Q2	M21	CY21Q2							M25	CY20Q3							M32	CY20Q2	M09	Replaced								
M29	CY20Q4	M33	CY20Q2	M22	CY21Q2							M26	CY20Q4							M33	CY20Q2	M10	Replaced								
M30	CY20Q4	M34	CY20Q2	M23	CY21Q2							M27	CY20Q4							M34	CY20Q3	M11	Replaced								
M31	CY20Q4	M35	CY20Q3	M24	CY21Q2							M28	CY20Q4							M35	CY20Q3										
M12	CY21Q1	M36	CY20Q3									M29	CY20Q4							M36	CY20Q4										
M17	CY21Q1	M37	CY20Q3									M13	CY21							M37	CY20Q4										
M16	CY21Q3	M38	CY20Q3									M14	CY21							M38	CY20Q4										
M19	CY21Q3	M39	CY20Q3									M15	CY21							M39	CY20Q4										
M18	CY21Q4	M17	CY20Q4									M12	Replaced							M40	CY20Q4										
M21	CY21Q4	M18	CY20Q4																	M24	CY21										
M22	CY21Q4	M19	CY20Q4																	M25	CY21										
		M20	CY20Q4																	M26	CY21										
		M21	CY20Q4																	M27	CY21										
		M40	CY20Q4																	M17	Replaced										
		M41	CY20Q4																	M18	Replaced										
		M42	CY20Q4																	M19	Replaced										
		M43	CY20Q4																	M20	Replaced										
		M22	CY21																	M21	Replaced										
		M24	CY21																	M22	Replaced										
		M25	CY21																	M23	Replaced										
		M26	CY21																												
		M27	CY21																												
		M23	Replaced																												

Table 1: Phase 1 MinEx CRC quarterly milestone summary to 30 June 2020. (New milestones created during the reporting period are highlighted in green text, redundant milestones highlighted in red text).

## Key research achievements

### Project 1 Drilling optimisation and automation

MinEx CRC conducted the first field trials of the iDrill drill rig recording system in Q4 2019 in collaboration with MinEx CRC Participant McKay Drilling at an operational drill site in the Pilbara iron-ore province of Western Australia. The McKay Schramm Reverse Circulation (RC) rig was instrumented with more than 50 top-of-hole sensors in one shift. Data were recorded at 10Hz, 1kHz and 20kHz while drilling two ~180m drill holes over two full days of drilling. The >4GB of data collected during the trial document the performance of the entire drill platform for a range of drilling practices. The spatial precision and detailed time resolution of the data allow calculation of fine-scale interactions between the drill bit and formation, for example, depth of penetration measured per hammer impact at hammer frequencies of >20Hz. Such data will provide the inputs for optimisation of RC drilling as a necessary step toward drilling automation and for recovering rock property information from drilling data.

The Dynamic Loop experimental facility at Curtin University was commissioned in Q2 2020, and MinEx CRC conducted the first series of experiments to test our online fluid monitoring system and automated dosing system. The Dynamic Loop is an instrumented plumbing system that simulates fluid circulation within drill holes under carefully controlled conditions. The facility enables development, characterisation and testing of fluid additives, hardware and software for development and rapid prototyping of our drilling fluid automation system iFluid, without requiring field deployment. During the first series of experiments, the fluid viscosity was measured in real-time and controlled via the automated dosing system to adjust to a simulated fluid-loss prevention scenario (rapid, transient increase in viscosity) and a drill hole maintenance scenario (gradual increase in viscosity). The experimental results allowed us to optimise our algorithms related to measurement and dosing and improve the design of the automated dosing system.

Two technical reports were submitted during the reporting period:

- Richard, T. and Kovalishen, Y. (2019). Down-the-hole percussive drilling: A literature review. Interim Technical Report, Project 1: Drilling Optimisation and Automation. MinEx CRC Report 2020/67, 20p. (September 2019)
- Mostofi, M., Zhang, H., Chai, S-C., Wurst, A, and Moghadam, S. (2020). Summary of Hydraulic Experiments 2019 and 2020. Interim Technical Report, Project 1: Drilling Optimisation and Automation. MinEx CRC Report 2020/007, 90p. (April 2020)

### Project 2 Coiled tubing drilling for discovery and definition of mineral deposits

Following project review meetings in Q3 2019, responding to demand from project Participants to increase the depth capability of CT drilling, the Project 2 team modified their research schedule to bring forward project milestones aimed at achieving 1000m reach. Engineering calculations have been completed for the CT Rig based on the modification of the existing RoXplorer® platform to carry and drill with 1000m of coiled tubing. The new calculations (including material strength, fatigue, operating stability, hydraulic systems requirements and power budgets) have been incorporated in the evolving design (160 new drawings) and operating specifications of the CT1000 drill rig. All aspects of the drilling operation (transport, tramming, drilling and maintenance) will require modification based on the new design. The CT Drill rig platform to which modifications will be made is being shipped from Curtin University to University of South Australia, and MinEx CRC is in dialogue with South Australian manufacturing company Century Engineering with plans to commence the CT Rig rebuild in Q3 2020 in advance of first field trials in Q1 2021.

Program 1 researchers completed the design of a Selective Interval Coring System for CT drilling based on a modified Epiroc 60TT conventional core barrel system (provided in-kind by project

Participant Epiroc) in combination with a MinEX CRC downhole motor (DHM). The 60TT is compatible with CT drilling because it requires lower weight-on-bit than conventional coring systems. Version 1 of the Selective Interval Coring System will provide a 1.5m section of drill core with 43.9mm diameter (drilling a 60mm hole). The prototype should be completed by end-2020 in time for field trials in Q1 2021.

The downhole positioning module provided in-kind by MinEx CRC Participant Wassara has been electronically integrated into the beta-version of the MinEx CRC smart bottom hole assembly (BHA). The Wassara module is an inertial measurement unit (IMU) which measures accurate linear and rotational accelerations from which velocity and position can be derived. The electronics required to integrate the Wassara IMU into the MinEx CRC BHA have been designed, built and bench-tested with successful connection to power supply from the MinEx CRC control unit and delivery of data from the IMU in a form that is suitable for communication with the MinEx control board. Further laboratory testing will be carried out in the second half of 2020 to test the performance and integration of the IMU in a range of drilling scenarios (e.g. penetration rate, orientation) and conditions (e.g. vibrations) with plans to incorporate the positioning module into the BHA prior to field trials in 2021.

Two technical reports were submitted during the reporting period:

- Fox, S. and Soe, S. (2019). Landscape review of downhole steering tools applicable to Coiled Tubing drilling. Interim Technical Report, Project 2: Coiled Tubing Drilling for the Definition of Mineral Deposits. MinEx CRC Report 2019/008, 34p. (September 2019)
- Prochon, E. (2020). Wassara module and MinEx CRC controller integration tests. Interim Technical Report, Project 2: Coiled Tubing Drilling for the Definition of Mineral Deposits. MinEx CRC Report 2020/022, 13p. (June 2020)

### **Project 20 Hydraulic processing system (HPS) for CT Rig integration**

This project commenced in January 2020. MinEx CRC is at an advanced stage of design of the hydraulic processing system (HPS) for CT drilling with the build expected to commence in Q4 2020 in advance of field trials in Q1 2021. Long lead items have been ordered, and the most significant components (8x8 truck, centrifuge and pumps) have arrived at the University of South Australia workshop ready for the build. The Project 20 team are working closely with Project 20.1 and 20.2 to incorporate findings from our centrifuge optimization and sampling experiments into the final design of the HPS.

### **Project 20.1 Centrifuge optimisation for fluid management in coiled tubing drilling**

This project commenced in April 2020. The first quarter of research activity included commissioning of the centrifuge test facility and Curtin University, risk assessment, and development of a workflow for conducting centrifuge characterisation experiments. A literature review informs our experimental design of experimental and theoretical studies related to centrifuge decanter separation in different engineering disciplines.

One technical report was submitted during the reporting period:

- Hakami, F. and Mostofi, M. (2020). Literature review and experimental program workflow. Interim Technical Report, Project 20.1: Centrifuge optimisation for fluid management in Coiled Tubing drilling. MinEx CRC Report 2020/28, 61p. (July 2020)

### **Project 20.2 HPS accelerator and fines sampling research**

This project commenced in April 2020. The solids removal unit (SRU) provided in-kind by MinEx CRC Participant Imdex Limited has been delivered to the University of South Australia and rewired to run from mains power. Commissioning of the SRU for experimental work included the installation of an

adjustable-flow, external feed pump with flow meter and adjustable-frequency vibration motors with vibration sensors. In the first experiments using a drilling fluid designed for CT drilling (viscosity inversely dependent on shear-rate), we were able to tune the shaker operating parameters to deliver a near 10-fold improvement on the flow of drilling fluid through a 141µm screen which meets the MinEx CRC Project 2 target particle size for sampling from the CT drill rig. Further research will be aimed at testing the performance of the shaker with fluids containing drill cuttings and reducing the mesh size to capture particles smaller than 140µm.

### **Project 3 Real-time downhole assay**

Significant progress was made regarding the design of our downhole laser-induced breakdown spectrometer (LIBS) prototype during the reporting period. The prototype will comprise three main components; i) the laser and its electronics, ii) the spectrometer and its electronics, and iii) the front end optical focusing assembly. The laser system, provided by Montfort Laser under a non-disclosure agreement with MinEx CRC, is housed in octagonal casing suitable for deployment in a drill hole created by the CT drill rig. In the benchtop prototype, the spectrometer assembly will comprise standard-sized components (slightly larger than the diameter of the laser housing) to modify to fit within slimmer housing once the benchtop prototype has been tested and we move toward downhole trials. The optical focusing assembly has been custom designed for our application. The housing for the benchtop prototype will be fabricated using polymer 3D printing technology. The entire tool will be ~150cm long and designed to connect with the CT bottom hole assembly and up-hole communications platform.

MinEx CRC continued laboratory experiments designed to test the suitability of LIBS for downhole assay – focussing on the effect of drilling fluids on the LIBS spectrum and the efficiency of optical transmission. The 22-sample marble and granite block (previously used for testing LIBS assay on a moving surface) was reanalysed to determine the effect of C-Trol drilling fluid additives on the rock surface. There does not appear to be any degradation of the raw LIBS spectrum when analysing a sample coated with 0.3 wt% C-Trol solution (which is typical of concentrations used in CT drilling applications) and there was no decrease in peak intensity for key chemical elements. However, there was significant wavelength-dependent attenuation of the optical signal (35 to 100% loss of intensity) when transmitted through 10mm of 0.3 wt% C-Trol solution. More work is required to characterise the effect of drilling fluids on optical transmission as an essential consideration for the design and operating parameters of the LIBS downhole assay tool.

Four technical reports were submitted during the reporting period:

- Stromberg, J., Tassios, S., Uvarova, Y., Francis, N., van der Hoek, B. and Tiddy, C. (2020). MinEx CRC Project 3, Test rock characterization study and preliminary results. MinEx CRC Report 2020/007, 57p. (April 2020)
- Francis, N., Stromberg, J., Uvarova, Y., Tassios, S., van der Hoek, B. and Tiddy, C. (2020). Downhole assay tool – data processing and management. Interim Technical Report, Project 3: Real-time downhole assay. MinEx CRC Report 2020/009, 14p. (April 2020)
- Francis, N., Stromberg, J., Uvarova, Y., Tassios, S., van der Hoek, B. and Tiddy, C. (2020). Experimental design and forward plan for testing LIBS downhole assay tool under downhole conditions. Interim Technical Report, Project 3: Real-time downhole assay. MinEx CRC Report 2020/010, 28p. (April 2020)
- Tassios, S., Stromberg, J., Uvarova, Y., Francis, N., van der Hoek, B. and Tiddy, C. (2020). First testing round of LIBS analyses of moving rock samples subjected to the first set of downhole conditions as identified in 2020 Q1 using the benchtop prototype and advancements in the data processing workflow. Interim Technical Report, Project 3: Real-time downhole assay. MinEx CRC Report 2020/026, 19p. (July 2020)



#### **Project 4 Petrophysical logging-while-drilling**

During the reporting period, we finalised the sensor development pathway for downhole logging-while-drilling tools, confirming that our priority will be to complete field trials of a TCG tool by the end of 2021. This will be followed by a low-power induction style electromagnetic (EM) sensor system from which we hope to recover electrical conductivity and magnetic susceptibility of the drilled formations. The third phase of sensor development will be a high-power EM system which can be used to reconstruct complex EM fields around the drill hole. Real-time imaging and trajectory update software will be developed throughout the project and will be updated to include new sensors as they come online. Recovery of seismic signal and related parameters that will also feed into our trajectory control software is the subject of a MinEx CRC opportunity fund project, recommended by our Science Advisory Committee at its April 2020 meeting and due to begin in January 2021.

MinEx CRC designed and built our prototype slim line TCG sensor and completed a series of preliminary tests incorporating newly developed baseline code for real-time data processing and display. We simulated movement of the sensor through rocks of varying radioactivity using a caesium 127 gamma source positioned at varying distances from the sensor. The TCG sensor system delivered a stable signal with counts proportional to the distance from the source as predicted. We then simulated performance of the sensor when subjected to vibrations (frequencies up to 10Hz and accelerations up to 10g) with no apparent degradation of the signal.

The next stage of this research will incorporate the prototype TCG sensor into the coiled tubing drilling bottom hole assembly (BHA) based on designs provided by the Project 2 research team. Redesign of the TCG sensor has included changing the main communications protocol to RS-485, modifying the power supply circuit and repositioning the SD card so that it is mounted directly to the circuit board. This design will first be built into a 3D-printed polymer model of the BHA module for further laboratory trials and then into a steel housing in preparation for field trials in 2021. There has also been good progress on the design of the graphic user interface for the LWD and trajectory control software, including an EM simulator. Computation of EM fields around both electric and magnetic dipole EM antenna (as planned for the third phase of sensor development) have been integrated into the EM simulator. At this stage, the simulator is being used to test and refine sensor design; however, the next stage will progress to imaging for real-time LWD and trajectory control.

#### **Project 5 Seismic in the drilling workflow**

We conducted field deployments of optic fibre distributed acoustic sensing (DAS) for seismic acquisition at two sites during the reporting period.

The deployment at a Queensland coal mine operated by MinEx CRC Participant Anglo-American involved cementing DAS cables in three boreholes with the aim of imaging coal seams at a depth of ~400m, beneath near-surface basalts that impair conventional surface seismic exploration. We obtained high-quality 3D seismic images that successfully illuminate the target coal horizon and allow it to be mapped in three-dimensions for 100s of meters around and between boreholes. The advantages of DAS technology (rapid downhole deployment, high-quality signal) in conjunction with downhole seismic methodology allowed us to overcome difficulties in imaging the subsurface formations below the basalt cover. The method could be included in the standard exploration drilling workflow at low cost and with little time penalty, leading to a reduction of the number of drill holes required to model the resource. Once deployed, the DAS can be used for continued monitoring of the mine operations.

MinEx CRC conducted the world's first square kilometre optic fibre distributed acoustic sensing (DAS) 3D seismic reflection experiment over the hyper-saline Lake Carey in Western Australia, in



collaboration with MinEx CRC Participant HiSeis and Affiliate Matsa Resources. Approximately 25km of fibre optic cable, equivalent to a conventional receiver pattern of 37,300 geophones separated by 0.67m, was laid out in a single day with the use of equipment designed by the MinEx CRC team. Two interrogators were used, each sensing a fibre optic segment of 6,200 m in length. The interrogators were shifted down the spread as shooting progressed. Two Betsy guns utilising 12-gauge blank cartridges, fired at 30 cm depth, provided seismic energy for the survey. The Lake Carey data will be processed and interpreted during Q3 2020.

### **Project 6 Automated 3D geologic modelling**

MinEx CRC has developed proof-of-concept codes that automate the conversion of digital geological maps into 3D geological models. The prototype codes enable deconstruction of digital geological maps into discrete data (structural dips of beds, fault and fold traces, and the stratigraphic base of each unit) which represent decimated equivalents of the source data that can be used as inputs to 3D geological models. We can derive secondary information (apparent fault throw, interpolated bedding orientations, local formation thickness) and tertiary information (spatial and temporal topology) information needed by some modelling systems. The software creates network diagrams showing stratigraphic relationships and structural overprinting from which relative geological histories can be derived. These are the first steps in developing an automated process that can significantly speed up the model-building workflow whilst ensuring the reproducibility of results. The codes are currently being tested in collaboration with MinEx CRC Participants Geological Survey of Western Australia (GSWA), Geological Survey of New South Wales (GSNSW) and Anglo-American.

In collaboration with MinEx CRC Participant MRIWA, a first pass 3D model was built of the entire Hamersley Basin by stitching together twenty-four 1degree models built from GSWA maps and constrained by the GSWA drilling database.

One technical report was submitted during the reporting period:

- Jessell, M., Lindsay, M. and Giraud, J. (2019). 3D Workflows. Interim Technical Report, MinEx CRC Project 6, Automated 3D modelling. MinEx CRC Report 2019/008, 54p. (August 2019)

### **National Drilling Initiative**

#### **Project 7 Maximising the value of data and drilling through cover**

MinEx CRC has built a web portal to allow the mineral exploration community to easily access, visualise, analyse and share exploration data collected during the National Drilling Initiative (NDI). The portal can be accessed via the MinEx CRC webpage with the aim of delivering NDI data in an efficient and accessible manner to the widest possible audience. The data are viewable on a mapping platform which includes built-in analytical tools designed to address specific stakeholder questions, turning drilling data collected by the NDI into knowledge. Data can be selected interactively based on combinations of spatial and text-based queries and downloaded for export to other software packages. As the portal evolves, new analytical tools will be added to provide greater functionality.

The development of next-generation data analysis tools for incorporation on the MinEx CRC NDI portal has focused on the extraction of structural data from image analysis of drill core. We held a two-day workshop at Participant GSWA's drill core library in Perth to bring together experts in structural geology, core logging, 3D geology modelling and data analytics, including image analysis, machine learning and complex systems analysis. The outcomes of the workshop included prioritization of structural features most useful (and amenable) for image analysis. Recommendations from the workshop have been used to shape the ongoing research plan and define the functionality of the proposed image analysis tool.

Three technical reports were submitted during the reporting period:

- Hill, J. (2020). Structural geology from drill holes – literature review. Interim Technical Report, MinEx CRC Project 7, Maximising the Value of Data and Drilling Through Cover. MinEx CRC Report 2020/015, 21p. (January 2020)
- Javeed, U. (2020). Automated image analysis for drill cores – literature review. Interim Technical Report, MinEx CRC Project 7, Maximising the Value of Data and Drilling Through Cover. MinEx CRC Report 2020/022, 30p. (April 2020)
- Hill, J., Chopping, R. and Oliver, N. (2020). Structure in drill core as an aid to mineral exploration. Setting research directions geology. Interim Technical Report, MinEx CRC Project 7, Maximising the Value of Data and Drilling Through Cover. MinEx CRC Report 2020/025, 20p. (June 2020)

### **Project 8 Maximising the value of data and drilling through cover**

MinEx CRC completed the pre-drilling research required in the East Tennant and South Nicholson NDI campaign areas in preparation for drilling in Q3 2020. In contrast to previous interpretations of the basement geology in the East Tennant area, there is a large volume of pre-1850 Ma metasedimentary rocks intruded by a bimodal igneous suite at ~1850 Ma with deformation and IOCG-style alteration continuing to ~1845 Ma. These rocks are of comparable age and event history to the host rocks of IOCG mineralization in the Tennant Creek Inlier. Regional geophysical data (including a detailed gravity survey, broadband magnetotellurics (MT) and the Barkly Seismic Survey) reveal the distribution of mafic and felsic igneous rocks and a network of crustal- to lithospheric-scale structures. Conductivity profiles generated from the MT data provide evidence for crustal-scale fluid flow along major structures that are connected to a large conductor in the lower crust and upper mantle. This is comparable to the conductivity profile in well-endowed Gawler Craton IOCG province in South Australia. The pre-drilling data has been used to prioritise drill targets and design our sampling and analytical strategy for the upcoming NDI campaign.

Pre-drilling research is well underway for our Delamerian NDI campaign area in eastern South Australia, due to be drilled in mid-2021. This work utilizes legacy drill samples and geophysical data and includes igneous and metamorphic petrology, geochronology, thermochronology, isotopic fingerprinting, sedimentary provenance, structural geophysics and mineral systems analysis. The work will be augmented by the acquisition of new geophysics (passive seismic, MT and gravity) and petrophysics. Two priority drilling areas have been chosen based on our preliminary work, with detailed targeting and prioritization of drill holes due to be completed in Q4 2020.

Covid-19 travel restrictions have necessitated a change in the location and timing of NDI drilling in Western Australia. Drilling in the West Arunta campaign area has been postponed indefinitely and drilling in the East Yilgarn campaign area has been brought forward to 2021. Planning and pre-drilling research in the East Yilgarn is underway and will be compressed into a relatively short time frame (Q3 2020 to Q2 2021).

Two technical reports were submitted during the reporting period:

- Schofield, A. and Jarrett, A. (2020). CY20Q1 – 2020 NDI campaign region: Summary report on compilation and legacy data and new work on East Tennant and South Nicholson. Interim Technical Report, MinEx CRC Project 8, Geological Architecture and Evolution. MinEx CRC Report 2020/14, 12p. (Submitted March 2020)
- Dutch, R. (2020). Quarterly milestone reports, CY19 milestones 10, 11, 12, 13 and 14. Interim Technical Report, MinEx CRC Project 8, Geological Architecture and Evolution. MinEx CRC Report 2020/13, 18p. (Submitted April 2020)

### **Project 9 Targeting mineral systems in covered terranes**

Pre-drilling mineral systems analysis and prospectivity mapping over the East Tennant NDI campaign area was completed during the reporting period. We compared a “knowledge-driven” weights-of-evidence approach (built on an existing mineral potential map produced by Geoscience Australia but incorporating pre-drilling NDI data and fuzzy logic principles) with “data-driven” machine learning approaches using both random forest and logistic regression classifiers. The machine learning approaches assume no prior knowledge of the mineral system but instead rely only on identification of spatial patterns in “training” data and recognition of those same patterns elsewhere. The machine learning approaches were more effective than fuzzy logic at predicting the location of known mineral deposits and prospects in areas where the prospective rocks are exposed. However, the fuzzy logic approach was more useful for highlighting prospective rocks beneath cover where there are fewer datasets and lower data density on which to apply the machine learning algorithms. Results of the prospectivity mapping have been used to help prioritise drill targets for the East Tennant NDI campaign.

The mineral systems targeting in the Delamerian NDI campaign area has focused on legacy data compilation and synthesis (including seamless stitching of geophysical data across the South Australian, New South Wales and Victorian borders), structural and lithologic reinterpretation of geophysical data, depth to basement modelling, and construction of a mineral system model for Cu porphyry mineralization. The next step will be to match key criteria from the mineral system model with proxies that are mappable in the collated datasets. This work will lead into our pre-drilling prospectivity mapping, which will take place in Q3 and Q4 2020.

### **Technical or scientific impediments and remediation strategies**

The main risk to the progress of MinEx CRC’s scientific program is Covid-19 with potential to lose support and income from Participants under financial stress and with workplace restrictions likely to impact fieldwork (including up-coming drilling campaigns), access to core libraries for legacy sampling and operation of laboratories.

MinEx CRC is heavily reliant on the mineral exploration budget of mining companies, which is generally seen as discretionary spend and subject to rapid changes. Currently, we are ahead of schedule on funding received from our Participants, and we will be able to endure a period of delayed or reduced contributions without impact on the research schedule. However, we cannot confidently model the future impact of Covid-19 on our Participants' capacity to remain engaged in collaborative research. This will be a major consideration for our Phase 2 project agreements (to cover calendar years 2022-2024), preparation for which will begin in Q2 2021.

The most significant impacts of Covid-19 workplace restrictions are being felt by postgraduate research students many of whom have a fieldwork component to their research, require access to core libraries for sampling and/or require access to analytical laboratories. Delays due to Covid-19 are a heightened risk for postgraduate students due to the tight timeframes of their projects (three years for PhD, two years for MSc, one year for honours). A risk matrix has been developed to help identify, monitor and manage these risks (see Section 3.7 Education and Training) and established regular videoconference sessions to inform and support the postgraduate cohort. These sessions have been run by the E&T Coordinator and attended by the MinEx CRC CEO, CSO, Program Leaders and Communications Manager.

MinEx CRC modelled the potential of the calendar year 2020 and 2021 milestones to be impacted by such restrictions. On 30 June 2020, MinEx CRC experienced minor impact as reflected in our ability to complete quarterly project milestones and commonwealth milestones. However, the degree of uncertainty in our modelling and potential for delays increases in the second half of 2020 and 2021

due in part to the uncertain Covid-19 situation and part to our increased dependency on fieldwork as we embark on NDI drilling campaigns. This may require us to modify our research program and rearrange some 2020 and 2021 project milestones – designing research to accommodate Covid-19 restrictions, bringing forward research that can be conducted without impact from Covid-19 and delaying research where necessary. The first example of such changes has been the bring forward (from 2022 to 2021) and relocation (from the West Arunta to the East Yilgarn) of NDI drilling in Western Australia. Any modifications to the research schedule will be carried out in close consultation and with the approval of our Project Review Panels.

At this stage, none of MinEx CRC Commonwealth performance milestones are under threat, with the next due date for many of these being mid-2022, a timeframe in which we are confident we can recover any changes that are currently foreseeable.

### **Industry involvement meeting industry needs**

Each MinEx CRC project manages relationships between research projects and industry and government survey organisations (GSO) Participants through a Project Review Panel (PRP), with a Chair appointed from the industry and GSO Participants group. The PRPs meet at quarterly intervals to align with the quarterly project reporting cycle. The PRP Chairs provide final review and approval of quarterly reports, including progress against quarterly project milestones. During Q4 2019 each PRP reviewed and approved quarterly project milestones for the calendar year 2020. For most research projects, this process involved the addition of quarterly milestones, consistent with existing yearly project milestones as per the project agreements, but with sufficient detail to monitor and assess progress every quarter. In parallel and supporting the PRP, industry and GSO Participants are invited. They regularly attend weekly or fortnightly project meetings, monthly program meetings and ad hoc meetings tied to specific challenges or opportunities.

Industry and GSO Participants are involved in high-level strategic and forward planning via membership of the MinEx CRC Science Advisory Committee (SAC). The SAC meets every six months to provide advice to the CSO in the realisation of the long-term goals of MinEx CRC, to review Opportunity Fund proposals and to provide recommendations to the Board on the allocation of the Opportunity Fund.

The SAC approved allocation from the Opportunity Fund to four new projects during the reporting period, two of which commenced during the reporting period:

- Project 20 Hydraulic processing system (HPS) for CT Rig integration (commenced Q4 2019)
- Project OP1 Technical data management (commenced Q2 2020)
- Project OP2 Coupled XRD mineralogy-chemistry prediction (to commence Q3 2020)
- Project OP3 Combined distributed sensing and high-speed fibre optic communications for the Coil Tube drilling (to commence Q1 2021)

In addition to formalised engagement with industry and GSO Participants via its management structures, MinEx CRC sought to provide multiple opportunities for communication between its Participants during the reporting period, including:

- MinEx CRC held its first Annual Conference over the period 12-14 November 2019 in Perth, WA. 175 delegates attended the conference (66% from industry/end-user organisations and 34% from research organisations). 85% of Participant organisations and 52% of Affiliate organisations were represented.
- MinEx CRC held a Project Integration Workshop online on 29 April 2020. There were 66 attendees, 50% from industry and Geological Survey Organisation (GSO) Participants.

- MinEx CRC CSO (David Giles), Program 1 Leader (Soren Soe) and Program 3 Leader (Anthony Budd) attended a National Drilling Initiative meeting held by the GSNSW at Maitland, NSW on 6-7 November 2019.
- MinEx CRC CEO (Andrew Bailey) and CSO attended the GSWA open day in Fremantle, WA on 21 February 2020 and presented a MinEx CRC poster.
- MinEx CRC CEO, CSO, Program 1 Leader, Program 2 Leader (Yulia Uvarova) and Program 3 Leader attended the Prospectors and Developers Association of Canada (PDAC) conference in March 2020. MinEx CRC shared booth space with MinEx CRC Participants Geoscience Australia, Geological Survey of New South Wales, Geological Survey of South Australia, Geological Survey of Western Australia and CSIRO and met with Participants Anglo American, BHP, South 32, Imdex Limited and Olympus.

Industry participation in research activities during the reporting period included:

- GSO Participants were highly engaged in the National Drilling Initiative (NDI), contributing 13.36 FTE and \$5.96M in-kind toward the research effort.
- Participant MRIWA are providing additional cash funding in support of Project 20.1 Centrifuge optimisation for fluid management in Coiled Tubing drilling.
- Participant Imdex Limited is a research partner in Project 20.2 HPS accelerator and fines sampling research, contributing cash and in-kind (including 0.4 FTE staff in-kind) to the project.
- Participant McKay Drilling hosted the first field trials of our prototype *iDrill* platform at an operational drill site in the Pilbara region of WA.
- Participant Anglo American hosted a field trial of drill hole seismic methods using optical fibre distributed acoustic sensing (DAS) at its Moranbah mine site in central Queensland.
- Affiliate Matsa resources hosted a field trial of surface seismic over a salt lake using DAS at its Lake Carey project in Western Australia.
- Affiliate Datacode is a research partner in Project OP1 Technical data management.

### **Changes to future research directions**

Four new research projects during the reporting period. These projects do not indicate a change in our research direction; rather, they have been established to augment and enable our existing research projects, as follows:

Project 20 Hydraulic processing system (HPS) for CT Rig integration will bring forward the development of a mobile fluid processing system which is critical to the successful operation of the CT drilling rigs. Project 20 is due to complete in Q2 2021, in time for deployment of the CT drilling platform (rig + HPS) to our 2021 NDI campaign areas in South Australia and Western Australia.

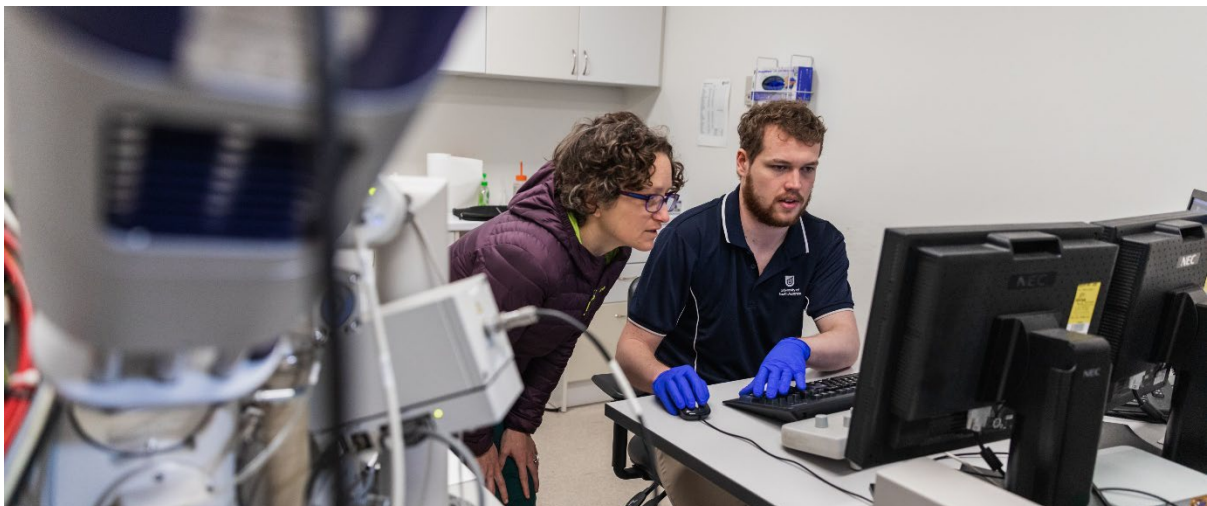
Project 20.1 Centrifuge optimisation for fluid management in coiled tubing drilling will provide a detailed characterization of centrifuge performance when dealing with drilling fluids and cuttings generated by CT drilling. There is very little prior research on this topic. Results will be used to inform centrifuge integration into the HPS and to optimise centrifuge operating parameters and procedures.

Project 20.2 HPS accelerator and fines sampling research will develop and test new technology and procedures aimed at reducing the minimum particle size (thus increasing the bulk sample mass) that can be efficiently separated from CT drilling fluids during the drilling operation.

Project OP1 Technical data management will enable inter-project collaboration by delivering a software platform and user interface to efficiently manage MinEx CRC metadata from all projects (upload, store, secure and access) and provide a reference and point-of-entry, with appropriate security, to underlying MinEx CRC data.

### **Quality of researcher contributions evidenced by publication in refereed journals**

At 30 June 2020 MinEx CRC projects had been active for 18 months. With the usual delays between conduct of research and publication of results, we are starting to see the first publications flow from our research projects. A list of the publications is included as Appendix A.



*E&T Program Coordinator Caroline Tiddy (left) and Postgraduate student Alexander De Vries Van Leeuwen (UniSA).*

### 3.6. Commercialisation

The commercialisation of Project Intellectual Property (IP) will be conducted in accordance with a Commercialisation Plan to be approved by the MinEx CRC Board. Each Party must ensure that any Commercialisation of Project IP is consistent with the nature of the Project and the CRC Program. The plan must specify the general approach to be adopted, including:

- objectives and strategies,
- target markets,
- resources to be utilised, and,
- risks and risk management strategies.

During the past reporting period, no commercialising activities were undertaken. Commercialisation rights for the Coil Tube drill rigs remain with MinEx CRC, and no decisions were taken in the past year regarding commercialisation options.

Past commercialisation activities, which originated from agreements undertaken by the Deep Exploration Technologies CRC and deeded to MinEx CRC, and which may generate revenue in 2020, are as follows:

- Wireless Sub (also known as the TruSub), with commercial product introduction by Boart Longyear in 2020.
- SwiftMin technology, with commercial product introduction by Olympus in 2020.



*MinEx CRC Program 1 Researchers conducting experiments at UniSA.*



## 3.7. Education and Training (E&T)

### Commonwealth Milestones

MinEx CRC is on target to achieve its E&T outputs. MinEx CRC has one Education and Training Commonwealth Milestone due in the reporting period, which has been met. The report is available to Participants via the MinEx CRC SharePoint, as follows:

4.1.1 Due on 30 June 2020: Vocation training modules designed in collaboration with Partners and VET sector providers completed.

Tiddy, C., Soe, S., Giles, D., Fox, S. and van der Hoek, B. (2020). Vocation training modules designed in collaboration with Partners and VET sector providers completed. Commonwealth Milestone Report, Education and Training. MinEx CRC Report 2020/21, 12p. (Submitted June 2020).

### Higher Degree by Research (HDR) program

MinEx CRC has an ambitious target of 50 HDR completions during its ten-year program. To achieve this target, in recognition that not all students will complete their program and assuming an average PhD timeframe of 3.5 years, MinEx CRC planned for a total 60 student commencements with the last commencements occurring before December 2024 (Figure 1). On 30 June 2020, MinEx CRC had registered a total of 20 HDR students (16 PhD and four MSc), which is ahead of the June 2020 target of 18 HDR students.

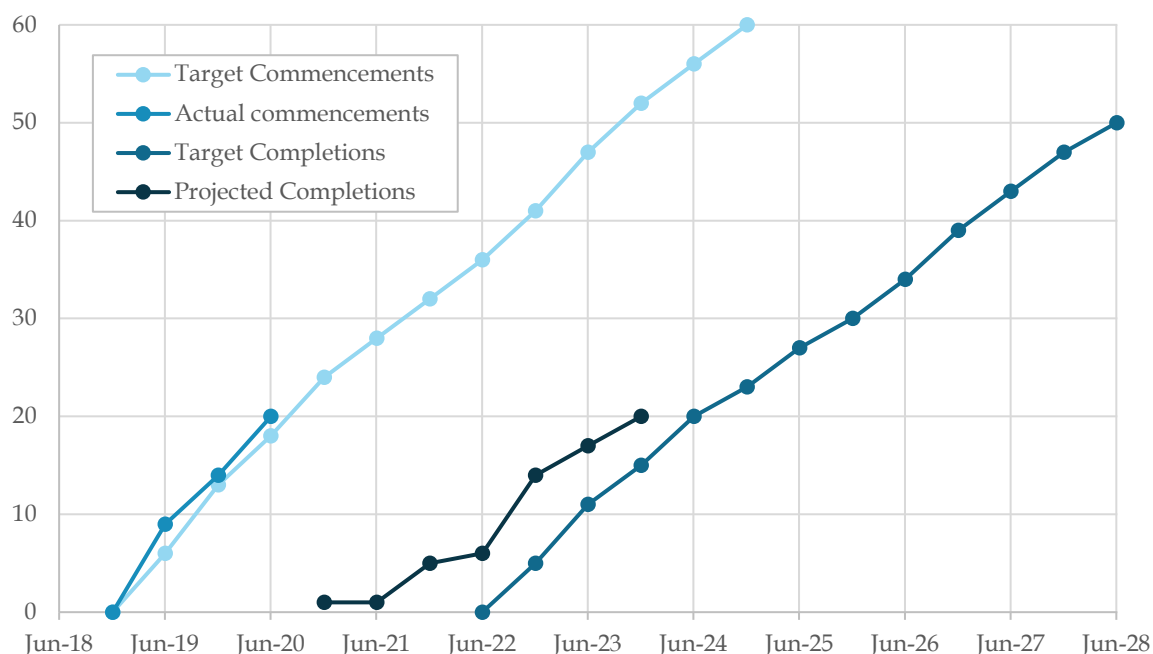
One PhD candidate has been awarded a University of South Australia PhD scholarship but has been stranded in Iran and unable to commence his PhD due to Covid-19 travel restrictions and delays in processing his student visa. Four Honours and three Masters by Coursework students completed their studies on MinEx CRC-related research projects during the reporting period. These students are not included in reporting against our HDR targets.

The student register listing all active students and project details as of 30 June 2020 is attached (Appendix B).



*MinEx CRC Postgraduate students Mitchell Bockmann Adrienne Brotodewo.*





**Figure 1: MinEx CRC HDR targets versus actual commencements and projected completions on 30 June 2020.**

### Vocational Education and Training (VET) program

MinEx CRC has a target of completing 200 VET trainees during its ten-year program. Our strategy is to engage with, and supply training materials, to appropriate partnering organisations, including Registered Training Organisations and TAFE to deliver VET courses.

During the reporting period, we conducted an in-house Training Needs Analysis to determine the needs of MinEx CRC's driller training requirements and identify new Units of Competency that could be added to current VET training packages and allow drillers to be accredited in coiled tubing drilling for mineral exploration. Two new Units of Competency that could be added to the current Certificate III in Driller Operations VET course were identified: 'Conduct coiled tubing drilling' and 'Assist coiled tubing drilling'. High-level descriptions of these units have been developed in collaboration with relevant MinEx CRC Participants and Affiliates and potential VET providers. The action plan for the development of VET training activities has been revised by the MinEx CRC Education and Training Committee, and Executive Management Committee based on the Training Needs Analysis. Discussions were initiated with several potential training providers and developed a timeline to achieve the delivery of the first VET courses.

### Risks to the E&T program and strategies in place to address any issues

Covid-19 poses risks to the MinEx CRC Education and Training program:

- Students or supervisors may become ill or suffer stress or mental illness as a result of the pandemic or the effect of the pandemic on their research, work and home life.
- Students may be stranded interstate or overseas as a result of Covid-19 travel restrictions.
- There may be a reduced pool of potential international HDR candidates due to Covid-19 travel restrictions and ongoing delays to student visa approvals.
- Students may have a fieldwork component to their research, require access to samples stored at core libraries and/or require access to laboratories to undertake analyses. Delays due to Covid-19 travel restrictions, lockdowns and working-from-home arrangements are already a reality for some students and are likely to continue to impact students in the coming year.

A risk matrix has been developed to help identify and manage the risks posed by Covid-19 to our student cohort and are working with individual students and supervisors to mitigate or eliminate the risks where possible. This includes modifying research plans, finding alternate samples or spreading workload to laboratories unaffected by Covid-19 lockdowns. Since the onset of the Covid-19 MinEx CRC students have been engaged in regular videoconference sessions to ensure they feel supported within the CRC environment. These sessions have been run by the E&T Coordinator and attended by the MinEx CRC CEO, CSO, Program Leaders and Communications Manager.

Although we are ahead of target for HDR commencements, we anticipate lower numbers of potential HDR candidates in the coming financial year. Reduced access to international candidates caused by Covid-19 combined with the strong demand from industry for domestic graduates with expertise in mineral exploration is likely to reduce the total pool of potential HDR candidates. In response, implemented strategies were developed to help retain and attract students to MinEx CRC projects:

- For each student enrolled in a MinEx CRC HDR project, the host university receives \$20,000 per annum bursary (maximum of three years for PhD and two years for Masters by Research) which must be spent in support of HDR students. The manner that this funding is disbursed is dependent on the needs of individual students and their projects but might include scholarship support, scholarship top-up, project funding (e.g. analyses) or travel and conference support.
- MinEx CRC provides \$1,000 to support Honours and Masters by Coursework students undertaking MinEx CRC-related research activities and who may go on to undertake a MinEx CRC postgraduate project. The scheme is not restricted to universities that are MinEx CRC Participants. Our aim is to raise the profile of MinEx CRC within the undergraduate population and allow advertisement of HDR opportunities across universities which are not MinEx CRC Participants. The initiative was implemented for the first time for students completing in 2020 and currently supports 12 Honours and two Masters by Coursework students.
- We will provide a \$3,000 bonus to PhD students and a \$2,000 bonus to Masters by Research students on completion of their Project.

#### **Details of the E&T activities conducted during the reporting period**

Research was ongoing for 20 HDR students (16 PhD and four Masters by Research) during the reporting period. Twelve of these students (eight PhD and four Masters by Research) commenced during the reporting period. In addition, there were four Honours and three Masters by Coursework projects completed during the reporting period. Postgraduate research students, topics and supervisory panels are summarised in Appendix B. There have been no graduates during the reporting period.

We produce a postgraduate booklet to advertise postgraduate projects through the MinEx CRC website and social media and at face-to-face events. We continued to work with our research, industry and GSO Participants during the reporting period to develop new postgraduate project ideas, which are including in periodic updates of the postgraduate booklet. Version 2 of the postgraduate booklet was released in July 2019, and Version 3 is being prepared with a view to attracting students into the Q3/Q4 2020 scholarship round at Participant universities. The Postgraduate Education Booklets are available on the MinEx CRC website.

#### **Evidence of the level of student involvement in the CRC's activities**

Student research is aligned with the vision and mission of MinEx CRC and individual HDR projects closely linked to our Research Project portfolio, for example:

- Curtin University students (Siew Hong Chai, Hing Hao Chan, Rui Huang and Victor Santos) are researching drilling fluid characterisation and drill-rock interactions for both diamond and

Reverse Circulation (RC) drilling techniques which will be fed into algorithms for drilling optimisation and automation being developed by the Project 1 research team.

- University of South Australia student (Fernando Fontana) is working closely with the Project 3 research team in developing laser-induced breakdown spectroscopy (LIBS) for downhole assay including the application of machine learning techniques to automate spectral analyses.
- Curtin University student (Anatolii Pakhomenko) is developing machine learning techniques for automated inversion of seismic data using data acquired by the Project 5 team and MinEx CRC Participant case study sites.
- University of Western Australia students (Mahtab Rashidifard and Ranee Joshi) are developing methods for automated multi-scale 3D geological models and uncertainty predictions from geophysical data that will be incorporated in automated 3D modelling software being developed by the Project 6 research team.
- University of Western Australia student (Nuwan Suriyaarachchi) is developing techniques to characterize cover sequences using passive seismic and electro-magnetic data, for integration into 3D modeling methods being developed in Project 6.
- Students from the University of Adelaide (Mitchell Bockmann, Angus Nixon, Alexander Simpson, Darwinaji Subarkah and Jie Yu), University of South Australia (Adrienne Brotodewo, Stacey Curtis and Alex de Vries Van Leeuwen) and Australian National University (Naina) are conducting geological research (including petrology, geochronology, thermochronology, isotope geochemistry, basin analysis, igneous and metamorphic geology) which provide essential constraints on the geological architecture, evolution and mineral prospectivity of the NDI campaign areas.
- University of New South Wales student (Joe Schifano) is analysing a camp-scale biogeochemical dataset collected from the Cobar NDI campaign area in western New South Wales.
- University of Newcastle student (Millicent Crowe) is developing techniques to integrate airborne electromagnetic data with borehole hydrogeochemistry to understand groundwater hydrology in the Cobar NDI campaign area in western New South Wales.

Our students are embedded within Project research teams, with supervisors across multiple Participant organisations and including at least one supervisor from industry or GSO Participant. Students attend regular Project meetings and workshops (including quarterly Project Review Panel meetings) to discuss their research, remain up-to-date with inter- and intra-Project research developments and ensure continued alignment with Project objectives. During the reporting period, one student attended the NSW NDI workshop held in Newcastle in November, seven students attended a Project 7 CloudStor online workshop in June, and three students attended a Project 6 online workshop in June, with one of these students also presented at the workshop. Four students attended the Drilling 101 workshop, and five students attended the Seismic Exploration workshop, which were conducted immediately before our Annual Conference in November 2019.

All 12 MinEx CRC postgraduate students who were active at the time of the inaugural 2019 Annual Conference were involved in the event. An additional three students who were registered shortly after the Annual Conference also attended. Each student gave a brief oral presentation introducing themselves and their Project. A dedicated workshop was held for the student cohort in conjunction with the conference. The students were able to meet and greet the E&T Committee, who gave a brief introduction of themselves and their role(s) within the CRC.

### **Involvement of end-users in developing and conducting E&T activities**

All MinEx CRC postgraduate projects are developed in collaboration with industry or GSO Participants or Affiliates and are required to have an industry or GSO co-supervisor. The registration process for MinEx CRC postgraduate students requires the approval of the project topic and supervisory panel by industry or GSO co-supervisor in addition to a MinEx CRC Project Leader,

Program Leader, E&T Committee Coordinator and CSO. Industry and GSO co-supervisors in current MinEx CRC postgraduate projects include staff from Anglo American, BHP, CSIRO, GSNSW, GSSA, GSWA, GA and McKay Drilling.

Relevant MinEx CRC Participants and Affiliates were engaged in the in-house VET Training Needs Analysis conducted during the reporting period. A strategy and timeline for further engagement of end-users and training delivery organisations, including Registered Training Organisations and TAFE has been developed.

### **Support structures and opportunities for postgraduate students**

Postgraduate students who travelled interstate to attend our Annual Conference in Perth in November 2019 received financial support (over and above their student bursary) from the E&T budget to travel to the event. We view the Annual Conference as a key opportunity for interaction between students working in different parts of the CRC and networking with other researchers and industry sponsors. To enhance the student experience, we ran a dedicated student workshop in parallel with the Annual Conference, which was attended, 15 students. The aim of the workshop was to introduce students to one another as well as to the E&T Committee, who will be supporting them through their postgraduate degree. Members of the E&T Committee introduced themselves to the students and gave a brief overview of their professional role, including their role within MinEx CRC.

During 2019 we ran a trial of an online student mentoring application developed by experiential learning company Practera. The app is designed to connect students with their industry supervisors and help develop the networking skills of students. The MinEx CRC HDR cohort discussed their experience of the Practera mentoring app during the Annual Conference student workshop in November 2019. The app received mixed reviews from students, and further engagement with the app has been suspended for now.

Regular videoconference sessions on a 2-3 weekly basis have been implemented to support students during the Covid-19 pandemic. The sessions have been an opportunity for the diverse and geographically spread student cohort to connect regularly. The sessions have been attended by the MinEx CRC CEO, CSO, Program Leaders and Communications Manager.

### **E&T activities and end-user needs**

E&T activities have featured prominently at the MinEx CRC annual conference and a student day, with widespread end-user participation in the form of MinEx CRC participant attendance. Feedback to date has been overwhelmingly positive that activities are meeting projected end-user needs.

To ensure the relevance of our E&T program to end-users MinEx CRC has engaged industry and GSO Participants and Affiliates in the design and implementation of HDR projects and our Training Needs Analysis for VET.

### 3.8. Intellectual Property (IP) Management

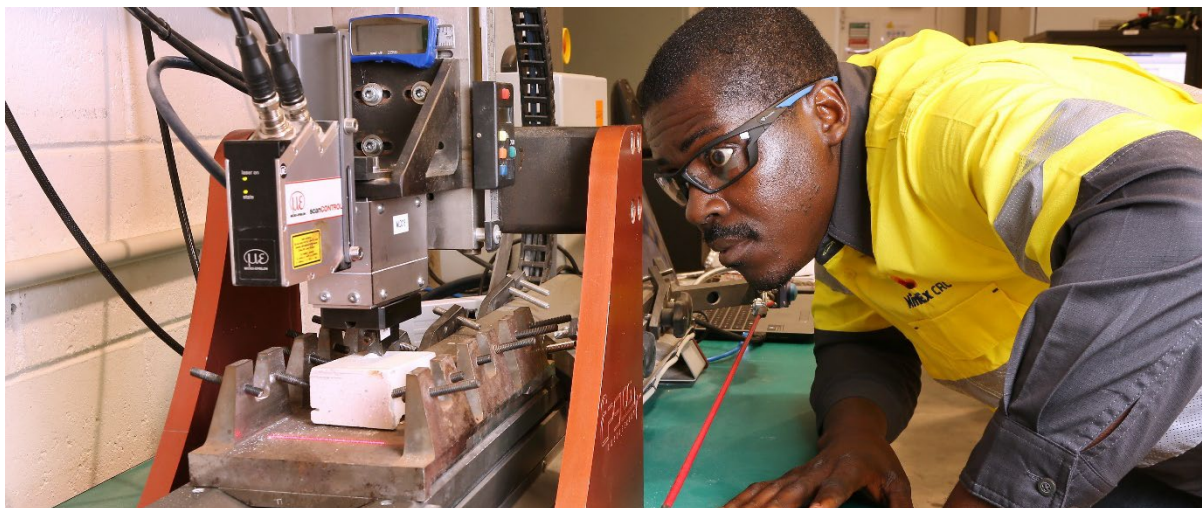
The following principles are applied in MinEx CRC under the guidance of a Board sub-committee:

- IP resulting from MinEx CRC research will be legally owned by MinEx CRC and beneficially owned according to project shares defined in individual Project Agreements. The only exception in Projects 1 to 6 is Project 6, where MinEx CRC legally and beneficially owns the IP due to open-source software being developed.
- IP will be licensed to the existing METS supplier sector.
- IP is to be diffused IP into the METS supplier sector as rapidly as possible as enhanced technology and/or services to mining companies, with the mining companies who sponsor MinEx CRC having first right of access.
- The METS supplier sponsoring each major Project will have the first right to submit a commercialisation plan regarding IP developed by that Project, as outlined in Section 3.6.

MinEx CRC currently holds:

- Fifty-four properties across nine patent families.
- Sixteen properties across three design families and three trademark registrations.

A list of Registered IP (patents, trademarks, designs) held by MinEx CRC is included in the MDQ and as Appendix C. The majority of Intellectual Property patents and families listed originated in the DET CRC and were deeded to MinEx CRC on the termination of DET CRC in 2018.



*Program 1 Researcher Ifechukwu Michaelis conducting experiments at the Curtin University Drilling Mechanics Lab.*

### 3.9. Collaboration

A key goal of MinEx CRC is to develop a research community of the size, scale and skills capable of delivering on the MinEx CRC vision. This requires a high level of collaboration between the Participant research institutes, government survey organisations (GSOs), mining companies and METS companies. Specific examples of collaboration during the reporting period include:

- The MinEx CRC Science Advisory Committee (SAC) met three times during the reporting period, at its inaugural meeting via telecon on 13 August 2019, at a face-to-face meeting following our Annual Conference on 14 November 2019 and in an online meeting following our Project Integration Workshop on 29 April 2020. The SAC comprises representatives of each Participant, along with one representative from the pool of GSO Affiliates and one representative from the pool of other Affiliates. The role of the SAC is to provide advice to the CSO on the strategic research direction of MinEx CRC and the allocation of resources from the Opportunity Fund.
- Research projects 1 to 6 each have a Project Review Panel (PRP), and the National Drilling Initiative (including research projects 7 to 9) has a Program Review Panel (PRP). Members of the PRPs are drawn from the industry, GSO or METS Participants with a rotating Chair appointed by members. The PRPs met four times during the reporting period, with timing aligned to our quarterly reporting cycle. Perhaps the most important task of the PRPs was to advise on and approve quarterly project milestones in advance of the 2020 calendar year.
- To ensure regular communication between collaborators, there are fortnightly teleconferences for each research project and monthly teleconferences for each program. Project Leaders convene occasional face-to-face workshops in consultation with PRP Chairs.
- All Higher Degree by Research (HDR) students are required to have a co-supervisor from a mining company, METS or GSO.
- MinEx CRC provides the opportunity for smaller mining companies, METS companies and GSOs to participate via its Affiliate program. Affiliates can be directly involved in research projects, either as active researchers, contributors of in-kind resources or through utilisation of the outputs, at a lower financial commitment than Participants.
- Regular meetings between the large and geographically dispersed NDI research team have been essential to establishing the framework for ongoing research. The nature of these meetings has changed in-light-of Covid-19, with face-to-face meetings increasingly replaced by online meetings since March 2020. During the reporting period, these meetings have included:
  - Project 3 held an industry workshop 22 August 2019, during which the specifications for the downhole assay tool were discussed, and the strategy for the tool development agreed upon.
  - We held NDI science workshops for 'the Gap' campaign area of Western Australia (held online on 11 October 2019) and the North and South Cobar campaign areas (held face-to-face in Maitland, 7 November 2019).
  - We held our Annual Conference in Perth on 12-14 November 2019. The conference was attended by 175 delegates, 66% from our Industry and GSO Participants.
  - Project 7 held a "Structure from drill core" workshop at the GSWA core yard on 10-11 December 2019. The workshop had 20 participants, including representatives from Participant METS and Mining companies, GSOs and research organisations.
  - Project 6 held a five-day workshop in Busselton, Western Australia in March 2020. There were forty attendees, including representatives from Participant Geoscience Australia, GSSA, GSWA and GSNSW. First public versions of map2loop and drillhole2loop algorithms were made available to Participants, earlier than planned, due to interest at the Busselton workshop.

- A Project Integration Workshop was held on 29 April 2020. The purpose of the workshop was to identify cross-project linkages and dependencies and determine how to manage the dependencies and maximise the opportunities of working together. The workshop was held via a combination of Zoom (live video + audio + screen share for presentations) and Slack (chat room + file sharing). We recorded 66 attendees at the meeting, including all Program Leaders, Project Leaders and Embedded Researchers. There were 25 attendees from research organisations, 27 from geological survey organisations, three from service provider companies, six from mining companies and five from MinEx CRC head office.

Phase 1 research projects include 32.36 FTE staff in-kind and \$8.6M non-staff in-kind contributions provided by mining, METS and GSO Participants and Affiliates. There is close collaboration between mining company, METS and GSO Participants and Affiliates and research organisations in the conduct of project research including:

- Participant McKay Drilling provided access to and drilling time on an RC drill rig, on a working drill site in the Pilbara region of Western Australia. The rig was instrumented with more than 50 sensors by the Project 1 research team, with 4GB data collected over 12 hours and hundreds of meters of drilling.
- Participant Sandvik has provided an underground drill rig to the Project 1 research team. The drill rig was shipped from Finland and arrived at Curtin University in December 2019. The drill rig forms the central component of a laboratory experimental drilling platform which will be completed in early 2021.
- Participant LKAB Wassara has contributed a bottom hole positioning module for Coiled Tubing (CT) drilling. The tool was shipped from Sweden in January 2020 and is undergoing assessment by the Project 2 research team as our first candidate positioning tool.
- Participant Epiroc has contributed a novel coring tool with potential for CT drilling applications. The Project 2 research team incorporated the Epiroc tool in designs for a 'spot coring module' which could be added on-demand to the CT bottom hole assembly to deliver short intervals of the core at chosen depths.
- Participant Imdex is contributing 0.4 FTE staff in-kind and significant research infrastructure to Project 20.2. This includes a commercial Solids Removal Unit (SRU) which has been shipped from Western Australia to the University of South Australia workshop in February 2020 and is providing the primary research platform for fine-fraction sampling experiments.
- Affiliate Sercel has contributed its DAS interrogator hardware, fibre optic cable, and software, which are critical to Project 5 optic fibre DAS field deployments.
- Participant Anglo American has collaborated with the Project 5 research team to conduct an in-mine trial of surface and borehole seismic acquisition using optic fibre distributed acoustic sensing (DAS). The trial took place at an Anglo American coal site in Queensland in October 2019.
- Affiliate Matsa Resources has collaborated with the Project 5 research team to conduct a 3D optic fibre DAS seismic survey.
- Participant MRIWA collaborated with the Project 6 research team to build a 3D model of the entire Hamersley Basin by stitching together twenty-four 1-degree models built from GSWA maps and constrained by the GSWA drilling database.
- Participants GSWA, GSNSW and Anglo American are conducting in-house testing of proof-of-concept map2loop codes developed by Project 6. The codes enable deconstruction of digital geological maps into discrete data (structural dips of beds, fault and fold traces, and the stratigraphic base of each unit) which can be used as inputs to 3D geological models.
- Participant and Affiliate geological survey organisations are contributing significant staff and non-staff in-kind to the National Drilling Initiative (NDI), including Program and Project

management, new data acquisition, access to legacy data, logistic support and co-supervision of HDR students. GSOs and Participant research organisations in the NDI share responsibility and workload for delivering project milestones.



*MinEx CRC Postgraduate student Angus Nixon (UoA)*



### 3.10. SME Engagement

MinEx CRC engages with METS and junior explorer SMEs both as Participants and via our Affiliate program.

Technologies and services developed by MinEx CRC will add to the value and export income of Australia's world-leading METS sector by creating new drilling and sensing technologies, determining how the technologies should be best applied and providing training to ensure most effective uptake of the technology and services. The Australian METS sector comprises ~2500 companies, over three-quarters of which are small to medium enterprises (SMEs). The Australian mineral exploration industry is currently ~1/8th of the global market. The remaining ~7/8ths of that market presents a significant growth opportunity for METS sector SMEs offering cheaper and more efficient products and services.

Affiliates, at the cost of \$10K pa, may be;

- METS Suppliers of any size,
- junior explorers/miners with market capitalization <\$AUD 500M or,
- Geological surveys which are not Participants.

Affiliate cash contributions may qualify for a tax offset under the Australian Government's R&D Tax Incentive Scheme.

New Participants and Affiliates may apply to join MinEx CRC at any time. This process requires approval by Participants (in the case of Participant applications) and by the MinEx CRC Board of Directors in all cases. Participants are also able to apply to become a Member of MinEx CRC Ltd.

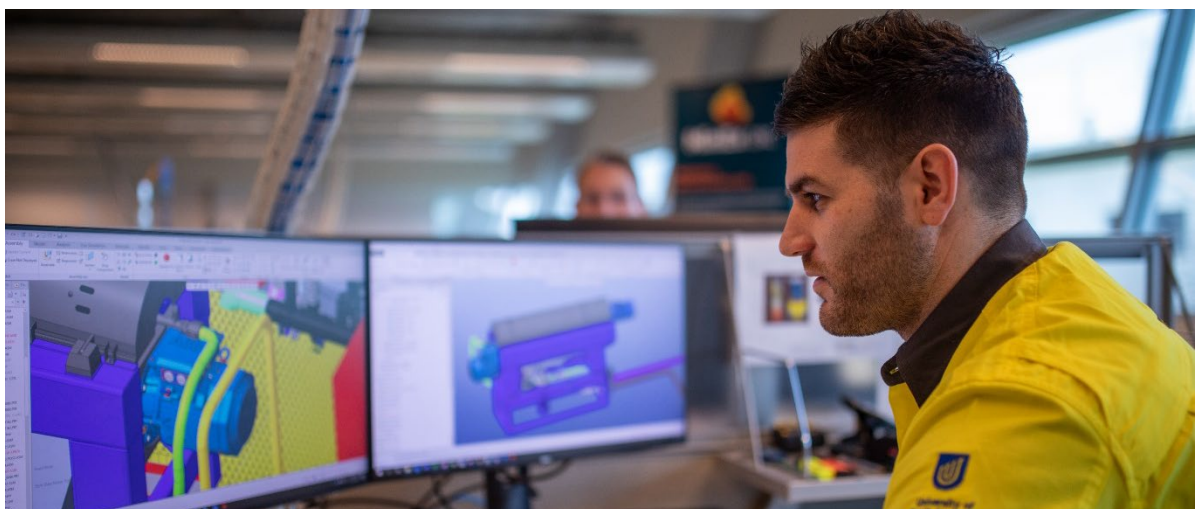
During the reporting period MinEx CRC had 17 Affiliate members comprising four junior mineral exploration companies, seven supplier/other companies and four State and Territory Geological Surveys. Nine of these Affiliate organisations are SMEs. A full list can be found in section 3.12.

There are a number of ways in which SMEs can engage with MinEx CRC, from becoming a full Project Participant through to regular updates and networking (see Section 3.11 Communications for a full list of communications activities available to Affiliates). Specific meetings catering for Affiliates were held in parallel with the MinEx CRC Annual Conference in November 2019 and at each of the Science Advisory Committee meetings.

Specific examples of research engagement with METS and junior exploration SMEs during 2019-2020 include:

- Participant McKay Drilling provided access to and drilling time on a RC drill rig, on a working drill site in the Pilbara region of Western Australia. The rig was instrumented with more than 50 sensors by the Project 1 research team, with 4GB data collected over 12 hours and hundreds of meters of drilling.
- Participant Imdex is contributing 0.4 FTE staff in-kind and significant research infrastructure to Project 20.2. This includes a commercial Solids Removal Unit (SRU) which has been shipped from Western Australia to the University of South Australia workshop in February 2020 and is providing the primary research platform for fine-fraction sampling experiments.
- Affiliate Sercel has contributed its DAS interrogator hardware and software, which are critical to Project 5 optic fibre DAS field deployments.

- Affiliate Matsa Resources has collaborated with the Project 5 research team to conduct a 3D optic fibre DAS seismic survey. The survey was conducted over a salt-lake in Western Australia in June 2020.
- Affiliate Minotaur Exploration has collaborated with research providers to propose a company supported PhD project with fieldwork located in the Peake and Dennison Ranges of outback South Australia.
- Affiliate Strategic Energy Resources has collaborated with research providers to propose a company supported PhD project with fieldwork located in the east Yilgarn region of outback Western Australia.



*MinEx CRC Project 20 Leader: Shane Fox (UniSA)*

### 3.11. Communications

MinEx CRC communications activities are summarised below.

INTERNAL COMMUNICATIONS	EXTERNAL COMMUNICATIONS
Social Media: Twitter	Social Media: Twitter
Social Media: LinkedIn	Social Media: LinkedIn
MinEx CRC Corporate Brochure	MinEx CRC Corporate Brochure
MinEx CRC Postgraduate Booklet v2	MinEx CRC Postgraduate Booklet v2
MinEx CRC Postgraduate Flyer	MinEx CRC Postgraduate Flyer
MinEx CRC TV	MinEx CRC TV
Website	Website
Quarterly vNews	Quarterly vNews
Project Animations	Project Animations
Externally Generated Media and Trade Press Articles	Externally Generated Media and Trade Press Articles
Internally Generated Media and Trade Press Articles	Internally Generated Media and Trade Press Articles
Project Summaries	Project Summaries
Board Dinners	Board Dinners
MinEx CRC Pull Up Banners	MinEx CRC Pull Up Banners
Annual Conference	Annual Conference
MinEx CRC Value Proposition Flyer	MinEx CRC Value Proposition Flyer
CEO and Directors' Liaison with Participant Reps	CEO and CSO Direct Contacts to Potential Participants
Chairman's Board Meeting Summaries	External Conference Presentations
CEO and Directors' Liaison with Participant Reps	External Conference Scientific Abstracts
Knack Reporting System	External Peer-Reviewed Scientific Journals
Internal Technical Reports	Externally Generated Media and Trade Press Articles
Science Advisory Committee Meetings	Internally Generated Media and Trade Press Articles
Education and Training Committee Meetings	
Executive Committee Monthly Teleconferences	
Monthly Program Teleconferences	
Project Integration Workshop	
Quarterly Chairman's Update	

#### Internal Meetings and Conferences

The communications highlight for 2019-2020 was MinEx CRC's first Annual Conference: Frontier Exploration. Events were held over the period 12-14 November 2019 in Perth, WA. Over 175 delegates attended the conference (66% from industry/end-user organisations and 34% from research organisations). 85% of Participant organisations and 52% of Affiliate organisations were represented.

Key components of the Annual Conference included:

- Drilling 1.1 Workshop led by Masood Mostofi (Project 1 Leader), attended by 21 delegates;
- Seismic Workshop led by MinEx CRC Affiliate member HiSeis, attended by 16 delegates;
- A session for PhD students led by Caroline Forbes (Education and Training Coordinator), attended by 23 students;
- A day of presentations by MinEx CRC sponsors and invited guests;
- One day of researcher presentations and meetings.

On 29 April 2020, a Project Integration workshop was held online and attended by 66 delegates. The purpose of this workshop was to a) identify cross-project linkages and dependencies and b)

maximise the opportunities of working together across research streams. This workshop facilitated a resulting set of actions to embed cross-project collaboration.

### **Board communications**

The Board has taken on key responsibilities concerning communications, and dinners precede Board meetings with MinEx CRC stakeholders.

A Chairman's Update is distributed to key stakeholders after each Board Meeting. These updates communicate key outcomes of the Board Meeting as appropriate.

Directors have also each taken on the responsibility of liaising with one or more participant representatives to ensure the lines of communication are kept open with key Industry Participants. The chairman circulates a summary of Board Meetings to participant representatives, program leaders and project leaders.

### **Internal reports and Participant information**

Minex CRC has developed in-house a research project tracking and reporting tool, using the Knack Database cloud based software. All quarterly project reports are completed and reviewed by Participants using the Knack system. Quarterly reports completed by the project leaders are reviewed and commented upon sequentially by the:

- Program Leader
- CSO
- CEO, and
- Chair of the Project Review Panel (end-user).

Completed reports are then saved to the MinEx CRC web-based SharePoint system and are available to the relevant Project Participants.

Scientific documents, including internal technical reports, conference and meeting presentations and papers submitted for external publication are checked for IP and confidentiality compliance by Project and Program Leaders, recorded as MinEx CRC documents and uploaded to SharePoint where they can be accessed by project Participants.

The MinEx CRC SharePoint system is also used to create a Participant and Members on-line library of key documents relating to the CRC, the various CRC Reports, Financial reports and Participant updates.

### **MinEx CRC printed media content.**

Although MinEx CRC is focussed on digital technology media for external engagement, we produce printed (or online printable) versions of content which can be disseminated in hard copy at conferences and events.

The following printed media content was also readily available:

- MinEx CRC Corporate Brochure;
- MinEx CRC Value Proposition flyer (updated during the reporting period);
- Project summaries of 1-2 pages prepared for each Project to provide condensed, public domain information;
- MinEx CRC Postgraduate Education Booklet V2 and;
- MinEx CRC Postgraduate flyer, V2.

### **MinEx CRC online content**

MinEx CRC distributed four editions of its quarterly vNews during the reporting period. The MinEx CRC vNews is distributed via email and is hosted on the MinEx CRC website and YouTube channel.

MinEx CRC TV continues to be a key communication tool for reporting on research outcomes. MinEx CRC TV is hosted on YouTube ([www.youtube.com/channel/UCIK1DM2n\\_MGVb08zWLvn7fg](https://www.youtube.com/channel/UCIK1DM2n_MGVb08zWLvn7fg)) and on the MinEx CRC website ([www.minexcrc.com.au/news/minex-tv-2/](http://www.minexcrc.com.au/news/minex-tv-2/)).

MinEx CRC TV consists of five channels:

- Corporate (general corporate information)
- vNews Quarterly Updates (quarterly updates)
- Research (videos showcasing research vision)
- '60 Seconds With...' (video campaign showcasing researchers and sponsors)
- NDI Drilling Campaigns (video campaign showcasing NDI drilling projects).

11 new videos were uploaded to MinEx CRC TV during the reporting period:

- Three vNews editions
- Four '60 Seconds With...' Profiles
- Four Corporate Videos

MinEx CRC videos generated over 2.2K views in total during the reporting period.

Social media channels via LinkedIn and Twitter are here:

- <https://www.linkedin.com/company/17923289>
- <https://twitter.com/CrcMinex>

The MinEx CRC website generated over ~6,000 visitors and ~31,000 page views during the reporting period. Online Media Reports are collated quarterly to manage engagement levels and compare website, vNews and YouTube metrics. Online Media Reports for the reporting period are included as (Appendix D).

### **External Media Coverage**

MinEx CRC has been well-represented in newspapers and trade press during the reporting period, generating 122 media hits. Key external written communications regarding MinEx CRC during the reporting period were:

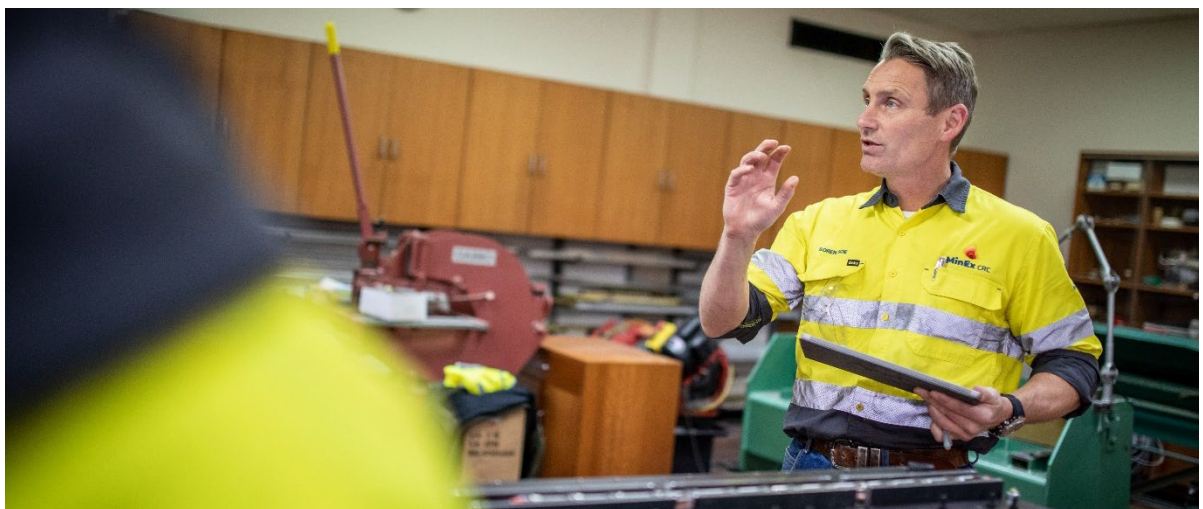
- The Adelaide Advertiser (July 2019)
- Western Herald (July 2019)
- Australia's Mining Monthly (August 2019)
- Australian Mining (November 2019)
- The Mining Chronicle (January 2020)
- Australian Manufacturing Technology Magazine (June 2020).

### **External Meetings and Conferences**

Key external oral communications at conferences regarding the CRC overall (as opposed to technical conference papers on specific research outcomes) were made at the following conferences during the reporting period:

- Uncover Curnamona, Broken Hill (July 2019)
- AUSTMINE Tech Talk, online (August 2019)
- Diggers and Dealers, Kalgoorlie (August 2019)
- DRILL 2019, Darwin, (September 2019)
- IMARC, Melbourne (October 2019)

- Geological Survey of South Australia (GSSA) Discovery Day, Adelaide (November 2019)
- Geological Survey of Western Australia (GSWA) Open Day, Perth (February 2020)
- PDAC 2020, Toronto (March 2020)
- METS Tech Talk Webinar Series, online (April 2020)
- IMARC METS Arena, online (June 2020).



*Program 1 Leader Soren Soe (UniSA) conducting experiments.*

### 3.12. Partners and third parties

#### List of Participants during the reporting period

PARTICIPANT'S NAME	ABN or ACN	ORGANISATION TYPE	CATEGORY
Anglo American	N/A (International)	Industry	Large Miner
Australian National University	52 234 063 906	Research	University
Barrick Gold Corporation	N/A (International)	Industry	Large Miner
BHP Billiton	46 008 700 981	Industry	Large Miner
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	41 687 119 230	Government Body	Statutory Body
Curtin University	99 143 842 569	Research	University
Epiroc	N/A (International)	Industry	METS
Geological Survey of New South Wales	38 755 709 681	Government Body	Geo Survey
Geological Survey of South Australia	83 768 683 934	Government Body	Geo Survey
Geological Survey of Western Australia	69 410 335 356	Government Body	Geo Survey
Geoscience Australia	80 091 799 039	Government Body	Geo Survey
Geotec Boyles Bros	N/A (International)	Industry	METS
HiSeis	83 136 507 429	Industry	METS
Imdex	78 008 947 813	Industry	METS
LKAB Wassara	N/A (International)	Industry	METS
McKay Drilling	21 009 392 625	Industry	METS
Micromine Pty	52 000 047 745	Industry	METS
Minerals Research Institute of Western Australia (MRIWA)	86 779 457 072	Government Body	Statutory Body
Olympus Scientific Solutions Americas Corps	N/A (International)	Industry	METS
Sandvik	N/A (International)	Industry	METS
South 32	74 601 343 202	Industry	Large Miner
The University of Adelaide	61 249 878 937	Research	University
University of Newcastle	52 234 063 906	Research	University
University of South Australia	37 191 313 308	Research	University
University of Western Australia	37 882 817 280	Research	University

#### Changes to Participants during the reporting period

PARTICIPANT'S NAME	WITHDRAWN or NEW	DEPARTMENT APPROVAL
Barrick Gold Corporation	Withdrawn	Yes

There was one withdrawal to the Participants during the reporting period. Barrick Gold Corporation withdrew effective 17 April 2020. The Commonwealth Agreement has been updated to reflect the withdrawal of Barrick Gold Corporation.

#### List of Affiliates during the reporting period

Affiliate's Name	ABN or ACN	Organisation	Category
AuScope	33 125 908 376	Government Body	Statutory Body
Datacode	N/A (International)	Industry	METS
EnviroCopper	19 635 434 721	Industry	Junior Miner
Geological Survey of Queensland	59 020 847 551	Government Body	Geo Survey
Geological Survey of Victoria	83 295 188 244	Government Body	Geo Survey
Major Drilling	46 001 393 139	Industry	METS
Matsa Resources	88 613 060 352	Industry	Junior Miner
Minalyze	N/A (International)	Industry	METS
Mineral Resources Tasmania	36 388 980 563	Government Body	Geo Survey
Minotaur Exploration	35 108 483 601	Industry	Junior Explorer
Northern Territory Geological Survey	84 085 734 992	Government Body	Geo Survey
Santos	80 007 50 923	Industry	Large Miner
Sercel	N/A (International)	Industry	METS
Snowden	99 085 319 562	Industry	METS
Strategic Energy Resources	14 051 212 429	Industry	Junior Explorer
Southern Geoscience Consultants	69 067 552 461	Industry	METS
University of New South Wales	57 195 873 179	Research	University

#### Changes to Affiliates during the reporting period

AFFILIATE'S NAME	WITHDRAWN or NEW	DEPARTMENT APPROVAL
AuScope	New	Yes
Matsa Resources	New	Yes
Sercel	New	Yes
EnviroCopper	New	Yes
Major Drilling	Withdrawn	Yes
Santos	New	Yes
Southern Geoscience Consultants	Withdrawn	Yes

There were five new additions and two withdrawals to the Affiliates during the reporting period.

AuScope, Matsa Resources, Sercel SAS, EnviroCopper Ltd and Santos QNT Pty Ltd joined MinEx CRC and were approved by the Board.

Major Drilling Pty Ltd withdrew as of 15 August 2019, and Southern Geoscience Consultants Pty Ltd withdrew as of 30 March 2020.



### 3.13. Governance – Board, Committees and Key Staff

MinEx CRC Ltd was incorporated on 12 April 2018 to carry out the activities of the Mineral Exploration Cooperative Research Centre. MinEx CRC is a company limited by guarantee, with Participants in the CRC eligible to become company members.

MinEx CRC Ltd is a registered charity and operates under the Australian Charities and Not-for-profits Commission (ACNC) regulatory regime and is governed by an independent skills-based Board and Chair. The Board are accountable to several stakeholders, including the Australian Government through the Commonwealth Agreement, our participants through the respective Participants Agreement and Affiliates Agreements, and our Members through the Constitution. In addition to monitoring the performance of the MinEx CRC, the Board plays an essential role in the approval and regular review of MinEx CRC funded Projects to ensure that research is aligned with its objectives.

The roles, responsibilities, delegations and authorities of the Board, the respective Committees of the Board and Management are defined in the MinEx CRC Corporate Governance Manual, which is the essential corporate governance reference of the Company. A key component of the governance structure is Board Committees, all of which are directed by their Committee Charters/Terms of Reference. These Board Committees are the Risk and Audit Committee, Remuneration and Nomination Committee (R&NC) and the Commercialisation Committee whose representatives are elected by the Members in accordance with the CRC Constitution. The R&NC will be established to identify suitable candidates for nomination and appointment as Directors when the need arises.

MinEx CRC's governance framework has been designed to ensure transparent accountability to all Stakeholders (Figure 2). No material changes in structure have been undertaken in the past year.

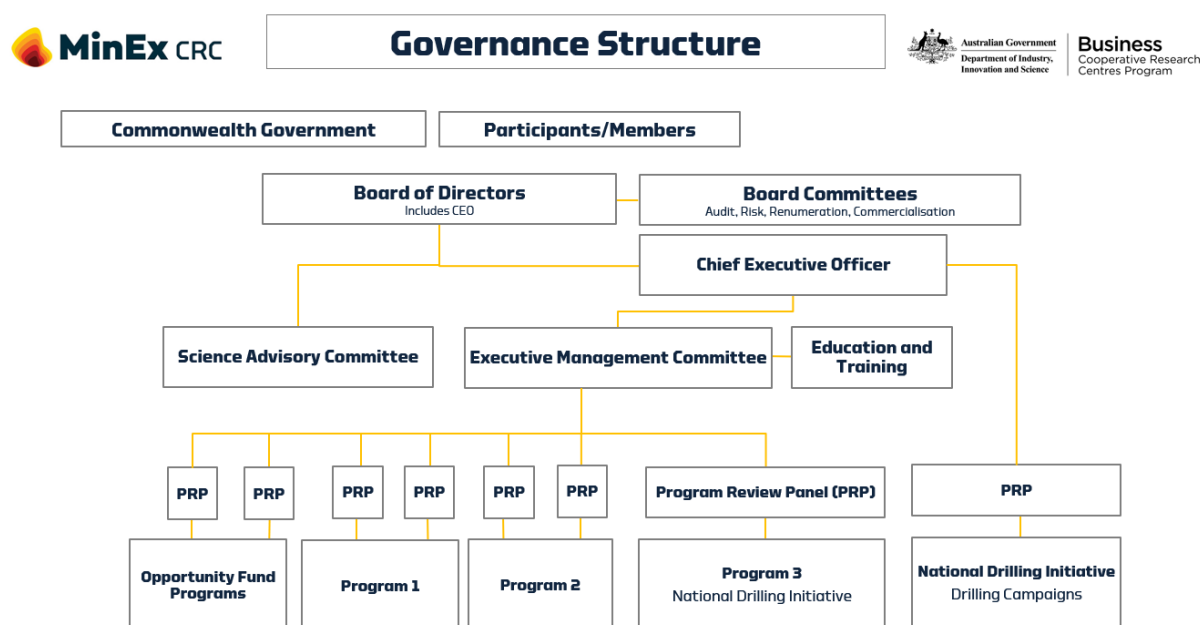


Figure 2: Governance structure of MinEx CRC.

MinEx CRC is dual-headquartered. The registered office is located at the Australian Resource Research Centre, Bentley, Western Australia. The secondary office is located at the Future Industries Institute of the University of South Australia, Mawson Lakes Campus, Adelaide, South Australia. Day

to day business is transacted through the Chief Executive Officer, under a contract overseen by the Board.

### **MinEx CRC Directors**



Chris Pigram AM



Andrew Bailey



Lindsay Gilligan, PSM



Kelly Keates



Linda Kristjanson AO



Erica Smyth AC



Peter Rossdeutscher, FAICD

### **Board Members and Board Attendance**

NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION	MEETINGS ELIGIBLE	MEETINGS ATTENDED
Chris Pigram	Chairman	Geology & Research, Governance	Independent	4	4
John Emerson*	Director	Mining & Exploration	Independent	0	0
Kelly Keates	Director	Geophysics & SMEs	Independent	4	4
Lindsay Gilligan	Director	Government Agencies	Independent	4	4
Linda Kristjanson	Director	Research, Education & Training, Governance	Independent	4	4
Peter Rossdeutscher	Director	Commercialisation, Governance	Independent	4	4
Erica Smyth	Director	Mining & Exploration	Independent	4	4
Andrew Bailey	CEO	Geology, Exploration, Research	MinEx CRC	4	4

\*John Emerson deceased 30 August 2019.

No board elections were required to be conducted in the past year. The number of Board Members decreased by one with the passing of John Emerson on 30 August 2019. An alternative for this position was not sought. Board Meetings held during 2019-2020:

- 10 September 2019, Adelaide
- 12 November 2019, Perth
- 11 February 2020, Perth, and
- 13 May 2020, Canberra, by telecon.

#### Committee Members as of 30 June 2020

COMMITTEE NAME			
Risk and Audit Committee			
NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION
Linda Kristjanson	Chair	Research, Education & Training, Governance	Independent
Lindsay Gilligan	Member	Government Agencies	Independent
Erica Smyth	Member	Mining & Exploration	Independent

Audit and Risk Committee Meetings held during 2019-2020:

- 3 September 2019, Telcon
- 10 September 2019, Adelaide
- 29 October 2019, telecon, and
- 29 January 2020, Telcon.

COMMITTEE NAME			
Remuneration and Nomination Committee			
NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION
Chris Pigram	Chair	Geology & Research, Governance	Independent
Lindsay Gilligan	Member	Government Agencies	Independent
Kelly Keates	Member	Geophysics & SMEs	Independent

Remuneration and Nomination Committee telecon Meetings held during 2019-2020:

- 30 January 2020, and
- 7 February 2020.

COMMITTEE NAME			
Commercialisation Committee			
NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION
Peter Rossdeutsch	Chair	Commercialisation, Governance	Independent
Erica Smyth	Member	Mining & Exploration	Independent

There were no Commercialisation Committee meetings held during 2019-2020.

COMMITTEE NAME			
Education and Training Committee			
NAME	ROLE	KEY SKILLS	INDEPENDENT/ORGANISATION
Caroline Tiddy	Chair	Geology, Research & Education	University of SA
Stijn Glorie	Member	Geology, thermochronology	University of Adelaide
Alistair Hack	Member	Mineral systems science	Newcastle University
Masood Mostofi	Member	Drilling Engineering	Curtin University
Mark Jessell	Member	Project 6 Leader	University of WA
David Giles	Member	Chief Science Officer	MinEx CRC
Soren Soe	Member	Program 1 Leader	University of SA
Yulia Uvarova	Member	Program 2 Leader	CSIRO
Anthony Budd	Member	Program 3 Leader	Geoscience Australia

Education and Training Committee Meetings held during 2019-2020, all by Telecon:

- 9 August 2019
- 1 November 2019
- 27 February 2020, and
- 29 May 2020.

<b>COMMITTEE NAME</b>			
<b>Executive Management Committee</b>			
<b>NAME</b>	<b>ROLE</b>	<b>KEY SKILLS</b>	<b>INDEPENDENT/ORGANISATION</b>
Andrew Bailey	Chair	MinEx CRC CEO	MinEx CRC
Michael McGilvray	Member	MinEx CRC Finance Manager	MinEx CRC
David Giles	Member	Chief Science Officer	MinEX CRC
Soren Soe	Member	Program 1 Leader, Engineering	University of SA
Yulia Uvarova	Member	Program 2 Leader	CSIRO
Anthony Budd	Member	Program 3 Leader	Geoscience Australia
Caroline Tiddy	Member	Geology, Research & Education	University of SA
Anna Porter	Member	Communications Manager	MinEX CRC

Executive Management Committee Meetings held during 2019-2020, all by Telecon:

- 26 July 2019
- 23 August 2019
- 24 September 2019
- 28 October 2019
- 11 December 2019
- 23 January 2020
- 20 February 2020
- 20 March 2020
- 23 April 2020
- 21 May 2020, and
- 25 June 2020.

### Key Staff

<b>NAME</b>	<b>ORGANISATION</b>	<b>CRC POSITION/ROLE</b>	<b>TIME COMMITTED</b>
Andrew Bailey	MinEx CRC	CEO	100%
Anna Porter	MinEX CRC	Communications Manager	100%
Michael McGilvray	MinEx CRC	Finance Manager, Company Sec.	50%
Denise Worthington	MinEx CRC	Asst Finance Manager	60%
Dianne McGilvray	MinEx CRC	Executive Assistant	50%
David Giles	University of SA	Chief Science Officer	60%
Monique Stagg	University of SA	Administration Officer	60%
Soren Soe	University of SA	Program 1 Leader	100%
Yulia Uvarova	CSIRO	Program 2 Leader	100%
Anthony Budd	Geoscience Australia	Program 3 Leader	100%
Caroline Tiddy	University of SA	E&T Coordinator, Researcher	80%

### Gender Diversity

- The MinEx CRC Board (excluding the CEO) comprises six members, 50% male and 50% female.
- The MinEx CRC Executive Management Committee, including the CEO, comprises eight members, 63% male and 37% female.
- Research Leads for the nine primary programs are 78% male and 22% female.

## 3.14. Financial Management

MinEx CRC commenced operations on 12 April 2018. The financial tables provided below compare FY20 to the period from 12 April 18 to 30 June 2019.

REF	TITLE
Table 2	Revenue and Expenditure
Table 3	Statement of Financial Position
Table 4	Cash Report, including a comparison to the Commonwealth Agreement budget.

The following key points provide an overview of the financial performance of the CRC during FY20:

### Cash Balance and Surplus

The CRC had a retained restricted surplus for FY20 of \$5.6M (FY19 of \$11.8M), and a cash balance one 30 June 20 of \$18.2M (30 June 19 \$13.7M). All of these funds are committed to future research programs, drilling campaigns, education and training activities and management of operational activities. NDI drilling campaigns expected to commence in September 2020, are expected to reduce the cash balance by up to \$8M.

### Participant Contributions

Total participant contributions received of \$5.3M (\$12.0M in FY19) exceeded the Commonwealth Agreement Budget (CAB) amount of \$4.2M by \$1.1M, primarily due to payments made in advance.

### Research Projects

Research projects commenced in January 2019. Payment to researchers is made quarterly in arrears based on actual expenditure. Project expenses were \$5.5M in FY20 (\$1.7M in FY19).

### Interest Income

Cash balances are being invested in a mixture of short- and medium-term cash deposits appropriate for cash flow requirements. No interest income was included in the original CAB. Total interest income earned to date is \$424K.

### CRC Contributions

Cash payments from the Commonwealth were \$6.6M in the period. Payments from the Commonwealth are paid quarterly in arrears, following completion of the quarterly CRC Report.

### National Drilling Initiative (NDI) Campaigns

The NDI drilling campaigns are expected to commence in September 2020.

<b>Table 2 - Revenue &amp; Expenditure (\$'000)</b>	<b>FY20</b>	<b>FY19</b>
<b>Revenue</b>		
Commonwealth Funding	6,597.0	2,729.5
Participant Contributions	4,811.8	12,067.5
Affiliates Contributions	285.0	150.0
DET CRC Unspent Participant Contributions	-	113.6
Non-financial asset acquired for Nil Consideration	850.0	-
Interest Income	300.5	124.0
Other Income	122.2	30.8
<b>Total Revenue</b>	<b>12,966.5</b>	<b>15,215.4</b>
<b>Expenditure</b>		
<b>Research Program Expenditure</b>		
- Program 1	2,121.4	486.1
- Program 2	1,524.6	544.8
- Program 3	1,859.8	653.5
- Opportunity Fund & Other Projects		-
<b>Total Research Program Expenditure</b>	<b>5,505.8</b>	<b>1,684.4</b>
Education & Training	384.5	200.0
Management Expenses	492.3	503.8
Salaries & Wages (incl Directors Fees)	996.9	1,005.3
<b>Total Expenditure</b>	<b>1,873.7</b>	<b>1,709.1</b>
<b>Restricted Surplus/(Deficit)</b>	<b>5,587.0</b>	<b>11,821.9</b>

**Table 2: Revenue and Expenditure**

<b>Table 3 - Statement of Financial Position (\$'000)</b>	<b>30-Jun-20</b>	<b>30-Jun-19</b>
<b>Assets</b>		
Cash at Bank	18,167.3	13,688.1
Trade Receivables	-	255.0
Other Receivables	396.6	166.4
Prepayments & Accrued Income	84.3	100.4
Equipment	1,031.2	9.2
<b>Total Assets</b>	<b>19,679.4</b>	<b>14,219.1</b>
<b>Liabilities</b>		
Trade Payables & Accruals	2,205.6	2,366.2
Employee Provisions	59.7	21.3
Lease Liability - Premises	5.2	9.7
<b>Total Liabilities</b>	<b>2,270.5</b>	<b>2,397.2</b>
<b>Net Assets</b>	<b>17,408.9</b>	<b>11,821.9</b>
<b>Retained Restricted Surplus</b>	<b>17,408.9</b>	<b>11,821.9</b>

**Table 3: Statement of Financial Position**

Table 4 - Annual Cash Report (\$'000)			
	ACTUAL	PER AGREEMENT	VARIANCE
Cash Carried Forward	13,688.1	10,404.0	3,284.1
<b>Receipts</b>			
CRC Program Funds for the period	6,597.0	6,694.0	(97.0)
Participant Contributions	5,311.9	4,180.0	1,131.9
Other Firm Cash/Third Party Cash	97.6	-	97.6
GST Received	1,068.6	-	1,068.6
Interest	303.1	-	303.1
<b>Total Receipts</b>	<b>13,378.2</b>	<b>10,874.0</b>	<b>2,504.2</b>
<b>Expenditure</b>			
GST Paid	1,370.0	-	1,370.0
Capital Expenses	237.0	-	237.0
Employee Expenses	5,323.1	5,200.0	123.1
Supplier Expenses	1,968.9	4,963.0	(2,994.1)
Other Expenses	-	-	0.0
<b>Total Expenditure</b>	<b>8,899.0</b>	<b>10,163.0</b>	<b>(1,264.0)</b>
<b>CASH BALANCE CLOSING</b>	<b>18,167.3</b>	<b>11,115.0</b>	<b>7,052.3</b>

**Table 4:** Annual Cash Report, including a comparison to the Commonwealth Agreement budget.

### **3.15. Other Activities**

Not applicable to MinEx CRC.

### **3.16. CRC future plans and transition arrangements**

Not applicable to MinEx CRC.

### **3.17. Monitoring and review activity update**

Not applicable to MinEx CRC.

### **3.18. Activities not covered by the Grant Agreement**

Not applicable to MinEx CRC.



*MinEx CRC Program 1 researcher Chai Siew Hong (Curtin University).*



**MinEx CRC Limited**

26 Dick Perry Avenue, Kensington, WA, 6151  
PO Box 1130, Bentley, WA, 6102, Australia  
admin@minexcrc.com.au



## **Appendix A**

### **Publications**

## Publications

MinEx CRC researchers are highlighted and underlined in the author lists.

**Chen, G., Fox, S.**, Lancaster, D.G. and **Soe, S.** (2020). Temperature-compensated interferometric torque sensor with bi-directional coiling. *Journal of Lightwave Technology*.8p. (Proj 2)

**Giraud, J., Lindsay, M., Jessell, M.** and **Ogarko, V.** (2020). Towards plausible lithological classification from geophysical inversion: Honouring geological principles in subsurface imaging. *Solid Earth*, Volume 11, Issue 2, Pages 419-436. (Proj 6)

Le, C.V.A., **Harris, B.D.** and **Pethick, A.M.** (2019) New perspectives on Solid Earth Geology from Seismic Texture to Cooperative Inversion. *Scientific Reports*, Volume 9, Issue 1, Article number 14737 (Proj 4)

**Reid, A.J.**, Halpin, J.A. and **Dutch, RA** (2019) Timing and style of high-temperature metamorphism across the Western Gawler Craton during the Paleo- to Mesoproterozoic. *Australian Journal of Earth Sciences*, 66 (8), pp. 1085-1111 (Proj 8)

**Reid, A.J., Pawley, M.J., Wade, C.**, Jagodzinski, E.A., **Dutch, RA** and Armstrong, R. (2020) Resolving tectonic settings of ancient magmatic suites using structural, geochemical and isotopic constraints: the example of the St Peter Suite, southern Australia. *Australian Journal of Earth Sciences*, 67 (1), pp. 31-58 (Proj 8)

**Tiddy, C.** and **Giles, D.** (2020). Suprasubduction zone model for metal endowment at 1.60-1.57 Ga in eastern Australia. *Ore Geology Reviews* 122, 30p. (Proj 8)

**Tiddy, C.**, Betts, P. G., Neumann, M. R., Murphy, F. C., Stewart, J., **Giles, D.**, Sawyer, M., Freeman, H. and Jourdan, F. (2020). Interpretation of ca. 1600-1580 Ma metamorphic core complex in the northern Gawler Craton, Australia. *Gondwana Research* 85, Pages 263-290. (Proj 8)

**Urosevic, M., Bona, A., Ziramov, S., Pevzner, R., Tertyshnikov, K.**, Martin, R., Dwyer, J., Felding, D., Guarin, C. and Foley, A. (2019). Seismic exploration of mineral resources in Western Australia with Distribute Acoustic Sensing. 25th European Meeting of Environmental and Engineering Geophysics; The Hague; Netherlands; September 2019 (Proj 5)

Yang, B., **Collins, A.S.**, Cox, G.M., **Jarrett, A.J.M.**, Denyszyn, S., Blades, M.L., Capogreco, N., **Farkas, J.** and **Glorie, S.** (2020). Using Mesoproterozoic sedimentary geochemistry to reconstruct basin tectonic geography and link organic carbon productivity to nutrient flux from a northern Australian large igneous province. *Basin Research*, 17p. (Proj 8)

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admin@minexcrc.com.au

**MinEx CRC**

ABN: 66 625 533 913

## **Appendix B**

### **Student Register**

## Student Register

### Postgraduate Students

#	Student	Uni	Supervisor	Industry co-supervisor	Degree	Project title	Project	Start Date	Finish Date	Date registered
1	Adrienne Brotodewo	UniSA	Caroline Tiddy	Adrian Fabris (GSSA)	PhD	Geochemical signature of zircon in relation to mineral systems	8	3/07/2017	3/07/2020	5/02/2019
2	Alexander Simpson	UoA	Stijn Glorie	Anthony Reid (GSSA)	PhD	Thermochronological and geochemical footprints of fluid alteration, recorded in apatite	8	15/03/2019	15/03/2022	13/02/2019
3	Angus Nixon	UoA	Stijn Glorie	Geoff Fraser (GA)	PhD	Thermochronological Evolution of the McArthur Basin and Surrounding Basement Areas	8	1/01/2019	1/01/2022	13/02/2019
4	Darwinaji Subarkah	UoA	Alan Collins	Amber Jarrett and Geoff Fraser (GA)	PhD	Shale geochemistry and geochronology of the greater McArthur Basin	8	2/06/2019	1/06/2022	6/03/2019
5	Jie Yu	UoA	Martin Hand	Rian Dutch (GSSA)	PhD	Tectonic systems and IOCG mineralisation in the Gawler Craton	8	15/10/2018	15/10/2021	26/03/2019
6	Joe Schifano	UNSW	David Cohen	John Greenfield (GSNSW)	PhD	Regional biogeochemical mapping (and associated regolith studies) of the Cobar Basin for mineral exploration at regional to local scales	9	1/03/2019	1/03/2022	18/04/2019
7	Mitchell Bockmann	UoA	Martin Hand	Rian Dutch (GSSA)	PhD	The tectonic setting of early Mesoproterozoic mineral systems in the Gawler Craton	8	19/03/2018	19/03/2021	26/03/2019
8	Naina	ANU	Marnie Forster	Anthony Reid (GSSA) and Geoff Fraser (GA)	PhD	Cambro-Ordovician magmatism and deformation at the eastern margin of Gondwana, South Australia: Insights into tectonic processes and mineral potential	8	29/03/2019	29/03/2022	6/05/2019
9	Ranee Joshi	UWA	Mark Jessell	Tim Ivanic (GSWA)	PhD	Multi-scale 3D geological modelling of the Yalgoo-Singleton Greenstone Belt using the Loop Platform	6	22/01/2019	22/01/2022	26/02/2019
10	Alexander De Vries Van Leeuwen	UniSA	Tom Raimondo	Rian Dutch (GSSA), Joel Fitzherbert (GSNSW)	PhD	Timing, duration and conditions of metamorphism and crustal melting in the Curnamona Province	8	26/03/2018	17/04/2022	16/09/2019
11	Siew Hong Chai	Curtin	Masood Mostofi	Phillip Fawell (CSIRO)	Masters	Drilling fluid automation	1	1/07/2019	31/06/2021	25/10/2019
12	Hing Hao Chan	Curtin	Masood Mostofi	Aaron Earl (McKay Drilling)	Masters	Experimental investigation on fundamentals of rock-bit interactions using impregnated diamond bits	1	1/07/2019	1/07/2021	28/10/2019

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ABN: 66 625 533 913

#	Student	Uni	Supervisor	Industry co-supervisor	Degree	Project title	Project	Start Date	Finish Date	Date registered
13	Joao Victor Borges dos Santos	Curtin	Thomas Richard	Bevan Eagle (McKay Drilling)	PhD	Experimental study of down-hole percussive drilling	1	30/07/2019	30/07/2022	10/01/2020
14	Mahtab Rashidifard	UWA	Mark Lindsay	Steven Micklethwaite (Anglo American), Richard Chopping (GSWA)	PhD	Constraining regional geophysics with sparse high-resolution data	6	21/10/2019	20/10/2022	12/03/2019
15	Nuwan Suriyaarachchi	UWA	Mark Jessell	Lachlan Hennessey (Anglo American), Richard Chopping (GSWA)	PhD	Integrated passive seismic/EM characterisation of cover as constraints on drilling	6	21/10/2019	20/10/2022	12/03/2019
16	Millicent Crowe	Uni of Newcastle	Alistair Hack	Robert Musgrave (GSNSW), Ian Roach (GA), Andrew King (CSIRO)	PhD	Integrating AEM and hydrogeochemistry: Implications for water resources	8	29/01/2020	29/01/2023	19/02/2020
17	Fernando Fontana	UniSA	Caroline Tiddy	Steve Tassios, Jess Stromberg, Neil Francis, Yulia Uvarova (CSIRO)	PhD	Laser-induced breakdown spectroscopy (LIBS) analysis for real-time downhole chemical assay	3	10/02/2020	9/02/2023	2/11/2020
18	Stacey Curtis	UniSA	Justin Payne	Mark Pawley (GSWA)	PhD	Integrated framework for the magmatic evolution of the greater Delamerian Orogen	8	10/02/2020	9/02/2023	1/04/2020
19	Sasan Farhadi*	(UniSA)	Caroline Tiddy	Neil Francis, Jess Stromberg, Steve Tassios, Yulia Uvarova (CSIRO)	(PhD)	Generating synthetic data for training predictive spectroscopic models	3			
20	Anatolii Pakhomenko	Curtin	Andrej Bona	Ashley Grant (BHP)	Masters	Machine learning to invert surface-wave data	5	18/05/2020	18/05/2022	19/06/2020
21	Rui Huang (Eric)	Curtin	Masood Mostofi	Yevhen Kovalyshen (CSIRO)	Masters	Fundamentals of rock fragmentation of impregnated diamond bits	1	1/04/2020	1/04/2022	22/06/2020

\*Preliminary registration

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ABN: 66 625 533 913

## Honours-Masters by Coursework Students

First Name	Last Name	Affiliation	Degree	Project Title	Primary Supervisor	Co-Supervisor(s) & Affiliation(s)
Cris	Cruz	University of Adelaide	Honours	Geochronological analysis of the McArthur and Tawallah Groups, McArthur Basin: age constraints, provenance and implications for basin evolution	Alan Collins	Morgan Blades (University of Adelaide)
Savannah	Liebelt	University of Adelaide	Honours	Testing the redox coupling between chromium and nitrogen isotopes in modern and ancient redox-stratified depositional systems: The Coorong Lagoon	Juraj Farkas	Alan Collins, Jonathan Tyler (University of Adelaide)
Christopher	Lowczak	University of Adelaide	Honours	Copper isotope method development for determining the source of mineralised provinces	Lucy McGee	Juraj Farkas (University of Adelaide)
Gareth	McFadzean	University of Adelaide	Honours	Geochemical analysis of the McArthur and Tawallah Groups, McArthur Basin: Chemostratigraphy & palaeo-redox proxies using shales and carbonates	Alan Collins	Juraj Farkas (University of Adelaide)
Rui	Huang	Curtin University	Masters by Coursework	Designing generic carrier Fluid	Masood Mostofi	Siew Hong Chai (Curtin University)
Shutong	Wang	Curtin University	Masters by Coursework	Drilling Fluid Contamination and Remediation	Masood Mostofi	Siew Hong Chai (Curtin University)
Xiaohan	Wu	Curtin University	Masters by Coursework	Hydraulics of drilling fluid with particles	Hongyang Zhang	Masood Mostofi (Curtin University)

**MinEx CRC Limited**

26 Dick Perry Avenue, Kensington, WA, 6151  
PO Box 1130, Bentley, WA, 6102, Australia  
admin@minexcrc.com.au



## **Appendix C**

### **Registered IP (Patents, Trademarks, Designs)**

**MinEx CRC Limited**

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 admin@minexcrc.com.au



ABN: 66 625 533 913

## Registered IP (Patents, Trademarks, Designs)

### Patents

PATENT FAMILY	RELATES TO	COUNTRY	APPLICATION NO.	FILING DATE	STATUS	MANAGEMENT
Borehole Logging Methods an Apparatus	AutoSonde	International	2013904475	19 Nov '13	Patent applications lodged in numerous countries by Boart Longyear	Boart Longyear
Sampling and Analysis System and Method for use in Exploration Drilling	Lab-at-Rig®	International	2014904646	19 Nov '14	Patent applications lodged in numerous countries by Imdex	Imdex
Drying apparatus and related method	Lab-at-Rig®	International	2014904649	19 Nov '14	Patent applications lodged in numerous countries by Imdex	Imdex
Capture of drilling fluid returns	Lab-at-Rig®	International	2015903272	Aug '15	Patent applications lodged in numerous countries by Imdex	Imdex
Mobile Coiled Tubing Drilling Apparatus	CT Rig	International	2017050508	30 May '17	Patent applications filed in numerous countries by POF on behalf of MinEx	POF (MinEx)
High Speed Downhole Coring System	CT Rig	Australia	2017101088	10 Aug '17	Innovation Patent Granted, 8 years Next renewal 10 Aug '20	POF (MinEx)
Sample Collection System and Parts Thereof	CT Rig, LAR for CT	Australia	2018050938	31 Aug '18	PCT filed, further action due 1 Mar '20	POF (MinEx)
Rotary Drill Head for Coiled Tubing Drilling Apparatus	CT Rig	International	2017051098	11 Oct '17	Patent applications filed in numerous countries by POF on behalf of MinEx	POF (MinEx)
Drilling Fluids and Uses Thereof	CTrol, CT Rig	Australia	2019050486	21 May '19	PCT filed, further action due 31 Sep '19	POF (MinEx)



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## Registered Designs

DESIGNS	COUNTRY	APPLICATION NO.	FILING DATE	STATUS	MANAGEMENT
Fluids Capture Apparatus	Australia	AU201514172	14 Aug '15	Registered, 10 years, renewal required at 5 yrs	Imdex
Mobile Coiled Tubing Drilling Apparatus	International	AU201710287	18 Jan '17	Registered various countries on behalf of MinEx	POF (MinEx)
A Cone Member for a Cone Splitter	Australia	AU201715232	1 Sep '17	Registered, 10 years, renewal required at 5 yrs	POF (MinEx)

## Trademarks

TRADEMARK	COUNTRY	APPLICATION NO.	CLASSES	FILING DATE	STATUS	MANAGEMENT
Lab-at-Rig®	Australia	1581982	7, 9, 37 & 42	23 Sep '13	Registered, 10 years	Imdex
RoXplorer®	Australia	1664080	7,37	11 Dec '14	Registered, 10 years	POF (MinEx)
CTrol®	Australia	1827061	1	21 Feb '17	Registered, 10 years	POF (MinEx)

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## **Appendix D**

### **Online Media Reports**

## Quarterly Analytics July 2019 - September 2019

### WEBSITE:

**1,945** **1,802** **8,616**  
 Users New Users Page Views

**n/a**  
 Previous quarter

**n/a**  
 Previous quarter

**n/a**  
 Previous quarter

**3,064** **78%** **21%**  
 Sessions New Visitors Returning Visitors

**n/a**  
 Previous quarter

**n/a**  
 Previous quarter

**n/a**  
 Previous quarter

### WEBSITE: TOP 10 VIEWED PAGES

RANK	PAGE	PAGE VIEWS	% PAGE VIEWS
1.	Home	2,147	25%
2.	What is MinEx CRC?	554	6%
3.	Annual Conference (main tab)	445	5%
4.	Annual Conference (secondary tab)	395	5%
5.	Team	392	4%
6.	Publications	317	4%
7.	Program 3: National Drilling Initiative	283	3%
8.	Education	276	3%
9.	Program 1: Drilling Technologies	266	3%
10.	Participants	228	3%

### WEBSITE: TOP 5 USER ORIGIN

RANK	COUNTRY	USERS	% OF USERS
1.	Australia	1,377	70%
2.	United States	136	7%
3.	China	55	3%
4.	India	44	2%
5.	United Kingdom	35	2%

**MinEx CRC Limited**

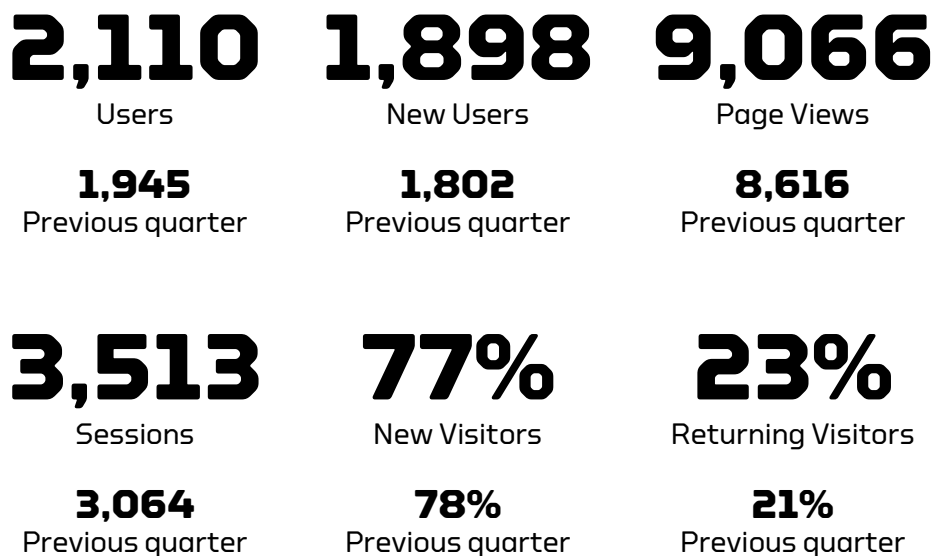
26 Dick Perry Avenue, Kensington, WA, 6151  
PO Box 1130, Bentley, WA, 6102, Australia  
admin@minexcrc.com.au

**WEBSITE KEY:**

TERM	DEFINITION
USERS	Total numbers of Users that have visited the website.
NEW USERS	New visitors that have not visited the MinEx CRC website before.
PAGE VIEWS	The number of page views by each individual user during a period of activity.
SESSIONS	A series of pageviews that a single user makes during a period of activity.

## Quarterly Analytics October 2019 - December 2019

### WEBSITE:



### YOUTUBE:



### WEBSITE: TOP 10 VIEWED PAGES

RANK	PAGE	PAGE VIEWS	% PAGE VIEWS
1.	Home	2,413	27%
2.	Annual Conference	1,360	15%
3.	What is MinEx CRC?	522	6%
4.	Publications	72	4%
5.	Team	326	4%
6.	Program 1: Drilling Technologies	324	4%
7.	Project 1: Drilling Optimisation	224	2%
8.	Board	221	2%
9.	Project 2: Coiled Tubing Drilling for Definition of Mineral Deposits	218	2%
10.	Program 3: National Drilling Initiative	218	2%

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**WEBSITE: TOP 5 USER ORIGIN**

RANK	COUNTRY	USERS	% OF USERS
1.	Australia	1,462	69%
2.	United States	188	9%
3.	China	55	3%
4.	India	55	3%
5.	Canada	49	2%

**YOUTUBE: TOP 5 VIDEOS VIEWED**

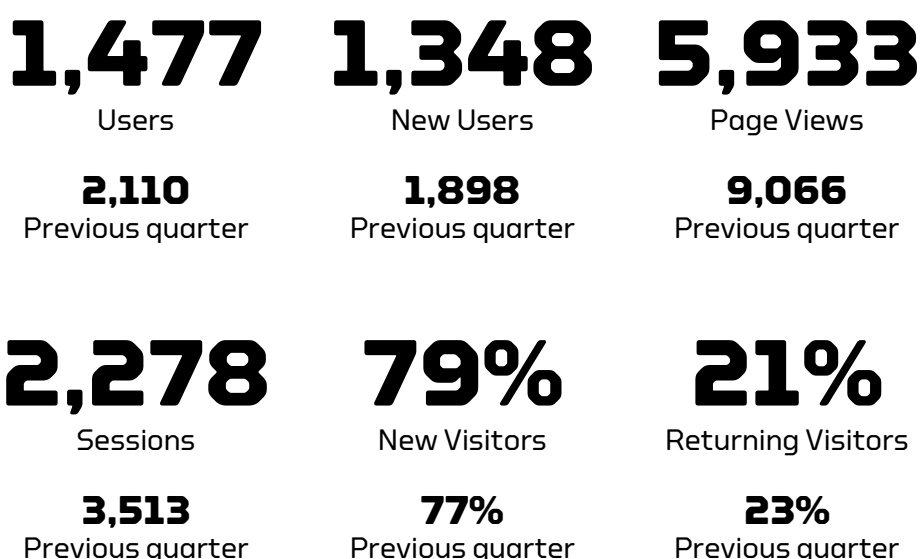
VIDEO	NUMBER OF VIEWS
What is a CRC?	398
2019 QTR 3 vNews	246
60 Seconds With...Masood Mostofi (Curtin University)	134
60 Seconds With...Michelle Carey (IMDEX)	78
Official MinEx CRC Launch	25

**WEBSITE KEY:**

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USERS	Total numbers of Users that have visited the website.
NEW USERS	New visitors that have not visited the MinEx CRC website before.
PAGE VIEWS	The number of page views by each individual user during a period of activity.
SESSIONS	A series of pageviews that a single user makes during a period of activity.

## Quarterly Analytics January 2020 - March 2020

### WEBSITE:



### YOUTUBE:



### WEBSITE: TOP 10 VIEWED PAGES

RANK	PAGE	PAGE VIEWS	% PAGE VIEWS
1.	Home	1,714	29%
2.	What is MinEx CRC?	561	9%
3.	Publications	374	6%
4.	Team	269	4%
5.	Postgraduate Students	192	3%
6.	Program 3: National Drilling Initiative	187	3%
7.	Program 1: Drilling Technologies	180	3%
8.	Project 2: Coiled Tubing Drilling for Definition of Mineral Deposits	177	3%
9.	Board	157	3%
10.	Contact	152	3%

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**WEBSITE: TOP 5 USER ORIGIN**

RANK	Country	USERS	% OF USERS
1.	Australia	935	63%
2.	United States	155	10%
3.	Canada	62	4%
4.	China	37	2%
5.	India	35	2%

**YOUTUBE: TOP 5 VIDEOS VIEWED**

VIDEO	NUMBER OF VIEWS
2019 Q4 vNews	253
60 Seconds With... Anthony Schofield (Geoscience Australia)	135
What is a CRC?	124
60 Seconds With... Matilda Thomas (Geoscience Australia)	41
2019 Q3 vNews	37

**WEBSITE KEY:**

TERM	DEFINITION
USERS	Total numbers of Users that have visited the website.
NEW USERS	New visitors that have not visited the MinEx CRC website before.
PAGE VIEWS	The number of page views by each individual user during a period of activity.
SESSIONS	A series of pageviews that a single user makes during a period of activity.



## Quarterly Analytics April 2020 - June 2020

### WEBSITE:

**2,019**   **1,887**   **7,972**

Users

New Users

Page Views

**1,477**

Previous quarter

**1,348**

Previous quarter

**5,933**

Previous quarter

**3,137**

Sessions

**81%**

New Visitors

**19%**

Returning Visitors

**2,278**

Previous quarter

**79%**

Previous quarter

**21%**

Previous quarter

### YOUTUBE:

**2**

Videos uploaded

**626**

Views this quarter

### SOCIAL MEDIA:

**1370**

LinkedIn followers

**293**

Twitter followers

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ABN: 66 625 533 913

**WEBSITE: TOP 10 VIEWED PAGES**

RANK	PAGE	PAGE VIEWS	% PAGE VIEWS
1.	Home	2,310	29%
2.	What is MinEx CRC?	582	7%
3.	Publications	410	5%
4.	2020-Q1	401	5%
5.	Team	274	3%
6.	Postgraduate students	240	3%
7.	NDI Data portal	229	3%
8.	Participants	201	3%
9.	Project 2: Coiled Tubing Drilling for Definition of Mineral Deposits	201	3%
10.	Program 1: Drilling Technologies	176	2%

**WEBSITE: TOP 5 USER ORIGIN**

RANK	Country	USERS	% OF USERS
1.	Australia	1,306	65%
2.	United States	180	9%
3.	Canada	50	2%
4.	China	50	2%
5.	India	45	2%

**YOUTUBE: TOP 5 VIDEOS VIEWED**

VIDEO	NUMBER OF VIEWS
Darwin Subarkah (UoA), PhD Major Review 2020	216 views
2020 Q1 vNews (COVID-19 edition)	201 views
What is a CRC?	62 views
2019 Q4 vNews	57 views
'60 Seconds With...' Masood Mostofi (Curtin)	22 views

**WEBSITE KEY:**

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USERS	Total numbers of Users that have visited the website.
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PAGE VIEWS	The number of page views by each individual user during a period of activity.
SESSIONS	A series of pageviews that a single user makes during a period of activity.

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**MinEx CRC**

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## **Appendix E**

### **Glossary of Terms**

## Glossary of Terms

**Affiliate:** parties with an Affiliate Agreement with MinEx CRC. Includes smaller exploration companies (juniors), mineral exploration service providers (suppliers) and certain geological surveys.

**Coil Tube:** a continuous tube to connect the drill bit and other downhole tooling to the surface (as opposed to a series of individual drill rods).

**Commercialisation:** the technology transfer, take-up and use of research outputs by end-users, including the manufacture, sale, hire or other exploitation of a product or process, or the provision of a service, incorporating Project IP or licensing of any third party to do any of those things, or otherwise licensing or assigning the Project IP.

**Commonwealth Agreement:** an agreement between MinEx CRC and the Australian Government for the provision of Commonwealth Funding to the MinEx CRC.

**Commonwealth Milestones:** measures of research productivity for MinEx CRC set in the Commonwealth Agreement.

**Department:** Department of Industry, Science, Energy and Resources.

**Diamond Drilling:** method of drilling with a rotating annular drill bit to cut the rock that returns a solid core to the surface for detailed analysis. So-called because a diamond drill bit is composed of industrial diamonds set into a soft metallic matrix.

**Drill Bit:** cutting tool at the end of the drill string used (rotated and/or vibrated up-and-down) to create holes.

**Drill Cuttings:** rock material cut by the drill bit and returned to the surface within the drilling fluids.

**Drilling Fluids:** fluids injected into the drill hole to assist drilling by lubricating and cooling the drill bit and by carrying drill cuttings to the surface. May be air or water and have various additives to assist drilling.

**Dynamic Loop:** a closed-loop system to simulate downhole drilling conditions.

**Geological Survey Organisation (GSO):** State or territory based geological organisation primarily undertaking geological related tasks and studies in respective states.

**HPS: Hydraulic Processing System.** a truck-mounted unit deployed at the drill site and used to separate drilling fluids from the drill cuttings that they contain after the fluids have circulated through the drill hole. Also used to introduce additives into the drilling fluid.

**IP:** Intellectual Property.

**LIBS:** laser-induced breakdown spectroscopy, a method of assaying a suite of chemical elements.

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**MDQ:** Management Data Questionnaire. Online component of CRC reporting to the Department of Industry.

**Non-Staff In-Kind:** contributions made to Projects without charge by Participants and Affiliates that is not staff time, for example provision of drill rigs, motors, software and geological/geophysical datasets.

**National Drilling Initiative (NDI):** the NDI will manage and deliver drilling programs in multiple case study areas proposed by MinEx CRC's partner geological survey organisations. The NDI vision is to drill multiple holes in a region to map the regional geology and architecture and define the potential for mineral systems in 3D.

**Opportunity Fund Projects:** MinEx CRC has a pool of funds available for new projects (Opportunity Fund). The Science Advisory Committee reviews applications for new projects and make recommendations to the MinEx CRC Board.

**Participants:** parties to the MinEx CRC Participants Agreement.

**Participants Agreement:** Agreement between MinEx CRC and the Participants.

**Phase I:** MinEx CRC's current 3-year Project Agreements (research contracts) that expire on 31/12/21.

**Phase II:** MinEx CRC's new set of Project Agreements (research contracts) that will extend from the end of Phase I for a further 3 years.

**Project IP:** intellectual property generated from MinEx CRC funded activities.

**RC Drilling:** Reverse Circulation Drilling. Method of drilling with a hammer mechanism that drives a full-face drill bit up-and-down to cut the rock (downhole hammer). Only drill cuttings, not core, are returned to the surface and these are recovered by high pressure air.

**RoXplorer<sup>®</sup>:** trademark term registered by MinEx CRC's Coil Tube Drill Rigs.

**SAC:** Science Advisory Committee. MinEx CRC's research advisory committee.

**Staff In-Kind:** portion of personnel time (full time equivalent) provided by Participants, Other Participants and Affiliates to MinEx CRC activities without cash funding from MinEx CRC in exchange.

**SwiftMin:** an algorithm for automated processing of XRD data.

**Solids Removal Unit (SRU):** a closed-loop fluid system to process drill cuttings.

**VET:** Vocational Education and Training.

**WHS:** Workplace Health and Safety.



Australian Government  
Department of Industry,  
Innovation and Science

**Business**  
Cooperative Research  
Centres Programme

08 6244 5270

Australian Resources  
Research Centre,  
26 Dick Perry Avenue,  
Kensington WA, 6151

[minexcrc.com.au](http://minexcrc.com.au)